Trends in Development of Information and Telecommunications

(With a focus on Pakistan)

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Trends in Development of Information and Telecommunications

Brig (Retd) Mohammad Yasin◆

Abstract

The world trends are privatisation, liberalization and deregulation of information technology and telecommunications. The providers of information and telecommunications services, the world over, realise that universal access to information resources is facilitated through lower tariffs and efficient services. The last few years have seen significant expansion in information and telecommunications infrastructures in the regional countries (Asia-Pacific region). These countries have, by and large, benefited from liberalization and modernisation of their networks. Pakistan has made some progress in developing its telecommunications infrastructure, both in content and quality, but we are still not in the "mainstream". No worth-while information sources/databases have been developed. PTCL continues to monopolise the telecommunications field thus inhibiting competition. We continue to suffer from serious shortages of trained manpower in telecommunications. A national policy on information and telecommunications remains a distant dream. This paper looks at the importance of information and telecommunications, global and regional developments, and Pakistan's current status in this vital field.

Introduction

Information technology and telecommunications play a major role in the economic development of a country. 75 per cent of the world's telephones are installed in just eight industrialised countries. According to a World Bank analysis, countries unable to modernise their telephone networks face economic ruin. The world telecommunication revenue currently stands at US$ 650 billion and the world broadcast revenue is about $350 billion. Out of these trillion dollars, the share of US, European Union, Japan and Canada comes to about $900 billion, the remaining 10 per cent is shared by all the developing countries[1].

"The foundation of modern society is based on the availability of an access to information that will drive a thriving economy upward on its course or propel a weak one into a position of power. Today's information is equivalent to yesterday's factories" (Schwartau 1994)[2]. The advanced economies became advanced because of their richness in the resources of information. They replaced the musle-based technologies with mechanical technologies and then replaced the latter with computers and information based technologies. They have continued their search for intelligent technologies. The poor countries neither had adequate resources nor the know-how to keep pace with developing countries in this race. However countries like Japan, South Korea and Singapore were able to reap the fruits of their better planning through the acquisition and progress in information-based technologies. The vehicle to carry information is the telecommunications infrastructure and services. Effective and responsive telecommunications infrastructure and efficient services is an essential component of information sources. This suggests that there is a strong correlation between

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telecommunications growth and information growth and in turn between information growth and economic growth. Internet is now exceedingly used for commerce and trade. It has brought companies and customers together. “The death of distance as a determinant of the cost of communications will probably be the single most important economic force shaping society in the first half of the next century” (the Economist September, 1995).

The information revolution, the current obsession, has been brought about by the world trends in the modernisation and expansion of telecommunications infrastructure and services. The current trends are higher speeds, higher capacity and broader bandwidth infrastructures. This has been possible by adopting asynchronous transfer mode (ATM), optical fibre cables and integrated services digital network (ISDN). Liberalisation, deregulation and privatisation have set in strong competition between the service providers which in turn have lowered tariffs resulting in an increase in the number of users, thus offsetting the losses due to decrease in tariffs.

The convergence of information and telecommunications has enabled the information to move at the speed of light. A nation's economic strength is associated to a significant degree with its sources of information and the scope of its telecommunications infrastructure. Economists and strategists analyse information to extract intelligence which, when suitably applied, facilitates the best course of action to achieve the objectives.

Information and telecommunications is now a potent weapon of war. The country which achieves mastery in the unimpeded use of information resources and can manipulate information resources of others, will dominate the latter. Nations enjoying information dominance have always been superior to their adversaries in all fields, may it be security and defence, economics and education.The history is full of such examples. Information dominance will act as a force multiplier, contribute towards security and economic uplift.

Technologies are emerging to cater for needs of the users. Some of the users' needs are:

- Personal needs.
- Business improvements.
- Research.
- Remote data access.
- Fast computers.
- Information exchange.
- Remote shopping.
- Entertainments.
- Child care assistance.
- Education at work/home.
- Interactive communications.

The paper has been organised into four parts. Part one looks at the global trends in the modernisation and expansion of information and telecommunications infrastructure and services. It looks at the impact of increased competition resulting in lower tariffs. In this part, some of the emerging technologies have also been discussed. Part two describes, how the regional countries are adopting the trends, the extent to which they have acquired such technologies and the effect on their revenues. Part three is Pakistan specific and covers developments that have taken place in Pakistan and the future prospects. It looks at the difficulties being faced by the public and private operators, the areas into which Pakistan must quickly move so as not to be bypassed by rapid developments in information and communications. It particularly highlights the problems of human resource development in telecommunications and software. In Part four, some recommendations have been made, which, it is hoped would facilitate Pakistan's progress into the 21st Century.

Vision of the Future

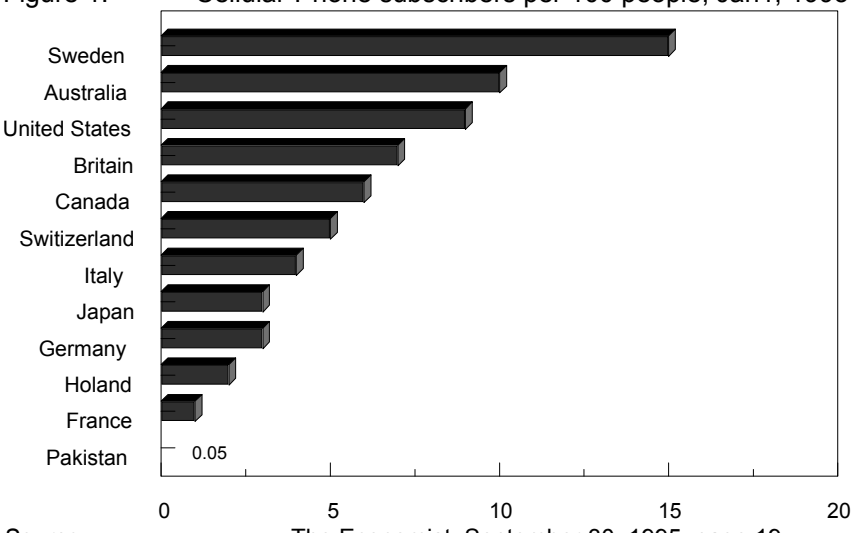
Information is shrinking the world to a global village which will have access to instantaneous communications enabling human dialogue and achieving better understanding. The rural areas will be no more rural because they will have all the conveniences. Men and machines will converse with each other. In persuit of knowledge, one wouldn't have to leave home and the Chinese proverb, "a scholar can learn anything without leaving his home" would become a practicality. The home and office will integrate. There will be less commuting and this hopefully would reduce problems of environmental pollution.

Global Trends

Adoption of Newer Technologies

The world trends in information and telecommunications are the expansion, modernisation, higher speeds and broader bandwidths, asynchronous transfer mode (ATM), optical fibre cable, video conferencing, integration of computers and communications and integrated services digital networks (ISDN). The ISDN market grew by 95 per cent in 1996 over 1995[3]. A number of inter-active services namely conversational, messaging, retrieval and distribution services are provided over broad-band ISDN (B-ISDN) for business, communications, consumer, education, entertainment, health and government services. The ISDN seems to hold the future by integrating computers and telecommunications. The key elements of ISDN are: architecture, structure, interface, standards, networks control, service offerings and tariffs. ISDN encompasses voice, data, fax and such other value added services integrated in the same network. Some of the popular and emerging technologies are described below:

Figure 1: Cellular-Phone subscribers per 100 people, Jan1, 1995



Source: The Economist, September 30, 1995, page 19
Source for Pakistan: The News, January 1, 1997

More Mobiles

Figure 1 shows the status of cellular-phone subscribers as on January 1, 1995, in some selected countries. This shows mobility trends. At the end of 1996, there were more than 50 million cellular telephones in the world. World-wide trend is that one in six subscribers gets a mobile telephone. *In Pakistan, after six years of operation there are about 65,000 cellular phone subscribers out of which 22,000 are in Karachi*[4]. According to a survey by HSBC Capel Asia Limited (1996), during the last

two years, wireless sector was preferred over fixed line. The annual growth rate in the wireless sector was 32 per cent and in the fixed line sector, it was 18 per cent[5]. This is because the wireless technology enjoys obvious advantages. It is flexible, easier to establish and easier to maintain. This is particularly suitable for connecting up remote areas.

GEOs and LEOs

In recent years, attention has focused on systems, using *low earth orbit satellites* (LEOs). As compared to geosynchronous earth orbit satellites (GEOs), LEOs are economically more feasible for some applications, technically more versatile, and thus becoming popular. These systems are more suited to rural communications and other domestic applications. They provide better functionality at lower cost than the GEOs. LEOs are also smaller, lighter, need lower transmission power, have greater portability, better signal to noise ratio and lower power propagation delays. The concept of LEOs is also now favoured for mobile satellite services. It can have one number for communicating worldwide. *Subscribers set is nearly the same size as hand held cellular telephone.* However, for one GEO, a number of LEOs will have to be launched.

From Subscribers Copper loop to Optical fibres and Wireless Loops

Optical fibre communication systems have made great strides. These have come to the forefront of communications technology. A single fibre could ,in theory, transport 25 terabits each second, an amount sufficient to carry simultaneously all the telephone calls in the US on Mothers' Day. However, because of some problems (which are in the process of being solved), in practice such a high speed of transmission of data is not yet possible.

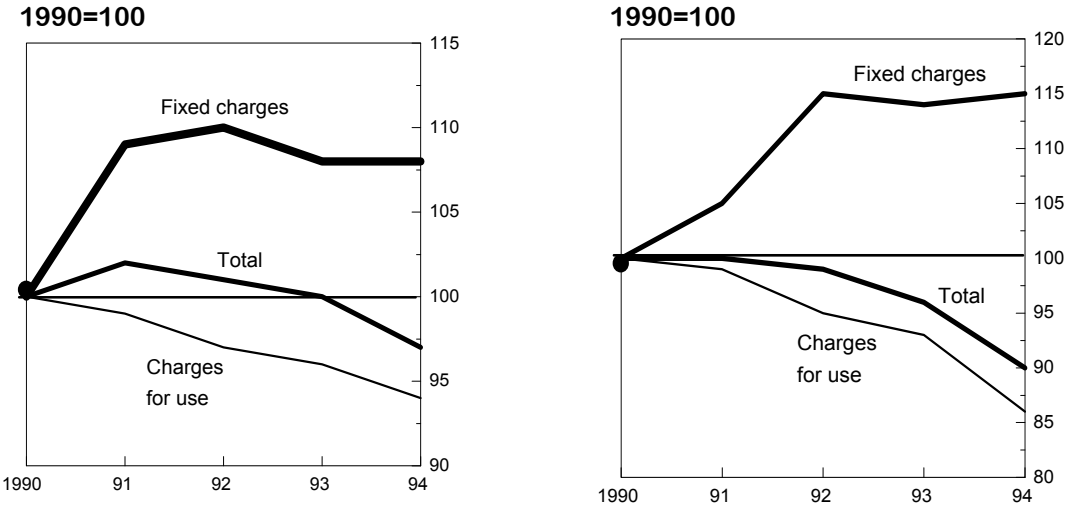
Until a couple of years ago, although optical fibres had established firmly in long haul and medium haul communications, these had not entered the subscribers' loop. However, now the trend appears to be changing and in many countries copper cables are slowly and selectively giving way to optical fibres for the subscribers' loops. So also their application in computers has vastly increased. Prior to 1989, worldwide installation of optical fibres for data links was only three per cent which has increased significantly now. Alongwith optical fibres, wireless loops are also becoming popular.

Declining International Tariffs

Presently, international traffic is governed by the international accounting rates. The system allocates the cost of a call between countries. For developing countries like Pakistan, where such calls are monopolised by a single government operator, these payments are an important source of income which is more important than foreign aid. However, things are changing fast in the rest of the world. The European Commission, for example, wants all countries of the region to be a single market. With this, the whole structure of call rates will change.

Figure 2: Changing the mix Average telephone charges in OECD countries

Residential **Business**



Source: The Economist, September 1995, Page 11

"The global trend in pricing of telecommunications services in the wake of rising competition is one of the downward revision and making the services more and more attractive. In the last decade alone, the service prices have fallen anywhere from seven to 30 per cent and even more in Europe and in some countries of Asia. International/long distance calling costs show downward trend in most of the 10 developed countries surveyed by the National Utility Services, an American consulting firm. It observed that the cost of international calls have decreased by 13 per cent and domestic long-distance call rates were down by 24 per cent in the last one year alone. *PTC's domestic long distance charges increased four times between 1986 and 1991 while local call rates increased five times in this period"(Masood, 1995)*[6]**.** Figure 2 shows the average telephone charges for both residential and business subscribers have been falling. However, the fixed charges have remained steady over the last few years. The fixed charges include line rent and other duties.

"Although software for making phone calls over the Internet computer network is already available, the technology is poised for a great leap forward this summer when Microsoft Corporation and Netscape Communications Corporation incorporate voice communications into their mainstream Internet software" (Silver, 1996). This means the users at the opposite ends of the globe would be able to talk to each other at the price of a local Call. The phone companies are worried because already they are losing revenues because of data communication networks. *Most people now prefer email and on-line computer communication than voice calls and the former are much cheaper.* According to some reports, international calls can now be made over the Internet at a cost far below public switched telephone network (PSTN) tariffs. Quality and convenience is still poor and the Net cannot cope with a massive switch of PSTN traffic. However, the technology is improving rapidly and phone companies are now trying to ban or regulate voice traffic on the Net.

The rapid growth in cellular and mobile telephony is being driven by declining prices and mobility trends.

Liberalization, Deregulation and Privatisation

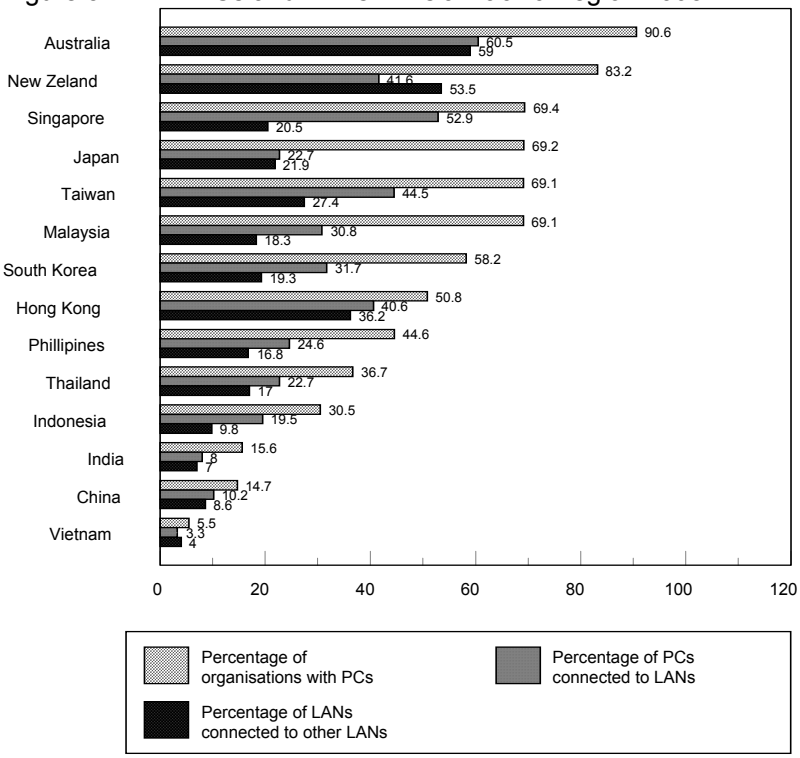
The world has now moved to liberalization, deregulation and privatisation of IT, telecommunication and the electronic media. Under a pact recently signed by 69 countries at the World Trade Organisation (WTO) Geneva, where 30 additional countries were present as observers, the world's leading telecommunications operators will allow foreign companies to compete in the telecom business. Presently, 20 per cent of the market is open to competition. It is estimated that 75 per cent of the market will open up by 1998 and 100 per

cent by the year 2006. Countries signing up the liberalisation agreement have promised to allow foreign companies free access to their markets from January 1, 1998. There will be a separation of local, national and international accounting and transparent access charges on competitive services. To ensure technology transparency, there will be no preferred buyer, no preference will be given to any country or nation and standards and specifications will be transparent. Pakistan has signed the WTO telecommunications agreement but has sought some exemptions upto the year 2004. However, Pakistan has not signed the WTO agreement on free trade of IT equipment but plans to sign this agreement during its 9th Five Year Plan (1998-2003). The signatories to the IT agreement have pledged to eliminate barriers on computers, software, telecommunications equipment, magnetic tapes and scientific equipment. It is estimated that there would be large scale IT trade. "The current IT trade is estimated to be over US$ 600 billion"(Baqai,1997).

Developments in Asia-Pacific Region

The last few years have seen significant expansion in information and telecommunications infrastructures in the region to keep pace with the growing need for generation, dissemination and management of information. More and more organisations have been adopting personal computers and local area networks (LANs) have been mushrooming.

Figure 3: PCs and LANs in Asia-Pacific Region 1995



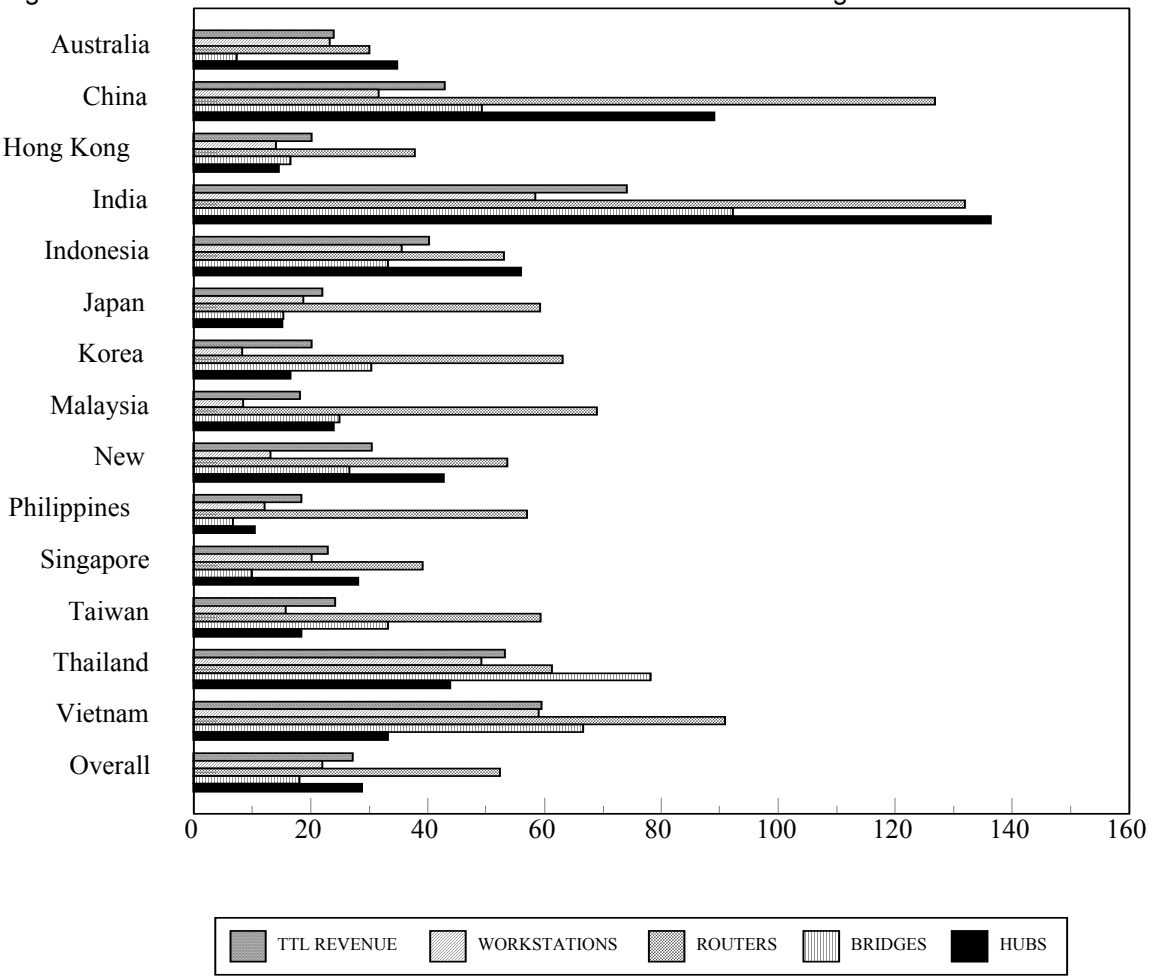
Source: Data Communications Asia-Pacific, May '95 (p.56F) (cited by Elci)
Note: Despite best efforts, data pertaining to Pakistan could not be obtained as there is no agency in the country which maintains this data.

The workstations in the region increased by 22.1 percent in 1995 as compared to 1994 (Figure 3)[7]. As a result there was an increase of 27.2 per cent in 1995 over 1994 in revenue earning. Libralisation, de-regulation and privatisation has been gaining ground thus introducing multiple operators. Because of the multiple operators, there has been a healthy competition in the provision of quality services. For accuracy

and reliability, Japan has seen leading followed by Singapore. As is clear from Figure 4, there has been a significant increase in the growth rate of LANs in the region. This is particularly so in case of India and China. The growth in Internet users in Asia-Pacific region has been keeping pace with the global trends. Table 1 shows the number of Internet users in some regional countries.

Because of tough competition between various operators, the call rates have fallen and the standards of maintenance and consequently the circuit reliability have risen. The cost of calls originating from Japan has fallen by 75 per cent. This resulted in 20 per cent increase in traffic.

Figure 4: LAN Growth Rate in Asia-Pacific in '95 over '94 as %ages



Source: Data Communications Asia-Pacific, May '95 (p.56F) (cited by Elci)
Note: Despite best efforts, data pertaining to Pakistan could not be obtained as there is no agency in the country which maintains this data.

Table 1: Volume of Internet Users in Asia 1995

Country	No. of Users
Japan	1,600,000
South Korea	100,000 (300,000)

Malaysia	100,000
Singapore	100,000
Taiwan	70,000
Thailand	35,000 (50,000)
Hong Kong	32,000 (40,000)
Philippines	20,000
China	15,000
Indonesia	10,000
Pakistan	5,000
India	(50,000)

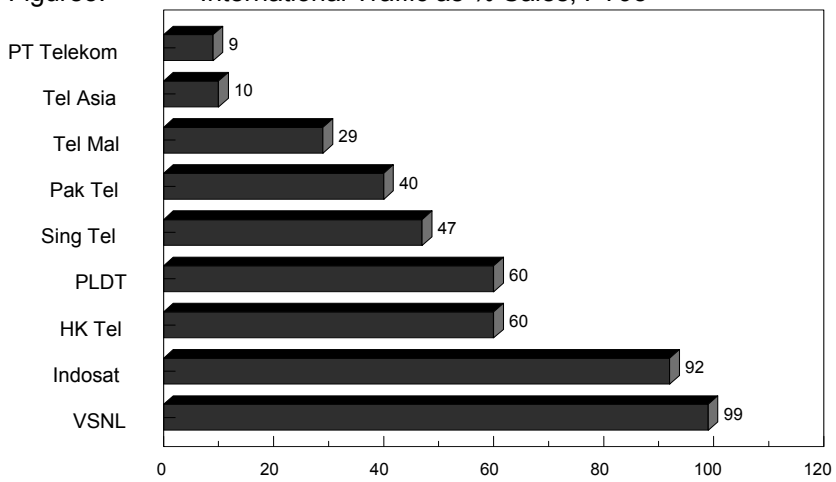
Source: Ahsan Abdullah, Internet & Pakistan (Second Edition), November 1996.
Figures in brackets have been taken from HSBC James Capel Asia Ltd, Telecoms in Asia, Regional Research, June 1996.

Note: According to some estimates, the number of user in Pakistan were between 8,000 and 10,000 (in January, 1997).

International Traffic as Percentage of Sales

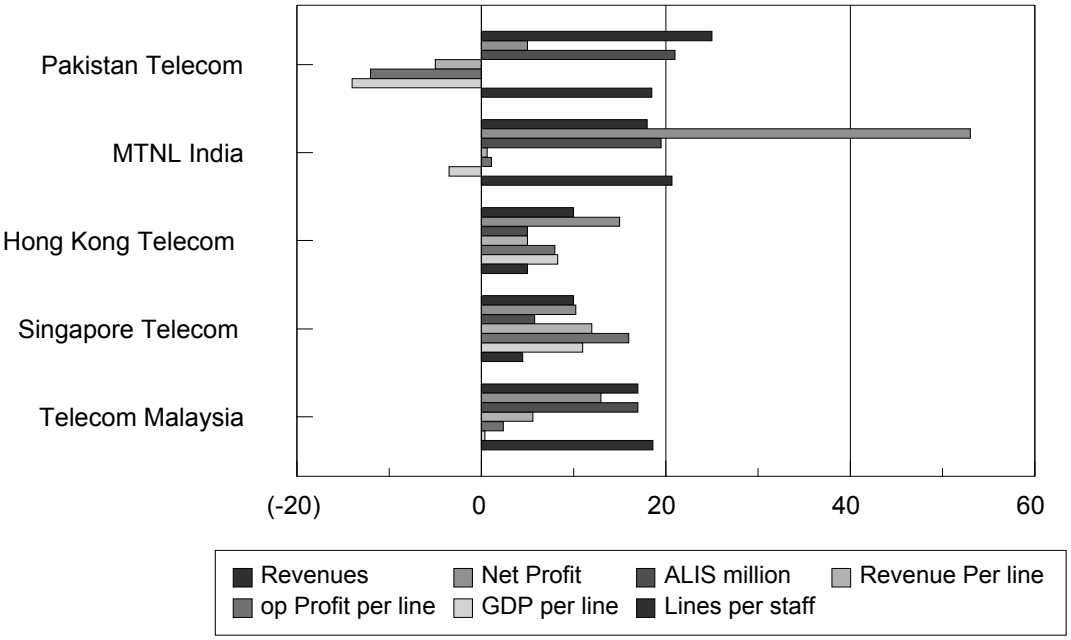
Across the region, accounting rates (wholesale prices) are falling at 5 per cent to 12 per cent annually, due to increasing liberalization and use of by-pass techniques such as call back and refile. Refile is referred to as a 'store and forward' technique which involves the creation of 'hubs' at suitable locations from where traffic is rerouted to desired locations. This also results in cost reduction because only a few locations (hubs) are upgraded on regional basis. This arrangement gives improved quality, resilience, and service availibility. Collection rates (retail prices) are falling even faster. The USA is trying harder to lower industry accounting rates in order to reduce its annual US$ 4 billion of net out-payments to overseas carriers. This is a big negative for operators with both a heavy dependence on international calls and a large net balance of inbound traffic (notably PLDT, Indosat, and VSNL). Please see figures 5 and 6.

Figure5: International Traffic as % Sales, FY95



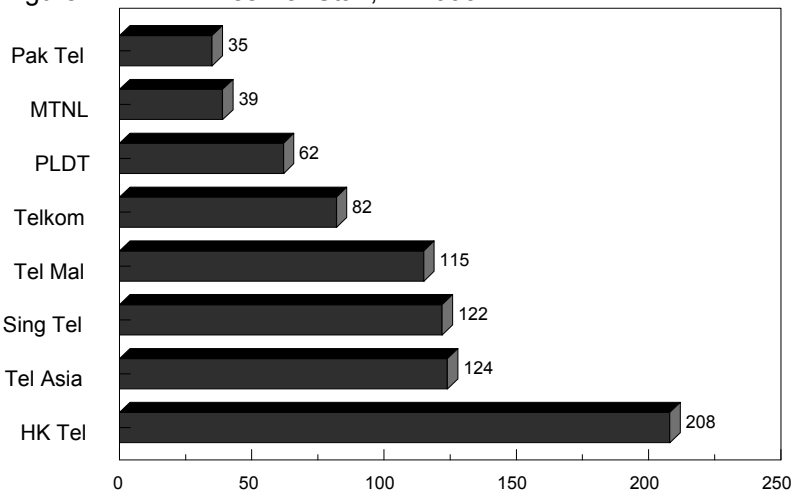
Source: HSBC James Capel Asia Ltd, Telecomes in Asia Regional Reserch, June, 1994

Figure 6: Percentage increase in 1995 over 1994



Source: HSBC James Capel Asia Ltd, Telecomes in Asia Regional Reserch, June, 1996

Figure 7: Lines Per Staff, FY1995



Source: HSBC James Capel Asia Ltd, Telecomes in Asia Regional Reserch, June, 1994

Efficiency Indicators

Regional(Asia-Pacific) Countries have, by and large, benefited from liberalization and modernization of their networks. Revenues have been increasing and so have been the net profits and actual lines in service (ALIS). Figures 5 to 7 shows various efficiency indicators. *In case of Pakistan, however, although ALIS increased by 21 per cent in 1995 as compared to 1994 but the revenue per line, operating profits per line and GDP per line decreased in 1995 as compared to 1994.*

Along with liberalization, deregulation and modernization of telecommunications networks, the regional countries have also gone in for staff reduction. However, lines per staff in regional countries still lag far behind the over 300 lines per staff achieved by leading Western operators. Figure 7 shows lines per staff in some of the regional countries. *Although Pakistan achieved an increase of 18.5 per cent lines per staff*

during 1995 as compared to 1994, yet its efficiency in this comparison remained the lowest among the regional countries[9]**.** To enhance its efficiency and improve service quality, PTCL will have to go in for a drastic reductions in staff. In regional countries, Hongkong has the maximum number of lines per staff (208 lines).

Status of IT and Telecommunications in Pakistan

While some progress has been made in improving the telecommunications infrastructure in Pakistan, both in terms of quantity and quality, there has been virtually no progress in setting up the infrastructure for information networks and databases. Even the telephone system will take quite sometime to reach acceptable levels. The "teledensity" in Pakistan has increased from 1.06 telephone lines per 100 people on 30 June, 1992, to about 2.2 lines per 100 people today (Figure 8). However, even the higher figure compares unfavourably with the density of 16 lines per 100 people in Turkey and 40 lines per 100 people in Western Europe. Based on PTCL's own conservative estimates, the cost of raising the density to these levels will be Rs 342 billion and Rs 846 billion respectively. Also the existing services are very poorly distributed. Ninety percent of the infrastructure is concentrated in urban areas serving 32 per cent of the population and 70 per cent in only four major cities with about 18 million population. The rural 68 per cent population has not benefited from this development, although better access to information may be helpful in raising crop yields, and generally improving economic conditions in rural areas. Even in urban area, the telecommunications infrastructure has come under pressure because of demand explosion for information.

Pakistan's rural 68 per cent remain ignored. Even the urban 32 per cent remain at the mercy of PTCL. Will old habits change?

In realising the importance of information and communications we woke up very late. Upto the late seventees the telephone density in Pakistan increased at a snail's pace. Little did we realise then that we were 'missing the boat'. It was only in the mid eighties that we decided to digitalise our telephone exchanges and switch over to optical fibres as far as trunk routes are concerned. Fortunately we appear to be picking up momentum. The question is, will we be able to maintain the momentum? Theoretically the Pakistan Telecommunications Company Limited should give us a quantum jump in information and communications. Unfortunately the PTC (now PTCL) continues to be the monopoly holders and it is said, "habits are hard to change". PTCL is manned by the same people who once manned the old Telegraph and Telephone (T&T) Department, who considered themselves above any accountability and generally adopted a 'couldn't care less' attitude. Corruption was rampant, and the customers were at their mercy. Even today, they dictate terms. *It is perhaps only in our country where subscribers have to physically queue up to get their utility bills and then again queue up to pay them. What a waste of time and energy, a recurring national loss.*

Figure 8 a: Telephone Density in Pakistan Per Hundred Persons

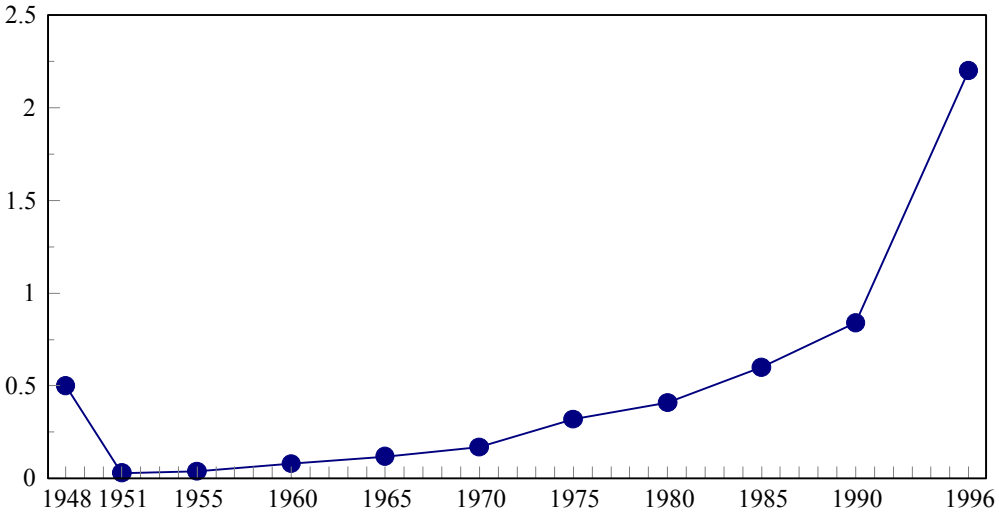
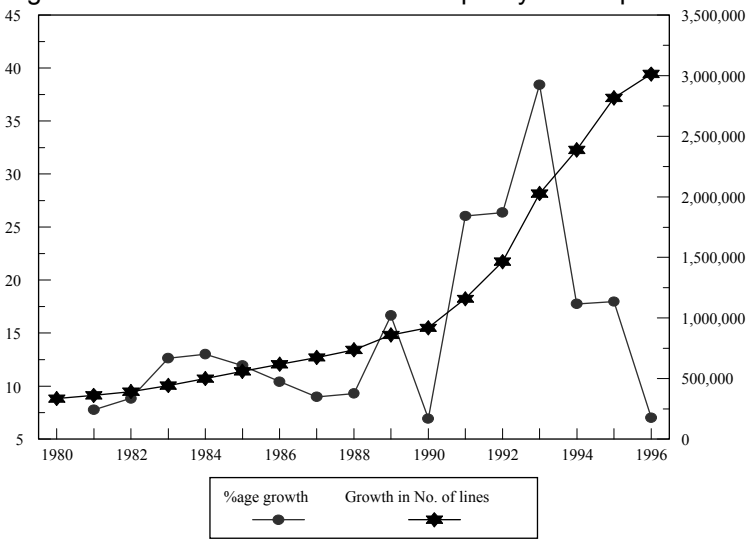


Figure 8 b: Growth of Installed Capacity of Telephone Lines



Source: Pakistan Telecommunications Company Limited (PTCL) 1997

Until 1962, Pakistan depended on open wire overhead long distance telegraph and telephone lines with a very limited capacity of simultaneous speech channels. The number of these speech channels depended on the capacity of multiplexing equipment at the terminals. It was in 1962 that Pakistan commissioned its first coaxial cable between Rawalpindi and Karachi which raised the speech channel capacity to 950. Table 2 shows how the telecommunications services in Pakistan have evolved. Digitalisation of our telephone exchanges gave us the ability to enhance the quality of service. The establishment of microwave in 1973, gave us the required backup to the coaxial cable. The optical fibre cable, a cutting edge communications technology, introduced in 1996 was a turning point in the modernisation of our telecommunication system as it has the ability to carry simultaneously more than 500,000 speech channels.

Table 2: Introduction of Telecommunications Services in Pakistan

Service	Year of Introduction	Present Status/Users
Coaxial Cable	1962	
Teleprinter	1965	
Microwave	1973	
Digital Exchanges	1984	Digital Exchanges: 78% Analogue Exchanges: 22 %
Optical fibre cable	1986	Longdistance: 27,000 Kms Junction networks: 1,145 Kms
Fax	1987	
PDN	1990	Users: 41(?)
ISDN	1996	Users: 100
e-mail	1996	Users: 6,000
Internet connectivity	1996	Users: 6,000
Universal Access Number (UAN)	1996	About 15 cities

Source: Pakistan Telecommunications Company Limited (PTCL) 1997

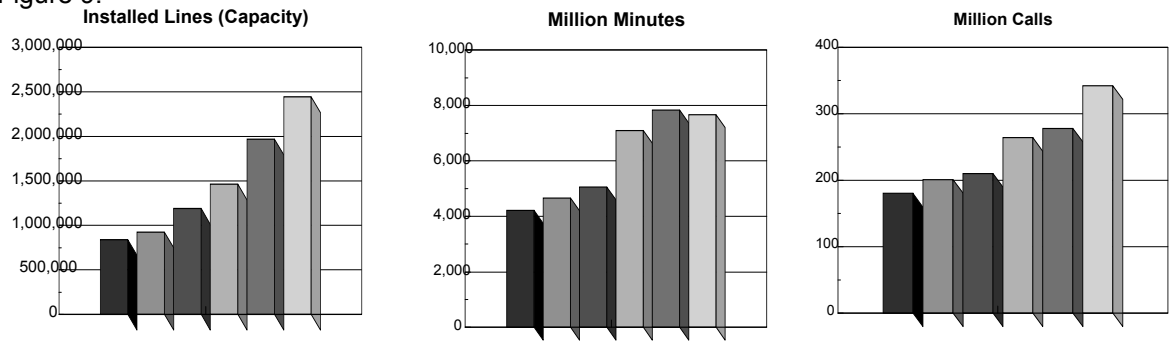
Table 3 shows, how the Internet has evolved in Pakistan. The present position is that the Internet is becoming increasingly popular in Pakistan Service providers are taking measures to increase the system bandwidth, increase speed and lower the cost to the subscribers. The year 1993 to 1996 have seen significant progress in email and access to Internet.

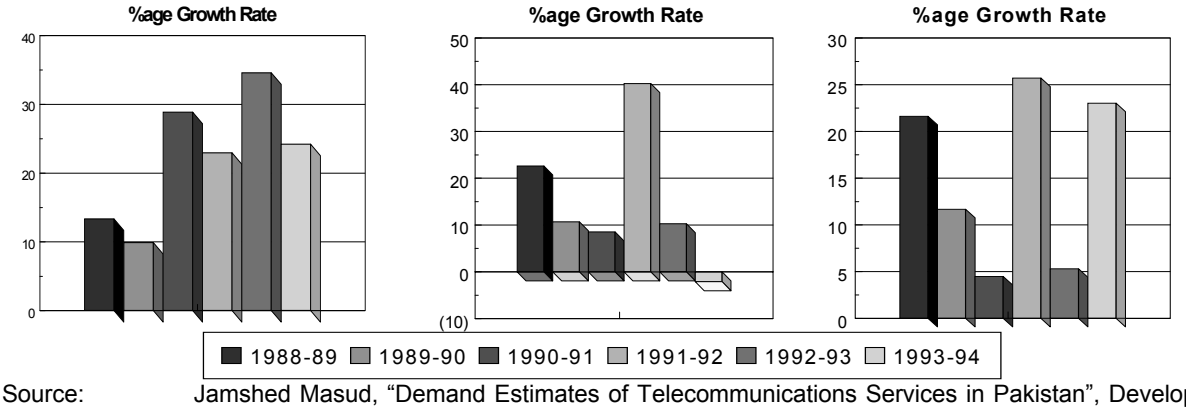
Table 3: Major Milestones of Pakistani Internet

•	Jan. 1992:	HEJ Institute Karachi establishes e-mail connection via UUNET.
•	Apr. 1992:	Ashar Research appointed PK domain operator
•	May 1992:	Commercial e-mail is introduced in Pakistan.
•	Mar 1993:	NUST establishes real-time Internet access over X.25.
•	May 1993:	Sustainable Development Network (SDN) introduces email service.
•	Jan. 1994:	NUST establishes TCP/IP WAN over 9.6 kbps leased line connecting three sites.
•	Aug. 1995:	Digicom offers commercial real-time Internet with graphical interface.
•	Nov. 1995:	Pakistan's first book on Internet “Internet and Pakistan” is published.
•	Jan. 1996:	Pakistani organizations offer hard disks of their WWW servers for rent.
•	May 1996:	PDN offers commercial real-time Internet with text interface.
•	June 1996:	Pakistan's first e-mail directory “A&A's email Directory” is published.
•	Sep. 1996:	More than 5 live Internet nodes in Pakistan with domain name PK are set-up.
•	Oct. 1996:	PDN introduces graphical WWW access.

Source: Ahsan Abdullah, Internet & Pakistan, November 1996

Figure 9:





Source: Jamshed Masud, "Demand Estimates of Telecommunications Services in Pakistan", Development of Information and Communications in Pakistan, SDPI, 1995 p29.

In Pakistan, the increase in installed line capacity in 1993 was 176 per cent as compared to 1988. However, the percentage growth rate of calls was 90 per cent and the growth in the duration of calls was only 81.9 (figure 9). This means that the installed capacity was not fully utilized. The reasons for this under-utilization were high tariff rates, poor services, bad maintenance and indifferent operation and management.

We have ambitious expansion and modernization plans. According to PTCL, it has taken firm initiatives and has launched the following services:

- Universal access number (UAN).
- Toll free telemarketing 0800 service.
- ISDN.
- email and Internet services.
- 2 Mbits data communications.
- Home metering service.
- Wake up service.
- Secret code service.
- Hot-line, abbreviated dialling, call transfer, call waiting, do not disturb services.

It is all fine because we must prepare ourselves to enter the 21st Century with dignity and the vehicle to enter the 21st Century will be the information and telecommunications. However, have we cared to analyse if our existing telecommunications infrastructure is optimally utilized? As the statistics above show, it is not optimally utilized. The users continue to have reservations to express their confidence in the infrastructure and its operation. For credible infrastructure the following elements are important:

Ambitious plans must incorporate quality services and customer convenience.

1. Quality of equipment must improve.
2. Quality of installations etc must meet international standards.
3. Quality of operation, maintenance and management must be of acceptable standards.
4. Quality of human resource must improve.
5. Affordable tariffs.
6. Strong regulatory framework.
7. Greater attention to rural communications.
8. Improvements in the system of issuing utility bills and collection of payments.

The equipment is generally foreign made. We are poor in the second but, the third one is our 'Achilles Heel'. It is the human factor where we are thoroughly lacking. So much so that the privatisation of the PTCL with the same human resource may fail to come upto expectations. There may be exceptions but these exceptions have so far failed to make a difference.

On the fifth element, our tariffs are unaffordable and there are no two opinions about it. As Clarke(199?) says, "with the historic abolition of long-distance charges on 31 December 2000, every telephone call became a local one, and the human race greeted the new millennium by transforming itself into a huge, global, gossiping family"❖ . But in our case, chances are that the things will be made so difficult that we will be reluctant to use even the telephones.

Still far from Information Superhighway

Currently Pakistan relies on AsiaSat series for information transmission and Internet connection. We are presently subscribers on AsiaSat 1 and 2. AsiaSat 3 was launched in December 1997 but was lost in space.Another satellite (AsiaSat 3) was to be launched in January 1998 but till March 1998 this could not be done. This may come about in 1998 followed by AsiaSat 4.The subscribers in Pakistan are, Pakistan Telecommunications Company Limited (PTCL), which uses half of a transponder for domestic applications, Pakistan Television (PTV2) uses a full transponder for domestic broadcast distribution, and Pak Datacom (Pakistan Telecommunication Foundation) uses about half a transponder. Other service providers in Pakistan have to obtain connectivity through the PTCL.

Pakistan still has not been able to launch its own satellite whereas many Asian countries like India, Thailand, Indonesia, Malaysia, China, Kazakhastan, Mauritius and even UAE have launched their own satellites. Pakistan with its ever growing population, fast rural to urban migration and slow economic development must move boldly to expand its telecommunications infrastructure. Satellite communications hold a promise, particularly for our rural and other remote areas that are inaccessible to land based telecommunication systems.

About 25 years ago, SUPARCO was reorganised and mandated to commence satellite launching programme. This involved the establishment of satellite ground stations, design, assembly/fabrication and launch of communication satellites in geosynchronous orbit and experimental satellites in near earth orbit. It may be added here that the project was conceived as a result of the Indian programme INSAT. In 1983, under a directive of the federal government, SUPARCO, in collaboration with Messrs Hughes Communications International of USA, prepared a feasibility study for the establishment of a Communication Satellite System, envisaging fabrication and launching of a 12 transponder satellite system at an estimated cost of Rs 1,348 million. This system was to provide facilities for direct television broadcast, telephone and data transmission services. It was believed that the Paksat system will not only augment the existing telecommunication services but will also provide new services considered essential for the socio-economic development of the country. *Accordingly, orbital satellite slots were allocated to Pakistan by the International Telecommunications Union (ITU). Fourteen years later, the allocated slots have not been utilized.*

Own communication satellite and connection to fibre optic cable girding the globe and TAE cable can ensure Pakistan a dignified entry into the 21st Century.

❖. Quoted from an email.

The project was reviewed in 1989-90, and in view of the non-utilization of the allocated slots, high cost and lack of demand, it was decided to offer the project to the private sector. Since then, although the government has received proposals from four consortiums, it has not awarded a licence to any of them. There is a danger that ITU may withdraw the slots from Pakistan if they are not utilized. As mentioned earlier many Asian countries have gone ahead with their communication satellite programmes still Pakistan continues to procrastinate on this vital issue. If this situation does not change, it would be a long time before the fruits of modern technology become accessible to the people in rural areas.

According to a recent report (The Nation, Islamabad, March 15, 1998), the Ministry of Communications has signed a contract with Alcatel (a French company) to launch a satellite over Pakistan on build, operate and transfer (BOT) basis. This will be an important step in the modernisation and upgrading of our information and telecommunications infrastructure[10]. However, it is not known when the satellite would be launched.

The concept of LEOs is also now favoured for mobile satellite services. Subscribers set is nearly the same size as a hand held cellular telephone costing US$ 500 to 700. The other main advantages of mobile satellite services (MSS) would be that Pakistan will have access to a low cost world wide communication expansion path. People 'on the move' can communicate regardless of location. They can use any service including paging, store and forward, fax, e mail and telephony.

There are two high capacity, high speed, broad band information superhighways which Pakistan is trying to enter. However, the start has been overly delayed already. First, the submarine optical fibre cable girding the globe passes through the Atlantic, the Mediterranean, the Red Sea, the Indian Ocean and on to the Pacific Ocean. This touches the Middle East, by-passes Pakistan and goes to Bombay. Second, another such superhighway will connect China, Kazakhastan, Kyrgystan, Uzbekistan, Tajikstan, Turkmenistan, Azerbaijan, Georgia, Turkey, Ukraine, Poland and Germany. The Second is the Trans-Atlantic Europe (TAE) information superhighway.

According to the Chairman PTCL, "Pakistan has signed a memorandum of understanding (MOU) with the Tran-Asia Europe optical fibre which will pass through Central Asian States. Pakistan hopes to be connected to it at Ashkabad in Turkmenistan through Quetta and Chaman. Another MOU have been signed with the South East Asia, Middle East and Western Europe submarine cable system". When these MOUs materialise, Pakistan will effectively be on the information superhighway because Pakistan already has an optical fibre cable running from Karachi to Peshawar which is backed up by microwave system. Another such cable is being laid between Karachi and Peshawar along the right bank of River indus. Work to connect Quetta with the existing optical fibre cable is also in progress.

Problems of the Private Sector

The pressure of the market forces was instrumental in compelling the Pakistan government to move towards liberalisation, deregulation and partial privatisation of telecommunications services. As a result of this policy, the government issued licences to private data network operators to establish such services. But the laws enacted by the Parliament, Pakistan Telecommunications (Re-organisation) Act 1996, for liberalisation, deregulation and privatisation have hardly any place for private networks and private operators. PTCL has been exempted from taxes. It has been allowed monopoly of basic telephony services for seven years and has been granted licence for 25 years whereas private operators are required to renew their licences every year. Therefore, there is an unfair competition between licencees and the PTCL and its off-shoot, the Pakistan Telecommunications Foundation. Consequently, the private sector has very limited role to play. This is clear from table 4 below:

Table 4:

Type of Business	No. of Applicants for Licences	No. of Licences Granted	No. of Licences in Operation
Paging	14	14	1
Card Pay Phones	22	22	3#
Data Network	19	15	5
Voice Mail	14	3	-
Audiotex	15	3	-
Trunk Radio	21	11	-
E mail/Internet		17*	15/ 5¶

Source: Data was collected by talking to various persons in business and PTA.

\# = Two more companies namely Cable & Wire and VTT have made preparations to commence service, shortly.

¶ = Digicom, LUMS, COMSAT, PDN

* = Almost all the service providers do not fulfil all the conditions laid down by the government and the latter can order there closure anytime.

The Pakistan Telecommunications Act 1996 was passed by the National Assembly in October 1996. The Act was pushed through the National Assembly in a 'hush hush' manner. Such an important Act, having far reaching implications, should have been discussed with the relevant persons in the telecommunications field and opened to broader public debate in the media. The resulting views should have been obtained and incorporated.

The text of the Electronic Media Regulatory Authority Ordinance, 1997 (EMRA) was published in the national newspapers on February 15, 1997. The Ordinance was obviously framed in a hurry by the caretaker government. It must be put through a public debate before it is presented to the National Assembly for enactment. However, some observations are made on EMRA in the succeeding two paragraphs.

Although information and telecommunications are the two sides of the same coin yet the Ministry of Communications and the Ministry of Information have been working in isolation of each other. The electronic media is an integral part of information technology and telecommunications. This convergence is being strengthened the world over.

The Pakistan Telecommunications Authority was established under the Pakistan Telecommunications (Re-organisation) Act, 1997 to regulate the telecommunications services in Pakistan. The same Authority duly strengthened should have been entrusted to regulate the electronic media in the country and issue licences for private broadcasting. This anomaly should be removed and only one regulatory authority should perform both the functions. This could be done by combining the two authorities into one.

Human Resource Development in Telecommunications

Rapidly evolving technologies in telecommunications require highly educated and trained manpower dedicated to cope with these emerging technologies. These technologies are changing so fast that it is very difficult to keep abreast with the change and soon produce technological obsolescence in engineers.

Software Industry in Pakistan

Currently the worldwide software market is valued at about US$450[11] billion per year, growing at the rate of about 15 percent per year. There is an excellent opportunity for Pakistan to tap into this market, because: (a) we can offer lower wage rates and (b) we do not have to deal with legacy systems and we can start right at the cutting edge of the technology. However, Pakistani industry is handicapped because of the shortage of trained personnel who can deliver quality software at competitive rates. Pakistan has only a few institutions which offer computer science programmes, and these too are not adequately staffed. Consequently, the country does not produce good computer scientists.

Liberalisation, deregulation, fair competition and convergence of telecommunications and broadcasting are the key to rapid progress in IT.

As a result, Pakistan's software export is estimated to be around US $ 15 million[12] while India is reported to have crossed US $ 1 billion in software exports. However, Pakistan can convert its initial disadvantage into an advantage, with the right approach and vision. First, software industry is labour intensive which caters to Pakistan comparative advantage. Second, it has a very small gestation period as compared to main stream industries (like sugar mills).

"The prestigious universities like GIK and LUMS have been offering undergraduate computer science programmes for 2 to 3 years with virtually no faculty. Quaid-e-Azam University and Engineering University Lahore have been offering M.Sc. computer science for over 10 years but have produced less than 350 graduates over this period. Punjab University, which has been offering M.Sc. computer science courses for the last 5 years has only one faculty member in the field, and have yet to produce a graduate despite inducting 15 students every year. The two institutes run by Foundation for Advancement of Science and Technology (FAST), at Karachi and Lahore, are in better shape. Other computer science institutes which offer all kinds of courses are simply ripping off money from poor people. Their graduates find it very difficult to get a decent job. The result is that we have only about 1000 software engineers, compared to India's 200,000. If we want to do better than US $15 million, we must first produce more computer scientists" (Lodhi 1996).[13]

Another problem facing the local software industry is the lack of communication infrastructure. The telecommunications business is being deregulated, but the pace is too slow. The field of data communication is dominated by PTCL's PDN, which is not very efficient.

Problems of Trained Manpower in Telecommunications in Pakistan

Telecommunications is not recognised as a separate discipline in engineering. The subject is generally merged with electrical engineering where various aspects of telecommunications are covered only very superficially. Sometimes this discipline is included in curriculum for electronics. In either case the electrical or electronics engineers turned out by the public sector universities in Pakistan possess at best a tertiary knowledge of telecommunications engineering. Given the poor quality of education in Pakistan and the unfair means allowed or used in the examinations, the graduating engineers are unable to become effective to the engineering profession. It was as early as in 1987 when it was felt in France to initiate a masters programme for systems engineering in telecommunications by merging together electronics and computer science. A balanced syllabus of telecommunications systems education and computer communications software was included in the programme. A pre-requisite of the course was bachelors degree in electronics and computer science. This programme has proved a great success with the industry and government organisations in Europe.

We continue to follow old and outdated curricula. The graduate engineers turned out by the universities are only fit to be absorbed by the government departments, because they are not fit for the industry and for research and development. Industry prefer to employ technicians and teach them skills on the job rather than fresh graduate engineers. As a result, there is massive unemployment of engineers in the country. There is no concept of 'on the job training' like for example the 'house job' for the doctors. Recently, some engineering institutions have made it compulsory for the graduating engineers to undergo six months of internship with relevant industrial units. The obvious solution is to revise, revamp, modify and update the curricula to ensure that these are more focused and their quality is comparable to such programmes in the developed countries. The number of graduates produced in one year is not important. What is important is that these graduates are equipped with necessary skills to accept real life challenges.

Production of quality manpower in telecommunications and software is essential if we want to join the bandwagon of $600 billion annual trade in IT.

"The linkage between universities, industry and government (the technology triangle) is non-existent. The technology triangle is determined by the characteristics of the education system. If the system is poor, the technology triangle will also be poor. The overall education system is itself shaped by its "inflow/outflow" conditions. This means that primary school determines the quality of secondary school, college and university education. The education system is a chain of interconnectedness. It can be as good as its weakest elements. *Overall the education system constitutes the basic investment in human resource development"(*Chourci and Moavenzedeh 1993).[14]

Military College of Signals affiliated with National University of Science and Technology (NUST) is perhaps the only institution in Pakistan where telecommunications engineering is taught as a discipline. Besides this the army trains it telecommunications technicians in Signal Training Centre Kohat and Army Apprentices Schools near Murree. Apart from this, the PTCL has their Staff College in Haripur and their technicians are trained in their regional training schools. The problem with NUST courses is that there are a limited number of seats for the civilian students and the courses are very expensive. Deserving but poor students cannot hope to enter NUST.

Pakistani engineering institutions provide vastly varying levels of education. Public sector universities/colleges produce poor quality engineering graduates. Private universities/colleges, (a few elite government-sponsored institutions like NUST or GIK) provide quality education.

Recommendations*

1. *National Policy on Information and Communications*

- A national policy on information and communications must be formulated to cover both information management and telecommunications. It should be framed by a Task Force specially constituted for the purpose. The basis of national information policy should be:
- Information must be available to every citizen who wishes access. The majority of the citizens need information of a local nature.

*. Some of these recommendations were sent to the government from time to time and also given for inclusion in the 9th Five Year Plan for Telecommunications.

- Government and private enterprises must join hands to establish national information systems (NIS).
- The national information service must integrate with international networks.
- Educational and research institutions must be supported to integrate with NIS.
- Easy access to public records.
- "Internal antiquated infrastructure is a greater constraint on telecommunications development than international connectivity."
- "There is a need to have atleast government acquiescence in viewing telecommunications as development infrastructure, not as a source of revenue".
- The rural population must be brought into the mainstream of information and communications.
- Liberalization, deregulation, privatisation and free trade in IT should be given due recognition.
- Pakistan must position itself to become a regional traffic hub.
- Development and export of software should be encou**rged.**

2. ***On the Information Superhighway***

- Memoranda Of Understanding (MOUs) signed to enter into two high capacity, high speed, broadband information highways should be implemented. It may be recalled that these superhighways are: first, the submarine optical fibre cable girding the globe and passing through the Atlantic, the Mediterranean, the Red Sea, the Indian Ocean, and the Pacific Ocean and second, a Trans-Atlantic-Europe (TAE) superhighway that will connect China, Kazakhastan, Kyrgstan, Uzbekistan, Tajikstan, Turkmenistan, Azerbaijan, Georgia, Turkey, Ukraine, Poland and Germany.
- A national information superhighway backbone should be set-up.
- Pakistan should launch its own communication satellites lest the orbital slots allocated to it by the International Telecommunications Union (ITU) are withdrawn.

3. ***Pakistan Telecommunications Act 1996***

- This Act suffers from serious weaknesses and is highly tilted in favour of PTCL. Such an important piece of legislation, having far reaching implications should have gone through a public debate. The private sector in the field of telecommunications should have been consulted and their point of view should have been incorporated. The Act needs revision and amendments.
- The regulatory body, namely the Pakistan Telecommunications Authority (PTA) has been established on bureacratic principles. This body should include eminent professionals in telecommunications, engineering, law, finance, economics, business and other related disciplines, which could respond to the changing needs and requirements of society.

4. ***The Electronic Media Regulatory Authority Ordinance (EMRA), 1997***

- The EMRA Ordinance (since lapsed) must be put through a public debate before it is introduced in the National Assembly in the form of a bill.
- PTA should be dully strengthened and should be entrusted to regulate the electronic media and issue licences for private broadcasting.

5. *Human Resource Development in Telecommunications*

- **Telecommunications as a Separate Discipline**
  Rapidly evolving telecommunications technologies require specialized staff. To cater to such requirements and fill the gap of trained personnel, telecommunications engineering should be declared as a discipline of engineering and should be introduced in the engineering universities.
- **Curricula for Telecommunications**
  A committee(s) of experts, including experts from the industry, may be constituted to lay down curricula for bachelors and masters of telecommunications engineering. The committee may also consider the programme followed by NUST and in developed countries like France who have excelled in this discipline.
- **Training in Software Engineering**
  By the turn of the century world software market will touch US $ 1 trillion. Pakistan should immediately launch training programmes in software engineering. In this connection:
  - Computer science curricula being followed by various universities must be reviewed and brought in line with the one followed in advanced countries.
  - University faculties should be strengthened by inducting competent computer scientists and software engineers at high salaries.
  - As it would take 3 to 4 years to produce software engineers, therefore, it is necessary to organize retraining of engineering and science graduates.
- **Creation and Maintaining Technology Triangle**
  Strong linkages between the universities, industry and policy making should be established. Industrial establishments should be linked with universities through law. Graduate engineers should be required to complete a year of internship (as for doctors) before being awarded degrees.
- **Scholarships for Studies in Quality Institutes**
  Liberal scholarship schemes should be initiated for deserving but poor students who wish to undertake studies in prestigious institutes like NUST and GIK Institute of Engineering Sciences and Technology.

References

1. Baqai Nooruddin, "World Trade Organisation Agreements on Information Technology and Telecommunications", *Development of Information and Communications in Pakistan,* Volume 2 (compiled by Sustainable Development Policy Institute, Islamabad), 1997.
2. Schwartau Win, *Information Warfare,* Emeryville, CA 94608, USA, Publishers Group West, 1994.
3. HSBC James Capel Asia Limited, *Regional Research, Telecoms in Asia,* Islamabad, 1E, Ali Plaza, Jinnah Avenue, Blue Area, Islamabad, 1996.

4. *The News,*Rawalpindi, January 1, 1997.
5. *Ibid*
6. Masood Jamshed, "Demand Estimates for Telecommunications Services in Pakistan", *Development of Information and Telecommunications in Pakistan,* Volume 1 (compiled by Sustainable Development Policy Institute, Islamabad), 1995.
7. Elci Atilla, Dr, "Data Communications Services in Asia-Pacific Region and their Impact on Pakistan", *Development of Information and Communications,* Volume 2, *op.cit.*
8. *Ibid*
9. HSBC, *op.cit.*
10. The *Nation,* Islamabad, March 15, 1998.
11. Lodhi Fakhar, Dr, "Industry and Manpower Rrequirements: Where do we stand", *Human Resource Development in Telecommunications* (Seminar proceedings), Sustainable Development Policy Institute, Islamabad, February, 1996.
12. *Ibid.*
13. *Ibid.*
14. Choucri Nazli, Dr, and Dr. Fred Moavenzadeh, "Technology Triangle", Messachussets Institute of Technology, USA 1992, Prepared for Government of Pakistan.

Additional Reading

Spar Dabora and Bussgang, "The Net", *Harvard Business Review,* vol 74, No. 3, May/June 1996.
Armstrong Arthur and Hagel Jhon, "The real Value of On-line Communities", *Ibid.*
Marcelo Alonso, "Infotech: Boon or Curse", *The World and I*, May 1996.
Libicki Martin, "The Emerging Primacy of Information", Orbis, Vol 40, No.2, Spring 1996.
Larry Press, "Cuban Telecommunications, Computer Networking and US Policy", RAND National Defence Research Institute, DRU-1330-1-OSD, July 1996.
Kennedy Paul, *Preparing for Twenty First Century,* New York, 1993, pp 50-51.
Molancler Roger C, *Strategic Information Warefare: a New Face of War*, Prepared for the Office of the Secretary of Defence, USA