OPPORTUNITIES FOR CANADA IN INDIA'S ELECTRONICS, COMMUNICATIONS AND TELECOMMUNICATIONS SECTORS

External Affairs and
International Trade Canada

Canada

REPORT ON OPPORTUNITIES FOR CANADA IN INDIA'S ELECTRONICS, COMMUNICATIONS AND TELECOMMUNICATIONS SECTORS

FOREWORD

Canada is a pioneer in telecommunications and Canadian ingenuity has been put to the service of a large part of the world. Telecommunications and Electronics have now been identified by India as key sectors in overall developmental strategies. *The Commercial Section of the Canadian High Commission, New Delhi has been closely monitoring India's plans in Electronics, Communications and Telecommunications Sectors. In their endeavour to assist Canadian companies in exploiting this potential a sectoral study was commissioned for providing closely integrated and focussed services to Canada's business community.*

This report will acquaint Canadian companies with the Indian Electronics and Telecommunications scenario. It is also designed to provide an insight into potential business areas. We hope that this report shall act as a catalyst for Canadian companies'involvement in India's endeavour to enter the 'information age' with a state-of-the-art telecommunications network.

The report has been prepared for the Commercial Section of the Canadian High Commission, New Delhi by:

Datamation Consulting Inc.

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PART I
OVERVIEW

INDUSTRIAL INFRASTRUCTURE, GEOGRAPHIC DISTRIBUTION, NATURE OF INDUSTRY

The Telecom Sector has been accorded top priority by the Government of India. The earlier growth based on imported technologies was slow and did not keep pace with the rest of the world. The reasons were:-

. *Old generation technologies offered by international suppliers.*
. *Inadequate investments for upgrading and adding new products.*
. *Bureaucratic production management and lack of expertise.*

The telecommunications network at the time of India's Independence was absolutely primitive.

The Telecom and Electronics Industry is concentrated mainly in the Southern part of India, though some of the terminal and transmission equipment manufacturing units were set up later in other parts of the country as well. Indian Telephone Industries(ITI) was set up in Bangalore in 1948 and has been a major supplier of telecom equipment to the Department Of Telecommunications(DoT) since then. Manufacture of strowger exchanges have been started in collaboration with Automated Test Engineering(ATE) of U.K.and VFT systems based on the design of the Telecom Research Centre(TRC), the R&D wing of the DoT. The DoT inducted coaxial cable system, Microwave Systems and Pentaconta cross-bar Systems in the sixties. Two manufacturing units; Hindustan Cables Ltd for manufacture of various types of cables in collaboration with STC of UK; and Hindustan Teleprinters Ltd(HTL) for manufacture of teleprinters in collaboration with Olivetti of Italy were set up. The manufacture of cross-bar exchange equipment was started in collaboration with Bell Telephone Manufacturing(BTM), Belgium at ITI. Initially the microwave system equipment was imported from NEC, Japan and Telettra, Italy.

The Government of India in 1981, decided to introduce digital mode of switching and transmission. A collaboration was finalised with CIT-Alcatel of France for technology transfer linked manufacture of E-10B digital local and trunk exchanges. A collaboration was also finalised with NEC of Japan for manufacture of digital microwave systems. In the early eighties India entered the optical fibre field in collaboration with NKT of Denmark. The mobile telephones and paging services were started in 1987. Cellular telephones were introduced in metropolitan cities on experimental basis. The Centre for Development of Tele-matics(C-DoT) was established in 1984 to develop indigenous design for large digital main automatic telephone exchanges(MAX) upto 20,000 lines and 512 lines rural digital automatic telephone exchanges(RAX).

India entered the field of satellite communication a decade ago. An experimental Packet Switched Data Network(PSDN) was introduced few years ago. The Department Of Space directly implements and monitors all Space Communications and Remote Sensing Programs. The main thrust of the Indian Space Program has been the establishment of national systems using space technology for television, telecommunications, meteorology and remote sensing for the survey, monitoring and management of natural resources and the environment. INSAT-1 and INSAT-2 series of multi-purpose satellites have been launched. The Indian Remote Sensing Satellite IRS-1A is the first of a series of satellites to form the space segment of the country's National Natural Resources Management System(NNRMS).

Unfortunately India's communications satellite programme, INSAT, seems to be suffering from a number of calamities. The Satellite INSAT I-A was a total loss in 1982, INSAT I-B is reaching its end of life and may be unusable in a while. The INSAT I-C lost half its capacity soon after launch due to a faulty power bus. The INSAT I-D that was to be launched about a year ago has been delayed by a further four to six months(from now) and in the meanwhile the INSAT I-C has been lost track of. Now India has two

alternatives-get leased space segment from INTELSAT or obtain it from the nearest regional organisation, the Arab Communication Satellite (ARABSAT) system. The INSAT I-D has since then been successfully launched in the month of June 1990. The INSAT I-D is expected to be used extensively for meteorology and remote sensing for the Survey, monitoring and management of natural resources and the environment.

The telegraph network in the country is still primitive. A decade ago Store and Forward Telegraph(SFT) system was introduced. The 16 ports equipment was designed and manufactured by the Electronic Corporation of India Ltd (ECIL) at Hyderabad. The telegraph network is wholly owned and operated by the Ministry Of Communications.

The Department of Electronics(DoE) has been entrusted with the development of Electronics, Control Instrumentation, Robotics, Artifical intelligence. All imports in these sectors are regulated by the DoE.

MAJOR INDIAN COMPANIES, RESEARCH CENTRES, GOVERNMENT INSTITUTIONS, AND END USERS

MAJOR INDIAN COMPANIES

The ITI started production with strowger equipment, and later switched over to Pentaconta cross-bar equipment and digital E-10B exchanges. The ITI is also manufacturing various types of transmission and terminal equipment. Bharat Electronics Ltd(BEL)Bangalore, and ECIL are manufacturing microwave systems and telex equipment in collaboration with Siemens. In the last few years,major state Governments have set up Telecommunications and Electronics companies with an objective of manufacturing and marketing professional electronic equipment and components. The communications needs of the Indian Armed Forces are being met by indigenous sources namely BEL, Hindustan Aeronautics Ltd(HAL), ITI, ECIL etc.

For telephone instruments, three technologies Siemens,Ericsson and Face of Italy have been standardised. Several companies are making telephone instruments under licence, using the above technologies and production is adequate. For the PABX,three technologies have been standardised. These are OKI,GTE and Jeumont Schneider. HTL was entrusted, with the production of modems upto 300 bauds. Private Sector has started manufacturing modems of higher ratings now.

RESEARCH CENTRES

The R&D activity in India basically started as an import substitution exercise for items having sizeable demand. The research and development in the telecom sector has been primarily undertaken by the TRC. The industrial research in the telecom field has also been undertaken by Central Electronics Engineering Institute(CEERI), Pilani; National Physical Laboratory(NPL), New Delhi; Railway Design Standards Organisation(RDSO), Lucknow etc.Recently the TRC has been re-constituted and merged with the C-DoT. The Telecom Engineering Centre(TEC) has been assigned the mandate of providing high technology inputs to the DoT. Indian Space Research Organisation(ISRO), Bangalore also undertakes research and development activities in frontier areas of space science and technology. The United Nations Development Program(UNDP) and its technical consultant, the International Telecommunications Union(ITU), have provided support in developing the facilities for the Satellite Instructional Television Experiment(SITE). India has benefitted from the help provided by a number of countries, particularly Canada, UK, USA, FRG, USSR, France, Japan for various space programs. *The priority given to R&D has enabled India to develop several sophisticated technologies indigenously and in the process strengthen the local industrial base.*

R&D activities in Electronics are also being undertaken by ITI, HAL, BEL, ECIL; it is also being done by Educational Institutions: Indian Institute of Technology(IIT), Delhi, Bombay , Madras; Centre For Artifical Intelligence and Robotics, Bangalore; Centre For Information Research, Trivandrum; National Centre for Software Technology, Bombay; Centre for Development of Advanced Computing(CDAC) and various universities. The research and development needs of Indian Armed Forces is the responsibility of the Defence Research and Development Organisation (DRDO),New Delhi which is a part of the Ministry of Defence.

The R&D activity in the field of medical electronics is mainly being carried out at the following institutions: Central Scientific Instrument Organisation(CSIO), Chandigarh; Defence Bio-Engineering and Electromedical Laboratory (DEBEL), Bangalore; Bhabha Atomic Research Centre(BARC), Bombay; IIT, Delhi, Bombay, Madras; Indian Institute of Science(IISC), Bangalore.

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GOVERNMENT INSTITUTIONS AND END USERS

The operation,provision and maintenance of public telecom services is the responsibility of the DoT. In the last few years however,some of the bulk users of the telecom services,have built up their own networks. As a policy they are not linked to the public network. Largest among such networks being used are Indian Railways,Defence, POWERNET-the network for the power segment commissioned by the Central Electricity Authority(CEA), OILNET-the network for the oil sector commissioned by the Oil and Natural Gas Commission(ONGC), SAILNET-the network for the steel sector commissioned by the Steel Authority Of India Ltd(SAIL). An autonomous Corporation called the Mahanagar Telephone Nigam Ltd (MTNL) was carved out of the DoT by the Government few years ago to provide telecom services for Delhi and Bombay. The other metros will eventually be covered under MTNL.

The Government Sector including Defence is likely to account for the bulk of requirements in Electronics, Process Control and Instrumentation, Artifical Intelligence and Robotics. The contact details of major end users have been highlighted in Appendix-II.While core sectors including Defence, Petroleum and Petrochemicals, Railways, Civil Aviation, Energy (both thermal and hydel), Heavy Engineering still constitute 80 per cent of the demand a small but nevertheless very strong private sector is emerging as a potential buyer.

GOVERNMENT OF INDIA POLICIES: PRIORITIES, IMPEDIMENTS, LICENSING AND JOINT VENTURES

GOVERNMENT OF INDIA POLICIES AND PRIORITIES

Technological self reliance is the key element of India's policy. The development of indigenous technology also entails risk of failure or delay. Hence telecom has to steer the course between self reliance and modernisation. Foreign investment is only regarded as a necessary vehicle for the transfer of technology for modernisation of different industrial sectors in India.

The Government of India has been pursuing a selective policy towards foreign collaborations and investment. The Government intends to channelise such investments into areas which require sophisticated technology, where critical production gaps exist or which would help in increasing India's export potential.

Recently there has been a relaxation in the restrictive attitude towards foreign investments and collaborations. Various steps have been taken to minimise constraints faced by Foreign Investment proposals. Attempts have been made to streamline approval of foreign collaborations and eliminate delays. Conse-

quently the rejection rates in foreign collaboration approvals has come down from 30 per cent to around 5-8 per cent.

In the recent years the manufacture of terminal equipment including telephone instruments, PABX's and other accessories has been opened up for the private sector; including joint-sector companies with Government or foreign participation. The manufacture of all types of transmission equipment is the exclusive domain of State Sector and so far no privatisation has been permitted.

The new telecommunications policy expected to be announced shortly will stress reliability and improvement of customer service as its basic goal. Keeping this objective in view the policy has been broken down into general thrust areas such as accessibility, reliability and rural communications. These areas have been further divided into sections on technology, production, services and finance. In the field of technology, the policy is expected to stress indigenous development including design. The thrust on indigenous development of technology is likely to result in a boom in the indigenous telecom equipment industry. Production is expected to rely on decentralised and deregulated manufacturing policy.

LICENSING AND JOINT VENTURES POLICIES

The Department Of Telecommunications, Department Of Electronics and Department Of Space which are the Administrative Ministries for all sub-sectors covered(See Part II) have been delegated with the authority to approve a collaboration, involving an outflow of not more than US $ 10 million in foreign exchange and without any foreign equity participation. The rules concerning payments of royalty and lumpsum technical fees have also been relaxed. Tax rates on royalties have also been reduced. Even a general ceiling of 40% on foreign equity participation has also been relaxed on merits of individual proposal. Some of the high technology areas have been delicensed and it is envisaged that the open door licensing policy shall continue.

The industrial and foreign investment policy presented recently delicenses all new units up to an investment of US $ 14 million in fixed assets in urban areas and US $ 43 million in industrially backward areas. The 100 % export-oriented units(EOUs) and units to be set up in export processing zones(EPZs) are also being delicensed up to an investment limit of US $ 43 million. The liberalised norms for foreign collaborations include automatic clearances up to 40 per cent foreign equity, easier norms for import of capital goods, raw materials and components. The most significant change is with respect to the transfer of technology. Henceforth, an entrepreneur, if he considers it necessary, can conclude an agreement with the collaborator without obtaining any clearance from the Central Government. However, this is subject to the condition that the royalty payment does not exceed five per cent on domestic sales and eight per cent on exports. In case the import of technology involves lumpsum payment, the proposal will require the Government's clearance but the decision will be communicated to the concerned entrepreneur within a period of 30 days. An entrepreneur can import up to 30 per cent of the total value of the plant and machinery(as long as it is in the imports permissible list) required by the unit as capital goods. While raw materials and components on Open General License(OGL) will not be included within the 30 per cent limit, import licensing procedures will continue to operate for all licensable items.

The policy changes have been effected with an objective of making the Indian Industry more competitive internationally.

Technical collaboration normally involves:

-Knowhow transfer fee in foreign exchange
-Supply of drawings and technical documentation
-Training of Engineers in various facets of the technology
-Visit of collaborators for installation, commissioning, training etc.
-Supply of capital equipment after assessing local availability
-Supply of raw materials after assessing local availability
-Royalty payments in foreign exchange

All payments shall be made in foreign exchange. The setting up of joint ventures would involve:

-Equity participation not exceeding 40 per cent, relaxable on merits of individual proposal
-Repatriation of profits as per approvals given by the Government
-Supply of capital equipment after assessing local availability
-Supply of raw materials after assessing local availability
-Flexibility to repatriate capital in event of disinvestment

The Government is expected to approve foreign collaborations for most of the areas of identified opportunities for Canadian companies.

IMPEDIMENTS

Canadian companies are however likely to encounter extremely tough competition from various multinationals operating in India for the last several years. The possibility of a return to a closed door policy for foreign collaborations, though remote, cannot be ruled out.The shortage of foreign exchange curtails the imports. The balance of payments position being precarious, the Government shall continue being restrictive for outright imports of equipment and technology.

EIGHTH FIVE YEAR PLAN AND ITS EFFECT

The Eighth five year plan(1991-1995) is still in the process of being finalised by the Government. It is difficult to estimate at present the precise plan allocations.However a perspective plan was made in 1983 by the Telecom Mission covering the period upto 2000. *The following objectives have been set to be achieved by the year 2000 :*

1. **20 million Telephones**
   To provide 20 million telephones and to provide telex connections on demand.Assuming a population of 100 million in the country by the year 2000 of which only 25% will be urban, and the rest rural. It was estimated that 20 million direct exchange lines will give a density of about 20 per 100 in metropolitan cities and less in smaller centres.
2. **Phone for Every Village**
   To extend the telecom services to every village by providing atleast one public payphone.
3. **Public Payphones for Urban Areas**
   To provide adequate payphones in the urban areas, within easy reach of people who cannot afford to have a telephone.
4. **Subscriber Dialled Calls**
   To build up such type of network that subscriber calls flow freely.
5. **Business Subscriber Network**
   To build up a comprehensive voice and data network for the industry compatible with similar international networks.

The interim review of the Seventh plan has indicated that the DoT has exceeded the Seventh Five Year Plan targets in the first four years of the plan itself.The momentum generated shall affect the Eighth Plan. Some of the major developments expected in the Telecommunications/ Communications/ Electronics sectors are as under:-

-All exchanges are expected to be electronic by the end of the 8th plan.According to the Planning Commission the existing level of 5 million telephone sets is expected to go up to a total of about 12 million telephone sets.

-Trunk automatic exchanges during the 8th Plan will require around 300,000 trunk exchanges.

-Telex equipment demand of 40,000 expected.

-To reach the target of 20 million telephones by 2000, India will need around US $ 500 billion worth of combined investment from domestic and international sources.

-A growth of about five times expected for micro-electronics, which are imported almost in bulk. Investment expected to the tune of US $ 1.16 billion.

-In Office automation equipment,total requirement is expected to the tune of over US $ 1.45 billion for Plain Paper Copiers and US $ 348 million for cash dispensors and US $ 406 million for electronic typewriters.

-Computers are expected to maintain a sustained growth and to reach US $ 750 million. PCs and micros requirements are expected to be tremendous. The demand for the low priced PC by the end of the decade is expected to be 500,000. Almost 300,000 PCs will be required for educational purposes covering around 30,000 schools. From the existing requirement of 600,000 PCs per annum the requirement by the end of the eighth plan would be 645,000 PCs per annum. A large number of peripherals will be required viz.disc drives, floppy drives, streamer drives, dot matrix printers, line and laser printers, digitisers, plotters, monitors, keyboards and mouse.

RECENT DEVELOPMENTS

The new Government appointed a thirteen member high level Committee to examine the working of the C-DoT. The report indicted the C-DoT for its various lapses,though four members dissented. The report points out that the 5,000-line exchange won't be ready for commercial production before 1992-93; and it has criticised the C-DoT for not being able to start commercial production of the 40,000-line exchange by 1987 as promised. The C-DoT has not yet started work on developing a central module-which connects different exchanges to one another-and an input-output processor which stores billing information in the computer. The C-DoT has also progressively reduced the specifications for busy-hour call attempts from 28 million in 1986 to 18 million in 1990. The Committee pointed out that despite its anti-imports stance, the Telecom Commission has not taken any action against CIT-Alcatel even though the company refused to upgrade the technology it supplied 'free of cost'as specified in an agreement with the ITI. The C-DoT also signed an agreement with the US-based Trans Tech for the development of cellular phones at US $ 2.4 million, though it has always been critical of the project on elitist grounds. The C-DoT has been asked to start work afresh on the design of a large electronic switching system. The delay of more than two and a half years to develop the exchange has already cost ITI, a whopping US $ 870 million.

Presently the merger of the DoT and DoE is being speculated in various echelons of the Government. The C-DoT was entrusted with TRC's mandate after it was disbanded. The revival of TRC is also being reviewed to strengthen R&D activities once again. The merger of the DoT and DoE with the Ministry Of Industries is also being considered. The final outcome is anybody's guess. Nevertheless these speculations have added new dimensions to the telecommunications scenario.

The C-DoT setback has created a sudden void in India. If Alcatel or MNCs like Ericcsson, AT&T, or Canadian leaders like Bell Canada or Northern Telecom submit a technically and financially attractive offer (which will fit into the bilateral trade arrangement) for the updated E-10B version(meeting 800,000 BHCA), it is expected to be approved by the Government. The collaborator can expect atleast 5 per cent royalty for eight years apart from major supply of production equipment and type-approved components for a long time.The royalty alone on 2 million lines at US $ 500 per line giving total sale value of US $ 1 billion works out to US $ 50 million per annum for the four ESS factories.

The recent policy on licensing for components needed for critical applications marks a major policy reversal. The leading edge technologies have been delicensed with an objective of achieving effective import substitution in the long run. It has been perceived by the Government that if the telecom and electronics sectors have to be modernised, then liberalisation will have to be introduced at all levels

The Import policy announced for 1990-1993 has made a number of provisions for meeting the import needs of the Telecom and Electronics Sectors.No items of machinery or equipment from the telecom sector has been prohibited for import. *The Import policy of India provides for licence free importation of machinery for manufacture of Electronics and Telecom equipment and components under the Open General Licence (OGL) facility. This is applicable only to Union and State Governemnt Departments including companies set up by them. The R&D Institutions have also been given liberal provisions to import.* All imports are however regulated by the foreign exchange available with the respective Ministries.The customs duty for imported equipment varies. The policy provides for Licence Free Imports for computers and peripherals of minimum configurations and Electronic Process Control and Instrumentation. A liberal policy has been adopted for allowing imports of Electro- Medical equipment for actual users as a majority of these equipment are life saving and essential. The list of items allowed for import has been indicated in Appendix-I.

It is being speculated that the Government may introduce a new policy for telecommunications and electronics sectors. Though most of the key officials interviewed for this report were of the view that the liberalisation will continue(infact even the transmission manufacturing is expected to be privatised with foreign collaborations); drastic policy revisions are not ruled out.

ENTERING THE MARKET AND COMPETITION

Major suppliers of telecom equipment are NEC, OKI, Fujitsu, Mitsubishi, CIT-Alcatel, STC, Farrinon and Ericsson.The communication equipment suppliers have traditionally been Marconi, Motorola, NEC, Radifon, REPCO, Racal etc.The communication system equipment suppliers have been GTE, CSF Thompson, Olivetti, Nixdorf, Racal Milgo etc.The role of the foreign companies is identified with the following areas:-

(1) Supply of equipment against competitive global tenders.
(2) Setting up of joint ventures with equity participation.
(3) Transfer of technologies against term payments or royalty.
(4) Supply of equipment against long term loan lease.
(5) Assistance in imparting training in hi-tech areas.
(6) Consultancy.

The first area remains open as long as the Government needs to import equipment. Bulk imports have been based on the aid from the World Bank and International agencies: IDA, ODA, OCEF, IMF, ADB etc. *The successful multinational companies have been active in India for a long time and have made concerted efforts to carve out a niche for themselves in a highly competitive environment. Close monitoring of frequent policy changes have enabled them to plan out their business strategies. Most of them have capitalised on Government's liberalisation policies. Long term collaboration agreements have been executed for most of the equipment required by the DoT.* Imports have been generally made on adhoc basis. Since the partial liberalisation of the telecom sector, imports have increased substantially. India imports mainly from developed countries and particularly from Europe (US $ 270 million in 1985). This increased to US $ 314 million in 1986 and to US $ 550 million in 1987. The import figures for 1988 and 1989 are still being compiled but are projected at US $ 632 million and US $ 1.09 billion respectively. *The indigenous production has been increasing by*

almost 15 per cent per annum. In 1986 the value of equipment manufactured in India was estimated at US $ 650 million, which increased to US $ 800 million in 1987 and to US $ 1 billion in 1989; a trend that compares favourably with the global trading in telecom equipment.

Major multinationals consider 15 per cent annual growth since 1985 a vital indication of the potential of telecom market in India. They are confident that a very large market is being opened up. In fact Indian market should witness a five-fold increase in imports in the near future. To reach the target of 20 million telephones by 2000 India will need around US $ 500 billion worth of combined investment from domestic and international sources.

UK doubled its trade with India in 1987. Sweden registered an 18-time increase. Similarly France has also doubled its sales to India in 1987 over its previous records. Canada achieved a target of over US $ 6 million in 1988 in the sales of telecom equipment.

Canadian companies should make serious efforts to capture market share. They should participate in global tenders, establish long term collaboration arrangements including joint ventures and technology transfer. As there is vast potential in almost all the sub-sectors covered in this report, they must have an effective local representation. Some of the major buyers have been included in Appendix-II with their contact details.

LOCAL REPRESENTATION

The Telecom Sector in India is very competitive and volatile, depending on political, bureaucratic and administrative vagaries. A streamlined local representation in India is critical to ensure early market intelligence and chalking up of appropriate follow-up strategies as well as to ensure long-term presence in the market. The ideal arrangement shall be collaboration with an Indian company as a licensing recipient or as a joint venture partner. The success of a collaboration is a long drawn out process depending upon mutual trust and confidence.

It is generally not possible to obtain tender documents from outside India without local assistance. Thus local assistance is needed for building contacts and relationships in an environment which is absolutely bureaucratic, slow and needs personalized attention. Due to political reservations it is not advisable for agents to deal with the defence sector. The Canadian High Commission in New Delhi and the Canadian Consulate in Bombay can assist in identifying suitable local support staff and joint venture partners.The contact details have been indicated in Appendix-III.

PART II

SUB-SECTORS AND OPPORTUNITIES FOR CANADIAN FIRMS

PRIVATE NETWORKS

These are being established by organisations having large exclusive operations. Several companies made ambitious plans for networking but abandoned them later because of the prohibitive costs.

In early 1984 Indian Airlines with an investment of over US $ 100 million, installed the UNIVAC system to solve their communication problem relating to over 30,000 reservations per day. Some of the newspapers to enable immediate reception, are installing their own networks to connect their headquarters with regional offices. The Global Telecommunication System (GTS) overseen by the World Meteorological Organisation(WMO) from its headquarters in Geneva has a regional telecom centre in New Delhi which is linked through the network. The National Informatics Centre's NET(NICNET) set up by Government of India to link the revenue districts with an objective of making the planning process more effective and mass responsive has already covered 340 districts out of 438 districts in India. The other networks in the country including SAILNET, OILNET, POWERNET are slated to become the sub-networks of NICNET.

Specific opportunities exist for the following:

*Audio/Video switcher; Fibre-optic transmission of video signals.
*X.25 Packet Assembler/Diassemblers(PADS) and statistical multiplexer.
*Maintenance of fibre-optic,twisted-pair and coaxial communication systems.

Canadian companies should offer these technologies under licensing arrangements. Outright imports are likely to be insignificant due to the balance of payments position. Nevertheless Canadian companies should compete for the various global tenders and carve out a niche in the growing imports market.

ORIGINAL EQUIPMENT MANUFACTURERS

The original equipment is being manufactured under license by multi- nationals: CIT-Alcatel, NEC, NKT, Olivetti, ATE, BTM and has enabled the country to achieve self-reliance in most of the bulk requirements. The ITI has also started manufacturing some of the exchanges designed by the C-DoT.

Specific opportunities exist for the following:

FIBRE-OPTIC SYSTEMS AND COMPONENTS

*Fibre-optic local network providing multi-vendor interconnection.
*Optical coupler,optical line terminating equipment.
*Single-mode and multi-mode transmission systems for video, data and voice, expandable 20-port optical transmission multiplexor plug-in configurable for digital data or analog interfaces, micro-portable fusion splicer, optical-fibre cable, optical attenuation test equipment

KEY SYSTEMS

*Line sensing relays, Ringer isolators, Communication Switches.
*Automatic ground start unit for PBX power fail mode.
*Radio spectrum monitoring systems for UHF and above.

MICROWAVE SYSTEMS COMPONENTS

*Microwave multiplexing and switching subsystems, multi-octave amplifiers.
*Surface components and subsystems with signal processing capability
*Passive microwave products: waveguide and coaxial circulators, isolators and isoadaptors.
*Components for microwave networks and subsystems (diplexers), antenna, transmission systems, filters, couplers and attenuators.
*Film/soft substrate materials for antennas and planar circuit applications.
*Fixed-gain and variable-gain RF amplifiers and a multipoint TDMA systems designed for use in thin-to-medium density routes.

MULTIPLEX

*Control Systems for radio and telephone communications.
*Marine simulators and Horizon Reference Systems.

ELECTRONIC MAIL AND MESSAGING SYSTEMS

*High-quality computerized voice-information systems.
*Video information network, combining TV quality images, high resolution graphics, touch screen menus and software.
*Multiple access digitized voice system integrated with computer and telephone systems to provide high-quality voice response storage and retrieval.

Canadian companies ought to tie up with the Indian counterparts for the manufacture of original equipment under license. The World Bank-funded ninth telecom project is expected to create several outright import opportunities for Canadian companies. The foreign exchange expenditure to the tune of US $ 438 million is expected to be used for the import of satellite based data networks, switches and peripherals for the packet switch network. Thus Canadian companies should identify the leading edge technologies which could be offered to India for import in the short term and plan effective strategies.

CONSULTING SERVICES

The Telecommunication Consultants India Ltd(TCIL), has been set up to offer turnkey telecom Consultancy Services to overseas clients apart from providing services to customers in India. A Subsidiary of TCIL, Intelligent Communication Systems Ltd specialises in computer communications. The DoT can also sometimes obtain the services of a Consultant. It is possible that some technologies: Cellular systems for example, may need assistance of an external consultant. Similarly the development and implementation of specialised software has potential.

It is estimated that in future consulting support might be needed in the following areas:
*Flight dynamics software particularly for military communications satellites; Spin stabilized satellites and ground control system.
*Satellite station-keeping strategy,transfer and geostationary manage ment studies.
*Mobile Communications Satellite and Communication receivers and channel amplifiers.
*Low cost earth stations particularly for rural telecommunications.
*Video teleconferencing equipment and turnkey management.
*Advanced communication architecture and standard protocols including advanced international videotex protocols development.

Due to the precarious balance of payments position it is unlikely that Consulting services will be hired from abroad. Nevertheless Canadian companies should endeavour to finalise technology transfer arrangements with the DoT, TCIL and other organisations for implementing the above opportunities. There is considerable scope for Canadian companies to finalise JVs for consulting services.

NETWORK MANAGEMENT

The Public Switching Telephone Network(PSTN), still employs obsolete electro-mechanical exchanges such as cross-bar/strowger making the public networking system inefficient resulting in frequent break-downs and high noise levels. These problems are eliminated in the Private Networks. India can gain a lot from the Canadian expertise i efficient network management. It is being realised in India, that Management of network requires full range of activities, from fundamental plans (which shape the network for the next several years) to minute-by-minute decisions in response to network crises. Whole series of standards that ensure national and international standards, have to be taken into account. Engineering and installation have to be complemented with Operational Support Systems. An efficient network should perform at its maximum capability even in adverse operational conditions.

Though a few private networks are operational, turnkey support in network management remains a very weak area. Opportunities exist for Canadian Network Consulting Companies to offer support as well as supply equipment expected to be imported against foreign exchange reserves. Thus Canadian companies should finalise strategies for exporting network management systems, satellite based data networks against global tenders.

VOICE AND INTEGRATED COMMUNICATIONS SYSTEMS

The DoT has in principle decided to introduce digital exchanges for the total network. However it will take a few more years to achieve this chiefly because of :

(1) severe limitations on material and resources.

(2) need to use the available stocks of equipment and service. In the last few years,projects have been approved for providing integrated digital net work in few districts. An experimental Integrated Services Digital Networks(ISDN) has also been started in Bangalore. It is possible that in ISDN area there would be need to import switches and terminal equipment.

Specific demand for the following products was visualised by some of the major buyers:

*Digital communications equipment,including multiplexing products, over such media as 4-wire line, terrestrial microwave links or satellite circuits.

*Network management systems,particularly those integrating X.25 switches and protocol convertors, limited distance sets, network synchronization equipment and digital repeater units, Cost effective solutions for smaller networks, from 64 to 5,000 lines.

*Air and marine traffic control communication systems; Simulators for aircraft and for communication networks; Quasi Doppler direction finders and VHF transmitters/receivers; HF communications system for ship-based helicopters.

*Automatic message-accounting system for non-electronic exchange.

*Intelligent network controllers and data switches,transmission devices, Radio/antenna switch systems/ Gateway switches.

*Cellular Telephone and communication systems, Bi-directional fax to telex conversion facility.

*Digital voice encryption radio and telephones; Solid-state and microprocessor-based radio/telephone patching; Loop conditioning micro-processor-controlled interface products for radio pager systems.

*Radio data modems for UHF; digital synthesized radio and a microprocessor-controlled 1200/9600 bps modem.

*Digital fault locator system for monitoring PCM repeaters.

*Terminals capable of transmitting and receiving information from up to four separate sources at the same time.

Canadian companies should avail themselves of these opportunities by finalising licensing arrangements and setting up joint ventures in India.

DATA COMMUNICATIONS SYSTEMS EQUIPMENT

As the need for the transmission of data increases more and more usage of the PSTN will be made. In the present conditions the telephone channels permit data transmission up to 2400 bauds. *The DoT intends moving towards Integrated Services Digital Network(ISDN) which would offer several opportunities to foreign companies for modernisation. The DoT has not yet introduced the electronic mail.* Leased lines support data speeds upto 9600 bps and are exclusively provided between terminals of a customer.

The DoT has set up the following two packet data networks:-

-Remote Area Business Message Network-RABMN
-Packet Switched Public Data Network -VIKRAM

The network covering initially 20 locations provides the following types of nonvoice services:-

-Interactive data communication.
-Connection to public telex network.
-Connection to packet switched data network,'VIKRAM'.
-Connection to international gate-way packet switch.

Canadians are the second largest users in the world of telephone services and are the first to put into service a national digital- packet switched network. This experience can be of immense use for India in planning its data networks.

Specific opportunities exist in the following areas:

*Information networks for application in the office,manufacturing and dispatch fields.
*Automated telephone which holds completely computerized conversation with callers using digital speech and DTMF tone commands.
*Computerised radio generating/transmitting broadcast-quality voice.

Most of the equipment is expected to be imported in the short term. In the long term the Government will encourage licensing and joint ventures to check the foreign exchange outflow. Canadian companies should bear this in mind while planning their business strategies for India. A realistic appraisal of the two options viz.long term business association with technology transfer or short term exports with support should be made by Canadian companies.

RADIO COMMUNICATIONS AND MOBILE COMMUNICATIONS

It is being realised increasingly in India that a fundamental need for communication is between people and not from a person to the terminal equipment. *A consideration for future mobile communications in India would be a pocket radio telephone which could hook into the communication network through strategically placed base stations.*

Some of the popular radio equipment used for land mobile communications in India are Handheld portable sets, popularly called walkie-talkies which are used extensively by police and para-military forces. The VHF Single channel duplex system provides full duplex communications between two points upto 40 to 50 km and is ideally suited for extending telephone lines to remote and inaccessible areas where cable laying is not possible due to inhospitable terrain. The Long-range communication systems operating in

the HF band(3-30 MHZ) are available. HF communications manufactured indigenously is characterised by fading, noise and interference. *There could be scope for better technologies in the manufacture of long range communication systems.*

The Point-to-multipoint systems provide communications links to various subscribers in an area to a nodal point. Presently both analog and digital multi access systems are available. Digital systems(TDMA) are becoming more popular due to their inherent advantages of better speech quality, simpler frequency management and superior noise/ interference performance. *Better designed radio equipment taking care of the EMI/EMC aspects have tremendous scope in India.*

Mobile Satellite Systems(MSS) could be used increasingly for Communications, Navigation and Search and Rescue. As a substantial part of the terrain in India is remote and inaccessible; MSS has tremendous potential. Canada has launched a mobile satellite(MSAT), which operates in the L-Band on interim basis, with dedicated services to follow in 1992. The technology could be used very effectively in the Indian scenario. *Particularly of interest to India will be the MSAT's extension of two-way mobile radio, telephone and data transmission services. This will allow users in rural and remote areas of the country to access a satellite as a relay station. This shall allow people to use relatively inexpensive terminals to transmit voice or data to virtually anywhere in the country.*

Cellular services operate across rural and urban Canada. This would have applicability in Indian context due to the large size of the country and the population to be covered from various points.

Specifically the following products are likely to have good potential:

*Mobile and fixed air traffic control tower systems and runway lighting systems
*Trading turrets,answering positions,telephone and radio communication consoles.
*Alarm reporting,remote control and telemetry systems.
*Power station wireline communications protection systems.
*Full duplex mobile telephones;digital voice recorders,announcers and loggers for public safety.

There are good possibilities for Canadian companies to finalise licensing arrangements and set up joint ventures with Indian partners in the area of radio and mobile communications. Canada's role in India's Defence communication has been marginal, though well established Canadian companies worldwide for Microwave subsystems, signal processing subsystems, surveillance radar EW stations, radio tracking, telemetry should seriously think of setting up joint ventures with technology transfer in India.

SPACE COMMUNICATIONS AND REMOTE SENSING EQUIPMENT

The Government of India approved setting up an earth station to receive earth resources data directly from the Landsat series of satellites. The entire data reception chain and the data processing systems were commissioned with different types of products: Raw CCT, pro CCT, B&W films of different bands, FCC of bands 1, 2, 4 and 70 mm B&W film. Thirteen projects were identified by India and USA including mapping of forest cover and wasteland, hydrological characteristics and geological and geomorphological surveys covering about 182 districts in the country.

Based on the success of the technology, thematic mapper(TM) data reception and processing systems were designed indigenously. The sensor's specific hardwares and the complete data handling and correction softwares were also designed, developed and integrated indigenously.

There is an opportunity for Canada to collaborate with the Department of Space and the National Remote Sensing Agency for surveys of natural resources and for conjunctive analysis from ground, satellite and aircraft. Such collaboration is possible only through bi-lateral agreement between the Government of India and Canada as no other agency is authorised to deal in this sector. The evolution of National Natural Resources Management System(NNRMS), using a series of Indian

Remote-sensing Satellited(IRS) is the outcome of extensive research in data reception, processing and interpretation.

Specific demand for the following products exist:

*Automated Satellite Carrier Monitoring System(ASCMS).
*Digital access and cross-connect systems.
*Airborne data acquisition systems.
*Uplink and downlink assemblies for satellite earth stations,Tx and Rx multiplexing for communications equipment.

The indigenous supply for the space communication and remote sensing equipment is almost non-existent and thus these equipments are likely to be imported. Canadian companies should seriously quote competitive prices for global tenders. This would certainly get them business as the main considerations while finalising tenders are competitive pricing, after sales support, track record and effective lobbying at various levels of the bureaucracy.

MEDICAL ELECTRONICS

The indigenous production of electro-medical equipment in India picked up only in the early seventies. This sector accounts for about 2 per cent of the total electronic equipment production in India. Some of the companies that have a substantial market presence are PRD Co., Nihon-Koden, Siemens, Philips, Cannon, Parker Labs, Sanyo , etc.

Budgetary constraints have curtailed the growth and usage of these equipment in the country to some extent. *The number of Primary Health Centres in rural, district and urban centres is expected to reach 25,000 by 2000. In addition to the broad demand projected above, a further 10 to 15 per cent demand for the Railways and Defence hospitals operated by the Ministries Of Railways and Defence is expected. The total requirement based on various estimates was arrived at US $ 812 million which is expected to be met mainly by imports.*

Computerised axial tomography(CAT) scanner with prices ranging from US $ 406,000 to US $ 580,000 will have sizeable demand. Nuclear magnetic resonance(NMR) scanner is gaining popularity. Clinical applications of ultrasound diagnosis have also broadened considerably.

Micro-processor based monitoring which reduces false alarms in ECG monitoring in intensive care units are expected to be chosen by a significant number of hospitals. Most of the hospitals are also getting equipped with Ambulatory ECG monitoring systems. Other potential demand areas include laser based surgical equipment, microprocessor based devices for the rehabilitation of physically disabled. The fibre optic based diagnostic devices are also expected to register significant demand. The equipment that has tremendous demand are Incubators, photo therapic equipment, cardiovascular, thoratic and neurology equipment. Specialised medical electronic instruments: ICC units with central monitoring electro encephalograph(EEG) storage, electromyographs, renographs, fast gamma ray medical scanners, scinti-scanners are also likely to be imported. Flexible import policy and duty structure are also encouraging various users to import this equipment.

The strategy for Canadian companies to achieve a breakthrough in India's medical electronics market is finalising licensing arrangements and setting up joint ventures. Canadian companies should make serious efforts in order to make a presence in this area of tremendous potential.

ELECTRONIC PROCESS CONTROL INSTRUMENTS

It is estimated that 4 per cent of the project financial outlay of the Government Of India would be spent on control instrumentation. The sector-wise outlay during the 8th plan has been indicated in Table-V.

A large share of this demand projected around US $ 3 billion is expected to be imported. There is a scope for Canadian companies to bid for turnkey projects to be able to supply total control instrumentation for these projects. The stand alone equipment is expected to be US $ 840 million by 1990 and has a growth potential of 30 per cent in the eighth plan.

India manufactures logic controllers; analysers; data analysers, temperature controllers; level,speed and flow detectors; digital loop control systems; distributed acquisition and control systems; telemetry equipment; integrated modulating, sequential control and data acquisition for plant control; analytical instrumentation; transducers for temperature,displacements; process computers and microprocessors. Leading Indian companies are collaborating with international companies : Siemens, Kent, Hitachi, Allen-Bradley, Taylor, Philips, Toshiba, ASEA, Control Belly, Honeywell, Foxborough, Goulds, Mitsubishi, etc.

There is scope for importing Process Control and Instrumentation with powerful graphic facility to help the user to change the logic diagram interactively. A distributor system with mutually linked micro- computers, each being assigned tasks through a data-highway of fibre optics, is a futuristic model in the Indian scenario. Telemetry and telecontrol systems for oil, pipe line, power systems applications with remote units based on microprocessors for acquisition and control functions also have potential. Semiconductor sensors based on fibre optics, with on-chip conversion and intelligence for checking are likely to have good demand.

Software support for various types of controls including cascade, ratio, feed forward, adaptive and process optimisation will be required. CAD/ CAM and process simulation are other areas which will need foreign inputs. Micro controllers with built-in timers, accounters, multiplexers, A to D convertors and powerful instruction sets will have considerable demand.

Canadian Companies should offer knowhow through licensing arrangement. There is scope for outright imports as several international agencies are offering development assistance. Thus Canadian companies should maintain interface with the international agencies which recommend any equipment purchases for the recipient Indian organisations.

ARTIFICAL INTELLIGENCE AND ROBOTICS

Industrial Robotics are becoming increasingly popular in India and are being used by Defence for mine detection; Railways for welding; Picture tube manufacturing and in pesticide plants. Atomic Energy Stations too are resorting to Industrial Robotics. Robotics were imported two years ago, from Mitsubishi and Info-Link of USA. *Though still in infancy,it has considerable potential.*

Artifical Intelligence is still confined to knowledge engineering for applications including expert systems for trouble shooting and crisis management; though IITs are carrying out extensive research in A.I. Canada has good opportunities in both fields as extensive usage of Robotics is being envisaged in Defence to perform various roles: chemical sniffing, surveillance and direct combat. New manufacturing areas aided by Industrial Robotics are being planned. Artifical Intelligence applications are being contemplated in medical diagnosis, CAD/CAM environments and also for industrial crisis management. It is estimated that the sophisticated Artifical Intelligence models in use abroad can be adapted very effectively in the Indian situation.

Canadian companies should offer knowhow through licensing arrangement. The prospects for setting up joint ventures in this area are good due to limited competition. Canadian companies should plan effective strategies as early as possible to be in an advantageous position.

PART III
TABLES AND APPENDIXES
Table I: PROPOSED TELECOM PLAN

	ITEM	1.4.1987	1990	1995	2000
1	Local Telephone Connections (Million)	3.5	4.5	9.5	20
2	Telex Connections (Thousand)	34	55	100	200
3	Villages having P. Telephones or Exchanges (Thousand)	35	43	100	600
4	Public Call Offices in Cities/Town (Thousand)	44	85	200	1000
5	Voice/Data Connections for Business/Few In (Thousand)		10	100	800
6	Progressive Capital Investment (US $ Billion)	3.0	6.4	14.8	31.6

Table IA: REQUIREMENT IN DIFFERENT SECTORS
SUMMARY OF TELECOM EQUIPMENT REQUIRED IN 8th PLAN (1990-95) (VALUE IN US $ MILLION)

SI.NO.	Type of Equipment	Value			
		DOT	Railways	Power Sector	Defence/Police etc.
1	Switching	3758.0	20.3	1.7	Not available. However total requirement is expec.to be of the order of US $ 298.70 million.
2	Transmission	2117.7	113.11	37.7	
2a	Underground Cables	2499.4	8.7	75.4	
3	Two Way Radio	105.5	11.6	1.7	
4	PLCC			26.1	
5	Terminals	1129.0	8.7	5.8	
6	Data	23.2			
7	Telegraph Services	30.1			
8	Computerisation of Billing. Fault Control, Office Automation, Enquiry etc.	20.3			
9	Power Plant	174.0			
		9857.20	162.41	148.40	298.70

TOTAL REQUIREMENT US $ 10.46 Billion

Source: Telecom Commission, Government of India

Table II: REQUIREMENT OF TELECOM EQUIPMENT FOR DoT SECTOR (Value in US $ MILLION)

SI.NO.	Type of Equipment	Requirement	
		Quantity	Value
1.	**SWITCHING**		
	a) Local SW (Small capacity upto 2000 & large capacity)	7500000	3357.7
	b) Trunk SW	306 K	266.2
	c) Transit SW	200	78.3
	d) Telex Machines	60 K	55.8
			3758.0
2.	**TRANSMISSION**		
	a) Digital UHF		
	- 30 Channel	1200	34.8
	- 120 Channel	600	17.4
	b) Digital Mircrowave		
	- 2GHz	400	18.5
	- 4GHz	250	17.4
	- 6GHz	1600	111.3
	- 7GHz	850	39.4
	- 11GHz	100	6.9
	- 13/15 GHz	900	41.7
	- 18GHz	360	16.8
	c) Satellite & Accessories		
	- TDMA	16	23.7
	- VSAT	500	69.6
	- KU Band	50	29.0
	- HPA (Various Types)	88	6.3
	- LNA	75	1.7
	- SCPC (Bays & Modems)	1974	29.1
	- Antenna	89	8.7
	d) Digital Coaxial Terminals		
	- 140 Mb/s + Regenerator	330	4.6
	- 34Mb/s + Regenerator	438	6.0
	e) Optical fibre System		
	- 565 Mb/sTerminal + Regenerators	40	1.3
	- 140Mb/sTerminal + Regenerators	1320	33.6
	- 34 Mb/sTerminal + Regenerators	452	4.4
	- 8Mb/sTerminal + REgenerators	860	5.0
	- 2Mb/sTerminal	100	0.6
	- 12 Fibre Cable	14300 Kms	50.6
	- 8 Fibre Cable	2650 Kms	6.8
	- 4 Fibre Cable	3000 Kms	6.1
	f) MUX		
	- FDM	1500	5.8
	- Digital		
	. 1st Order	8580	25.6
	. 2nd Order	21476	57.3
	. 3rd Order	6838	18.2
	. 4th Order	1596	4.3
	. 5th Order	Yet to be ascertained	

(Cont'd to next page)

	g) PCM	39300	361.9
	h) Carrier & VFT		
	- 3 Chlopen Wire	2000	8.7
	- 8 Chlopen Wire	750	5.2
	- TDM VFT	3000	67.9
	- 5+4 DX	1500	4.8
	i) Rural Transmission System (6/10/30 chl UHF.2/15,8/88 VHF.PCM. Optical fibre etc) UHF.2/15,8/88 VHF.PCM.	28045	1011.7
			2117.7
2A	Underground Cables Accs & Pressurisation Yet to be ascertained	79000000 Kms	2499.4
3.	**TWO WAY RADIO COMMUNICATION**		
	. HF (100 W & 15 W)	10000	9.9
	. VHF Mobile	15000	17.3
	. Cordless Telephones	2500	20.3
	. MARR	500	58.0
			105.5
4.	**PLCC**	NIL	
5.	**TERMINAL**		
	. Telephone instrument	891	263.8
	. Teleprinter Machines	72 K	146.4
	. Facsimile	100 K	480.0
	. PC Facsimile	25000	79.8
	. Payphones	75	65.0
	. Baseband Modems	2500	3.2
	. Voice Band Modems	5000	3.8
	. Videotex Terminals	50 K	29.0
	. Economic Message Terminals	100 K	58.0
			1129.0
6.	**DATA COMMUNICATION EQUIPMENT**		
	. Packet Switches	350	23.2
	. concentrators, PADS video Tex, computers etc.(various types & quantities)		
7.	**TELEGRAPH SERVICES EQUIPMENT**		
	. Store Forward Msg Switch (SFMS)	5	2.9
	. SFMS 64 Ports	10	3.5
	. SFMS 32 Ports	15	2.6
	. Message Handling	4	4.6
	. Electronic Key Board	8000	7.0
	. EKB Concentrator	1000	5.8
	. Phonocom Concentrator	1000	0.9
	. Electronic Cash Machine	600	2.8
			30.1

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8.	COMPUTERISATION FOR TELEPHONE BILLING, FAULT CONTROL DIRECTORY ENQUIRY, OFFICE AUTOMATION	100	20.3
9.	**POWER PLANT**		
	a) Float Charger		
	- 800 Amps	340	3.5
	- 400 Amps	830	6.4
	- 200 Amps	2000	11.6
	- 100 Amps	2200	0.9
	- 25 Amps	585	1.4
	b) Battery Charger		
	- 600 Amps	170	1.7
	- 300 Amps	633	5.1
	- 150 Amps	2765	20.9
	- 75 Amps	1070	3.5
	- 25 Amps	585	1.0
	c) Switching Cubicles		
	- 4000 Amps	170	2.1
	- 2000 Amps	195	1.0
	- 1000 Amps	438	1.9
	- 500 Amps	3196	13.3
	- 100 Amps	585	0.7
	d) Float Cum Battery Charger	11800	12.3
	e) Battery		
	- 5000 AH	340	22.5
	- 3000 AH	390	13.9
	- 1000 AH	769	9.0
	- 600 AH	4012	5.9
	- 400 AH	2339	8.4
	- 120 AH	25770	17.0
	f) Inverters (1KVA,6KVA, 25 KVA,35KVA)	500	10.0
			174.0

Hence Total DoT requirement is approximately $ US 9857.20 million.

Source: Telecom Commission, Government of India

Table III: REQUIREMENTS OF TELECOM EQUIPMENT FOR NON DoT SECTOR (Value in US $ Million)

SI.NO.	Type of equipment	Railway		Power Sector	
		Qty	Value	Qty	Value
1.	**SWITCHING**				
	. Local	0.60 L	19.0	-	-
	. Telex	0.96 K	1.3	-	
	. PABX			0.915 L	1.7
2.	**TRANSMISSION**				
	a) Digital UHF				
	- 30 Channel	250	7.3	125	3.7
	- 120 Channel	145	4.2		
	b) Digital M/W				
	- 2 Ghz			360	17.7
	- 7 Ghz	1250	59.1	110	5.1
	- 11 Ghz			55	3.8
	- 18 Ghz	360	16.7		
	c) Satellite				
	- VSATS	134	17.4	Accessories HPA, LNA ANT, SCPC	2.7
	d) Optical Fibre Systems				
	- 34 Mb/s Terminal+ Reg	32+76	0.9	43+32	0.6
	- 8 Mb/s+Reg	40+420	2.7	43+60	0.6
	- 2 Mb/s+Reg			19	0.1
	- 8 Fibre Cable	3350 Kms	8.6	6458 Kms	75.4
	e) Digital MUX				
	- 2 Mb/s	1050	2.8	1000	2.7
	- 8 Mb/s	650	1.7	190	0.5
	- 34 Mb/s	160	0.4	95	0.2
3.	**2 WAY RADIO**				
	a) HF Transreceiver(15 w)			145	0.8
	b) Base Station VHF	90	1.0	1520	0.9
	c) Terminal VHF	900	0.6		
	d) Mobile VHF				
	e) UHF Station Base	240	4.3		
	f) UHF Mobile	9900	5.7		
4.	**PLCC EQUIPMENT**				
	. Terminal			3300	21.2
	. Coupling Devices			3650	3.2
	. Signalling Equipment			650	1.7
5.	**TERMINAL EQUIPMENT**				
	. Telephones	0.6 L	1.9	1.0l	3.5
	. Teleprinter	0.96 K	2.4	0.95 K	1.9
	. Fax Equipment	170	0.5	140	0.4
	. Modems	4000	3.9		
			162.41		148.40

Detailed requirements for Defence and Police are not readily available. Hence Total Non DoT requirement is approximately $ US 310.81 million.

Table IV: MARKET SHARE OF MAJOR COUNTRIES FOR TELECOM EQUIPMENT, COMMUNICATION EQUIPMENT, TELECOM SYSTEM EQUIPMENT VALUE IN US $ (000)

MAJOR EXPORTERS TO INDIA	TELECOM EQUIPMENT		COMMUNICATION EQUIPMENT		TELECOM SYSTEM EQUIPMENT	
COUNTRY	1987	1986	1987	1986	1987	1986
AUSTRIA	200	153	1135	403	374	-
BELGIUM	1817	2685	3287	3368	931	306
CANADA	2423	482	5762	2915	-	-
DENMARK	17	12	644	364	86	132
FINLAND	—	—	63	49	-	-
FRANCE	10617	8807	198406	94678	106798	35439
GERMANY(WEST)	2617	1536	20907	21931	8947	14646
HONG KONG(EXPORTS)	36	71	2528	2768	1731	2303
HONG KONG(RE-EXPORTS)	179	41	9441	16974	5831	11918
ITALY	2529	1004	14777	2890	6491	361
JAPAN	31595	20882	80948	82679	29704	38369
NETHERLANDS	4767	10965	94831	19344	42505	823
NORWAY	572	2457	2130	3561	53 176	
SINGAPORE	557	112	16668	8684	7432	4634
SWEDEN	2154	1785	32515	2050	21686	35
SWITZERLAND	1614	985	6368	2848	---	---
U.K.	3284	1106	28868	14779	10386	5787
U.S.A.	5759	7669	32311	33961	4209	4200

Table IVA: RADAR APPARATUS VALUE IN US $(000)

COUNTRY	1987	1986
FRANCE	2935	112
GERMANY(WEST)	725	916
HONG KONG(EXPORTS)	49	14
HONG KONG(RE-EXPORTS)	88	179
NORWAY	-	48
SINGAPORE	464	11
U.K.	3868	2219
U.S.A.	4068	505

Table IVB: RADIOTELEPHONES AND RADIO PAGERS VALUE IN US $ (000)

COUNTRY	1987	1986
BELGIUM	5	19
GERMANY(WEST)	24	319
JAPAN	1228	456
SINGAPORE	48	6
U.K.	3897	688
U.S.A.	603	2146

Table IV C: MARKET SHARE OF MAJOR COUNTRIES FOR TELECOMMUNICATIONS EQUIPMENT PARTS TO INDIA VALUE IN US $ (000)

COUNTRY	1987	1986
Belgium	445	299
Denmark	10	27
Finland	62	48
France	72947	50300
Germany (West)	4532	484
Hong Kong (exports)	367	174
Hong Kong (re-export)	123	122
Italy	364	355
Japan	4709	6289
Norway	1432	702
Singapore	402	107
Sweden	6758	219
U.K.	2538	1743

Estimates for imports of all equipment for the year 1989 are to the tune of US $ 1.09 billion.

Source: Director General Of Technical Development/Chief Controller Of Imports And Exports, Government Of India, Interviews

Table V : PROCESS CONTROL AND INSTRUMENTATION ALLOCATIONS VALUE (US $ MILLION)

Sector	Expected outlay during 8th plan	Expected expenditure on control instrumentation during 8th plan
1. Coal	2850	114
2. Steel	4886	195
3. Petroleum	16286	650
4. Fertilizers	5700	227
5. Heavy Engg.	652	26
6. Iron ore	293	11
7. Non-Ferrousmetals	1221	49
8. Paper & newsprint	326	13
9. Textiles	163	6.5
10. Power	18729	747
11. Cement	977	39
12. Transportation	12214	487
13.Communication	9771	390
TOTAL	74068	2954.50

Source: Planning Commission, Government Of India Interviews and Confederation Of Engineering Industry.

Table VI: ELECTRONICS PROJECTIONS

Table VIA: INDUSTRIAL ELECTRONICS PROJECTIONS (US $ Million)

	1984	1985	1986	1987	1988	1989	1990	1995	2000
I OPTIMISTIC TOTAL	406.03	516.24	630.22	778.71	986.07	1097.73	1436.48	1061.48	9497.96
II PESSIMISTIC TOTAL	324.82	430.39	515.37	647.62	811.48	901.39	1147.62	3226.79	7679.23
1. Process Control	154.87	197.79	228.82	431.84	328.88	338.16	406.03	971.28	1919.95
2. Power Electronics	63.22	82.65	98.02	121.80	150.81	165.89	208.81	548.72	115.68
3. Instrument	41.47	54.23	63.80	77.72	95.70	104.40	131.09	335.55	67.98
4. Computers & Office Elec.	65.25	95.70	124.70	172.85	236.07	292.92	401.68	137.12	388.34

Table VIB: INFRASTRUCTURE ELECTRONICS PROJECTIONS (US $ Million)

	1984	1985	1986	1987	1988	1989	1990	1995	2000
i. OPTIMISTIC TOTAL	424.50	594.00	840.25	1144.20	1354.10	1704.15	2112.00	4814.30	11372.60
ii. PESSIMISTIC TOTAL	337.50	405.50	472.50	596.90	716.85	890.45	1100.95	2568.10	5851.25
-TELECOM	109.00	132.65	163.25	204.15	248.00	320.10	408.30	1020.80	2381.80
-WIRELESS	31.15	38.35	47.30	58.85	72.10	92.00	117.65	294.15	689.75
-BROADCAST	44.45	53.95	66.35	83.05	100.95	130.05	166.10	415.25	968.90
-RAILWAY ELEC	6.95	8.65	10.40	13.85	15.00	17.90	20.20	40.40	63.45
-DEFENCE ETC.	145.95	171.90	202.45	238.75	286.65	330.45	338.70	797.60	1750.90

Table VIC: INDUSTRIAL ELECTRONICS PROJECTIONS (US $ Million)

	1984	1985	1986	1987	1988	1989	1990	1995	2000
I OPTIMISTIC TOTAL	**649.10**	755.50	859.30	1067.00	1193.80	1332.20	1542.70	2148.80	2754.35
II PESSIMISTIC	**564.60**	656.90	747.15	926.20	1038.10	115.75	1340.25	1868.80	2395.35
1. RADIO	**145.10**	148.80	156.30	166.10	169.85	177.35	186.00	243.10	254.35
2. AUDIO	**155.15**	177.65	200.70	219.15	235.60	250.60	269.10	402.55	541.55
3. VIDEO	**236.45**	299.35	348.10	480.40	555.95	636.10	763.55	979.25	1200.40
4. OTHERS	**26.85**	31.15	42.10	59.40	76.70	95.75	121.70	232.45	399.10

Source:Confederation Of Engineering Industry, Department Of Electronics Government Of India And Interviews

Table VII:ELECTRONICS CONSUMPTION AND GROWTH RATES VALUE (US $ MILLION)

		1985	1990	1995	2000
TOTAL	OPT	2,428	6,555	14,202	30,725
			(23)	(17)	(16.5)
	PES	1,972	4,806	10,200	21,082
			(19.5)	(16)	(15.5)
INDUSTRIAL	OPT	516	1,437	3,961	9,498
			(23)	(23)	(23)
	PES	430	1,147	3,227	7,680
			(21.5)	(23)	(19)
INFRASTRUCTURAL	OPT	597	2,124	4,840	11,438
			(29)	(18)	(18)
	PES	407	1,107	2,583	5,885
			(22)	(18)	(18)
CONSUMER	OPT	760	1,552	2,161	2,770
			(16)	(7)	(5)
	PES	660	1,348	1,880	2,410
			(15)	(6.5)	(5)
COMPONENTS	OPT	554	1,490	3,237	7,019
			(22)	(17)	(17)
	PES	473	1,203	2,510	5,108
			(20)	(16)	(15)

NOTE: Bracketed figures indicate average annual growth during five year period.
OPT : Optimistic Forecast/PES : Pessimistic Forecast.

Source: Confederation Of Engineering Industry, Department Of Electronics Government Of India And Interviews

Appendix-I: IMPORT POLICY FOR TELECOM AND ELECTRONICS SECTOR

The Import policy for 1990-1993 has made a number of provisions for meeting the import needs of the Telecom Sector. Equipment which can be imported on paying the necessary customs duty(which varies from 80 per cent ad valorem to 250 per cent ad valorem) includes the following:-

(1.) Switching equipment
  a) Local switching equipment including PABXs
  b) Trunk switching equipment.
  c) Electronics - Transit Switching.
  d) Telex Exchange.

(2.) Transmission equipment
  a) UHF/VHF Systems - Analog/Digital.
  b) Micro Wave Systems -Analog/Digital.
  c) Satellite Communication Equipment.
  d) Coaxial Systems - Analog /Digital.
  e) Optical Fiber systems (excluding of cables).
  f) Multiplex Equipment.
    i) FDM multiplex equipment
    ii) Digital Multiplex equipment
  g) Subscriber carrier systems
  h) Carrier and VFT Systems.

(3.) a) Packet Switching Exchange for Data Communications.
  b) Data Multiplexers

(4.) Equipment for telegraph service and telex

(5.) Subscribers Terminal equipment.
  a) Telephones and attachments.
  b) Tele printers
  c) Fascimile equipment

(6.) Public net work management systems.

The following capital goods and machinery are freely allowed to be imported on paying the customs duty (which varies from 80 per cent ad valorem to 100 per cent ad valorem):-

-Ferrites, Semiconductors, ICs
-Automated Manufacturing equipment for electronic components viz.
-Resistors, Capacitors
-Transformers, PCB manufacture
-Circuit variable resistors
-Potentiometers
-Automatic test equipment
-Process equipment including moulding,assemblying,sorting,cutting, welding,wire bonding
-Screen printing
-Diffusion(ICs,Transistors)
-Computer and peripheral assembly equipment
-Media(Audio,Video,CD,official media equipment)
-Ceramic process equipment
-Quartz process equipment
-Microprocessor based testing and measuring equipment with digital readings for all electronic equipment and component manufacture.

Source : Import Policy(1990-1993), Government Of India

Appendix-II:MAJOR END USERS

AIR HeadQuarters, Ministry Of Defence, Government Of India, Vayu Bhawan, New Delhi-110 011.
Phone : 91-11-301-0231
Contact :Wg.Cdr.R P Mathur, Sr-Signals-Officer-In-Chief

Army HeadQuarters, Ministry Of Defence, Government Of India, Sena Bhawan, New Delhi-110 001.
Phone : 301-5661/301-8915
Contact : Lt.Gen.Harbhajan Singh, Signal-Officer-In-Chief

All India Radio, Akashwani Bhawan, Parliament Street, New Delhi-110 001.
Phone : 91-11-371-049
Contact : Mr H O Srivastava, Director Telecom Engineering and EDP

Bharat Electronics Limited, Trade Centre, 116/2, Race Course Road, Bangalore 560 001.
Telex : 845-2477 HOBL
Contact : Capt S Prabhala (Retd), Chairman & Managing Director

Bharat Heavy Electricals Limited, BHEL House,Asian Games Village, Siri Fort Area, New Delhi 110 049.
Phone : 91-11-644-2031/91-11-644-6437/91-11-643-4839 Telex : 031-65329 BHMS
Contact : Mr P S Gupta, Chairman & Managing Director

Central Electricity Authority, Government Of India, Sewa Bhawan, R K Puram, New Delhi-110 066.
Phone : 91-11-60-9212/91-11-60-2583/91-11-67-5005 Telex : 031-72171 CEA
Contact : Mr J K Bhasin, Member(Planning)

Centre for Railway Information Systems, Chankyapuri, New Delhi-110 021.
Phone : 91-11-60-6717
Contact : Mr M T Varghese, Specialist-Datacom

CMC Limited, 1, Ring Road, Kilokri, Opp.Maharani Bagh, New Delhi-110 014.
Phone : 91-11-683-0087 Telex : 031-66082
Contact : Dr P P Gupta, Chairman-Managing Director

Department of Defence Research and Development, Ministry of Defence, Government of India, North Block, New Delhi-110 001.
Phone : 91-11-301-1519
Contact : Dr V S Arunachalam,Secretary

Directorate of Electronics and Instrumentation, Defence Research & Development Organisation, Ministry Of Defence,South Block, New Delhi-110 001.
Phone : 91-11-301-3119/91-11-301-4012
Contact : Mr A N Murthy, Director

Department of Telecommunications, Government Of India, Sanchar Bhawan, Ashoka Road, New Delhi-110 001.
Phone : 91-11-371-7300/303-2785
Contact : Mr B N Bhagwat, Additional Secretary(Telecom Commission)

Department of Telecommunications, Government Of India, Sanchar Bhawan, Ashoka Road, New Delhi-110 001.
Phone : 91-11-371-1550/91-11-303-2846
Contact : Member(Technology)

Department of Science and Technology,Government Of India, Technology Bhavan, New Mehrauli Road, New Delhi-110 016.
Phone : 91-11-66-2260/91-11-66-7373/91-11-66-0068
Contact : Dr Vasant Gowarikar, Secretary

Department Of Electronics, Government Of India, Lok Nayak Bhawan, Khan Market, New Delhi-110 003
Phone : 91-11-69-873
Contact : Mr R Rajamani, Secretary

Director General Of Meteorology, Mausam Bhavan, Lodi Road, New Delhi-110 003.
Phone : 91-11-61-1842/91-11-61-1029
Contact : Dr R P Sarkar, Director General

Electronics Systems Punjab Limited, B-81, Industrial Area, Mohali, Chandigarh.
Telex : 395-391 ESPL
Contact : Mr S S Agrawal, Chairman & Managing Director

Electronics Trade and Technolgy Development Corporation Limited, Akbar Bhawan Annexe, Chanakyapuri, New Delhi-110 021.
Phone : 91-11-60-0270/91-11-60-8818 Telex : 031-6205 ETDC IN
Contact : Mr P Guha Biswas, Joint General Manager(Imports)

Geological Survey Of India, 27-Chowranghee Road, Calcutta.
Telex : 021-7814 GSRY
Contact : Director General

Hindustan Aeronautics Limited, Corporate Office, 15/1 Cubbon Road, Bangalore 560 001.
Telex : 845-2234 HALM
Contact : Wg Cdr I M Chopra, Chairman

Hindustan Petroleum Corpn. Petroleum House, 17, Jamshedji Tata Road, Bombay 400 020.
Telex : 11-2233 HPVM
Contact : Mr S T Bambawale, Chairman & Managing Director

Hindustan Teleprinters Limited, G.S.T. Road , Guindy, Madras 600 032.
Telex : 41-26085 DEIT IN
Contact : Mrs Lakshmi G Menon, Chairman & Managing Director

HCL Limited
806 Siddharth,96-Nehru Place
New Delhi-110 019
Phone : 91-11-643-0051/91-11-641-8567 Telex : 031-61181 HCL IN
Contact : Mr Shiv Nadar, Chairman

Indian Railway Consulting Organisation for Telecommunications, Shivaji Bridge, Connaught Place, New Delhi-110 001.
Phone : 91-11-332-1533/91-11-301-6330
Contact : Mr H C Gupta ,Chief General Manager

Indian Airlines, Airlines House, Gurudwara Rakabganj Road New Delhi 110 001.
Phone : 383524/385089 Telex : 31-66252 ICDD IN
Contact : Managing Director

Indian Telephones Industries Limited, 45/1,Magrath Road, Bangalore 560 025.
Phone : 91-0812-56-6262 Telex : 845-2222 ITI IN Fax : 567144
Contact : Mr U D N Rao, Chairman & Managing Director/Mr R Narayan

Instrumentation Limited, Jhalawar Road, Kota 324 005.
Telex : 305 203 ILK
Contact : Mr K Vasudevan, Chairman & Managing Director

International Airports Authority of India, Yashwant Place, Chanakyapuri, New Delhi 110 021.
Phone : 91-11-67-4434/91-11-67-4691
Contact : Air-Vice Marshal C M Khurana (Retd.), Chairman

JCT Electronics Limited, Thapar House,124 Janpath, New Delhi-110 001.
Phone : 91-11-332-2860/91-11-332-3924 Telex : 031-7733 JCI IN
Contact : Mr Arjun Thapar,Managing Director

JK Organisation, Link House,Bahadur Shah Zafar Marg, New Delhi-110 002.
Phone : 91-11-331-1112/91-11-331-0422 Telex : 031-61426 TKLN
Contact : Dr B B Bhatia, Vice President

KELTRON Systems Limited, Keltron House, Vellayambalam, Trivandrum(Kerala).
Telex : 435-283 KCMO IN

Mahanagar Telephone Nigam Limited, Jeewan Bharti Tower I , 12th Floor, 124 Connaught Circus, New Delhi 110 001
Phone : 91-11-35-0012 Telex : 031-66675 MTN
Contact : Mr M P Shukla, Chairman & Managing Director

National Informatics Centre, Planning Commission, Govt.of India,CGO Complex, 'A' Block, Lodhi Estate, New Delhi-110 003.
Phone : 91-11-361504 Telex : 031-61274 NIC IN Fax : 91-11-362489
Contact : Dr N Seshagiri, Additional Secretary

National Instruments Limited, 1/I Raja Subodh Chandra Mullick Road,Jadavpur, Calcutta 700 032.
Telex : 21-3339 NIL
Contact : Mr S R Das, Chairman & Managing Director

National Airports Authority, East Block II , R.K.Puram, New Delhi 110 066.
Phone : 91-11-60-4593/91-11-61-8271 Telex : 031-61471 IAAI
Contact : Air Marshal C K S Raje (PVSM,ACSM), Chairman

National Thermal Power Corporation Limited, "SCOPE Complex", 7 , Lodhi Road, New Delhi 110 003.
Phone : 91-11-36-0044/91-11-36-0608 Telex : 31-62058 NTPC
Contact : Director(Technical)

National Remote Sensing Agency, Bala Nagar, Hyderabad(Andhra Pradesh),
Telex : 425-2076 NRSA
Contact : Prof.B L Deekshatulu, Director

National Research Development Corporation Limited, 20-22 Zamroodpur, Community Centre, Kailash Colony Extension, New Delhi-110 048.
Phone : 91-11-643-2821/643-2121
Contact : Mr N K Sharma, Managing Director

Naval HeadQuarters, Ministry Of Defence, Government Of India, South Block, New Delhi-110 011.
Phone : 91-11-301-1406
Contact : Cmd.V P Kapre, Director Of Naval Signals and Telecom

Oil & Natural Gas Commission, Tel Bhawan, Dehradun 248 003 (U.P).
Telex : 585-206 ONGC
Contact : Mr P K Chandra, Chairman

Oil India Limited, Allahabad Bank Building , 17, Parliament Street, New Delhi 110 001.
Phone : 91-11-31-0841/31-0844 Telex : 031-62024 OILD
Contact : Mr Surjit Chaliha, Chairman & Managing Director

Petrofils Cooperative Limited, P.O.Petrofils, Dist : Baroda 391 347 (Gujarat)
Contact : Mr V N Jikar, Chairman & Managing Director

Rural Electrification Corpn., DDA Building,Nehru Place, New Delhi 110 019.
Phone : 91-11-643-2601/91-11-643-1615 Telex : 031-66194 REC
Contact : Mr Satish Khurana, Chairman & Managing Director

Railway Board, Ministry of Railways, Government Of India, Rail Bhavan, New Delhi-110 001.
Phone : 91-11-38-3815
Contact : Mr S K Kashyap, Advisor (Telecom)

Semiconductors Complex Limited, Phase VIII SAS Nagar, Punjab 160 059.
Telex : 395-270 LSI
Contact : Mr V Arvamudhan, Chairman & Managing Director

Space Commission, Department Of Space, Government of India, Antariksh Bhawan, New Bel Road, Bangalore-560 094.
Phone : 91-0812-33-4474
Contact : Prof U R Rao, Chairman Space Commission

Steel Authority of India Limited, Integrated Office Complex, Lodhi Road, P B 3049, New Delhi-110 003.
Phone : 91-11-69-0481/91-11-69-3493 Telex : 031-3933 ISPT IN
Contact : Director(Technical)

Surveyor General Of India, Government Of India, Hati Parakala State, Dehradun, Uttar Pradesh.
Telex : 585-218 SRVY
Contact : Surveyor General

Tata Telecom Limited, 55 Park Street, Calcutta
Telex : 21-7733 TTEL IN
Contact : Mr K BalaSubramaniam, Vice-President

Telecommunications Consultants India Limited, Chiranjeev Towers, 3rd Floor, 43-Nehru Place, New Delhi-110 019.
Phone : 91-11-643-8514/91-11-643-2666 Telex : 031-62135 TCIL IN
Contact : Mr Y L Agarwal, Chairman & Managing Director

Videsh Sanchar Nigam Limited, Videsh Sanchar Bhawan, M.G.Road, Fort, Bombay 400 001.
Telex : 11-2077 ICBM
Contact : Mr V Babuji, Chairman & Managing Director

WIPRO Technologies Limited, 1/E, Peenya, Bangalore(Karnataka).
Telex : 845-5019 WPRO IN
Contact : Mr Ashok Soota, President

Appendix-III:ASSISTANCE AVAILABLE FROM THE GOVERNMENT OF CANADA

1. The Department of External Affairs and to some extent the Canadian International Development Agency manage a program of Trade Development activities in support of Canadian companies interested in exporting to India.The program includes missions, technical seminars, trade fairs,

incoming buyers,and market studies.

Deputy Director, Asia Pacific South Trade Development Division,
Department of External Affairs and International Trade, Canada, 125 Sussex Drive, Ottawa, Ontario, KIA OG2.
Telephone : (613) 996-5903 Telex : 053-3745 Fax : (613) 996-4309

Program Manager, South Asia.
International Cooperation Division, Canadian International Development Agency (CIDA), 200 Promenade du Portage, Hull, Quebec, Canada K1A 0G4.
Telephone : (819) 997-0563 Telex : 053-4140 CIDA SEL Fax : 819 953 5024

2. The Canadian High Commission, New Delhi and the Consulate of Canada, Bombay are in touch with Indian Telecom/Electronics/ Communications Sectors key buyers on a daily basis. They can provide information on Indian marketing conditions,Indian companies, Government regulations,reputable agents,and a range of other commercial information pertinent to doing business in India.

Counsellor (Commercial)
Canadian High Commission, P.O. Box 5208, Shantipath, Chanakyapuri, New Delhi 110021, India.
Telephone : 91-11-687-6500 Telex : 031-72362 DMCN IN Fax : 6876500 Ext. 401

or Consul and Trade Commissioner
Consulate of Canada, Hotel Oberoi Towers, Suite 2401, Nariman Point, Bombay 400021, India.
Telephone : 91-22-202-4343 Ext. 2401 Telex : 011-4153 OBBY IN Fax : 204-3282

3. The Department of Industry,Science and Technology cooperates closely with the Department Of External Affairs to develop and manage programs in support of Canadian exporters of Telecom/Electronics/ Communications products. The Department receives copies of Indian tender documents issued for international competition and informs interested Canadian companies.

Information Technologies Industry Branch, Industry Development Directorate, Industry Science and Technology Canada, 235 Queen Street, Ottawa, Ontario, KIA OH5.
Telephone : (613) 954-3344 Telex : 053-4123 Fax : (613) 952-8419

4. The Canada-India Business Council (CIBC) has established a close partnership with India's Federation Of Indian Chambers Of Commerce and Industry (FICCI). In addition the Canadian Manufacturers Association (CMA) has a close understanding with the Confederation Of Engineering Industry (CEI). Both represent the Indian private sector.

Canada-India Business Council
1160-55 Metcalfe Street, Ottawa, Ontario, Canada K1P 6N4.
Telephone : 613-238-4000 Telex : 053-3360 CANCHAM OTT Fax : 613-238-7643
Contact : Mr Peter Egyed, Executive Director

The Canadian Manufacturers Association
One Yonge Street Toronto, Ontario, Canada M5E 1J9
Telephone : 416-363-7261 Telex : 065-24693 Fax : 416-363-3779
Contact : Ms. Doreen Wallace Ruso, Director Trade Development

Appendix-IV: REFERENCES

1. Telecom Commission's 'Perspective Plan Upto 2000 A.D'.
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2. Telecom Commission's 'Telecom Technologies And Products In IndianNetwork'.
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18.Interview Of Lt.Gen.R P Singh, Former Head of the Corps Of Signals On Defence Communications-Published in Telematics india.

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Canadian High Commission
P.O. Box 5208, Shantipath
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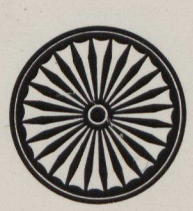

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