ELECTRONIC COMMERCE AND INFORMATION INFRASTRUCTURE : INDIAN PERSPECTIVE

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1. INTRODUCTION

Information technology (IT) industry and its components including IT-based services have become major contributors to the economy of the developed countries. According to the International Data Centre (IDC), a world leader in IT-based market research, the value of worldwide IT market in 1996 was US$ 630 billion which is expected to reach US$ 937 billion by the year 2000. The various developments in the IT field have ushered in the 'Information Society'. The information society is characterised by information as the key resource with information (knowledge) workers as main type of employment, research institutions as its base, and computers, electronics and telecommunications as basic technology components. Internet has been the most significant development of the information society, the effect of which is being felt in every walk of human life. And commerce is no exception to this phenomenon. Electronic funds transfer (EFT), electronic payments and electronic data interchange (EDI) are some of the business activities carried out using Internet (and World Wide Web) for quite some time. The major factors which made Internet a popular medium over conventional print medium for conducting business include :

* Enhanced geographical reach
* Unrestricted domains
* Universal applicability to all products, services, vendors, customers in all the subject areas
* Relatively less expensive, provides unlimited space involving low premium
* Easy updation and cheap maintenance
* Non-discriminatory accessibility to all customers 'absolutely free'
* Instant selling of non-material goods (like software)

The advances in telecommunications and computers made it possible to make the home, or even a bed room as 'virtual office' to carry out the tasks assigned to an individual or even supervise the work of team members. This is possible due to the acceptance of use of laptops or notebook computers, cellphones, fax machines and e-mail. Further the same setting can be used for making business transactions; one can buy, sell or market a product or service, using computers. This facilitates increased productivity as it is possible to stretch working/duty hours and minimise or avoid to commuting time to reach offices. Despite drawbacks like visibility, isolation, out of touch with latest developments unless one is in constant touch, it is increasingly becoming popular in the developed countries. This has given rise to the Small-Office-Home-Office concept. In the US, nearly 43 per cent houses possess some form of home office (see Craumer & Marshall, 1997; Hawkins, 1997) and the home-based work-force is expected to increase at an annual rate of about 20 per cent.

Coupled with the above mentioned benefits, the business companies realised that the competitive edge/advantage of traditional commerce is fast becoming limited and started looking for newer avenues to enhance profitability. They found that Internet provides seamless access to customers, partners, suppliers, and distributors in a networked environment. Thus, Internet has become a medium to achieve corporate competitiveness and profitability.

Internet is holding enormous volumes of information in each and every field of human knowledge. It also holds guides to techno-commercial information covering sources of business information (for example, see Sinha and Tulasi, 1998, p. 6). Although it contains only a fraction of one per cent of the world's publicly available data, it is tripling in size each year and in six or so years it will be growing a thousand fold. According to a speculation, in five years from now, 80 per cent of publicly available data will be available on the Net (quoted in Cronin and Mckim, 1996, p. 164). In fact, Internet users are already buckling under the information overload and are using metadata and a host of information search engines to browse through the myriads of information hay-stack.

The Internet resources provide data including profiles of companies, institutions, industries, professional consultants, organisations and their activities, areas of work, expertise, products, services, technolo-

gies etc. The Web sites maintained by manufacturers, vendors, financial institutions participating in e-commerce and organisations supporting it like CommerceNet, Netscape, Microsoft, etc will be more useful for those who would like to enter into the world of e-biz (see Appendix for a short list of important players in some of these areas). E-mail distribution lists, manufacturer's and product directories, listserves, etc are also available for product marketing.

2. ELECTRONIC COMMERCE

Variously known as e-commerce, e-biz, cyber commerce, online commerce, Net commerce, etc, electronic commerce is the latest phenomenon of Internet. E-commerce is re-defining the way business is conducted by individuals, institutions and industries. It has provided new avenues for marketing, novel ways for advertising, large customer base for vendors and manufacturers, increased visibility for products, and a variety of alternatives for customers.

E-commerce is profoundly influencing the structure of business dealings and supply chains. It is growing at a rate of more than 30 per cent and facilitating business-to-business and business-to-customer/consumer transactions manifold. This is mainly because Web-based transactions offer low service costs. For example, sending a 40 page document from New York to Tokyo costs an average of US$ 26 if sent through courier services; about US$ 30 if sent by fax and a mere 10 cents if sent via Internet (Chasia, 1998, p. 43). Internet facilitates use of a host of electronic payment systems resulting in cheaper operational costs; it costs about 5 cents per transaction for digital currency as against 45 cents per transaction for credit card payments, 75 cents for check payments and US$ 1 per transaction for paper currency payments (ter Maat, 1997, p. 69). Internet offers online bank transactions costing five paise per transaction as against Rs 1.50 through a teller (Balasubramanian, 1998, p. 49). Internet follows true socialism - it has no preference or favouritism on any product or firm; it provides the same facilities, opportunities and avenues to all. Thus, right from advertising and automobiles to software and value-added services, all thrive over cyber space. See, for example, the usage of Internet of some of the companies:

*   Boise Cascade Office Products, the first office supplier to put its catalogue on the Web to reduce the costs and increase the speed of order processing while improving order convenience for customers not only recouped its investment in this technology, but also saved US$ 1 million in just one year.

*   The AIM Management Group, a mutual fund company, has developed an extranet to provide its customers with up-to-the-minute information, twenty-four hours a day accessible from anywhere. It is able to satisfy all customers and brokers with brochures, literature and financial information all the times.

*   Knight-Ridder New Media, electronic publisher, has developed a Web-based application for making financial operations more efficient, and attracting new subscribers and advertising revenue through innovative online publishing for all the company's newspapers.

*   The Hongkong Telecom, the largest Internet Service Provider in Hong Kong with an annual sales of US$ 32 billion (in 1997), developed and deployed an online application on Internet to deliver higher levels of cost-effective service, twenty-four hours a day, seven days a week.

*   The Internet Commerce of Cisco Systems in 1996 was US$ 100 million which rose to US$ 3.2 billion in 1997.

*   The Web site of Amazon.com was visited by 15,10,000 during the fourth quarter of 1997 and 22,60,000 in the first quarter of 1998. The sales during these periods was US$ 66 and 87.4 millions respectively.

*   The daily sales of Dell Computers on Internet in January 1997 was less than US$ 1 million which rose to about US$ 6 million daily during December 1997 holiday period.

*   Auto-by-Tel, a Web-based automotive market place, had auto sales worth US$ 1.8 billion (3,45,000 purchase requests) during 1996. By 1997, it rose to about US$ 6 billion (12,00,000 purchase requests).

*   Chrysler Corporation reportedly saved more than US$ 1 billion in cost of materials in 1997 merely by linking its suppliers through a Web-based network and by the year 2000, the annual average savings estimated will amount to US$ 2 billion.

Although there is a difference of opinion as to the revenues generated by e-commerce, it is steadily growing. IDC estimated that transactions worth US$ 10 billion were executed over Internet in 1997 (equal to a mere 0.05 per cent of the global commerce). It estimated the value of e-commerce for 1998, 2000, 2001, and 2010 to be US$ 45.8, 150, 220 and 1000 billion, respectively (Brand Equity, 1996. p. 4). Another firm, Forester Research estimates that the revenues from e-commerce in the year 2002 would reach US$ 327 billion, about one per cent of the global economy. As per the survey of CMP Research in December 1997, it was observed that nearly two-thirds of the US companies will be resorting to e-commerce by the year 1998. About 40 per cent of the US companies conducted business on Internet in 1997 and another 23 per cent will be joining them by the year 1998 (Punja, 1998, p. 10). This demonstrates the growing value and importance of e-commerce for companies.

The main characteristic of e-commerce is the anonimity it provides to the customers and vendors as well as to the transactions which take between them. Other problems include privacy, and integrity of messages sent, authenticity and non-repudiation of transactions taking place on the Net. This has given rise to initial hick-ups including insecurity, fraud, money laundering and impersonation (Lakshmana Moorthy and Karisiddappa, 1998). This situation in turn led to the formulation of security protocols like Secure Hypertext Transfer Protocol (SHTTP), Secure Sockets Layer Protocol (SSLP), Secure Electronic Payment Protocol (SEPP), Secure Electronic Transaction Protocols (SETP), and so on. As of today, both material goods and non-material goods (like software) are available over Internet through vendors. While the latter can be procured instantly (by downloading from the site), in the case of the former, the goods are sent separately by post. Online ordering facilities are available for both the transactions. In the case of instant purchases, the payments are to be made either through deposit accounts or smart/credit cards or any of the electronic payment systems. A host of electronic payment systems like First Virtual Internet Payment System, E-cash, ICVERIFY, NetCash, Secure Internet Payment System, CyberCoin, MilliCent, Payword, PayNow, NetBill etc are available to choose from. These have been discussed in detail elsewhere (Loshin and Murphy, 1998; and Opplinger, 1998).

In electronic market place, search costs are heavily reduced, as all the information about an item/ product is available at one place. This reduces search time and related costs and also enables in locating suppliers matching the needs of the buyers. However, this is not true in all cases. As per a study, the average prices of second hand cars sold through AUCNET, an electronic market place for used cars in Japan, were found to be much higher than that of traditional non-electronic markets. But the higher prices made many sellers list their cars on AUCNET which in turn attracted more buyers as it offered better choices (Lee, 1998, p. 73). It had also created risks of buying inferior quality vehicles as transactions are made without physical inspection.

2.1 Web Advertising

Internet advertising (or Netvertising) is another rapidly growing area of e-commerce. As Internet supports audio, video, animation and graphics, this area is gaining more and more attention. As against print media, here the consumer goes to the advertiser. The Web advertising and marketing are generally skewed towards educated, middle and high income groups. Many newspapers, newsletters, and ad agencies are advertising on the Net. The ad revenues for Web sites during April-June 1998 was US$ 422.7 million which is almost double when compared to the revenues for the same period in 1997. According to ActiveMedia, Netvertisements will be earning US$ 19 billion by the year 2001 (see Kaur, 1998, p. 75, for more details).

2.2 Impact of Internet

Although the benefits of Internet were felt a long time ago, it is only recently that the country is realizing its potential and taking necessary steps for popularizing usage of Internet among scientific and R&D community. This is because of the policy of the government which made providing Internet services a virtual monopoly of Videsh Sanchar Nigam Ltd (VSNL). Till late 1998, India had only four ISPs: NICNET, ERNET, VSNL and SoftNet of Software Technology Parks. Where as, smaller countries like Japan, Hong Kong and Korea have 1300, 90 and 15 ISPs, respectively. The number of Internet hosts and subscribers in the country is also very small.

Internet access in India is mostly urban oriented. The communication networks like NICNET of the National Informatics Centre (NIC) and ERNET of the Department of Electronics (DOE) started providing Internet access to the academic and R&D in

stitutions and made Internet popular among the research community. NICNET is the first network in India to establish a Web server to cater the needs of Internet users. It had a target of establishing 30 Web servers by 1995. With its nodes in each and every district headquarters in the country, NICNET has been successful in taking Internet to schools, colleges and polytechnics. Although VSNL launched its 'Internet for Masses' programme on 15 August 1995, at present the country has only about 1.2 lakh Internet subscribers which is growing by 10,000 every month. This is because of lack of sufficient Internet nodes and a communication backbone network of adequate bandwidth. VSNL and DOT together operate 30 nodes and another 24 are under various stages of execution. Internet users from places other than those having nodes have to use I-Net of DOT or dial-up and are thus forced to bear extra charges. This situation led some users approach courts for legal redressal (Akila, 1998, p. 48).

Despite these problems, the popularity of and access to the Internet is on the increase. Many academic, research and commercial institutions both from public and private sectors, and many government agencies have their home pages maintained on the Net. Many more are planning to follow the suit. A number of computer and business magazines and almost all leading newspapers in the country are making their publications available over Internet (see Lakshmana Moorthy and Karisiddappa, 1998 for a detailed discussion). Some of these are even displaying advertisements.

The IT Action Plan recommended withdrawal of the monopoly of VSNL and participation of private industry in providing Internet services. Already Satyam Infoways, a subsidiary of Satyam Online, became the first private sector ISP from November 1998; it is offering Internet access from 12 cities spread over the country. With the government's acceptance of the Internet-friendly measures suggested by the IT Task Force, Internet usage in the country is expected to improve manifold.

2.3 India and E-Commerce

In tune with adopting other technologies, India embraced e-commerce late. When the second generation e-commerce is taking the developed countries by storm, India is slowly but steadily catching up with it. It is also a bliss in disguise; for, the initial problems faced in standardising various routines and protocols and the security considerations have not been felt by the country. As per the estimation of the Indian subsidiary of IDC, the value of e-commerce in India was about US$ 2.8 million in 1997 which is expected to reach US$ 160 million by the year 2001. Oracle Corporation plans to generate Rs 300 crore from India through e-commerce solutions by the year 2000. NASSCOM (1997, p. 98) estimates that by the year 2000, the Indian market for EDI solutions and services would be generating over Rs 500 crore annually.

E-commerce is the new buzz word in the Indian business industry. Observing the successful exploitation of Internet for promoting business across cyber space, many business firms in India are taking interest in e-commerce. Sinha and Tulasi (1998) provide a number of techno-commercial Web sites including those exclusively dealing with Indian scenario. Indian software industry took the lead in establishing Web sites and home pages for marketing Indian software products and value-added services. Many computer magazines and almost all leading newspapers in the country are available over the Net. Publication groups like The Hindu, India Today, etc are publishing Internet editions of all their publications. In Bangalore and Hyderabad, cinema tickets could be booked over Internet; fresh vegetables are being traded through the Net. MCDNET has been established by Manipal Control Data Electronic Commerce Ltd, a Bangalore-based company in collaboration with Control Data Systems of USA to offer e-commerce solutions in the country. Indian book publishers are also joining the race. The Chemicals and Allied Products Export Promotion Council (CAPEXIL) is launching a Web site which will support home pages of its members to display their company profiles and catalogues.

The computer-to-computer business transaction standard, EDI (a part of e-commerce), is gaining acceptance in India for both domestic and overseas transactions. EDI, coupled with bar coding technology and electronic funds transfer, is capable of drastically reducing processing time manifold besides financial savings. It is most suitable in cargo handling systems where a number of players, viz. banks, customers, Customs, cargo forwarders, transporters, and importing and exporting agents, are involved. With the active support of the EDI Council of Ministry of Commerce, Govt of India, for adopting EDI technology by all departments in foreign trade, the scenario is fast changing. In India, the current usage of EDI (among the various Internet services) is only 4 per cent and is expected to grow (NASSCOM, 1997, p. 111). VSNL is the first to start EDI services in the country in 1993 which installed an EDI system in Mumbai with access nodes at New Delhi, Calcutta and Chennai. EDI is being promoted to be adopted by all port trusts; Kochi Port Trust is the first to implement it. Apart from port trusts, the key players in EDI include BHEL, Electronic Research

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and Development Centre (ERDC, Calcutta), CMC, Customs and Director General of Foreign Trade (from public sector); and Tata-IBM, Satyam Infoway, WIPRO Infosys, etc (from private sector). The Federation of Indian Export Organisations (FIEO) is encouraging its members for switching to e-commerce as many overseas companies have started demanding that Indian exporters operate through EDI; and already a few cases were encountered where potential overseas clients declined to deal with the companies which do not have EDI facilities. Satyam Infoway (P) Ltd of Chennai is implementing a pilot project for the Indian auto-mobile industry with an EDI application which is also aimed at speeding up the transaction cycle in the industry. Eleven major companies are involved in it along with major automobile associations.

Internet banking has already been introduced in India for the first time an year back by the ICICI Bank, which in collaboration with Infosys Technologies, developed a software 'Infinity-Internet Banking, a complete online banking solution, wherein Internet can be used as a banking channel for retail and corpo-rate consumers. With this, the ICICI Bank joined a select group of banks in the Asia Pacific region (about 150) which have banking sites on Internet (Cyber-update, 1998, p. 69).

Apart from these developments, the IT Action Plan recently announced by the government (Govt of India, 1998), has also identified, among others, information infrastructure and e-commerce as critical areas for national needs. The Plan envisages training citizens in the use of e-commerce, tele-banking, tele-documents transfer, tele-library leading to IT-led economic development. Other salient points of the Plan related to e-commerce include :

(a)   Opening of Internet access points at all district HQrs by 26 January 2000,

(b)   Withdrawing the monopoly of VSNL for Internet access and allowing public/govt agencies to become ISPs,

(c)   Providing Internet access through authorised cable TV by ISPs without licensing fee,

(d)   Meeting data communication requirements for e-commerce and EDI by Department of Telecommu-nications (DOT),

(e)   Giving maximum flexibility in organising marketing of software packages through Internet, and

(f)   Creating 'Mega Web sites' on Internet servers located in India.

The IT Panel has also urged the Reserve Bank of India to allow use of international credit cards for IT-related purchases (thus enhancing the e-commerce) and also for accessing latest technology as soon as it is available.

At present, a few companies in the country are offering Web advertising services. The DSF Internet Services has exclusive advertising rights to two of the most popular Indian sites—the All India Radio and Doordarshan. The Web sites of IndiaWorld, Khel, Khoj, Dhan and NewsAsia of IndiaWorld Network, launched in August 1998 has generated Rs 5 lakh till November 1998 (Kaur, 1998, p. 76). Rediff On The Net is expecting hoping to sell Rs 5-5 lakh worth of books, music titles and hotel reservations per day within next six months and Mumbai Mart is targetting Rs 5-10 lakh per month (Financial Express, 1998).

3. INFORMATION INFRASTRUCTURE—INDIAN SCENARIO

The Govt is taking necessary steps to introduce IT Act to amend cyber-related laws and put forth legal amendments for facilitating effective trade on the Net. If the country has to penetrate the cyber commerce and retain a respectable chunk of the global e-business, it has to invest in advanced Internet technologies. This only would allow growth of meaningful Internet-based commerce. The following sec-tions examine the status of the computer and communication infrastructure currently available in the coun-try for doing business over Internet.

3.1 Growth of Computers

It can be said that indigenous computer industry had its beginnings in 1973 when the Electronic Corporation of India Ltd (ECIL) started manufacturing computers in the country. The industry has grown at an annual rate of about 10 per cent during late 1970s and only in 1985 the production of computers had

reached Rs 200 crore. Initially there has been a slow growth in the computer base; the country had an installed base of 120 computers in 1970 which reached a lakh by the end of Seventh Plan (1990). The economic liberalisation policies of the Government during the early 1990s boosted the growth of the computer industry in the country. Further, the computer industry got a shot in the arm from the New Computer Policy announced by DOE, Govt of India in November 1994. During the past five years, the computer hardware industry has grown at a compound average growth rate (CAGR) of 15 per cent and is expected to grow 46 per cent annually during the Ninth Plan. Table 1 provides details of computer hardware production and exports during 1988-97 (DOE, 1998, p. 70-71).

In the recent years, the production of PCs has registered a phenomenal growth. Table 2 shows the details of PC production in the country during the last four years (Dataquest, 1996-1998). The PCs segment of the computer industry has grown by over 25 per cent during 1997-98 (as compared to 1996-97). About 8,00,000 PCs were sold in the country out of which 6,20,493 were manufactured in the country. The PC/AT 286s disappeared from the scene in 1995-96; 386s in 1996-97, and 486s may disappear in the current financial year, if figures are any indication. Pentiums reached their zenith and may go into oblivion in a couple of years as Pentium Pros and PIIs are coming into the scene.

Penetration of PCs is an effective indicator of an information society. However, the PC density (PCs per 100 population) in the country is too low to be happy. This figure indicates the usage of PCs in various activities such as business, marketing, information retrieval, electronic messaging, e-mail, file transfer, etc and the extent of the diffusion of IT and of computer culture in the society. As per the International Telecommunications Union (ITU) data during 1995 India had only 0.1 computer per 100 people or 1 computer for every 1000 population (ITU, 1995).   The developed countries have 10 PCs and above per 100 population with USA and Switzerland leading the table with PC densities of 29.7 and 28.8, respectively (see Table 3) (The Observer, 1995). India ranks behind Hungary, Greece, Chile, Malaysia, Thailand, Brazil, China, etc.

The PC density reached to 2 per 1000 now (1998) and it has been proposed to improve this ten fold to bring the figure to 2 per 100 by the year 2008 (Govt of India,, 1998, p. 1). The installed PC base of the country at present at the current PC density works out to be 1.8 million (for a population of 90 crore) which is expected reach 10 million by the year 2000.

3.2 Communication Infrastructure in India

The communication network is the backbone for accessing and providing Internet services. The telecommunication network in our country is the monopoly of the government (DOT) till recently although the economic liberalisation has given way to a limited participation of the private sector in some areas. Plans are afoot for the involvement of private sector in the domestic long distance traffic by the year 1999 and international traffic by 2002. However, the quality of telecommunication services is poor and unreliable. Starting from 1991, private sector is involved in areas like telecom equipment manufacturing, value-added services, private networks in industrial areas, radio paging services, cellular services, etc. The announcement New Telecom Policy in May 1994 gave momentum to these efforts. The long distance network in the country has a total of 2,14,858 km of which the coaxial cable accounts for about 14.3 per cent (30921 route km). The microwave/UHF link accounts for 56.4 per cent (121072 route km); and the remaining 29.3 per cent (62865 route km) is optical fibre cable. The proportion of digital lines to the total telephone line network is 66 per cent (the rest being electro-mechanical) as against the world average of 61.9 per cent.

There were 1.3 million telephone lines in 1970 which almost doubled to 2.8 million lines in 1980 and 3.8 million in 1988. The number of telephone lines in 1991 crossed 5 million (5.07 millions to be exact) and in 1994 it was 8.03 million which rose to   11.98 millions in 1996. In 1995, India with 9.8 million lines ranked 14 in terms of total number of lines behind Spain, Brazil and Turkey. By the end of 1997, the country had about 14.54 million telephone lines and in the next 10 years 67.4 million lines would be added to the existing network (Deccan Chronicle, 1998, p. 4). An estimated 30-35 million lines would be added to the existing lines by the year 2002 making it to be among the six largest telephone networks in the world (Expert Group, 1996). The number of telephone connections grew at an average rate of 19 per cent between 1991-92 and 1995-96. This has resulted in considerable reduction in the waiting time for a telephone line. However, the waiting list still continues to grow; from 1.03 million lines in 1986 to 2.28 million lines in 1996. At present the waiting list corresponds to approximately one-fourth, i.e., for every 100 lines existing, 25 are in waiting.

The number of telephone lines per 100 population (known as telephone density or teledensity) in the

country is very small when compared to other developing countries like China, Mexico, Argentina, Brazil, etc. India had a teledensity of 0.4 telephones in 1988 (compared to 75 in the US, 65 in Japan, and 7 in Malaysia). This rose to 0.55 in 1990, 1.07 in 1994 and 1.29 in 1996 (compare this with 14.7 for Malaysia, 8.1 for Brazil, 4.7 for Thailand and 2.3 for China). According to the ITU (1995) report released in October 1995, the average teledensity of the world was 11.57. India had a teledensity of 1.07 in 1994, lower than the average teledensity (1.48) for low income countries (see Table 3; India ranked 39 in both PC density and teledensity. By the end of 1997 India had a teledenisty of 1.5 which rose to 1.6 in 1998; less than the neighbouring Pakistan (2.4) or Indonesia (2.4) and China (3.8). The aim of the government is to achieve a teledensity of 10 by the year 2007 (Chowdappa, 1998, p. 6).

While the number of telephone lines is on the increase with considerably reduced waiting lists and marginal qualitative improvements, the prices of the telecom services are extremely high when compared to world standards. A comparative and critical evaluation of local, long distance, leased line costs, personal Internet connectivity charges and international trunk calls has been done by Shah (1997). The high costs makes the Indian telecommunication services egalitarian or elitist and keeps these services away from common users of information. The high prices of leased lines (which is about ten times of international standards), closed user group policy prohibiting interconnection between any two computer networks, high license fee for e-mail providers (which in many countries is at nominal rates making individual users to pay literally nothing), the monopoly of VSNL and the DOT in making Internet available in the country are a few examples (Shah, 1997) which are not information user-friendly. These restrict the percolation of computer culture in the information society.

3.2.1 Telecommunication Technology Vision

Advanced telecommunications offer opportunities and benefits which have a direct bearing on the national economy. It is essential to allow private sector participation for better competition in telecommunication services; offer low-price interconnection privileges; deregulate e-mail, bulletin board and Internet services from the government purview and encourage dial-up services; and to promote Internet connections at low prices (Shah, 1997).

The technology vision for telecommunications for the year 2020 brought out by the Telecom Task Force set up by the Technology Information, Forecasting and Assessment Centre (TIFAC) of the Department of Science & Technology projects a three-fold increase in the current network size by the year 2002; 70 per cent of the network to be digital by the year 2000—cent per cent digital network could be expected only by the year 2015; tele-shoping, tele-banking, electronic payments and home banking services via online and videotext networks by the year 2002; wide spread use of broad band for ISDN applications, use of multimedia terminals to support video telephony and video conferencing applications on demand; entire switching system to be digital by the year 2000 with about 2 per cent to support ISDN; 2.5 Gbps capacity transport network backbone in metro cities, 622 Mbps in major cities, and 155 Mbps for international traffic; high capacity and almost synchronous optical network by the year 2015; services of high bandwidth with data applications including Internet; ISDN services including intelligence network services in cities and major towns by the year 2002 (TIFAC, 1997). It has also recommended deployment optical fibre in the national telecommunication network for reliable and high capacity services, evolving a mechanism to provide latest technology information to the R&D including complete information related to standards, patents and indigenous and foreign know-how.

3.3 National Information Infrastructure

India has a strong IT base with a CAGR of about 40 per cent over the last five years and accounts US$ 2.2 billion. About 15-20 per cent of computers installed in the country are connected to local areas networks which is expected to grow at a faster rate in the next 3-5 years. However, the IT diffusion in India is lower than other developing economies. This is because of low IT spending in the country (0.7 per cent as against 3-5 per cent of GDP for developed economies), high costs of technology, lack of inter connectivity between existing networks making non-utilisation of bandwidth, lack of IT education and training, and absence of a common agenda and thrust by government, IT industry and users. Although the PC density is rather low at present, if the recommendations of the IT Task Force including making computer hardware and software available to the students at Rs 20,000; providing Internet access through cable TV operators at Rs 12,000; and production of vital components like microchips and semiconductors in the country, the situation in bound to improve. The info-infrastructure drive of IT Action Plan targets 30 per cent annual growth rate from the 1998 level of fibre optic backbone of 75,000 route km. Steps are afoot to connect all

the state capitals and the 12 major cities through fibre optic links to facilitate long distance communication. The IT Task Force has made 18 recommendations covering bottleneck issues and promotional measures to improve the info-infrastructure in the country (Govt of India, 1998).

Although the benefits of National Information Infrastructure (NII) initiatives were well known from the experiences of such initiatives taken by developed countries, neither the government nor the industry made efforts in this direction in the country. Wide dispersion of education and training supporting lifelong learning, information network-based economic growth, improved communication links, research applications in engineering, healthcare, science and technology, etc. are some of the major benefits of NII initiatives.

Towards strengthening the information infrastructure in the country, the Ninth Five Year Plan (1997-2002) for Electronic Industry (DOE, 1997) suggested an Action Plan and constitution of an NII Commission comprising a Policy Making Board and an Executive Board. While the first two will be headed by the Prime Minister and the Executive Board will be chaired the Cabinet Secretary. Formulation of a National Information Policy and amendments to the existing acts and enactment of new laws encompassing intellectual property rights, IT and EFT are some of the other suggestions. The implementation of NII is proposed in phases; at the Block Level by Ninth Plan, and at the Panchayat level in the following five years, at an estimated cost of Rs 1000 crore. The Plan also recommends taking a pilot project of about 50 blocks with a budget of Rs 10 crore to demonstrate the benefits of NII (DOE, 1997).

The existing 22 Mbps bandwidth at major Internet hubs located at Bangalore, Delhi and Mumbai is inadequate to support growing traffic. The NII Action Plan envisages building up of the NII backbone with 2.5 Gbps in phases by 2000. The government is working on this national Internet backbone at an estimated cost of Rs 85 crore. This is expected to serve over one million subscribers in more than 100 cities. Other salient points of the NII 2000 Action Plan include inter connection of networks, PC penetration, ERNET upgradation, e-commerce and regulatory and legal framework (DOE, 1998, p. 37). The Vision for 2020 of TIFAC forecasts that in the next 5-10 years time the technologies like (a) debit cards for EFT at point of sale, (b) smart cards with built-in microchips for electronic cash etc, (c) EDI for EFT at point of sale; smart cards with built-in microchips for electronic cash etc, (d) and EDI for paperless banking transactions, will be introduced in the country (Abdul Kalam and Rajan, 1998, p. 184). All these measures are expected to accelerate the march towards e-commerce.

4. CONCLUSION

The IT Action Plan, when fully implemented, is going to change the existing scenario. The cent per cent depreciation on IT products and software would further enhance penetration of PCs in the society. Use of cable TV means reaching of over 15 million users without any problem of bandwidth. When DOT meets the data communications requirements for e-commerce and EDI, the implementation of EDI across the country will speed up and exporters would be enthused to shift to e-commerce faster. Use of international credit cards over Internet for IT-related transactions, as and when permitted, by the Reserve Bank of India, for transactions of other goods would definitely have a major impact on e-commerce. Setting up of national level Information Security Agency; formulation of National Policy on Information Security, Privacy and Data Protection Act; and modification of the Indian Telegraph Act of 1885, the Indian Post Office Act of 1888, and the Indian Wireless Telegraphy Act of 1993, are all would improve the status of e-commerce in the country.

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APPENDIX

The following list provides important players in Electronic Commerce. The list is indicative only and is not exhaustive. Some of the firms may be involved in more than one category listed below:

Credit/Smart Cards

Card Service International (www.cardsvc.com)
Icverify Ind (www.icverify.com)
PaylinX Corp (www.paylinx.com)
Mondex (www.mondex.com)
Visa International (www.visa.com)

Electronic Commerce Security

Cylink Corp (www.cylink.com)
NetMarket (www.netmarket.com)
RSA Data Security Inc (www.rsa.com)
Sun MicroSystems (www.sun.com)
Terisa Systems (www.terisa.com)
VeriSign Inc (www.verysign.com)

Electronic Currencies/Payment Systems

Checkfree Corp (www.checkfree.com)
Click Share (micro payment system)
CyberCash Inc (www.cybercash.com)
DigiCash bv (www.digicash.com)
First Virtual Holdings Inc. (www.fv.com)
Mondex USA (www.mondexusa.com)
NetCash/NetCheque (gost.isi.edu/info/NetCheque)
VisaCash (www.visa.com)

Financial Institutions

Bank of America (www.bofa.com)
Bank of Montreal (www.bmo.com)
Citibank (www.citibank.com)
Master Card International (www.mastercard.com)
Security First Network Bank (www.sfnb.com)
Visa International (www.visa.com)

Hardware/Software Support

BroadVision Inc (www.broadvision.com)
Hewlett-Packard (www.hp.com)
MegaWeb Inc (www.dynamicweb.com)
Microsoft Corp (www.microsoft.com)
Netscape Communications (www.netscape.com)
Premenos (www.premenos.com)

Online Shopping Catalogues

All-Internet Shopping Directory (www.all-internet.com)
Altavista (www.altavista.digital.com)
America Online (www.aol.com)
Galaxy/WebCrawler (www.webcrawler.com)
InfoSeek (www.infoseek.com)
Internet Shopping Network (www.internet.com)
Lycos (www.lycos.com)
World Avenue of IBM (www.ibm.com)
Yahoo (www.yahoo.com)

Periodicals Published

Electronic Commerce World (momthly)
International Journal of Electronic Commerce
The EM-Electronic Markets Newsletter (quarterly)
(www-iwi.unisg.ch/iwi4/cc/em/emnewsl.html)

Table 1. Computer hardware production and exports (Rs in crores)

Year	Production	Export
1988	486	137.8
1989	700	243
1990	820	297.5
1991	830	177
1992	1205	260*
1993	1342	420*
1994	1775	600*
1995	2015	775*
1996	2500	932*
1997	2700	1250*

* Turnover during financial year

Table 2. Production of PCs in the country during the last 4 years

PC type	1994-95	1995-96	1996-97	1997-98
286	6185	—	—	—
386	110859	37510	—	—
486	116049	268091	167028	58570
Pentium	897	53076	277396	441100
Pentium Pro II	—	—	1000	85277
Laptop/Notebook	4500	11329	15960	25546
Macs	6310	13000	6003	10000
Total (Desktops)	2,44,800	3,83,006	4,67,387	6,20,493
Non-servers	3074	2990	—	—
Workstations	3483	2548	3676	4582

Servers	17216	28851	66520	17650

Total	2,68,573	4,17,395	5,37,583	6,42,725

Table 3. Density of telephones and PCs of selected countries

Country	Telephones	PCs
Sweden	68.3	17.2
Denmark	60.4	19.3
Switzerland	59.7	28.8
United States	59.5	29.7
Australia	49.6	21.7
Britain	48.9	15.1
Greece	47.8	2.9
Singapore	47.3	15.3
Belgium	44.9	12.9
South Korea	39.7	11.2
Spain	37.1	7.0
Czech Republic	20.9	3.6
Hungary	17.0	3.4
Argentina	14.1	1.7
Malaysia	14.7	3.3
Mexico	9.2	2.2
Brazil	7.4	0.9
Thailand	4.7	1.2
China	2.3	0.2
Philippines	1.7	0.6
Indonesia	1.3	0.3
India	1.1	0.1