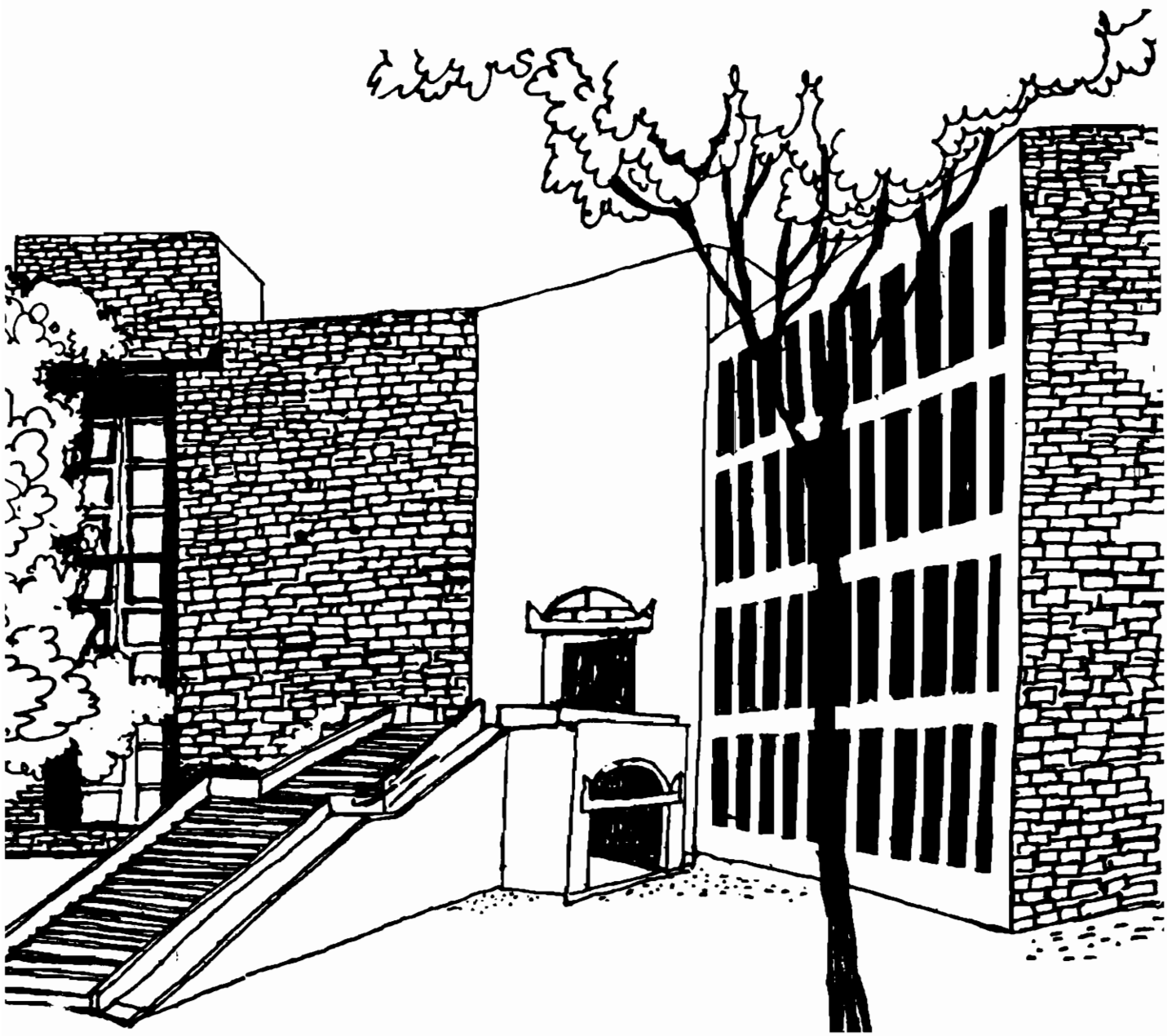
विद्याविनियोगाधिकारमः
IIM
AHMEDABAD

Working Paper



REVIEW OF THE POLICY CHANGES IN THE INDIAN TELECOM SECTOR: IMPLICATIONS FOR DECISION MAKERS

By

Rekha Jain

W P No. 1096
April 1993

The main objective of the working paper series of the IIMA is to help faculty members to test out their research findings at the pre-publication stage.

INDIAN INSTITUTE OF MANAGEMENT
AHMEDABAD-380 015
INDIA

REVIEW OF THE POLICY CHANGES IN THE INDIAN TELECOM SECTOR: IMPLICATIONS FOR DECISION MAKERS

Rekha Jain
Indian Institute of Management
Ahmedabad

ABSTRACT

In response to the business needs of faster, cheaper, and more varied modes of communication, the telecommunication sector in many countries has been undergoing rapid technological and structural changes over the past few years. Since the mid 80s, the telecommunication sector in India, too, has undergone major transformations. Private participation in the manufacture of end user equipment and services, reorganization of the monolithic Department of Telecommunication, and raising finances from the public for investment in the state owned factories and organizations have been some of the policy initiatives of the government.

In a scenario where the features of the Indian telecom sector such as under-investment, amalgamation of regulatory and operational functions, ill-defined sector policies, and lack of financial and administrative autonomy are common to many other developing countries, the consequences of sectoral changes have implications both for decision makers at the national level as well as in other developing countries. This paper attempts to critically review the policy changes initiated by the government and draw lessons from them.

INTRODUCTION

Technological changes in the telecommunications and computers have radically changed the business scenario. In turn, the new demands of business have spurred many telecommunication technological innovations. In order to exploit these innovations for competing in global markets, business community the world over has been putting pressure on governments to revise the policy, regulation, and structure of the telecommunication sector. The consequent changes to the environment have ranged from deregulation in US to privatization in UK and Japan. The emergent organizations have been more responsive to the business needs and have evolved mechanisms to remain competitive even under tremendous pressures [Uehara, 1990; King, 1990; Kim, Kim, and Yoon, 1992].

The developing countries too are beginning to recognize the important role a responsive, business oriented, and technologically advanced telecom sector plays in the growth of the economy. Many developing countries which operate under a state or government control have come to recognize the limitations of a monolith state monopoly in responding to the twin challenges of spurring internal growth and competing in an increasingly global economy [Melody, 1986]. Consequently, telecom sectors in many developing countries are undergoing a reform process [Wellenius, 1990; Jussawala, 1992]. In a developing country, the complexity of introduction of new policy and organizational structures are compounded by resource shortages, lack of trained manpower, and technology and political expediency.

Past experience of reform across many countries suggests that the fundamental underlying issue that must be addressed to in telecom reform is effective separation of the basic function of policy making, operational management and regulation [ITU Report,1989]. The second level consideration is that of access to capital and human resources. The third level concern is introduction of competition for efficiency in the telecom sector. Competition is considered to be a more important factor than ownership in introducing efficiency. Further, the order in which structural adjustments take place will also determine their effectiveness [Melody, 1990].

The Indian telecommunications sector which was wholly under government ownership until recently and was characterized by under-investment, outdated equipment, and unfocused growth has witnessed a process of reform since the 80s. The imperatives for reforms were the overall trend of economic liberalization and the technological advances in this sector. The Indian experience of implementing policy changes brings forth issues and alternatives which have implications for decision makers in India as well as in other developing countries, where telecom sectors have similar characteristics.

This paper provides an overview of the various organizations in the Indian telecom sector and assesses the policy initiatives of government on whether it addresses the issues listed above: separation of policy, regulations and operations, access to capital and human resources, introduction of competition, and the sequencing of these reforms. It also attempts to provide answers to some relevant issues such as: In view of the organizational changes initiated by government what have been the consequences with regard to policy implementation? Have the new organizations been able to respond better to the policy initiatives? Do the roles and relationships of these organizations amongst themselves facilitate/hinder policy implementation? How successful have these attempts been?

INDIAN TELECOM SECTOR: PAST AND PRESENT

The Indian telecommunication sector was a state monopoly until end of the 70s. Government departments and 100 per cent government owned corporations controlled all facets of the telecom sector including policy formulation and implementation, manufacturing of equipment, operations, maintenance, and regulation of services. Investments in the telecom sector were funded from government resources. Planning for the telecom infrastructure and services is centrally done by Planning Commission, an apex level body. The telecom sector therefore competed with other developmental priorities of the government for a share in resource allocation.

There was little investment in this sector and no overall direction for growth. Outdated equipment, a significant number of manual exchanges, shortage of equipment, and a bureaucratic mode of functioning were further impediments to growth. Since this sector operated in a monopolistic environment, there was little imperative to respond to changing business and subscriber needs.

Over a period of time, increasingly larger investments have been earmarked for this sector. Table 1 provides data on government investments since the 1950s. The targets for this sector in the eighth five year plan (1992-97) are ambitious: an investment of nearly $6000 million (1 US$ = Rs.30 approximately), doubling of telephone lines from 5.2 million to 10.7 million, and extending the area of operations in terms of route-kilometers from 59000 to 1,05,000. Telecom was included by the government as a part of technology missions -- a set of dedicated, welfare oriented, and well-focused programs being implemented at the national level [Dhir, 1992].

THE TELECOMMUNICATION NETWORK[1]

The Indian telecommunication network handles over 40 million telephone calls daily. The network is characterized by a high urban bias. Ninety per cent of the telephones are in urban areas serving 10 per cent of the population. About 30 per cent of these are concentrated in the four metros of New Delhi, Bombay, Calcutta and Madras. Though, the network has exhibited an average growth rate of 8 per cent since independence, it has not been translated into an equal level of benefits, since the network has diverse types of switching technology and transmission media. For example, there are more than 10 types of switching systems in the network [Ravi,1992]. In addition, meager investments have been spread across areas ranging from developing basic infrastructure for rural areas to provision of integrated digital services network, albeit at a limited pace.

Table 2 presents some financial and operational indicators related to this sector. It is evident that infrastructure availability has increased significantly over this period. This has partly been due to a rise in investment levels and partly due to introduction of advanced technology.

Growth in Network

The growth in the network since 1987 has been both in route-kilometers and induction of new technologies. The trunk routes are predominantly fibre optic cables, while coaxial cables, microwave (both analog and digital), digital UHF for rural communication, and satellite systems constitute the network. However, coaxial cable and analog microwave are increasingly being replaced by fibre optic cables on trunk routes. Table 3 presents growth data. In rural areas multi-access rural radio systems are proposed. Satellite communication is increasingly being used to hook up to remote and difficult to access areas. In addition, India has over 1000 earth stations for domestic and international communications [Annual Report, Department of Telecommunications, 1991].

Growth in the Switching Exchanges

About 15000 local exchanges and over 50 long distance exchanges constitute the exchange network. There are a large number of manual and crossbar exchanges. Table 4 shows the proportion of different kinds as in 1987. It is seen that digital trunk exchanges are increasingly replacing the older exchanges.

End-User Equipment

Terminal equipment availability, quality, and features have undergone a major change since 1989. Until the early 80s, only rotary-type phones manufactured by government owned factories were available. Push button phones, cordless phones, and answering machines are today available in the Indian market. Though the number of telephone connections provided increases every year, there is a long waiting list of telephone subscribers owing to a faster growth in demand. Table 5 which provides year-wise number of direct exchange lines provided by DOT and the number of wait-listed of telephone subscribers gives a rough estimate of the increase in the number of end-user instruments introduced in the network and the potential demand.

---

[1] Data for this section are largely taken from the Annual Reports of the Department of Telecommunications, Government of India, 1986-91.

TELECOM SERVICES

Telephone or basic voice service constitutes over 80 per cent of the telecom network by investment and revenue [Ravi,1992]. The telephone density is 6.8 per 1,000 population, compared with 458 for Japan, 380 for South Korea, 18 for the Philippines, and 99 for Argentina [Pyramid Research Reports, p 17, 1991]. Public payphones and telecom bureaus provide enhanced access. However, by western standards access is still very restricted. The ratio of payphones per person is 1:3600. Access to telephones in rural areas is severely limited. Out of 575,495 villages according to the 1981 census, only 28,525 were served by long distance telephones by 1990. In rural areas at least a public phone is proposed to be set up in every village by the end of the eighth five year plan.

Advanced communication services like fax, data transmission over telephone and leased circuits are increasingly being made available. Electronic mail and voice mail services are provided on a limited scale. EDI standards are currently being worked out.

Data Communication Network

The first network was started in 1985 by CMC Ltd., a public sector undertaking. It links up the major cities in India on 2400 bps leased lines. Since 1992, another data communication network called I-NET has also become available. It links up eight metropolitan cities in India through 9.6 kbps and 64 kbps data links. I-Net is based on international standards and interfaces.

Setting up privately owned data communication networks is expensive for Indian organizations since rentals of leased lines are fairly high. The tariff policy also seems to discourage networking. For example, if the leased line is connected to more than one terminal, the tariff is doubled. In addition, DOT provides very little choice in the transmission media it leases out.

Cellular Phones and Paging Systems

In May 1991, government announced its intention to award licenses to private operators for providing cellular phones in the four metro cities of New Delhi, Calcutta, Bombay, and Madras, and paging services in 27 cities across India. The cellular phone is seen as a lucrative segment by the industry and a large number of proposals (nearly 30) were received. Almost all the proposals plan for foreign collaboration in view of the high cost of initial investment [Telematics India, 1992].

Software Exports

To facilitate software exports -- a thrust area identified by the government -- exporters have been allowed to set up satellite communication at 64 kbps from selected locations at Bangalore, Pune, Bombay, etc. Ordinarily, such high speed data links were not available. Procedures for establishing high speed data links for software export were simplified by dovetailing and coordinating the activities of various telecom organizations.

ORGANIZATION STRUCTURE

Telecommunication services in India are provided and administered by the Ministry of Communication headed by a minister. Planning, engineering, installation, maintenance, management, and operations of telecom services for nearly the whole of India is managed by the Department of Telecommunications (DOT). It lays down technical standards and monitors adherence to standards

and frequency usage. The annual revenue of the department is more than $ 13,000 million. It is also the second largest employer of manpower (over 0.45 million) in the public sector.

There are a number of government telecom factories and regional departments to manage the operations within the country. Mahanagar Telephone Nigam Ltd. (MTNL) provides telecom services in the cities of Bombay and New Delhi and Videsh Sanchar Nigam Ltd. (VSNL) provides international telecom services. Telecom Consultants India Ltd. is a project organization, under DOT providing consultancy and turnkey project management services in India and other developing countries. C-DOT (Center for Development of Telematics) is the flagship research organization which was set-up with the objective of initiating and managing research in indigenization of telecom products in the switching and transmission segments. A number of regional and national level training centers provide telecom related training to employees in this sector. A number of private manufacturers and state level enterprises in collaboration with foreign companies have now started manufacture of EPABX, jelly filled cables, optical fibre cables, and telephone equipment. A brief description of the various organizations is given in Exhibit 1. Exhibit 2 provides the organizational structure of the Indian telecom sector. Exhibit 3 shows a framework for understanding the influences of various global actors on the Indian telecom sector.

ORGANIZATIONAL CHARACTERISTICS

The Indian telecom sector has a number of organizations varying in financial, structural, and decision making autonomy. The departmental structure of DOT provides the least amount of flexibility in financial or strategic decision making. It is also entrenched in bureaucracy with little autonomy or decision-making powers at most levels. One of the biggest problems that DOT faces is of retraining and deployment of a large number of staff. Thirty-two per cent of its staff which was trained in the telegraph now require training and upgradation of skills as the telegraphic segment is fast declining and currently contributes only half per cent of the revenue. There is little market or customer orientation within DOT as there is hardly any pressure to be competitive. MTNL and VSNL being public sector corporations, do not have financial autonomy and all financial decisions related to MTNL are largely taken by DOT. All proposals related to market borrowing, foreign exchange requirements, expansion of network related to switching equipment, introduction of new technology, equipment or material, import of technology, and allotment policies of telephones must be approved by DOT. DOT regulates MTNL's procurement from government owned factories. In addition, MTNL must follow administrative instructions from DOT. All equipment used by VSNL also needs to be approved by DOT. Thus, decisions regarding import or introduction of new technology which it may appear could be faster implemented in autonomous organizations are unlikely to be as speedy in the current decision-making framework of DOT vis-a-vis MTNL and VSNL.

Organizations such as Telecommunication Consultants India Ltd. are designed to be more open and have a relatively greater amount of financial and operational autonomy. C-DOT is an autonomous body which has operational autonomy in deciding future plans, areas of growth, and internal operations. However, it does not have the financial autonomy that corporations have.

Telecom factories which have started manufacturing modern telecom equipment recently have to contend not only with old outdated manufacturing equipment, but also with outdated management practices. Competition from the private sector will make it imperative for these factories to adopt more efficient technical and managerial approaches. For example, the cost of DOT owned telecom factory's single line of exchange is approximately $30, and that quoted by private organizations is $15.

Policies regarding tariffs are decided by DOT even in those cases where MTNL or VSNL initiates new telecom services.

RESTRUCTURING INITIATIVE

In one of the earliest steps towards improving telecom operations and providing a boost to indigenization efforts, the government set up a research and development organization called the Center for Development of Telematics (C-DOT) in 1984. The Department of Posts was separated from the Department of Telecommunications (DOT) in 1985 so as to focus sharply on telecommunications development. However, DOT was still a monolithic entity, with a huge work force managing the telecom operations of the entire country. The bureaucratic approach and the slow acceptance and induction of new technologies with very little customer orientation were perceived as barriers to growth. Consequently, in 1986, two new public sector corporations --MTNL and VSNL-- were set up to provide decision making autonomy and flexibility and allow public borrowings to supplement internal resources [Annual Report, DOT, 1986-87]. MTNL was carved out of DOT and took over the operation, maintenance, and development of telecommunication services in Bombay and New Delhi. VSNL was set up to plan, operate, develop, and accelerate international telecommunication services in India. However, policy formulation, regulation, and implementation, by and large, still rested with DOT. A new organization named the Telecom Commission was created in 1989 with a wide range of executive, administrative and financial powers to formulate and regulate policy and prepare the budget for DOT. Four full time members look after technology, production, services, and finance and four part time members represent the Planning Commission, Department of Finance, Industry, and Electronics.

RECENT POLICY CHANGES AND THEIR IMPACT

The government had initiated policy changes largely in the following areas:

i) restructuring of the sector
ii) investments in the sector
iii) technology development and transfer
iv) provision of services.

The objective was to provide accelerated growth in infrastructure and services, improve customer service, provide autonomy and flexibility within the sector to expedite growth, raise finances from the public, and provide an effective regulatory and policy environment. In the following we attempt to review the policy changes, assess the impact, and suggest directions for improvement.

ORGANIZATIONAL ALTERNATIVES FOR THE TELECOM SECTOR

Creation of MTNL, its subsequent operations, and the relationship of the personnel employed in MTNL to their counterparts in DOT raised questions about the organizational structure most suited for this sector in the Indian context. Therefore, in 1991, at government initiative a high powered committee submitted a report on the appropriate structures for this sector. This report is to be discussed by a parliamentary committee in the near future.

The broad objective of this committee were to evolve appropriate organizational structures to ensure rapid growth in infrastructure and services, assist in the establishment of an effective regulatory

framework for existing and new services, and identify mechanisms through which this sector could raise more finances [Report of the High Level Committee on Reorganization of Telecom Department, 1991]. The nine member committee examined various organizational structures and the majority of members (six out of nine) recommended the following:

a) both policy and regulatory mechanisms be placed under the Telecom Commission since this organization has a broad overall perspective of the sector and the country;

b) Zonal telecom operating corporations be formed. These would be spread across the country to manage telecom services. They are initially planned to be 100 per cent public sector enterprises;

c) a corporation to handle the long distance network be formed. Initially it would be in the public sector. Over a period of time, its equity could be shared by public, zonal telecom operating corporations, and possibly private bodies involved in providing value added services;

d) value added services be provided by the private sector;

e) production of equipment would be undertaken both by private organizations and government owned telecom factories;

f) research and development organizations should be planned as autonomous bodies with a fair amount of operating freedom;

g) training institutes to be autonomous bodies with flexibility for recruitment, promotion, and interlinkages with other institutes.

Exhibit 4 shows the committee's proposed structure of the Indian telecom sector.

ASSESSMENT OF RESTRUCTURING INITIATIVE

The committee's report may be viewed as an initiation of a process of examining organizational options. It still remains to be evaluated. The primary focus of our analysis is to assess whether the restructured organizations satisfy the basic conditions necessary for reform.

The report recommends separation of operations from policy and regulation even though experience of other countries and well documented body of literature have stressed the need to separate policy, regulation, and operation. Separation of policy, regulation, and operations usually requires changes in legislation. The need and scope of appropriate changes in legislation is not considered in this report. For example, the restructuring of the Japanese Nippon Telegraph and Telephone Public Corporation and Kokusai Denshin Denwa was preceded by appropriate changes in the legal framework [Mutoh, 1990].

The proposed structures provide limited scope for autonomy in financial and operational decision-making. Management incentives which would allow these organizations to increase profitability and the structural mechanisms which would allow them to raise capital from markets have been very sketchily outlined [Jain and Chhokar, 1993]. Thus access to capital would still remain a problem. Access to manpower trained to be responsive to fast changing needs of the global market place will be a constraint as there are few well designed training programs in this segment.

The scope of the proposed organizations allows for competition only in the value added components of telecom services. Competition across various functional units in basic services and competition from foreign firms in at least some segments could have been considered.

Besides the three limitations listed above, the suggested changes are superficial since most "restructured" organizations show too much of a control orientation and would continue to work with the old workforce without adequate retraining. Further, the committee has not identified a mechanism for redressal of user issues and problems. For example, it did not deliberate on how organizations would deal with delays in certification of equipment or in evolving specification for emerging technologies. The report does not specify formal mechanism for integrating the needs of large user groups like railways, police, and financial institutions into the overall telecom plan for the country.

A variety of features and options that could be designed into the Indian restructuring initiative could have been drawn from the experience of many other countries such as Indonesia, Malaysia, Pakistan, Philippines, Sri Lanka, Thailand, and Korea where at least some degree of organizational restructuring has been introduced [Wellenius, 1990; Jussawala, 1992].

Korean Experience in Restructuring

In Korea, the restructuring initiative was defined by the telecom policy : provision of one telephone per family and switching automation [Kim, Kim, and Yoon, 1992]. As a first step towards this, the telecom operations were removed from the Ministry of Communication and several incorporated public common carriers (PCC) were made responsible for it. In 1982, the PCCs were placed under a Korean Telecommunications Authority which had financial and operational autonomy. Subsequently the telecom authority offered a number of specialized services such as data communication, port communication, and cellular mobile communication with active private participation. The Ministry of Communication coordinated policy formation, design, and implementation issues. At this stage the various organizations that provided these services were still monopolies and were public entities. In the late 80s, PCCs were privatized, telecom services were further deregulated, and now competition exists both in the basic and specialized services segments. Both domestic and foreign companies may offer data and specialized services, while the specialized service providers have been allowed to offer services across a number of other service categories. International competition is allowed in manufacturing and some services. The government felt that domestic manufacturers could withstand competition from foreign firms whereas it adopted a more cautious approach for the service providers. There is a stage-wise well defined framework for opening up the market : a tariff rate reduction of 7.5 per cent, greater role of foreign firms in public procurement, and simplification of technical standards. To ensure smooth transition, the government introduced these changes gradually.

The Korean government has had a very focused telecommunication policy in contrast to the Indian policy. The Korean policy was responsive to changing environment and the government took measures such as privatization, restructuring, and deregulation at various points in time to ensure that the Korean telecommunications sector remained competitive. The key elements of successful implementation of this policy have been the strong government support and political will for implementing reforms as exemplified by it's decision to open up the domestic market for foreign companies for equipment procurement and provision of services. In contrast, the Indian attempts at restructuring have been halfhearted as exemplified by the high degree of operational and financial control within MTNL and VSNL.

IMPACT OF INCREASED INVESTMENTS

Though government investment in this sector has steadily increased, telecom's share of investment in the economy has remained more or less steady at an average of 2.81 per cent. Even in a country like Kenya telecom investment as a share of GDP rose from 3.28 per cent in 1978 to 8.61 in 1987 [Akwale, 1992]. The effect of under-investments in this sector is compounded by the diffusion of these scarce resources over a number of areas resulting in a situation where no specific area in telecom is well-developed.

Coupled with under-investment, is the problem of finding capital. Government allocations are bound to be limited. In the past, international bodies have funded some expansion and technology upgradation programs [MTNL Report, 1991]. However, that is not a long-term, and stable solution. Until 1984, there were a number of restrictions in the telecom sector relating to raising of finances. Subsequently, state owned telecom factories, MTNL, and VSNL have been allowed to raise funds by issuing low interest tax free bonds.

To mitigate resource shortage, government has allowed investment by the private sector in the end-user segment. Since the deregulation in manufacture, some of the domestic private companies have been able to avail easy relatively finance schemes as a part of multinational corporations' (MNCs) overall strategy of establishing themselves in a growing market [Business Today, January 1992]. Consequently, government investment in this segment has decreased, allowing it to focus on network and switching segments. Investment is also sought through private provision of radio paging and cellular services. However, government has not been able to clear proposal for investments in this segment, primarily because it was not sure about the scope of services and also because it wants to limit the number of service providers in different geographical areas. Government is now considering disinvestment of shares of some public sector enterprise. To ensure adequate supply of funds, a telecom finance corporation with the objective of raising funds from the public has been set up.

With the increasing liberalization in the economy, there is a pressure on telecom organizations to raise interest rates. The low interest rates offered by government bonds generally make them unattractive as a source of investment. The pressure of high interest rates on these bonds is likely to be borne by the customers. But, given the current low levels of services and indifference to customer requirements, there is likely to be public resistance to any such increase. Moreover, many public sector executives feel that raising the interest rates would increase the cost of capital and decrease their profitability.

The experience of other developing countries which have successfully raised finances needs to be explored by decision makers. For example, in Korea the government consciously decided not to raise money for the telecom sector through tax and bonds as these mechanisms required consent from the Ministry of Finance and the National Assembly. The government bonds would face increasing pressure for high interest rates [Kim, Kim, and Yoon, 1992] and the customer would have to pay higher tariffs. The government then decided to incorporate the telecom entity as a public corporation, in order to allow it to raise capital and provide management incentives to improve the overall functioning of the organization. Profits from telecom service operations could then be invested back into the sector. This strategy removed financial constraints on investments. In Mexico the shares of the public telecom companies were sold to private bidders not on the basis of offered price alone but also on the technical expertise of the bidders [The Economist, 5 October, 1991, p 34]. This ensured not only access to capital but also technical and managerial expertise of the successful bidder.

In India, it seems likely that access to capital and foreign exchange would continue to be a problem. Privatization in the end user segment will ease the government burden only to a small extent. Massive investments for the network and switching segment will be difficult to finance at least in the near futur..

ASSESSMENT OF TECHNOLOGY TRANSFER AND DEVELOPMENT POLICY

India has attempted to follow a policy of achieving self-reliance in manufacture of products through indigenization. Until 1986, most telecommunication equipment was backward with few international advanced technology, if any. However, in the wake of liberalization, DOT attempted to introduce some advanced technology both by indigenization and seeking foreign collaborators wherever possible. Until July 1991, DOT shortlisted the technology that may be imported and the licensed capacity for manufacture. Import of technology was also linked to the requirement of phased indigenization. The private companies could not choose the technology. The introduction of the new industrial policy in July 1991 removed the constraint on choice of technology, capacity, and phased indigenization program for imported technology. India has started manufacturing EPABXs, electronic push-button telephones, switching exchanges, and jelly filled and optical cables. The success in these segments has been varied.

EPABX Segment

Initially, three foreign firms, Jeumont Schneider of France, OKI of Japan, and GTA-ATEA of Belgium, were shortlisted for transfer of technology for manufacture of EPABXs. Through this limited the technology choices, government at least ensured that Indian manufacturers developed expertise in EPABX manufacture. Today, a number of Indian firms manufacture EPABXs. In addition, C-DOT also planned to develop and license indigenous technology. Initially, there was a lot of government support for C-DOT's program, based on the championing of these ideas at the highest political levels by C-DOT's mentor. However, delays in achieving the targets, the high profile nature, and the political connections of its mentor, put C-DOT under a lot of controversy, resulting in further slowing of C-DOTs plans. Though it is well behind schedule in indigenization of medium and large sized exchanges [Business Today, January 1992], C-DOT has successfully developed exchanges for rural conditions characterized by dust, heat, and humidity.

EPBT Segment

For electronic push button telephones, the companies initially chosen for transfer of technology were Siemens AG of Germany, Ericsson of Sweden, and FACE of Italy. Indian companies could develop in-house expertise for manufacture of push button telephones if they wished to do so. The result of private participation in this segment has been a drastic fall in prices of end user equipment. Answering machines, pay-phones, and cordless phones have also recently begun to be manufactured by Indian companies. However, the number of new products available in the market is not very large. For example, answering machines constitute only 0.7 per cent of the total market share in this segment. The experience of private manufacturers has not been very good. A survey of manufacturers of EPBTs listed in the compendium brought out by the Center for Monitoring Indian Economy showed that, out of 10 manufacturers listed in this segment, only five have a capacity utilization of 50 per cent or more [Market and Market Shares, Electronics, 1992]. The possible reason for this is that demand is limited by the number of lines made available by DOT and DOT usually finds it difficult to meet its own targets.

Switching Segment

In addition to allowing foreign technology transfer in the end user segment, DOT also planned to introduce digital transmission and exchanges in all newly opened exchanges and upgrade the old exchanges. Table 6 presents DOT's plan for digitalization of the network. However, DOT has simply not been able to introduce the technology at a pace which could lead to faster progress, largely because of its dependence for supply of material and equipment from government factories. Moreover, India's indigenization program in the switching segment is well behind schedule owing to delays in C-DOT's plans. India does not as yet have the technical and financial resources to manufacture large digital exchanges and these must be imported.

Transmission Segment

Jelly filled cables and optical fibre cables have been chosen by DOT as standard media for transmission for the national network. In the transmission segment, government and some private organizations have tied up with foreign collaborators for manufacture of jelly filled cables. Technology for manufacture of optical fibre cables is imported and only licensed to be manufactured by state and central government owned factories. In this segment too, delays in absorption, diffusion, and indigenization have been pronounced [Mani, 1992]. Government restrictions in only allowing state and central government organizations to manufacture optical fibre cables could mean constraints in availability of funds and consequent delays in indigenization and manufacture.

Lessons from Korea's experience of successfully developing indigenous switching technology are worth noting. The key components of this strategy were the alliance between the telecom authorities, equipment manufacturers, and telecommunication research institutions. Continued and stable financial support from government and the role of government in effectively coordinating the interlinkages between business and research institutes were important instruments in this program. Further, the government closely monitored the progress and removed bottlenecks during the development phase.

Many developing countries have been able to successfully coordinate the efforts of internal R & D units with those of foreign collaborators. For example, Korea's experience of not only adoption and diffusion of imported technology in the digital electronic switching but also in diverse fields such as petrochemicals, synthetic fibers, machinery, and iron and steel is an example of how a government can facilitate technology development [Enos and Park, 1988]. In all cases the Korean government could negotiate precise terms with foreign suppliers in its favour. The Korean government not only negotiated for technology transfer but also for a range of auxiliary services such as financing, training, channelizing for excess output, etc. Monitoring of absorption of technology was incorporated as a part of the negotiation with the foreign supplier. In addition, the government was successfully able to coordinate the efforts of various ministries and was actively involved in the implementation at various stages.

In contrast, the Indian attempt at indigenization suffered from lack of resources, few if any linkages with the business and research institutions, and support which was based on a single individual's relationship with politicians.

IMPACT ON IMPROVEMENT OF SERVICES

All telecom related services were provided by DOT until 1985. From 1985 onwards government has allowed privately operated telecom bureaus, public networks, and satellite transmission of software for

export. Changes in policy with respect to provision of services has, in general, led to an increase in the levels of customer service both in access and quality.

Telephone Service

In spite of an increase in the number of direct exchange lines, digital switching exchanges, provision of telecom bureaus, and pay-phones, the average waiting time for telephone connection has increased. Data in Table 5 highlight this point. Innovative solutions may help reduce the demand a little. For example, MTNL plans to provide out-of-turn cooperative telephone services to a group of 25 or more people in the same residential or commercial complex.

In digital exchanges it has been possible for DOT and MTNL to improve the scope of services by providing features and services such as call forwarding, teleconferencing, voice mail, etc. The more serious concern in increasing quality of service is not technologically impediment but the senior decision-makers' orientation to customer service. DOT assesses customer service in purely technical parameters such as number of STD links provided, call success rate, etc. In spite of increasing value of these parameters, a large number of subscribers have experienced delays, non-redressals of complaints, and apathy due to lengthy and outdated departmental procedures.

Networking Services and Value Added Services

The slow speed of INDONET and its high tariffs acted as deterrents for organizations to use this network. Consequently, CMC was not able to generate revenue for upgradation of the network. Lack of interfacing software and hardware which could run on this network have been the other problem. In addition, there was a dearth of professional expertise in CMC to enable organizations to hook up to the network it provides. Many Indian firms have felt the need for an advanced data network, especially those having collaboration with foreign partners, to enable them access to computing resources [Jain, 1992]. DOT has not been able to provide networking services at a speed at which organizations now demand.

Besides the technological impediments to networking, many Indian organizations themselves had been passive about using networks since computerization in a large number of Indian organizations began to take place in a significant manner only after 1985. The other reason why Indian organizations are not networked is because a large number of organizations, especially government and those in the public sector, operate in protected and almost monopolistic market conditions. Until recently there was no pressure to hone up the organizational competitiveness due to the closed and protected economy. Though a large number of studies have shown that networks have enabled organizations to become more competitive [Parson, 1987], Indian organizations had no imperative to use networking.

Since DOT does not have a well defined policy and implementation schedule for introduction of telecom services, availability and quality of services is low. It has spent little effort in marketing its network. Getting information about the facilities on the network, tariff, etc. is difficult since DOT has not widely publicized this information. Wherever DOT has sought private participation of services, as for example in the cellular phone segment, DOT itself does not seem to be clear about the scope of services, the mechanism of revenue sharing, tariff policy, and regulation. Consequently, the initial round of bidding for provision of services ended in a legal wrangle.

There is no competition in the existing services and hence there are problems of inefficiencies, low levels of availability, and lack of innovations. In many other countries, competition in the services segment has compelled companies to become more competitive and produced visible benefits for the consumer such as increased range of services and reduced tariffs [Glynn,1992; King,1990].

Given the large base of employees who have been entrenched in a typical bureaucratic mode of functioning, orientation to customers and business perspective appears to be the most difficult to implement. DOT has no specific training policy in this regard. Though there are regional training centers and a national level training center, these are not equipped to handle managerial issues.

POLICY IMPLICATIONS

With the setting up of the Telecom Commission, a division between policy and regulation and operations has taken place; a further separation between policy and regulation needs to be affected. This could be done by setting up a policy unit and a regulatory body. The policy unit should be separate from the government to ensure objectivity in policy design and fairness in implementation. The problems of political expediency can thus be minimized. The advantage of a separate regulatory body would be that it could ensure fair enforcement of government policy, hold operators accountable for performance, address consumer issues, monitor changing industry needs, and provide feedback to the policy making unit. Given that India is slowly moving from a closed economy to a competitive one, intensive monitoring, detailed implementation plan, and guidelines to ensure fair access to the network also need to be designed in the restructuring plans [Melody, 1991].

Politically, public consensus for providing financial and operational autonomy of various organizations in this sector could possibly accelerate the introduction of reforms. In the absence of a well defined strategy, reforms are likely to get implemented in an adhoc manner.

Access to capital, skilled manpower and foreign exchange are major determinants of the speed of reform. Therefore, capital market funds either through partial or full privatization would have to be obtained.

Competition which is considered essential for ensuring efficiency, profitability and new products and service innovation should be enhanced in the basic and value added services and manufacturing. In the context of the changing business scenario, policy regarding marketing, usage, and ownership of datacom channels and other telecom services must be amended. Delays in introduction of competition will further delay India's reform program.

The Indian government must evolve a coherent technology transfer policy. It can play a positive coordinating role between foreign collaborators and internal R&D units in technical development.

A long term training policy to train and educate the large workforce in the immediate future in technical, managerial, software design and maintenance, and service development has to be an integral part of any future telecom policy. Establishing linkages with management schools to overcome some of these problems could be a possible solution. Decision making committees must consist of professionals from a wide range of subjects to strengthen the analytical component of any policy design and implementation.

CONCLUSIONS

India has begun a process of telecom reform but for the benefits to be available to the economy a number of actions will have to be taken, viz., separation of policy and regulation function, privatization of at least some components of telecom service, design of long term training policy, and designing of

monitoring systems to ensure fair access to the network. The organizational structures that have resulted from the reorganization initiative -- specifically MTNL and VSNL -- have not been able to fulfil the objective with which they were designed: that of providing decision making autonomy and flexibility vis-a vis DOT. The current decision-making frameworks give them very little autonomy. The speed of implementation of reforms has been slow. It also appears that there is no coherent long term plan for continuing the reform process. Implementation of many of these suggested measures may require strong political will and a concerted effort.

REFERENCES

Akwule, R.U. (1992): "Telecommunications in Kenya: Development and Policy Issues," **Telecommunications Policy**, September-October 1992, pp 603-611.

Annual Reports, Department of Telecommunications, 1986-1991.

Antonelli, C.(1991): Technological Change and Leapfrogging Opportunities: The Case of Advanced Telecommunication, Paper presented in the ITU Conference, 13-15 Oct, Geneva.

"Cellular Arrives in India," **Telematics India**, June 1992.

Center for Monitoring of Indian Economy, **Market and Market Shares**, Electronics, March 1992, pp 566-70, March 1992.

Dhir, K.S. (1992). "The Challenges of Introducing Advanced Telecommunications in India" in **The Global Issues of Information Technology Management**, ed. Palvia, Palvia and Ziegler, Idea Group Publishing, Harrisburg, USA.

Enos, J.L. and W.H. Park. (1988): The Adoption and Diffusion of Imported Technology: The Case of Korea, Croom Helm, USA.

Glynn, S. (1992): "Japan's Success in Telecommunication Regulation: A Unique Regulatory Mix," **Telecommunications Policy**, pp 5-12.

"Gunning for Sam," **India Today**, January 11, 1991, pp 115-119.

ITU Report, (1989): The Changing Telecommunications Environment: Policy Considerations for Members of the ITU, Report of the Advisory Group on Telecommunication Policy, ITU, Geneva, 1989.

Jain R. (1992): "Networking for Competitive Advantage: The Case of HCL," Indian Institute of Management, Teaching Material.

Jain, R. and Chhokar, J.(1993): "Reorganization of the Telecom Sector: Past and Future," **Economic Times**, February 3, 1993.

Jussawalla, M. (1992) Is the Communications Link Still Missing?, **Telecommunications Policy**, Vol.16, No.6, August 1992, pp 485-503.

Khanna, S.(1992): "Trapped in a Tangled Web," Business Today, April 1992, pp 82-83.

Kim, C., Kim, Y.K. and Yoon, C.(1992): "Korean Telecommunications Development: Achievement and Cautionary Lesson," World Development, Vol. 26, No.12, pp 1829-41.

King, J.A.C. (1990): "The Privatization of Telecommunication in the United Kingdom," Restructuring and Managing the Telecommunication Sector, ed. by B. Wellenius, P.A. Stern, D.E. Nulty and R.D. Stern, The World Bank, Washington D.C., pp 55-60.

Mani, S. (1992), Foreign Technology in Public Enterprise (New Delhi: Oxford & IBH).

Melody, W.H. (1986): "Efficiency and Social Policy in Telecommunication: Lesson from the U.S. Experience," Journal of Economic Issues, September 1986.

Melody, W.H. (1991) Telecommunication Reform: Which Sectors to Privatize, ITU Conference, October 13-15, Geneva.

"MTNL Completes Five Years", MTNL, 1991.

Mutoh, N. "Deregulation of Japan's Telecommunication Business and the Role of Kokusai Denshin Dinwa," Restructuring and Managing the Telecommunication Sector, op.cit., pp 61-69.

Parson, G.L. (1987): "Strategic Information Technology" in Towards Strategic Information Systems, ed. by E.K. Somogyi and R.D. Galliers, Abacus Press, Cambridge.

Ravi, N. (1992), Telecommunications in India: Past, Present and Future, IEEE Communication Magazine, March 1992.

Report of the High Level Committee on Reorganization of Telecom Department, March 1991.

Skaria, G. and Khanna. (1992) "The Telecom Pie," Business Today, January 1992, pp 50-55.

"Telecom Policy: An Anaemic Draft", Telematics India, July 1992, pp 14-16.

"Telecommunications," Economist, October 5, 1991, p 34.

"The C-DOT Baby Matures", Telematics India, September 1992, pp 24-26.

Uehara, T.(1990): "Privatization and Reorganization of Nippon Telegraph and Telephone", Restructuring and Managing the Telecommunication Sector, op.cit., pp 67-69.

Wellenius, B. (1990): "Beginning of Sector Reform in the Developing World" Restructuring and Managing the Telecommunication Sector, op.cit., pp 89-98.

Table 1: Share of Telecom Sector in National Plan Outlays

	Period	Total Outlay	Telecom Outlay	
		Rs. Billions*	Value Rs. Billions	Percent Total
First	1951-56	19.60	0.47	2.40
Second	1956-61	46.72	0.66	1.41
Third	1961-66	85.77	1.64	1.91
Annual	1966-69	66.24	1.59	2.40
Fourth	1969-74	157.99	4.15	2.63
Fifth	1974-78	286.53	7.81	2.73
Annual	1978-80	229.50	5.19	2.26
Sixth	1980-85	1096.46	27.22	2.48
Seventh	1985-90	2230.00	81.47	3.65
Eighth	1990-95	4000.00	250.00	6.25
AVERAGE TELECOM OUTLAY (PERCENTAGE OF TOTAL)				2.8

One US dollar was equal to Rs.18 till July 1991 when the rupee was devalued and now equals Rs.30 approximately.

Source: N. Ravi, "Telecommunications in India-Past, Present and Future," in IEEE Communication Magazine, March 1992.

Table 2: Some Operational Parameters: Indian Telecom Sector

Parameter	1984	1990
Local Exchange	321	14,285
Equipped capacity (Million Lines)	0.1	5.3
Working Connections (Millions)	0.08	4.6
Long Distance Public Telephones	338	30,800
Public Telegraph Office	3,324	36,400
Toll Exchanges Capacity (Million Lines)		0.7
Direct Distance Dialing Stations		867
Coaxial Cable (Route Km)	A D	22,948 1,769
Microwave (Route Km)	A D	30,047 2,540
UHF (Route Km)	A D	12,747 1,335
Fibre Optic Cable (Route Km)		1,615
Satellite Earth Station - Fixed - Mobile		67 17

A: Analog
D: Digital

Source: Same as Table 1.

Table 3: Growth in Network (1987-91)

Technology/ Year	Route Kms up to	Route Kms Added				No.of channels up to	No. of Channels Added			
	1986-87	1987-88	1988-89	1989-90	1990-91	1986-87	1987-88	1988-89	1989-90	1990-91
Coaxial Cable	19,807	1,032	664	1,186	1,589	37,066	3,342	1,938	3,828	6,774
Microwave System	24,818	1,704	838	2,940	1,173	26,427	4,626	4,854	4,758	7,164
UHF	9,522	1,605	1,305	3,810	2,525	***	***	***	***	***
Open Wire Carrier System	***	***	***	***	***	25,098	1,215	1,575	1,975	2,030
PCM System	***	***	***	***	***	37,402	42,450	53,068	61,500	52,868
HF/VHF	40,581	34,250	-2,015	-4,270	1,215	458	12*	6*	-24*	-4*
Optical Fibre System	120	***	***	2,174	***	***	***	***	***	***

* No. of stations added.

Source: Annual Report 1987-1991, DOT, India

Note: (-) sign indicates closing down of the route or station.
*** indicates data not available.

Table 4(a): Local Exchange Installed Base (1987)

Technology	No. of Lines ('000)
Digital	276
Elec. Analog	332
EM/X Bar	3606
Manual	120
Total	**4334**
% Digital	6.36

Table 4(b): Trunk Installed Base (1987)

Technology	No. of Lines ('000)
Digital	77
Analog	32
Total	**109**
% Digital	70.3

Source: Pyramid Research Reports

Table 5: Direct Exchange Lines (DEL) and Waiting List for Telephones (1985-1990)

Year	DEL (in '000)	Telephone Wait List (in '000)
1985	3166	956
1986	3486	1125
1987	3801	1287
1988	4167	1420
1989	4560	1714
1990	5074	1961

Source: Annual Report 1991, Department of Telecommunications

Table 6: India's Digitalization Plan (1987-1995)

Year	% Digital
1987	7.0
1988	16.3
1989	25.5
1990	34.8
1991	44.0
1992	53.3
1993	62.5
1994	71.8
1995	81.0
% Growth	**18.4%**

Source: Pyramid Research Reports

Exhibit 1: Organizations in the Telecom Sector

The Wireless Planning and Coordination Wing assigns, regulates, and monitors the frequency usage and setting up of radio receiving and transmitting equipment. It is also the nodal agency for coordination of frequency allocation with ITU, Geneva.

The government owned **telecom factories** manufacture a large variety of telecom products. Until 1984, these were the sole manufacturers of telecom equipment in the country. Currently, large digital exchanges, telephone equipment, modems, and PABX are being manufactured by them.

The Center for Development of Telematics (C-DOT) was set up to indigenously develop telecom technology, especially switching and transmission components. C-DOT has successfully designed and produced rural automatic exchanges which constitute 87 per cent of the total lines being manufactured using C-DOT technology [Business Today, January 1992]. EPABX and medium size exchange (10,000 lines) are other products using C-DOT technology.

The Mahanagar Telephone Nigam Ltd. (MTNL) is a public sector organization wholly owned by DOT and government. Since its inception, it has raised finances from the market by floating telephone bonds. Its revenue and profit have steadily increased over the years. MTNL has introduced a number of telecom services in its area of operations such as payphones on franchise basis, limited radio paging services, voice mail, and access to a national data network [MTNL Completes Five Years, 1991].

Videsh Sanchar Nigam Ltd. (VSNL) provides international telecom services to Indian users. It evolved from the Overseas Carrier Department in the Ministry of Communication. It operates principally through four main gateway centers, Bombay, New Delhi, Madras and Calcutta. All the VSNL gateways are mesh connected through direct national telecom links. VSNL, too, has successfully raised finances from the market and has introduced a number of value added services such as fast data communication satellite services, and access to international gateway through PADs at eight locations in the country.

Telecommunication Consultants India Ltd. is a consulting organization involved in implementation of turnkey projects in India and developing countries.

Training centers provide mainly telecom related training to DOT personnel. There are a large number of regional **telecom training centers** including a national Advanced Level Telecom Training Center.

Exhibit 2: Organizational Structure of the Indian Telecom Sector

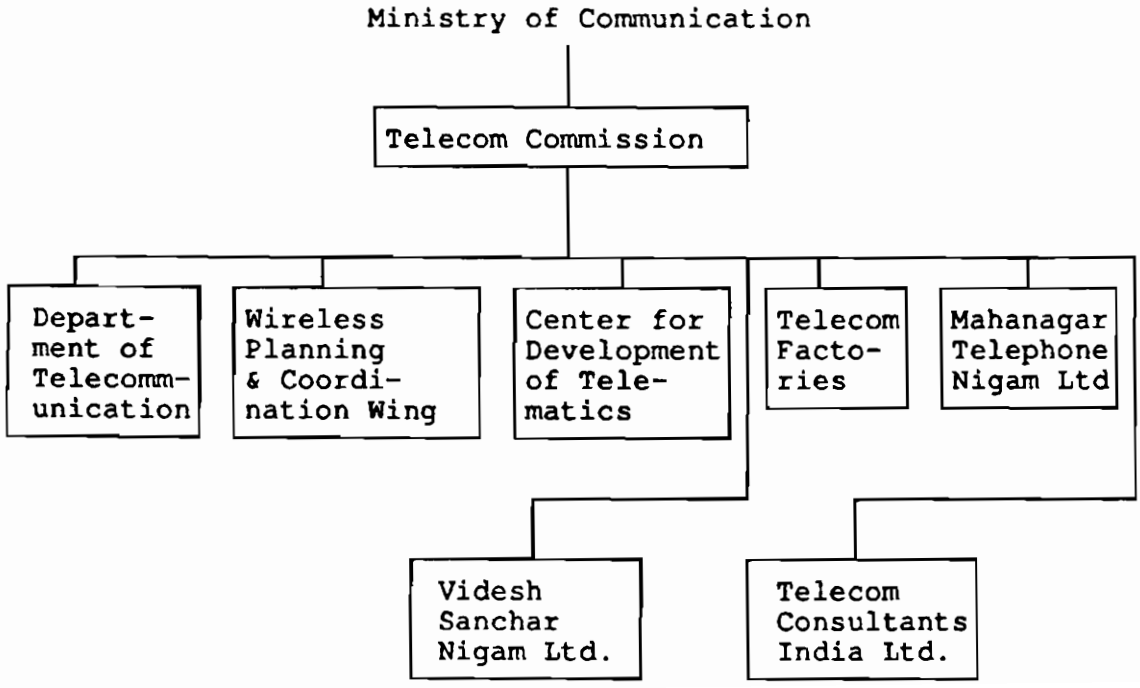


Exhibit 3: Global Influences on the Indian Telecom Sector

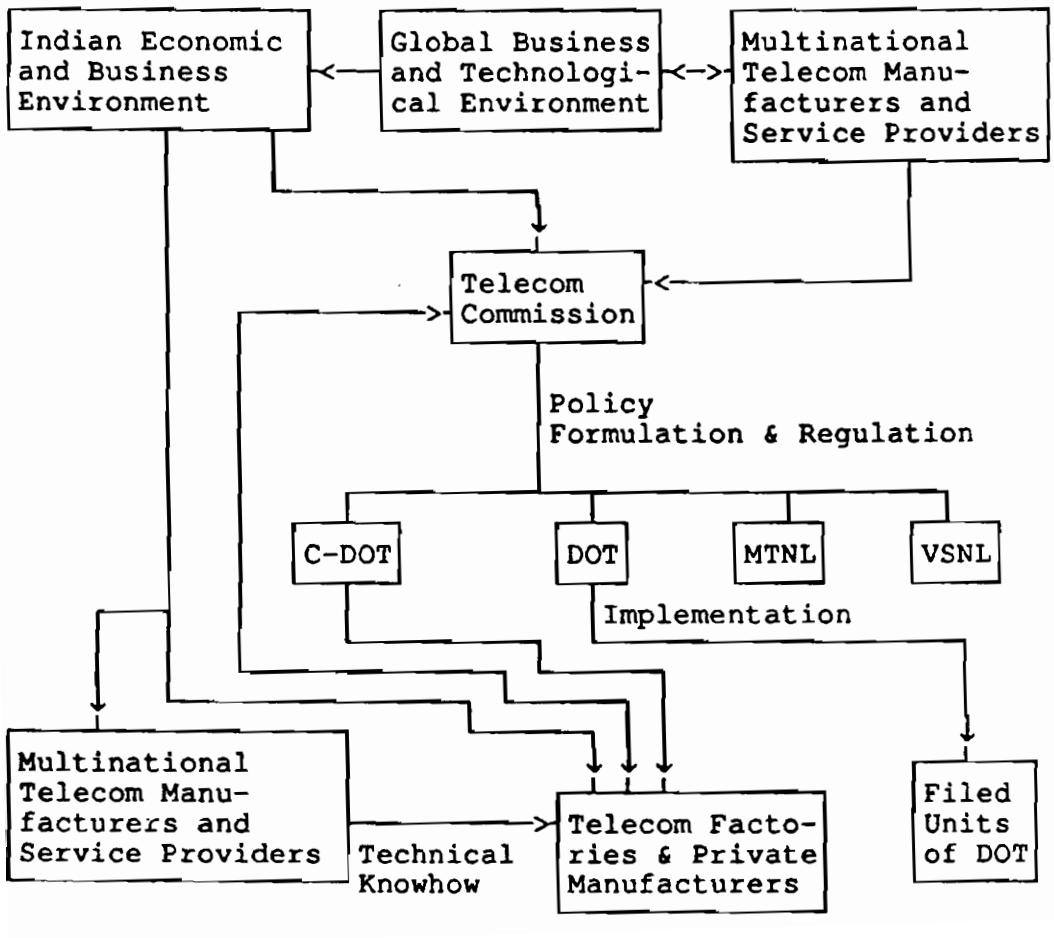


Exhibit 4: Proposed Organizational Structure