

# IT Training Requirements for the Year 2000 and Beyond

**Cmdr Premchand and Praveen M Jabali**  
*Weapons and Electronics Systems Engineering Establishment (WESEE)*

## ABSTRACT

The paper examines a wide spectrum of training needs to enable India to participate and compete in the development of future technologies, products and services and suggests a training framework for their development and management.

## 1. INTRODUCTION

In India, the National Task Force on Information Technology and Software Development is in the process of evolving a framework which should enable the country to translate its objective of becoming an IT super power into a reality. One of the significant components of this framework would be to create a section of IT-literate population, which should possess world-class expertise, competence and understanding of technology issues. This would necessitate requisite training curriculum, infrastructure and expertise.

In the emerging cyber environment, the capacity, capability and reach of an adversary to wage information warfare (IW) would emanate out of its native IT base. While the most wired and IT capable nations are vulnerable to IW attacks, they would be equally agile and capable of defending themselves. In this direction, the US has already created a single point agency to assure the availability of critical NII to the nation under all conditions of war and peace. This would require unprecedented efforts and investments in the development of skills and technology.

This paper examines a wide spectrum of training needs, which would enable India to participate and compete in the development of future IT technologies, products and services for

civil and military use. It presents an overview of key technologies, products and sciences that would be relevant in the near future and suggests a training framework to prepare the nation for their development and management. This paper is not intended to cover basic awareness, school or lower level curriculum for penetration of basic IT in the country.

## 2. FACTORS & ASSUMPTIONS

The training needs for any field would depend primarily on the following factors and assumptions:

- (a) The skills learnt and information acquired will be useful over a reasonable period of time.
- (b) The economic and strategic gains from training must justify the training costs.
- (c) It would be necessary to provide periodic updates to the knowledge acquired.
- (d) Most significantly, if the nation is to surge ahead as a super power in IT and software development, the skills of its people would have to be honed adequately in this direction to the requisite level of competence.
- (e) In the field of knowledge, the worthiness of indigenous companies, organisations or even the nation would depend upon the quality of human resources and the quickness with which the organisations and the nation can

absorb and retain a large chunk of workforce with the latest knowledge.

Keeping these assumptions in view, a large number of training related issues have been examined for consideration of the IT Task Force in general, and Services, in particular, while formulating a strategy for the training needs.

### **3. KEY CONSIDERATIONS**

- (a) It is assumed that to be a super power in IT, India has to master leading edge technologies and be cost competitive.
- (b) India should be recognised for its strengths in value-added areas of IT and in pushing the barriers in leading edge technologies to global level.
- (c) To know what to do and how to quickly make a beginning, is of utmost importance; more so in the field of IT where the changes are measured in terms of days and months, unlike in mature industries where these are measured in terms of years and decades.
- (d) Emerging technology trends need to be examined and analysed to find out the fields to concentrate on. From this, the skill sets that the people of India are to be equipped with, would be identified.
- (e) Once these aspects are clear, infrastructure and technologies needed to assist the same would be identified.
- (f) Policy and bureaucratic changes need to be examined for introduction of IT knowledge in radical ways.
- (g) A focussed programme with mission-specific development is needed.

### **4. EMERGING TECHNOLOGIES TO WATCH**

The ten emerging technologies receiving attention worldwide, which would have a significant impact on IT-related areas during the next few years, have been examined by experts to identify where one lacks in training. The ability of the nation to capitalise on emerging technologies stakes high and time-sensitive issue. Jumping onto a new technological bandwagon too early could be a costly mistake

but missing the right opportunities could be just as costly. Therefore, steps are to be taken with utmost care and in the right direction.

#### **4.1 Product-Related Technologies**

The survey of technology assessment and forecasting reports reveal that the following ten areas would gain prominence. These are equally important to military and the civil sectors.

##### **4.1.1 Biometrics**

In computing, the ability of a system to recognise an individual according to one or more unique physiological characteristics like a fingerprint, facial features, voice, or even the iris of an eye. This area has potential in IT security-related applications.

##### **4.1.2 Desktop Video Conferencing**

It is the ability of two or more geographically separated users to meet via their personal computers (PC). A typical system involves a PC, a monitor-mounted camera, a network connection, and a special software that facilitates exchange of video and audio streams. This field would have tremendous applications in command and control as well as decision-support applications.

##### **4.1.3 Data Mining**

It is the process of discovering meaningful correlation, patterns, or trends by sifting through large amounts of stored data using pattern recognition technologies as well as statistical and mathematical techniques. This would have direct bearing on the reaction times in peace and war.

##### **4.1.4 Document Imaging**

Document imaging is the conversion (digitising of paper documents into electronic documents) using a scanner or similar device, and the subsequent storage and management of those electronic images. This would be of immense value to organise and present comprehensive picture for decision support.

##### **4.1.5 Electronic Cash**

Electronic cash is digital money, typically in the form of downloadable 'digital coins' that

can be stored in an online bank account, the user's PC, or on a smart card. This would enable user to be current with the rest of the world and would also increase the business transactions manifold.

#### **4.1.6 Network Computer**

Network computer is simplified, low cost desktop computer designed to take advantage of a network. Network computers access applications and data from the network to minimise storage requirements of the desktop thereby reducing cost of the computer. This would be the lynchpin of operations during peace and war.

#### **4.1.7 Personal Digital Assistant**

Personal digital assistant is a computer that can be held in the palm of a hand and that processes information for an individual. Common functions include a directory of names, addresses and telephone numbers along with a calculator, to-do list, and note pad. This would enhance users mobility and capacity to organise.

#### **4.1.8 Push Technology**

Push technology is the software that automates the delivery of information to individuals. In contrast, the world wide web is a 'pull' environment where users go to the web for information. In a 'push' environment, information is sent to the user through a web browser, e-mail, or even voice mail or a pager. These technologies would form the foundation of our C<sup>4</sup>ISR infrastructure.

#### **4.1.9 Smart Card**

Similar in look and size to a credit card, a smart card has an embedded microprocessor or memory chip, or both, instead of magnetic strip commonly found on credit and debit cards. This technology will have several applications in identification, authentication, access control, healthcare, finance, administration, etc.

#### **4.1.10 Speech Recognition**

Speech recognition pertains to a computer's ability to 'hear' the user. Special software takes the sound of a user's voice, digitises it and then compares it to a library of waveforms. When matches are found, the computer can use user's

words just as if they had been typed through a keyboard. This has extremely large potential in military applications.

### **5. WHEN WILL THESE TECHNOLOGIES BE READY FOR BUSINESS?**

The emerging technologies typically follow a pattern of hype, disillusionment, enlightenment and productivity. Understanding this predictable pattern of new technologies helps to make intelligent decisions about when to implement these technologies.

Initially, the market expectations of a new technology are greater than its real world contribution. However, specific industries can benefit by adopting technologies at the height of market enthusiasm. Banking, insurance and media organisations should adopt push technology in the early stages of development. Moreover, governments will find relevant uses for biometrics. Consumer-packaged goods; government and higher education will find productive use for electronic cash during the next five years.

### **6. APPLICATION-SPECIFIC IT TRENDS**

A brief overview of worldwide trends in application-specific IT and their relevance to India is presented. The aim is to focus on areas which can help the country to identify its training needs and to create expertise of requisite level so that goals of becoming IT super power as well as military needs are fulfilled.

#### **6.1 Input/Output Technologies**

- (a) Basic input devices, such as keyboards and mouse are becoming more complex as *de facto* standards become outdated.
- (b) Specialised input/output devices, namely, touch screens and speech recognition are being used in specialised applications like kiosks, which can be useful for less literate communities in India.
- (c) Image capture devices, such as scanners and video and digital cameras, are moving from expensive, specialised uses such as graphics,

arts and video conferencing systems into mainstream.

- (d) CD devices are expected to make inroads into the cathode-ray tube market, replacing the bulky power-hungry picture tubes of today.

## 6.2 Intelligent Cards & Systems

The trend towards intelligent cards or smart cards and systems would continue. This means a lot of opportunity in designing application-specific integrated chips (ASICs) to service a large number of applications would exist.

## 6.3 Transmission Media

Worldwide, copper has an edge because of lower cost of enabling technology vis-a-vis optical fibre, which is predominantly used in long haul carriers by telecom companies. Wireless offers an opportunity in Asia and parts of the world to cut down costs associated with wireline infrastructure. This has significant potential in the Indian context.

## 6.4 Telecommunications

- (a) The trend is towards transmission of both voice and video on the same lines as well as development of personal communication services and cell phones.
- (b) Growth in Internet use will increase the demand for high-speed remote access networks, like ISDN, ADSL/HDSL. Data traffic will increasingly become a much higher market than voice.

## 6.5 Internets & Intranets

- (a) The growth in Internets and Intranets is expected to be high. The Internet is still in the infancy stage and offers a lot of opportunities in creation of web pages, enabling business-to-business connectivity and organisation-to-organisation connectivity. Since most of these activities are client-specific, there will be a requirement for a lot of Internet-specific professionals, with knowledge of technology as well as creation of the content that goes with it.
- (b) Web commerce will also take off in technology savvy, high-income groups to begin with. Traditional network vendors and

service providers will play a significant role as suppliers of new Internet services.

- (c) Distributed model for indexing the Web will emerge, enabling a more systematic access to information and sites.
- (d) Demand for multimedia and video content will rise sharply giving a lot of opportunity in multimedia for content generation.

## 7. OPERATING SYSTEMS ENVIRONMENT

### 7.1 Desktop Operating Systems

- (a) 32-bit OS and 64-bit OS
- (b) Specialised devices like cellular phones and set-top boxes will increasingly use Microsoft's Windows CE, Sun Java OS.
- (c) User interfaces will move beyond the desktop file/folder metaphor and will gain tighter integration into the OS. Voice recognition systems will also get integrated into the OS.

### 7.2 Departmental Server

- (a) Optional electronic commerce software that goes beyond basic web server would be available by 1998.
- (b) Optional support for enterprise security standards will be widely available for all major departmental server operating systems.

### 7.3 UNIX Server

UNIX will remain popular for deploying high-end web-servers and mission-critical databases.

### 7.4 Windows NT Server

Microsoft will continue to target specific markets like, large enterprises, small businesses and departmental networks.

### 7.5 Novell NetWare

This will remain popular for file and print services.

### 7.6 Enterprise Server Operating System

- (a) Enterprise server operating systems, particularly MVS will continue to anchor

large corporate networks because of scalability, reliability and security.

- (b) More Internet, Intranet and client/server applications will be run on them.

## **8. SOFTWARE COMPONENT ARCHITECTURE**

### **8.1 Message-Oriented Middleware TP Monitors**

- (a) Message-Oriented Middleware (MOM) and TP monitors will see increasing convergence of their features: TP monitors are already providing pure communications capability associated with MOM. MOM is enhancing its offerings to provide more transaction-oriented features.
- (b) The CORBA-oriented programming will be increasingly adopted by enterprises for distributed computing infrastructure but its usage in India may not gather momentum.
- (c) Microsoft's DCOM will remain popular in desktop applications.
- (d) ActiveX and JavaBeans will become important drivers for distributed computing.

### **8.2 Computing Platforms**

- (a) Computer systems mainly divided into two categories (i.e., clients and servers), will dominate the environment.
- (b) The market will grow modestly for mainframes.
- (c) Mid-range servers will focus on increasing system bus speeds, memory bandwidth, and I/O throughput of their products to support high volume transaction processing applications.
- (d) PCs will increasingly capture the workstation market.

## **9. GROUPWARE, WORKFLOW, DOCUMENT & KNOWLEDGE MANAGEMENT**

### **9.1 GroupWare**

- (a) GroupWare will continue to play a major role in developing virtual offices that allow

workers to overcome constraints of geographic location, time and personal locations.

- (b) Low-end products will be web-based and offer real-time chat in addition to Internet mail and threaded discussion capabilities.
- (c) The drive behind workflow would be governed by the need to move information from the application suites to desktops, both inside and outside the organisation.
- (d) Workflow will accelerate transition onto Internet. This is expected to break corporate barriers within and outside the government.
- (e) Document management systems (DMS) will more tightly integrate workflow as part of the core software.
- (f) DMS will address all types, from text to images, audio and video. The cycle of document publishing will be shortened dramatically as a result of this.
- (g) Active agents in the form of autonomous processes capable of taking independent actions on behalf of individual users and business teams promise to simplify, personalise and customise access to online information. These tools will help manage knowledge across business networks.
- (h) Organisation that can develop unique approaches to manage their access to the intellectual resources of their customers, suppliers, products and business staffs will have a distinct competitive advantage in the marketplace.

### **9.2 Data Warehousing**

- (a) The use of data warehousing will increase significantly.
- (b) Web-enabled data warehouses will open to more users and, therefore, increase the importance of scalability and performance issues.
- (c) The market for application-specific data warehouse products will emerge, while ERP vendors, such as ORACLE and SAP would develop data warehousing solutions that would sit on top of their core applications.

- (d) Companies will increase their use of consulting partners when implementing data warehousing solutions.

### 9.3 Corporate Applications

- (a) Large-scale ERP packages, such as ORACLE, SAB, MARSHAL, PeopleSoft, etc will become easier to implement and use. ERP would move into an object-oriented domain.
- (b) Packaged applications will increasingly improve workflow capabilities in the organisations.
- (c) Best of the breed approach will be adapted while implementing, which will result in vertical-specific and industry-specific solutions.

## 10. IT INDUSTRY IN INDIA

Hitherto, the IT industry in India has been characterised by focus on immediate gains, especially where the companies have a cost advantage. In the past few years, the Indian industry had focused on the 42K bug. However, with the realisation that this would last not more than a couple of years, some of them already started looking at the opportunities offered by the European Monetary Union. This is one example where skills need to be retrained to focus on different markets and geographies. However remunerative this may be to the companies in the short and medium term, it would be more in the interest of the country to pursue industry to create value-added products and services with a long-term focus. It would be extremely necessary to develop core competencies to compete globally.

## 11. SKILL SETS & EXPERTISE

The requirements of the IT field have been briefly covered. The skill sets required for competing at global level are those that involve above-mentioned areas. These have been briefly classified below as distinctly separable areas.

- Basic programming skills like C++, Java, ActiveX etc
- CASE tools to build and operate scalable environments viz., software engineering environment (SEE) using functional as well

as object-oriented approaches be promoted on a large scale.

- Computer-aided engineering (CAE) environments
- Knowledge engineering environment (KEE)
- Concurrent engineering environment (CEE)
- A large spectrum of electronic design automation (EDA) tools
- System engineering
- Skills to evolve and/or customise standards for software engineering, quality assurance, configuration management, reviews and audits, testing, validation, verification, reverse engineering, metrics, costing etc
- Skills to prepare and implement process models in consonance with existing and evolving standards/models viz., MIL/DOD/CMM/ISO etc
- Skills to provide consultancy services in high-end areas of network engineering, application engineering, estimation, costing, management, etc.
- Expertise in assessment, forecasting, development, acquisition, transfer, absorption and management of technology
- Expertise to bring into focus and integrate domain knowledge with IT applications and tool development in different areas
- Skills in cyber laws in consonance with constitutional and sovereign rights of citizens
- IT security technologies, viz., encryption, firewalls, signature management, identification, authentication, access control, network surveillance, control, monitoring, computer virus counter-measures, hacking, security audits, disaster control and recovery, security modelling, security planning and administration management etc.
- Skills in evolving, planning and implementation of strategies for protection of critical information infrastructure
- Skills in design and implementation of a system of systems (very large and interwoven information infrastructure)

- ❑ Internet and Intranet technologies
- ❑ Skills in transitioning m-commerce to e-commerce.
- ❑ Information warfare (IW) technologies and techniques
- ❑ Business application package skills—ORACLE, SAP, MARSHAL, PeopleSoft, etc.
- ❑ Document and spreadsheet tools like Microsoft Word, Excel, PowerPoint, etc.
- ❑ Database and LAN/WAN administration skills
- ❑ Coding skills in assembly language and other low-level languages
- ❑ Project management skills in software development and implementation
- ❑ System integration skills and change management skills
- ❑ Knowledge management skills
- ❑ Multimedia skills and content generation capability
- ❑ Management of technology
- ❑ Software metrics
- ❑ Software contracting

## **12. INFRASTRUCTURE, TECHNOLOGY & METHODOLOGIES**

The strides made in the area of communications with the introduction of the world wide web, or the Internet has enabled the developed countries to use this technology to leapfrog the way in which the masses are educated. The time factor too has been greatly compressed in learning even complex subjects by several degrees through the use of multimedia and interactive learning methodologies as well as the NET. The implementation of these enablers will be useful not only in the area of IT learning but also in numerous other areas, right from school subjects to graduate and postgraduate subjects. The path to enable delivery of better training skills at a large scale is discussed further in the succeeding paragraphs.

## **13. WEB-BASED IMPARTATION OF KNOWLEDGE**

- (a) Develop/acquire content for training, both in interactive as well as passive mode.
- (b) Develop and acquire a massive library of computer based training (CBT) material and enable these to be used on the web.
- (c) Enable the massive proliferation of ISPs and Internet users to enable access at nominal rates, as encouraged in countries like Malaysia, which have equally ambitious IT-related programmes.
- (d) Provide dynamism and competition by inviting and actively soliciting leading companies worldwide to participate in this programme.
- (e) Telecommunication infrastructure needs to be improved significantly to take care of the greater requirement in bandwidth and data communication. Unless this is corrected, it will be one of the biggest stumbling blocks in realising this goal.
- (f) The penetration of telephones and the rate of increase in new subscribers in India, is low and as of now, highly inadequate for becoming an IT super power. The quality of the lines and their reliability is another big factor in this regard.
- (g) Allow knowledge management tools and technologies to be used widely for getting the greatest benefit in a more scientific way.
- (h) Develop and encourage regional universities to impart web-based interactive learning centres. Since time is an important factor these regional institutes could act as nodal agencies and tie up with content and CBT-based training organisations to enable the same.
- (i) Open, encourage and enable information kiosks in business centers where mere, photocopying, faxing, STD/ISD are provided as of today. (Fig. 4)

## 14. PREPARING INSTITUTES/ INDUSTRIES FOR TRAINING

Here are some suggestions to prepare educational and research institutes and industries for training.

- (a) Network institutes should enable sharing of data, research as well as computer facilities throughout the country. This is being done presently to some extent using ERNET.
- (b) Encourage educational institutions (engineering and science colleges) impart computer education to the general public and their own students on a commercial basis. This is being done but the content and quality needs to be improved.
- (c) Though the curriculum of private IT training institutes as well as engineering colleges abroad are changed and reviewed every year, the same does not happen in the engineering colleges in India. These are bogged down by resistance from less capable colleges, incapable of incorporating fast changes required by the IT world. Allowing engineering institutes greater freedom in formulating their courses and to be unrestricted from university system and regulations would enable our engineering institutes to constantly improve their curriculum and overhaul it every year, independently, without being bogged down by laggard institutes. These forerunning institutes then can act as role models for other institutes to follow.
- (d) Encourage educational and research institutions to keep their infrastructure facilities open for 24 hours a day. A method may be evolved where students and institutions could participate in the efforts made to enable students acquire knowledge. This could be done by encouraging students to pay more for the computing facilities they use, and by looking after the LANs themselves, as is being done in select premier institutes like the IIMs, etc.
- (e) Encourage research institutes to take up more work of practical significance than of mere academic importance. Towards this end, more developmental work as well as R&D

work in cooperation with the local industries should be encouraged.

- (f) Have more optional subjects in IT offered at the colleges, which can be taken up by the interested students, while not being a burden on the less inclined ones.
- (g) Induct more people from the science and engineering into the IAS and state administrative services to enable IT-oriented culture.
- (h) Industries and public sector companies may be encouraged to open their computer facilities to be accessed by students on holidays and after office hours. An appointee of the students could help in the LAN/WAN maintenance on these holidays. These are the practices prevalent in most advanced countries. Once the mindset is developed, security issues can be tackled.

## 15. ENTERPRISE-WIDE LEARNING SYSTEM

The following tool-based model illustrates enterprise-wide learning system that can be particularly used by institutes and government agencies, both at the state and central level.

### 15.1 Learning Management Information Systems

The Learning Management Information Systems (LMIS) offers a comprehensive, web-based knowledge management solution. LMIS components provide capabilities to manage competencies, assessments and training logistics. Additionally, LMIS can launch, track and manage all varieties of technology-based training. LMIS comprises a set of integrated modules to help focus learning activities toward achieving training objectives. These are:

#### ***Training Management System***

This module maintains an electronic catalogue of an organisation's learning activities. It manages enrolments, confirmations, classroom and instructor assignments, course materials, departmental charge-backs and invoicing, course completion certificates and learner profiles.



### **Competency Management System**

This module maintains a comprehensive database of an organisation's work force skills. It highlights skill gaps for an organisation, a department or an individual to show where additional learning is needed; and it can generate reports for budget forecasting, career planning, and skill charting. The system can automatically generate a curriculum of learning events for any person or group that needs to acquire skills based on the organisation's roles and learning objectives.

### **Assessment Management System**

This module offers the management an opportunity to administer online tests and surveys for immediate feedback on workhorse skills. The system is tied into all learning activities to upgrade learner transcripts as new skills are successfully acquired. Whether a student takes an instructor-led course, a CBT course or attends a seminar, the student can use the assessment system for objective or subjective measurements to gain the skills critical for success.

### **Enterprise Knowledge Management Software**

Technology-based training with open, independent software platform provides a full training solution. To facilitate an organisational wide learning, coordinated by IT, the above-mentioned concepts are explored.

LMIS can help relate courseware and curriculum options to individual's needs. LMIS can also help maintain a learning relationship with a student.

## **16. COURSES TO PROVIDE SKILLS BEYOND TECHNICAL TOPICS**

IT business skills courses, targeted specifically for IT professionals, are briefly examined. These courses are delivered over LANs. This new curriculum features multimedia components to enhance the learning process and increase skill retention. Studies show that the incorporation of multimedia elements is instrumental for effective instructional delivery

of non-technical, soft skills. Streaming technologies are being used to allow video and audio to be streamed over enterprise networks at low bandwidth. Skills beyond technical subjects, such as system administration or programming are critical to the overall success of today's IT professionals. These are:

### **Planning an IT Project**

It teaches IT managers how to scope out a project prepare a project plan and schedule, assess and manage risks, and estimate project costs.

### **Collaboration with IT Professionals**

Educates IT managers on the importance of being able to interpret others' behaviour, recognising the differences in individual's perceptions and working with business partners.

Lack of management and leadership skills can inhibit an IT professional's job performance. More than 87 per cent of IT users have recognised the need to provide ongoing soft skills training to their MIS staff.

## **17. REAL-TIME TECHNOLOGY-BASED TRAINING**

The enterprise learning centres (ELC) are Intranet-based resources for IT professionals and end users to gain and maintain critical IT technical and desktop skills. The ELC enables enterprises to deliver training directly on the desktop while eliminating Internet security, bandwidth and data confidentiality concerns.

Additionally, the ELC provides tools for skill management, course and organisation administration, and performance support through robust testing, tracking, reporting, course catalog, organisation management and full-text search functions.

ELC can offer skill management resources for IT professionals and end users on a wide variety of subjects, including Lotus Notes, Microsoft Office 97, Oracle, Sybase, Informix, client/server' Unix, Java and SAP R13.

The ELC is another stride in the overall strategy to leverage Internet technologies to provide cost-effective, value-added skills

management solutions to organisations. The ELC is installed on a web server behind an end user's firewall. Like the Internet learning centre, the ELC offers distinguishable features, such as no downloading or waiting, no special configuration or memory requirements, as well as increased functionality and ease of enterprise-wide installations without requiring access to, or reliance on the Internet.

The ELC should offer tracking, administrative tools and testing. The additional features are:

#### **Reporting**

Allows administrators to monitor course usage, evaluate user process, track costs and measure return on investment by generating reports at the user organisation and department levels.

#### **Searching**

Users can conduct full-text searches, across all courses, within the ELC library. Students can then link to specific screens of instruction that match their needs. This provides performance, support and true 'just enough,' 'just-in-time' learning.

#### **Personal Home Page**

It is generated when students enroll in their first course, this feature creates a 'personal catalog' of courses in which the student is enrolled. The personal home page contains links to the course menu, course test and course bookmark.

#### **Bookmarking**

Allows a user to mark a specific page or location within a course to enable later reference to that page, thus providing greater flexibility in accessing only the training that is needed and when it is most convenient.

### **18. PROGRAMMES FOR 21<sup>st</sup> CENTURY**

The high-tech boom began with the PC explosion in the early 1980s. However, due to this boom, India is grappling with a skill shortage for 17 years. One major reason is lack of training and knowledge at universities and college campuses. With a view to compete in the global market, the quality and competence of human resource need to be of very high caliber. To achieve this objective, it would be

necessary to deploy strategic IT training programmes in colleges and universities. The goal is to help alleviate the IT skilled-labour shortage facing Indian employer in both private and public sectors.

To achieve this goal, it is proposed that suitable IT depots or skill learning libraries, training material banks should be created, which can act as nodal repositories of CBT's and training materials for use through various institutions and organisations. The state and central governments could own these IT depots. The aim is to augment and support the private sector with material or content required for training as well as to kick-off the initiative. With this initiative, higher-learning institutions can have access to IT depots research and materials for all faculty members and students. Universities and institutions all over India can then be encouraged to take up initiative to use the knowledge wealth created by IT depots and cater to their students.

### **19. INTERACTIVE LEARNING CENTRES**

As organisations worldwide gear up to spend billions of dollars during the year 2000 to address the digital challenges of the new millennium, the skilled-labour shortage will become more pronounced. To cater to this demand, interactive learning centres (ILC) in the Business Centres or STPs could be set up. Each ILC can house 15 to 20 computer workstations, and members can select training titles of their choice for a predetermined price.

There is no reason why India cannot and should not grab the US technological edge as Japan did with the auto industry in the 1970s. The National Task Force on IT and Software Development must sound a wake-up call for all major companies and the Indian govt. to invest in the future of our education system and our high technology industries.

### **20. CONCLUSION**

No meaningful IT penetration can take place unless our human resource becomes IT savvy. Once this foundation becomes firm, our efforts would be to develop ITs, devices, products, systems and services which would enable us to

sustain our economic, political, social and military prowess in the global terms. This can only become possible if we look beyond today's needs and prepare our human resource in such a way that it can join the international mainstream of IT professionals. This would require training initiatives on unprecedented scale in terms of cost, complexity and technology.

In keeping with the above-mentioned needs and objectives, this document brings out the level and areas of training to be addressed as well as the underlying technology and management needs. The National Task Force on

Information Technology and Software Development as well as the HRD Ministry would need to address this issue in right earnest.

The military, on its own, has always played its part in addressing formal and informal training issues to very high standards. It is also making serious attempts to create IT skill sets for its future needs. However, there are certain areas that are beyond their generic needs but are critical from the point of self-reliance. These would have to be addressed by the other national agencies.

### **Contributors**

**Cmde Premchand** is working at the Weapons and Electronics Systems Engineering Establishment (WESEE), Ministry of Defence.

**Praveen M Jabali** is also working at the Weapons and Electronics Systems Engineering Establishment (WESEE), Ministry of Defence.