2.8 Telecom environment in the rural areas and digital divide among regions

2.8.1 Present status of telecommunication facilities and technology

Table 2.8.1-1 describes the difference in telephone density by area.

Divide in communication service provision exists in Myanmar undoubtedly. For example, Yangon has telephone density of 3 %, while nationwide average is 0.6 % approximately. MPT is on the hedge whether to increase telephone density in Yangon and big cities more or to increase that in rural areas. Telephone services in rural areas are often provided through manual boards. MPT is better to decide what percentage of its income has to be spent for rural areas through close discussions with the Government. Investment in urban areas make financial conditions of MPT better as well as contribute more to Myanmar economy ultimately.

Table 2.8.1-1 Telephone density by State/Division

State/Division	Telephone	Population	Area (Square mile)	Tele-density (per 100 people)	Population density
Kachin State	6,309	1,224,866	34,379	0.52	35.6
Kayah State	1,445	252,795	4,530	0.57	55.8
Kayin State	2,828	1,431,377	11,731	0.20	122.0
Chin State	1,509	465,361	13,907	0.32	33.5
Sagaing Division	11,798	5,280,362	36,535	0.22	144.5
Taninthayi Division	4,031	1,297,518	16,736	0.31	77.5
Bago Division	16,353	4,930,146	15,214	0.33	324.1
Magway Division	12,860	4,382,182	17,305	0.29	253.2
Mandalay Division	33,348	6,313,938	14,295	0.53	441.7
Mon State	7,773	2,390,681	4,748	0.33	617.2
Rakine State	5,060	2,653,529	14,200	0.19	186.9
Yangon Division	168,767	5,382,051	3,927	3.14	1,370.5
Shan State	19,205	4,701,669	60,155	0.41	78.2
Ayeyawady Division	15,770	6,548,241	13,567	0.24	482.7
Total	307,056	47,254,716	261,228	0.65	180.9
Reference	Difference of tele-density: maximum 3.14 minimum 0.19 Ratio (max/min)=16.5 Difference of population density: maximum 1370.5 minimum 33.5 Ratio (max/min)=40.9				

Note: Population in this table is extracted from MYANMAR facts and figures 2002, P5, Area and Estimated Population.

MPT employs various methods such as VSAT systems to give telephone access to people in rural areas. If people can afford, they can subscribe BCT's satellite services that provide data communication and telephones.

2.8.2 Introduction plans of technology

There are several options for rural networks. They are:

- Remote Switch Unit (RSU)
- Point to Multipoint Microwave Radio System (PMP)
- Wireless Local Loop (WLL)
- Fixed Satellite Service (FSS such as VSAT)
- Cellular Mobile
- Digital cordless

MPT has started a digital cordless project that offers one line to villages along long distance trunk lines in 2002. It may be the cheapest way, although the number of lines is very small and transmission speed is low.

The selection of the best technologies suitable for each region is important. It is also important to take future IT demand into consideration. Very low-speed transmission may result in change of equipment.

Considering future IP networks in mind, a Radio IP Router may be a good option. It is IP-based and does not require wires to connect terminals. It can accommodate data and telephone traffic.

2.9 CATV (Cable Television)

There are two terrestrial TV channels broadcast by government. On the other hand, there are many satellite channels waiting for people to put up antennas. Hotels and buildings have equipped with TVs with satellite channels. More than 30 % of the population in Myanmar can access TV via satellite now. Because of this reason, no CATV network has developed.

In some areas in the world, CATV has been considered an important telecommunication infrastructure. But its advantage as an economic and high-speed medium is now decreasing because of introduction of DSL. In Myanmar, there is no need to consider CATV as an option of information media at present.

2.10 Power supply

Power supply is one of the biggest problems in Myanmar. Outage occurs frequently and many people cannot access electric power at all. Electric bulbs and computers are useless without electric power. Big companies can afford to install generators. But it will be difficult for houses and small companies. Telecommunication facilities have to install at least two diesel engine generators in areas where power supply is not available. Diesel fuel has to be replenished at least once a week. This is specially a problem for microwave relay stations some of which are high on the mountains where there is no access road for a car. Using solar cell panels and rechargeable batteries may be an option, but for the moment, they are expensive and only for equipment with low electric power consumption.

2.11 Telecom environment of industrial parks

Results of hearing survey in an industrial park or city in Hlaingthayar township are shown below:

- Management Committee of this industrial park is volunteers' committee to treat common problems in the industrial park. It consists of 23 members, including 1 president, 2 vice president, 1 treasurer, 2 secretaries, and 1 additional secretary. All members are chairmen, vice chairmen, managing directors of companies that have factories in this industrial park.
- The industrial park was established in 1995, and has area of 1,300 acres or 526 hectors. The management committee was formed in 1996.
- 366 factories are in operation now, and additional 213 factories are now under construction. At present, total employment in the industrial park is about 40,000 people. Total investment to the industrial park amounts 40,463 million Kyats or 124 million US$. Although 100 % foreign companies are 10 now. Even they cannot use email and FAX services in Myanmar.
- Telecommunications here are handled by MPT. As seen when you arrive here, there are 2 housing complexes around this industrial park. MPT installed 3 remote exchanges with a capacity of 500 lines each for the industrial park, and housing complexes. 2 out of 3 remote units are for the service to the housing complexes. Therefore, only 500 telephone lines are available for the industrial park. We consider 1 telephone line per 1 factory is a government policy, and we voluntarily distribute 1 telephone line to a factory fairly.
- We have 1 substation of a capacity of 40 MW installed, of which present consumption is 30 MW. However, as the electric power supply is not so stable, most of factories are running their own diesel generators.

- Problems of the industrial park are:
  ① Electricity
  ② Telecommunications: the industrial city has only 500 lines supplied, and email service is costly. VSAT necessitates 20,000 US$ for installation. iPSTAR will be a bit cheaper, 1,950 US$.
- This industrial city is composed of Zone 1 to 4, and finally 600 factories can be accommodated. In addition 2 more industrial estates are under development. If they are completed, 1,000 additional factories will be installed.
- 265 GSM phones are used in the industrial city.
- We can purchase a line at US$. However, we have to pay 1,500 US$ for a line as well as all call charges in US$, too. If we pay normally, we can get a line at 200,000 Kyats, or around 200 to 500 US$.
- Foreign companies are not allowed to connect directly with leased lines outside the country.
- Although there is no Internet user in this industrial city, awareness, usefulness and availability of the Internet are principal problems. In order to disseminate the Internet services here in Myanmar, some seminars should be held to solve the above problems.
- Here in the industrial city, 1 company has 3 to 4 computers.
- Although almost all participants of this meeting have computers at home, it is because the participants possess important positions in companies. Normally those who have computers at home are few in this country. First, almost all household do not have electric power supply all day, but at night only.
- It is necessary to provide the industrial park with a feasibility study on IT. As a worldwide trend, computerisation of SME disseminates. The Committee should selected 15 to 20 companies for the above feasibility study.
- Export companies receive special treatment from the Government. They have to pay all electric charges in US$ as well as 10 % export tax in US$. Of course, they have to pay 30 % income tax. Non-export companies pay 30 % income tax and 5 % commercial tax, or value added tax, in Kyats.
- Our company has headquarters and factory here and 11 branches in other cities. 350 people as a total work in our company. We have here a LAN connecting the sales, marketing and finance departments formed as Novell Network over DOS and CC mail service can be used within the LAN. Although we have automated bottling lines, they do not have any relation to LAN.
- Our company here has 6 to 7 telephones in the factory. They are used for FAX and email service, too. In addition, we have 3 CDMA telephones here. However, these 10 telephones

are not enough for the factory.

- Although FAX connections to branch offices are available, FAX messages are not good sometimes.
- We have to pay 700,000 Kyats / line / month or more.
- We import material from abroad in US$ and sell bottled items 4 US$ or 45 Kyats per bottle. We are losing here.
- We run other business for export in other area. 50 office workers have 8 telephones and utilise a LAN there. Another company provides 30 office workers with 6 telephones.
- Telephone lines in Myanmar are of bad quality, or otherwise they are congested.
- We have headquarters in downtown and a factory here. We have a LAN in the headquarters, but no LAN in the factory. We use 7 computers for 46 office workers. There are 100 people in production lines.
- Although we have 3 telephones here, but only one telephone line has been supplied from the Zone. 1 line was transferred from HQ. And 1 CDMA-WLL.
- We plan to establish a LAN in the factory after setting up accounting software made locally by A Co. B Co. uses another accounting software developed locally by C Co. Our software costs 300 US$ for initial installation and 150 US$ for an installation to an additional computer.
- Infrastructure in whole territory of Myanmar is very poor and needs to be improved and developed.
- Now in this factory 3 telephones are available. However, calls originated from all of them are very difficult to get connected to called parties. Call handling capacity of an exchange system may not be sufficient during busy hours.
- Equally dealers in local cities and areas are always experiencing a very hard time to call up here. Always they call repeatedly.
- Concerning the quality of speech, not only I cannot get connected to the other party, but also sometimes I hear leaked voices.
- Also, there are down times of telephone service due to electricity failures. As there are so frequent breakdowns of electric power supply, the batteries in an exchange office may not be able recharged to sufficient level, and thus, it fails to provide service. This is true especially for the exchange system in the industrial zone.
- There is shortage of lines.
- We have a lot of noise and cross talks in rainy season here.
- As we do not have sufficient main telephone lines connected, we can receive FAX messages only at night.
- We have another factory in another area in Yangon. Two weeks ago, a truck cut an electric

transmission line and the line dropped over telephone cable. Surge voltage transmitted over telephone cable entered up to PABX in the factory to have it shorted. At the same time, the surge voltage transmitted to an exchange office and made its 34 subscriber circuits shorted there. MPT so far fixed only 1 out of 34 damaged circuits.

- The company is connected to the Internet through BCT, but connections are by dial-up method.
- Software for human resources management system is necessary.
- In a new IT era, suppliers and buyers should be connected worldwide by the use of the Internet.
- Technical levels related to IT are getting improving.
- Young people can design web pages easily. What is important is what to be placed in web pages. The important items are: what information to show and how to make web pages looked up.
- Dial-up connections have certain defects: its bandwidth is narrow, so it can transmit only 28.8, 32, up to 59 kbps, there always exist congestions, and, as the cables have already been laid for a long time, quality of cables is generally bad. ADSL may not be applicable from the last viewpoint.
- What is important for the improving telecommunications and IT services is to create a competitive environment by 2 to 5 companies privatised.

As clear from the above, business owners or general managers of business strongly want to have better telecommunication services. Some of them want to have the Internet services at a reasonable cost and at higher speed, although some of them seem necessary to get enlightened on benefits of IT services through seminars and so on.

If they are enlightened, there will be a considerable demand for IT services, like the Internet, email, and, if IT infrastructure can respond their needs, Myanmar economy will accelerate its growth. For this objective, some opine that competitive environment in telecommunications business is indispensable.

2.12 Telecom environment of the Government and public organisations

2.12.1 Department of Relief / Ministry of Social Welfare, Relief and Resettlement

- In 1983 we had 173 governmental fire stations and 245 volunteer fire stations. In 2002, we have altogether 545 fire stations, of which 217 are governmental and 328 are volunteers.

- Department of Relief has telecommunication methods by I-com System in Yangon and Mandaleay, thanks to the grant aid project of the Government of Japan. In Yangon, it has 4 base stations to cover whole area with UHF band transmitters and receivers. The control centre of system is connected to PSTN in order to receive people's fire calls. In Mandalay, the system is a similar one. In addition, the department has UHF band Kenwood Walkie-Talkie transceivers for communications with each other.
- Now the department adopts unique fire call numbers of 191 and 192 nationwide.
- Concerning IT, the department tries to install GIS system, which can show places of fire stations and water pumps on displayed map of Yangon. The system is now being developed by MCC Ltd.

2.12.2 Department of Higher Education / Ministry of Education

- Myanmar Ministry of Education has two Departments of Higher Education: one in Yangon and the other in Mandalay.
- Departments of Higher Education have already established 40 VSAT stations for e-Education.
- All of 62 universities in Myanmar will avail the Internet accesses through fibre optical links within this year.
- 304 learning centres of e-Education were established in townships in 2000. They are used for distance university courses.
- Main studio here is made as data broadcasting system for secondary level, English summer courses and distance university courses.
- Although IT systems were initially introduced in 2000, the department now has 304 e-Education learning centres. Additional 100 learning centres will be introduced in future, and learning centres will be 403 altogether finally.
- These e-Education learning centres are also used for human resources development like Diploma CHIT, etc.
- Every university has already been connected by IT systems, or LAN systems connected to VSAT systems and/or optical fibre WAN.
- Concerning the distance university, lectures made in the studio are transmitted to MRTV in the neighbourhood by a microwave link. The lecture signals, then, transmitted to 304 e-Education learning centres connected to VSAT receiving systems with 3-m diameter antennas via Thaicom 3 satellite using 6 MHz bandwidth. Questions are received at the distance university centre through telephones or email. Distance University has 1 studio in Yangon at present.
- As Thaicom system is expensive, the department wants to change the present system to

iPSTAR system, which offers at a more reasonable price.

- The Institute of Economics has optical fibre LAN system and VSAT connection to the Internet. The universities and Institutes are now connected by optical fibre systems and/or VSAT systems. For example, an optical fibre cable connects LANs of Institute of Economics, Yangon University, University of Foreign Language, University of Distance Education, Department of Higher Education Yangon, University of Education, Broadcasting Station are to form a WAN. This WAN goes out through a VSAT system installed at Department of Higher Education, excluding a link from University of Distance Education to the broadcasting station.

2.12.3 Department of Medical Science / Ministry of Health

- Department of Medical Science (DMS) undertakes the education of medical students. In order to perform this undertaking efficiently and effectively, DMS started a 4-year plan for promotion of medical education by utilising IT technologies.
- The plan started in 2000 and will end in 2004. It aims at development of infrastructure among medical training institutes, and augmentation of trained people. Along with the plan, this Medical Resource Centre was opened recently. This Centre has an electronic library connected to other training institutes. Doctors in other training institutes can retrieve papers, CD-ROM materials through VSAT connections and can request to library personnel to send copied materials by normal mail or by email.
- DMS plans to introduce e-Nursery, e-Pharmacy, e-Medicine, etc., at proper timing.
- The Centre has studio for distance education of doctors, nurses, etc. Lectures sent from the Centre via VSAT system had got a good reputation from the students.
- Hospitals in Myanmar are organised in a hierarchical way. First come 2 central hospitals in Yangon and Mandalay. Then come state and divisional hospitals, which are 14 altogether. Third are district hospitals, fourth township hospitals (314), fifth station hospitals, sixth rural health centres (1,400), and the last seventh sub-rural health centres (about 7,000). DMS considers ICT is not needed below district hospitals.
- Ministry of Health seems to plan to establish a medical database centre having accesses to necessary hospitals, but its details are not clear here.
- Medical Resource Centre (MRC) was established as a medical education centre, a medical museum and an e-Library. Institutes and training centres under DMS are altogether 13, all of which locate in Yangon or Mandalay, and additional 43 nursing and midwifery training schools in states and divisions.
- In relation to MRC establishment, LAN development and WAN development in related

institutes were planned. Some of LANs have already been completed in 6 areas. For WAN, DMS plans to establish fibre optic cable installations and VSAT connections. Fibre optic cable WANs have already been almost installed in 2 areas in Yangon and 1 area in Mandalay, all of them connect DMS-related institutes and hospitals in neighbourhoods.

- DMS plans to connect these WANs and other necessary medical facilities by VSAT in near future, some VSAT connections have already been completed.

2.12.4 Myanmar Police Force / Ministry of Interior

- Myanmar Police Force (MPF) mainly uses wireless sets for communications. HF radio systems connect its headquarters to state and divisional police centres, and police forces in border areas.
- VHF transceivers are used for communications between each state or divisional centre and police stations or patrol cars in its control area or remote area. 48 townships have VHF networks, including Yangon, Mandalay, and other state or divisional capitals.
- MPF has been utilising the Internet service and email service by dial-up connections for these 3 to 4 years. The headquarters and state and divisional centres can access to the Internet. They have their own intranet within their offices.
- INTERPOL donated an X-400 packet switching system on 16 May 1998. MPF installed the donated system in the headquarters to get connected to INTERPOL worldwide network through SIDA Network. This system can transmit data and images. A regional centre to which MPF is connected is at Tokyo.
- There is a plan to establish ASEANAPOL network among ASEAN countries. MPF plans to cooperate and participate in the project, if it starts.
- MPF plans to establish a computer network among the headquarters and state and divisional centres by means of VSAT or iPSTAR.

ICT related officers in ministries need better Internet services with connections to necessary local offices. Some ministries have already established their own LANs and WANs by VSAT systems of BCT and optical fibre cables.

MPT and/or BCT should consider to establish optical fibre networks to respond the needs of ministries, big enterprises, etc., and to incorporate individual networks into an integrated optical fibre subscriber network.

2.13 Quality of telecommunication services

An example of access network failure rate is listed in Table 2.13-1.

Table 2.13-1 Monthly variation of fault occurrence rate /line / year

	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR
1997	1.66	1.60	1.61	1.63	1.64	1.64	1.66	1.67	1.67	1.68	1.67	1.66
1998	1.67	1.70	1.73	1.71	1.69	1.70	1.68	1.66	1.66	1.65	1.65	1.69
1999	1.71	1.74	1.74	1.75	1.76	1.76	1.77	1.79	1.79	1.78	1.76	1.76
2000	1.78	1.80	1.82	1.79	1.78	1.77	1.75	1.73	1.71	1.73	1.75	1.77
2001	1.74	1.70	1.67	1.69	1.72	1.70	1.72	1.72	1.71	1.70	1.69	1.68

Source: Yangon Auto Telephone / MPT

An example of duration of fault rectification is shown in Table 2.13-2.

Table 2.13-2 Duration of fault rectification in %

	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	Av.
24 hr.	75.0	73.0	72.0	70.0	67.0	72.0	70.0	70.5	72.0	73.0	71.0	68.0	71.1
72 hr.	15.0	13.0	14.0	16.5	11.0	13.0	12.0	13.9	16.0	16.0	15.0	14.5	14.2
120 hr.	6.2	9.5	6.0	4.5	20.0	9.6	9.5	10.0	8.0	8.5	9.5	10.0	9.3
Above	3.3	4.5	8.0	9.0	2.0	5.4	8.5	5.6	4.0	2.5	4.5	7.5	5.4

Source: Yangon Auto Telephone / MPT

An example of classification of faults is shown in Table 2.13-3.

Table 2.13-3 Classification of faults

		Cable	Instrument	Exchange	Drop wire	Other	Total
1997	Faults	40,086	637	4,836	101,907	65	147,531
	%	27.17	0.43	3.28	69.07	0.04	100
1998	Faults	46,784	301	7,702	108,939	31	163,757
	%	28.57	0.18	4.70	66.52	0.02	100
1999	Faults	47,698	247	4,924	111,802	87	164,749
	%	28.95	0.15	2.99	67.86	0.05	100
2000	Faults	57,860	285	7,493	136,250	79	201,967
	%	28.65	0.14	3.71	67.46	0.04	100
2001	Faults	56,696	416	12,890	135,998	79	206,079
	%	27.51	0.20	6.25	65.99	0.04	100

Source: Yangon Auto Telephone / MPT

According to Table 2.13-3, number of faults itself is considerably big compared with installed telephone lines shown in Table 1.3.1-2 as well as it is increasing outstandingly year by year. Its increasing rate seems higher than increasing rate of installed telephones. IP services utilising existing cable access network seems very difficult at high speed. In relation to the telecommunication services, reporters requested data of call completion ratio in Myanmar in vain.

Some results of hearing study are listed below:

- When a fault continues for a long duration due to shortage of repairing materials or cables, sometimes we are compelled to use cable-sharing method.
- Telecommunications here are handled by MPT. MPT installed 3 remote exchanges with a capacity of 500 lines each for the industrial park, and housing complexes. 2 out of 3 remote units are for the service to the housing complexes. Therefore, only 500 telephone lines are available for he industrial park. We think the Government policy of distributing telephone lines is 1 telephone line per 1 factory, and we voluntarily and fairly distribute 1 telephone line to 1 factory, although some factories have headquarter functions.
- Problems of the industrial park are:

1) Electricity
2) Telecommunications. As stated earlier, the industrial city has only 500 lines, email service is costly, VSAT necessitates 20,000 US$ for installation. IPStar will be a bit cheaper, 1,950 US$.

- This industrial city is composed of Zone 1 to 4, and finally 600 factories can be accommodated. In addition 2 more industrial estates are under development. If they are completed, 1,000 additional factories will be installed.
- 265 GSM phones are used in the industrial city.
- We can purchase a line at US$. However, we have to pay 1,500 US$ for a line as well as all call charges in US$, too. If we pay normally, we can get a line at 200,000 Kyats, or around 200 to 500 US$.
- Our company here has 6 to 7 telephones in the factory. They are used for FAX and email service, too. In addition we have 3 CDMA telephones here. However, these 10 telephones are not enough for the factory.
- Although FAX connections to branch offices are available, FAX messages are not good sometimes.
- We have to pay 700,000 Kyats / line / month or more.
- Telephone lines in Myanmar are of bad quality, or otherwise they are congested.
- Although we have 3 telephones here, but only one telephone line has been supplied from the Zone. 1 line was transferred from HQ. And 1 CDMA-WLL.
- Infrastructure in whole territory of Myanmar is very poor and needs to be improved and developed.
- Now in this factory 3 telephones are available. However, calls originated from all of them are very difficult to get connected to called parties. Call handling capacity of an exchange system may not be sufficient during busy hours.
- Equally dealers in local cities and areas are always experiencing a very hard time to call here up. Always they used to recall repeatedly.
- Concerning the quality of speech, not only I cannot get connected to the other party, but also sometimes I hear leaked voices.
- Also, there are down times of telephone service due to electricity failures. As there are so frequent breakdowns of electric power supply, the batteries in an exchange office may not be able recharged to sufficient level, and thus, it fails to provide service. This is true especially for the exchange system in the industrial zone.
- There is shortage of lines.
- We have a lot of noise and cross talks in rainy season here.
- As we do not have sufficient main telephone lines connected, we can receive FAX messages only at night.
- We have another factory in another area in Yangon. Two weeks ago, a truck cut an electric transmission line and the line dropped over telephone cable. Surge voltage transmitted over

telephone cable entered up to PABX in the factory to have it shorted. At the same time, the surge voltage transmitted to an exchange office and made its 34 subscriber circuits shorted there. MPT so far fixed only 1 out of 34 damaged circuits.

- The company is connected to the Internet through BCT, but connections are by dial-up method.
- Dial-up connections have certain defects: its bandwidth is narrow, so it can transmit only 28.8, 32, up to 59 kbps, there always exist congestions, and, as the cables have already been laid for a long time, quality of cables is generally bad. ADSL may not be applicable from the last viewpoint.
- In certain areas in Yangon, MPT still provide subscribers with analogue lines, that is, lines connected to analogue exchanges.

As shown in the above opinions or complaints, quality of services rendered by MPT does not seem satisfactory. Although there exist problems of workmanship and budget constraints, MPT seems better to start improving the local cable network, or otherwise, faults and occasional cross talks suggest that ADSL would not be applicable widely.

If lines or terminals are not sufficient, they have to be supplied to productive sectors first. Of course, MPT has the same strategy, but budgetary constraints might make for MPT to implement its own strategy. Anyway, as MPT in general cases cannot expect considerable revenues from residential subscribers, it should place a priority on meeting needs of business users. Business users seem to need stable and not congested connections of telephones as well as they have strong demands for the Internet services.

Present local network in Yangon suffers from considerable faults, still has analogue systems and shows not satisfactory quality. In order to promote IT industry in Myanmar, priority should be placed upon digitalisation of analogue exchanges, and expansions and improvement of local networks in Yangon and Mandalay urban areas.

According to hearing survey, faults are not easily repaired because almost all repairing materials are to be imported. The Government is better to encourage and support domestic assembly of terminal equipment such as telephone sets, personal computers, and domestic production of simple manual boards and small capacity cables. The domestic production is desirable for improving existing telecommunication networks.

2.14 *Human resources development*

MPT has Telecommunications and Postal Training Centre (TPTC) that trains MPT staff advanced and modern communication technologies. It was established in 1968, and taught many engineers skills in their fields; telephone switching, radio & transmission, external plant, and telegraph & telex.

Outside facilities, especially drop wire portion, look to be installed improperly. It may need to teach workmanship and spirit too.

TPTC teaches IT-related courses and training looks going well. TPTC wants to expand training courses into newer technologies such as broadband satellite communication, broadband IP switch, 3G-mobile communication, rural telecommunications, network planning and intelligent network.

It seems important to prepare for the change into IP networks and study technologies such as VoIP and IP broadband networks to create infrastructure for IT. In these fields, the technical cooperation like dispatch of an expert from such counties as Japan is needed by TPTC as well as is considered effective and useful for human resource development in Myanmar as a whole.

2.15 Future plan of telecom networks

2.15.1 Progress of communication infrastructure development projects

Before addressing to the development plans, present telecommunication networks in Myanmar are roughly sketched first: they have 307,056 telephone subscribers as of 2002, which equals to a telephone density of 0.59 % to the population of 51.226 million. This means that MPT has achieved one of development targets, the number of subscribers, with a delay of about 2 years.

Development plan for the telecommunications network, or Master Plan for 1991 - 2010, was prepared under an ITU project (C/HYA/87/001) jointly with ITU/CTD experts and MPT members from August to December 1990, based on a basic method formulated under an ITU project (BUR/81/016). The Master Plan envisaged 260,000 subscribers in 2000 and 530,000 subscribers by the end of 2010, achieving a telephone penetration ratio of 0.9 %.

An Integrated Digital Network (IDN) was planned as a network structure, so that MPT could provide ISDN services, when the IDN was completed. The project cost was estimated US$ 264 million from 1996 to 2000, and US$ 667 million from 2001 to 2010.

As the environment around telecommunications has changed rapidly within these ten and a few more years after the formulation of the current Master Plan, for example, vitalisation of information technologies, telephone demand increase related to social and economic activities, development of advanced telecommunications technologies, etc., it is suggested the MPT formulate a new master plan for 2001 to 2010 or 2020.

The 5-year Development Plan 1996 - 2000 is shown below:

Table 2.15.1-1 5-year Development Plan 1996 - 2000

Description	1996	1997	1998	1999	2000	Total
DEL	27,316	31,960	37,393	43,750	51,188	191,607
Exchanges	12	17	21	23	25	98
Mobile phones	5 towns	4 towns	6 towns	7 towns	5 towns	27 towns
Wireless local loop	7 towns	4 towns	3 towns	2 towns	2 towns	18 towns
Pager systems	2 towns	4 towns	5 towns	2 towns	2 towns	15 towns

Source: JTEC "Preliminary Survey on Telecommunications Network Development in the Union of Myanmar"

Telephone subscribers were 158,716 in 1995 and they were 277,807 in October 2001. The achievement ratio to target value is about 80 %. Existing digital exchanges in 1995 were 48, while they increased to 98 in March 2002. The achievement ratio is 66 %. Mobile phones have been introduced in 4 towns, which means an achievement ratio of 15 %, and wireless local loop (WLL) systems, including ARTS systems, are actually accommodating subscribers in 10 different towns, which signifies an achievement ratio of 56 %. The achievement ratio of paging systems was 0 %. Judging from these facts, MPT, although it wanted to achieve the target as much as possible, could not achieve them completely, especially in relation to systems to be purchased from foreign countries. The fact that 80 % have been achieved in subscriber number shows the endeavour of MPT to fulfil the targets as much as possible using the most cost effective means.

Telecommunication infrastructure provides the basic and indispensable element for the development of whole information technologies. In Myanmar, its telephone density is about 0.6 % after the completion of 5-year development plan and is among the lowest in ASEAN countries. E-National Task Force aims at a rapid development of telecommunication infrastructure. To attain this goal, a concrete institutional development is required.

2.15.2 Ongoing projects

The ongoing project is 'Installation of New Digital Exchange Systems in Provincial Area'. This project aims at installing new digital exchanges at Meikhtilar, Pyithayar, Thazi, Yamaethin, Pyawbwe, Kyaukse, Sagaing, Myittha, Nyaunglaypin, Pyuntaza, Bagan/Nyaungoo, and Taikyi within a period of 1 and a half year. Total switch capacity is 13,500 terminals and outside plant capacity is 8,100 lines. Transmission systems to connect these switches into existing telecommunication network are microwave systems or optical fibre systems. Myanmar has obtained US$ 6.5 million loan for this project and contracted with China National Electronics Import & Export Shanghai Company, which manufactures ZTE.ZXJ-10 switches. The project is detailed in Table 2.15.2-1.

According to hearing survey, new Minister of MCPT signed the Loan Agreement with Kinsei Group (Korea) on 13th June for expansion of telecommunication network.

Digitalisation of the existing telecommunication network is progressing steadily in Myanmar. Usually, outside plant is installed 1.3 to 1.6 times of the capacity of switching equipment due to uncertainty of demands, but MPT might install additional local cables itself, or might utilise the reserved capacity for rural TMP systems or urban WLL systems. Judging from this fact, MPT seems to be using its appropriated fund in the most efficient and effective way.

Table 2.15.2-1 ZTE.ZXJ-10 Switch project

Exchange	Type	Capacity		Transmission	Outside plant
		Terminal	Trunk		
Meiktilar	Host	4,000	1,500	MW (D)	2,500
New Industry	Remote	1,000	120	O/F	500
Pyithayar	Remote	500	120	O/F	500
Thazi	Remote	1,000	120	MW (D)	500
Yamaethin	Remote	1,000	120	MW (A)	500
Pyawbwe	Remote	500	120	O/F	500
Sub-total		8,000	2,100		5,000
Kyaukse	Host	1,000	480	O/F & MW (A)	500
Singaing	Remote	500	120	O/F	300
Myittha	Remote	500	120	MW (A)	300
Sub-total		2,000	720		1,100
Nyaunglaypin	Host	1,000	300	MW (D)	500
Pyuntaza	Remote	500	120	O/F	500
Sub-total		1,500	420		1,000
Nyaungoo/Bagan	Host	1,000	300	MW (D)	500
Sub-total		1,000	300		500
Taikkyi	Host	1,000	240	MW (D)	500
Sub-total		1,000	240		500
Total		13,500	3,780		8,100

2.15.3 Preparation of new telecommunication network development plan

Telecommunications network development plan of MPT is shown in Table 2.15.3-1. This is an ambitious development plan compared with ITU's Master Plan that was a bit pessimistic, but a part of it could not be achieved actually. The environment of telecommunications has changed greatly in these years. Telephone density increases from 0.59 in 2000 to 0.878 in 2006, and 8.44 in 2011. Although domestic satellite earth stations increase from 19 in 2000 to 29 in 2006, and to 31 in 2011, the increment is not so surprising as before, because replacement of old SCPC/ IDR systems is taken into account. It should be noted that satellite earth station for international communications are to be installed at Mandalay in the period of 2006 to 2011, and international

gateway exchanges will be added at Mandalay in the period of 2001 to 2006 as well as of 2006 to 2011. Growth rate of Myanmar's economy is supposed to be 6 % in the long-term plan.

Table 2.15.3-1 Telecommunication network plan

Description	Existing	2001 to 2006	2006 to 2011
Population (Million)	51.226	55.206	60.949
Telephone (Million)	0.307	0.878	5.144
Telephone density (%)	0.59	1.59	8.44
Exchange			
Local	105	158	218
International	1	2	3
Mobile	5	12	18
Microwave	228	240	268
Satellite Earth Station			
International	1	1	2
Domestic	19	29	31
Submarine fibre cable	1	1	1

Source: MPT

Moreover, optical fibre backbone routes are not included in the above plan yet. Microwave radio systems occupy the role of main backbones. According to hearing study, the following comments to be included in the long term plan, if possible:

- MPT plans to construct optical fibre backbone routes within Myanmar in near future.
- MPT also wants to participate in sub-regional projects, including establishment of an optical fibre route, with close cooperation with countries in the sub-region.
- MPT plans to expand IP-based VSAT broadband network to villages where people can utilise the network for the Internet, email services, etc.
- As many villages in Myanmar do not have even telephone services so far, MPT basically wants to put emphasis on increasing telephone density in Myanmar.
- MPT plans to install The GSM systems in about 20 cities in border areas, and in coastal areas for 20,000 subscribers.
- Capital cities of States and Divisions are to be covered by CDMA systems, which have functions of 2.5 G mobile systems at present. The CDMA systems may be installed along the main road between Yangon and Mandalay.
- At this moment, MPT does not plan to carry out voice service over the IP network at all.

Therefore, MPT does not plan to install any gateway to PSTN.

To prepare for the liberalisation of telecommunications market, MPT is better to revise the development plan so as to place emphasis upon digitalisation of its main routes and principal spur routes, re-utilisation of replaced facilities as much as possible, and provision of more leased lines of wideband, etc.

According to observations on Myanmar telecommunication networks as a whole, the investments are better to be concentrated in backbone routes. In order not to hinder the development of IT industry, the investments is better concentrated to expansions and improvement of terrestrial backbone routes and related local networks. Considerations upon present conditions of power supply and other infrastructures seem to support the above conclusion.

2.15.4 Demand forecast for telecommunication services

MPT plans to offer services as Table 2.15.4-1 shows.

Table 2.15.4-1 MPT's Telecommunications service plan

Description	Existing (as of March 31, 2002)	April 1, 2001 – March 31, 2006	April 1, 2006 - March 31, 2011
Population (million)	51.226	55.204	60.949
Telephone (million)	0.307	0.878	5.144
Telephone Density (%)	0.59	1.59	8.44

This section tries to verify whether those figures are appropriate. The figures for 2001 are the telephone density actually served by MPT and not a demand density. To make them demand, it needs to add a backlog. World Telecom Visual Databook 2002 states that Myanmar had a backlog of 84,000. Because it is difficult to believe the backlog was reduced, the demand can be considered the sum of the number of telephones in 2001 and this backlog. Table 2.15.4-2 shows the present demand.

Table 2.15.4-2 Telecommunications Demand

Description	Existing (as of March 31, 2002)
Population (million)	51.226
Telephone (million)	0.307
Telephone Density (%)	0.59
Backlog (million)	0.084
Demand (million)	0.391
Demand Density (%)	0.76

(1) Forecast with a change in the number of telephones

First, the paper forecasts with the extrapolation method by using past figures. The upper part of Table 2.15.4-3 shows the past data and the lower one shows the forecast. Fig. 2.15.4-1 shows those figures on a graph..

The graph shows that a regression of linear equation has a high correlation. The demand in March of 2011 is only 510,000, one tenth of MPT's forecast of 5,144,000.

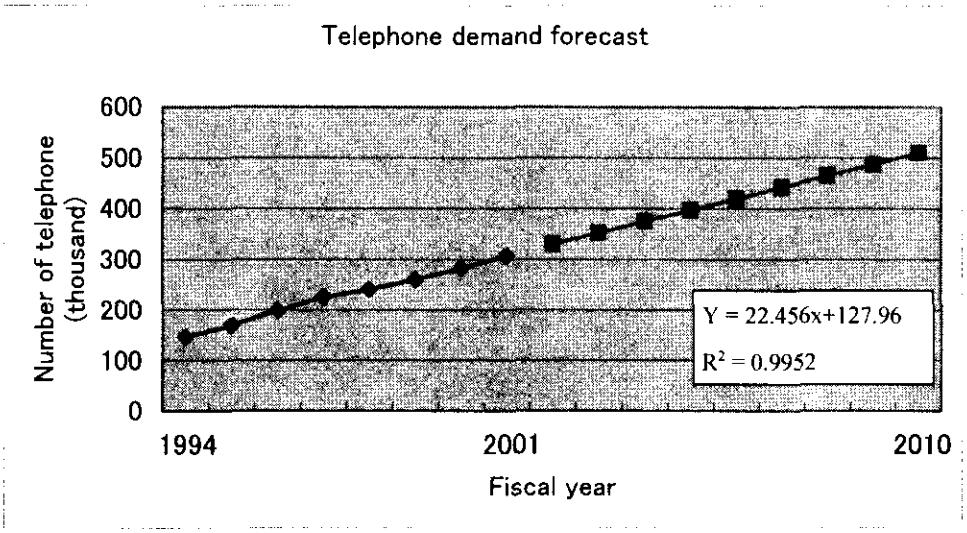
Table 2.15.4-3 Forecast of the number of telephones

Fiscal Year	1994	1995	1996	1997	1998	1999	2000	2001
Telephone in use	147,107	169,530	199,017	225,315	240,673	260,579	282,853	307,056

Fiscal Year	2002	2003	2004	2005	2006	2007	2008	2009	2010
Telephone forecast	330,000	353,000	375,000	397,000	420,000	442,000	465,000	487,000	510,000

Note: Fiscal year means a year from April to March next year.

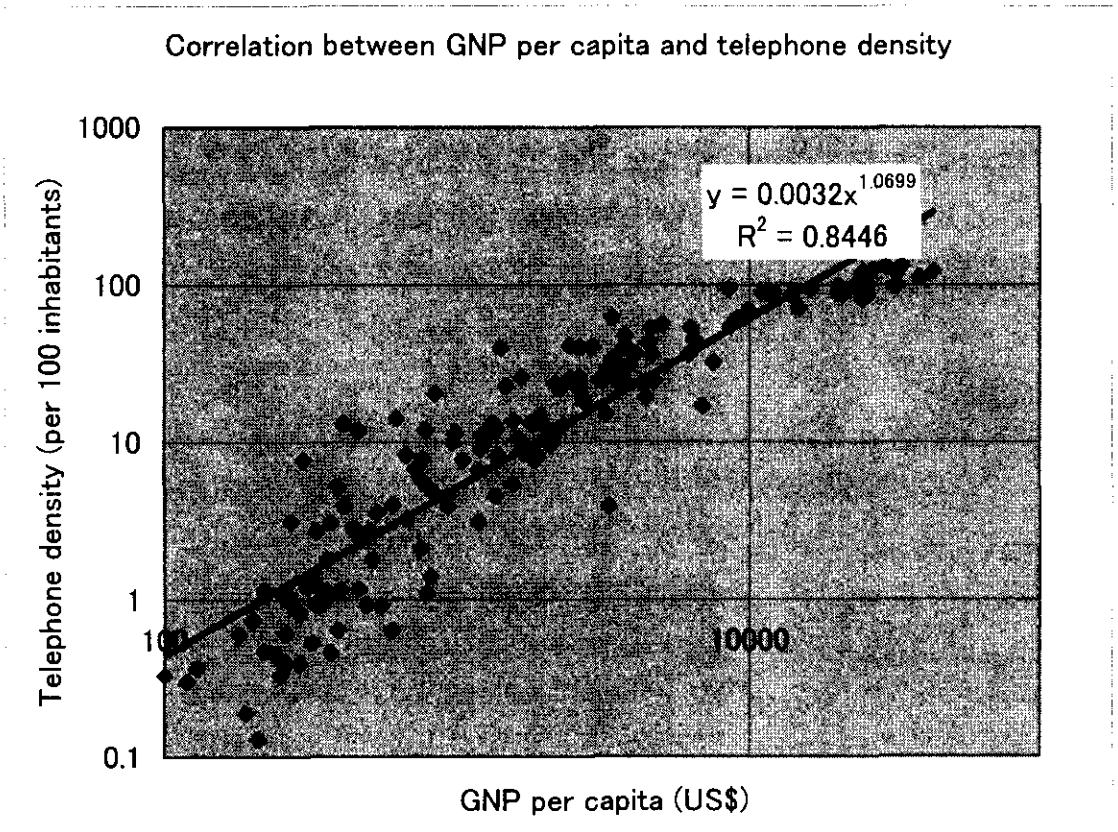
Fig. 2.15.4-1 Telephone demand forecast



(2) Forecast using gross national product (GNP) per capita

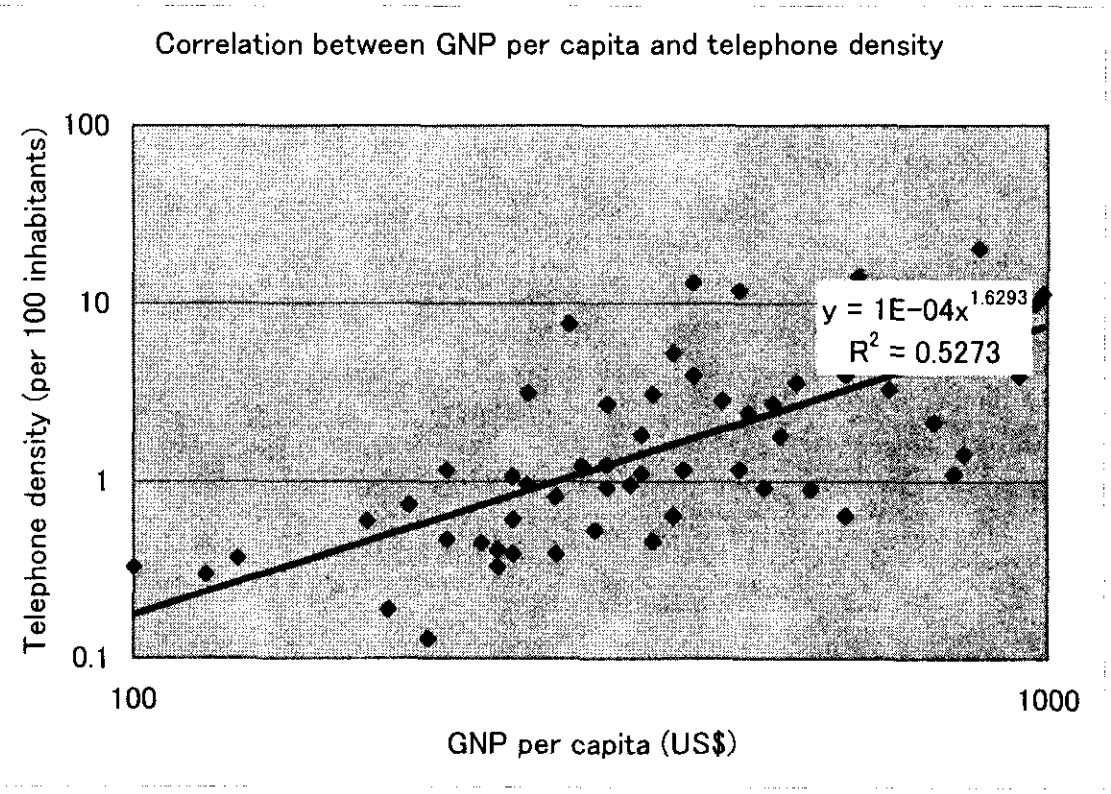
It is recognised that there is a high correlation between GNP per capita and telephone density. Fig. 2.15.4-2 is a scatter diagram made by using country data indicating GNP per capita and telephone density from World Telecom Visual Databook.

Fig. 2.15.4-2 Correlation between GNP per capita and telephone density



The graph has a high correlation with an exponential approximation, but high-income countries show saturation in telephone density. To use data of similar income countries, the paper extracts low-income countries earning less than 1,000 dollars a year. Fig. 2.15.4-3 shows the scatter diagram of low-income countries.

Fig. 2.15.4-3 Correlation between GNP per capita and telephone density



The equation has a low correlation coefficient, but the inclination corresponds to the overall tendency. The report adopts the inclination. Myanmar has adopted a GNP growth rate of 6 % in its long-term plan. As for Myanmar's GNP, table 2.15.4-4 describes recent figures extracted from JBIC's international cooperation handbook. From this table, the 6 % is appropriate.

Table 2.15.4-4 Real GNP growth

Fiscal year	1998	1999	2000	Average
Real GNP growth (%)	4.8	5.7	6.2	5.6

To calculate GNP per capita, population forecast is also necessary. To make it simple, the paper considers the growth of GNP per capita as 6 %.

Myanmar has two exchange rates: market rate and government rate. That makes it difficult to calculate GNP per capita in U.S. dollars. Because of this, ITU considers that Myanmar's GNP per capita is not known. JETRO calculated GNP in 1999 as US$ 5,220 million and the population as 45 million. That equals to US$ 116 per capita. On the other hand, IMF estimated GNP per capita in 1999 as US$ 300. The difference between both figures is attributed to the difference of exchange rate to the dollar and how much the figures included the underground economy that is not included in the government data. Because, according to a hearing survey, many voiced that US$ 116 is too small to reflect the real economy, the paper adopts IMF's US$ 300 per capita. Table 2.15.4-5 describes the forecast.

Table 2.15.4-5 Demand forecast with correlation

Fiscal year	1998	1999	2000	2001	2002	2003	2004
GNP per Capita	300	318	337	357	379	401	426
Telephone density				0.59	0.648	0.713	0.784
Demand density				0.76	0.836	0.919	1.010
MPT plan				0.59			

Year	2005	2006	2007	2008	2009	2010
GNP per Capita	451	478	507	537	569	604
Telephone density	0.862	0.948	1.043	1.147	1.261	1.386
Demand density	1.111	1.222	1.343	1.477	1.624	1.786
MPT plan	1.59					8.44

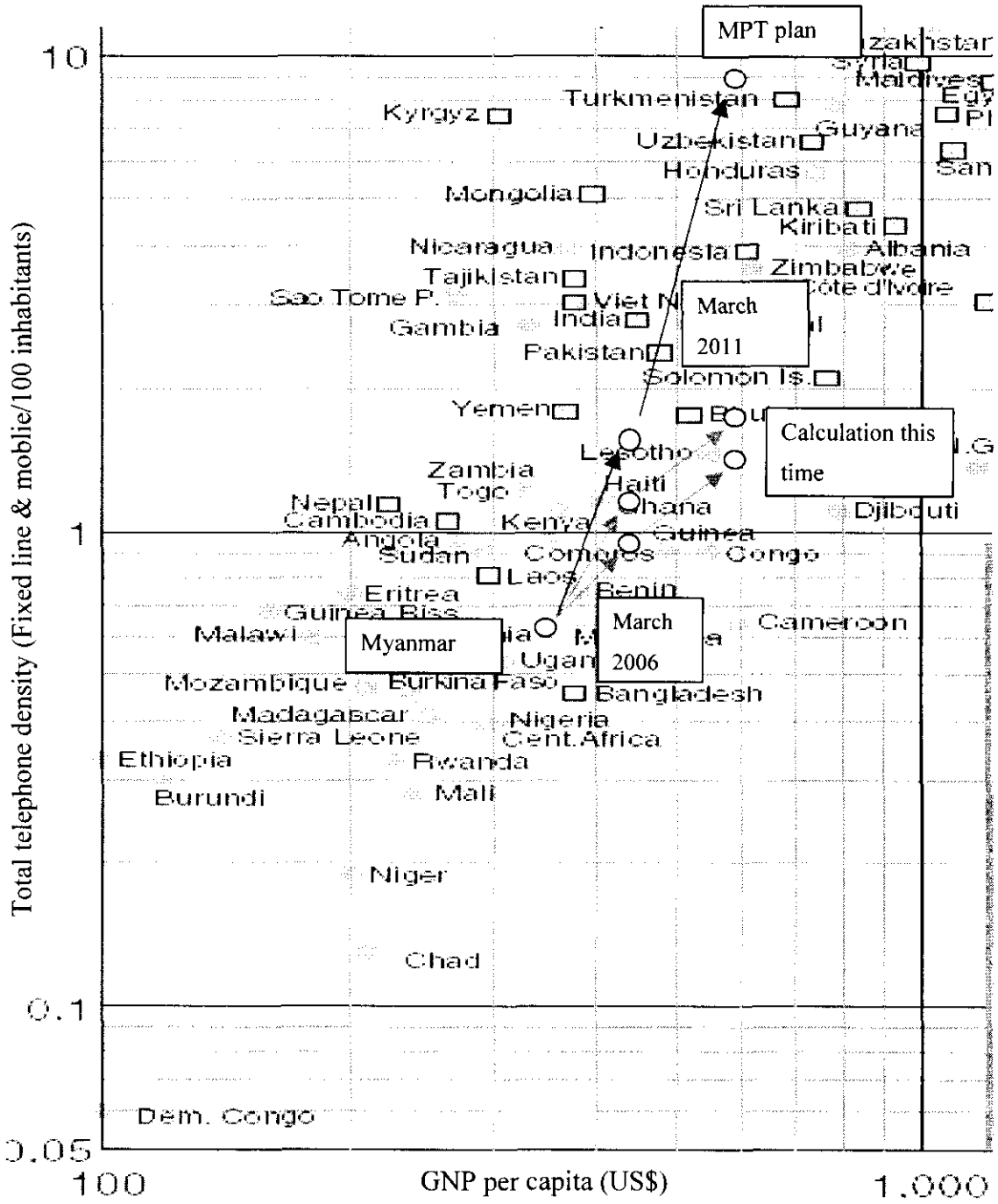
Note: GNP per capita and telephone density are as of the end of March in a respective year.

GNP per capita= (GNP per capita of the previous year)×1.06

Telephone density=$0.59\times(\text{GNP per capita}/357)^{1.629}$

Demand density=$0.76\times(\text{GNP per capita}/357)^{1.629}$

Fig. 2.15.4-4 Forecast of telephone dinsity of Myanmar



Judged from the graph, MPT's plan for 2010 looks too big. However, there are countries with Myanmar's GNP in 2010 of US$ 604 per capita and the telephone density of 8.44 per 100 inhabitants. Therefore, it is wrong to say the goal is too high. It is important to have a high goal and try to achieve it.

2.15.5 Communication network development plans

2.15.5.1 Necessary fund

This section studies communication development plans between fiscal years 2002 and 2005. As MPT's plan is already mentioned before, this section focuses on the fund to achieve its target. The necessary fund to accommodate one subscriber is around US$700. In order to achieve the short term development plans, MPT will have to increase subscribers an average of 143,000 per year. That means MPT needs US$ 100.1 million every year.

Table 2.15.5.1-1 Telecommunications Plan

Description	Existing (as of 31 March 2002)	1 April 2001 - 31 March 2006	1 April 2006 - 31 March 2011
Population (million)	51.226	55.204	60.949
Telephone (million)	0.307	0.878	5.144
Telephone Density (%)	0.59	1.59	8.44
Total increase (million)		0.571	7.869
Increase per year (million)	--	0.143	1.574
Necessary Investment (million US$)		100.1	1101.8

2.15.5.2 Revenues

On the other hand, ITU's World Telecommunication Indicators Database (6th edition 2002) states the telecommunication revenue in Myanmar is low. Table shows telephone revenues comparing with other Asian countries.

The table shows that one telephone line only earns US$ 58 in Myanmar. It takes 12 years to recover a US$ 700 installation fee even if other expenses are not considered. This fact tells that MPT cannot invest money into telephones. It has to depend on aid from other countries.

The reason for the low revenue is because domestic telephone charges are very low. The local currency Kyat devaluates against U.S. dollars and other currencies quickly but the Myanmar

government has not increased telephone charges. As a result, revenues in dollar terms have decreased quite a lot. Only exception is overseas calls that are charged in dollars. The comparison with other countries shows that it is high time MPT increased domestic call charges.

Table 2.15.5.2-1 Telecommunication revenue in 2000

Country	Total (MUS$)	Per population (US$)	Per main line (US$)	Per employee (US$)	Ratio to GDP (%)
Myanmar	15.5	0.3	58	1,993	0.2
India	7,328.5	7.2	226	17,324	1.6
China	37,125.6	28.7	256	--	2.8
Nepal	69.7	3.0	261	14,998	1.4
Indonesia	2,347.8	11.1	352	62,268	1.2
Mongolia	47.2	19.9	402	10,368	4.0
Vietnam	1,079.5	13.5	425	--	2.2
Sri Lanka	387.5	20.5	505	32,605	2.0
Thailand	3,234.6	53.4	579	97,721	2.4
Cambodia	21.8	1.7	705	32,541	1.0

2.15.5.3 Financial aid

Although MPT or the Myanmar government does not have fund, countries, such as China and South Korea, are willing to help the Myanmar's telecommunication sector. South Korea seems to have agreed a $12 million credit loan recently. The money will finance telephone expansion in Yangon and Mandalay. It may add about 17,000 new subscribers, but still too low to complete MPT's annual target.

Many advanced countries are hesitant to aid Myanmar because of political situation in Myanmar. It is better for MPT to find a way to finance by itself.

2.15.5.4 Technology

When installing new equipment, new technologies are introduced. Actually, buying equipment with old technology is more difficult. In advanced countries, IP networks are introduced, especially in the trunk transmission routes. It is crucial to decide when MPT introduces IP equipment in the telephone network.

Many telecommunication equipment manufacturers have withdrawn from producing the Digital

Switching System. They are focusing on the production of the cellular mobile and IP equipment. This may cause problems to telecom careers about procuring additional equipment and maintenance parts in the future.

BCT is introducing new services with new technologies. It has introduced IP and broadband systems. It will adapt to future technical change.

2.15.5.5 Plans

MPT has a plan, but it looks difficult to achieve it. The biggest problem is finance. It does not have financial autonomy and cannot increase telephone tariff. It has to invest in rural areas instead of profitable large cities. MPT has a lot of things to do before it makes viable development plans.

2.15.6 Communication infrastructure development strategies

This section studies infrastructure development strategies between fiscal years 2006 and 2010. First of all, MPT's plan is very difficult to achieve. However, the year of 2006 will be a good year to start building an IP network for MPT. All the technology and equipment will be ready then. The demand for IT as well as telephones will be high.

The telecommunication market may be liberalised in accordance with the ASEAN agreement. Introduction of international telecom careers will increase the number of telecommunication users in large cities rapidly.

On the other hand, rural areas will be not profitable for careers and left without telephones. Therefore, to bridge digital divide, a financial aid to rural areas may be necessary. For that purpose, a universal fund will be created to flow investment money from large cities to rural areas.

3. The Internet

3.1 The Internet services

3.1.1 Current situation of usage

Two Internet Service Providers (ISPs) offer Internet services: one is MPT and the other BCT. MPT mainly offers services to governmental agencies, whereas BCT serves to private companies and the public. Users access the Internet through the X.25 packet switch network and the telephone network. Most of the users, including ISDN subscribers, use a dial-up service. Both ISPs have servers and access points in Yangon.

BCT has started broadband wireless access (BWA) service. One reason is that MPT's telephone network is slow and its transmission quality is low because of old subscriber cables. The BWA network allows users to connect BCT's Internet and email servers without using MPT's network. The network features IP-based LAN technology.

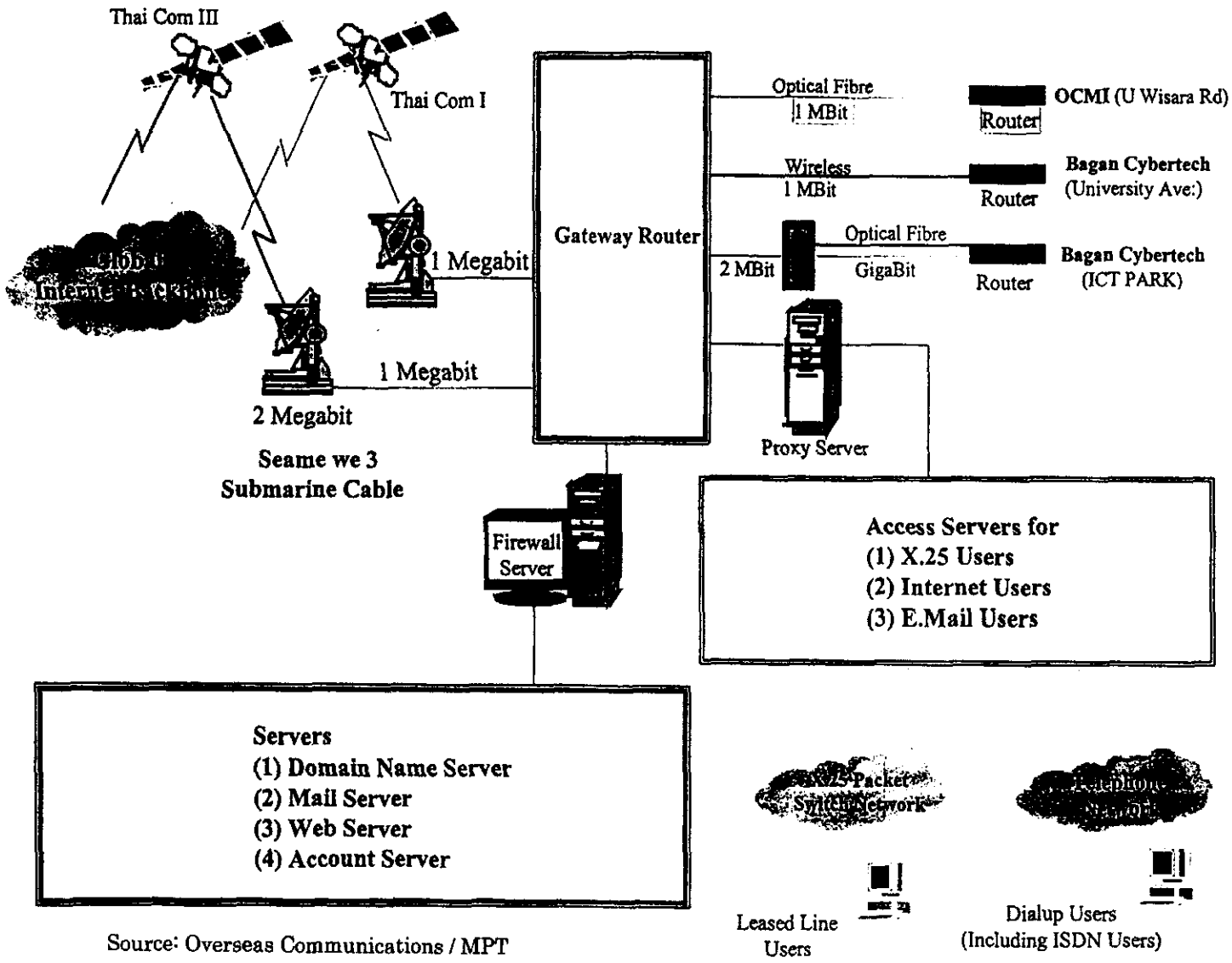
Although both organisations offer Internet services, it is not that anyone can subscribe the Internet service. MPT offers the Internet service only to government organisations, although it offers the email service to the public. BCT offers the Internet service to the public, but it is not BCT to decide whether BCT offers the service to an applicant. When BCT receives an application, it passes the application on to Information Ministry and lets it judge whether BCT can accept the application or not. The government strictly controls information and the use of the Internet.

BCT started Bagan Net service by which users can visit websites BCT has already screened.

3.1.2 Services and facility of ISP (Internet Service Provider)

Both organisations offer Internet connection and email services. MPT's facilities as ISP are not so large in capacity. Fig. 3.1.2-1 shows MPT's Internet system configuration.

Fig. 3.1.2-1 Myanmar Internet System Configuration



Source: Overseas Communications / MPT

On the other hand, BCT's facilities are new and developing. Fig. 3.1.2-2 shows the main functions of BCT facilities. BCT functions as an Internet Service Provider (ISP) and data communication carrier. The features of its facilities are as follows:

(1) As an ISP, it has servers.

(2) It has VoIP routers so that it can offer telephone services. It has a gateway and gatekeeper to connect telephone calls with MPT's telephone network.

(3) BCT has a broadband wireless access network so that it can accommodate customers directly to offer high-speed data communication services.

(4) BCT has satellite communication facilities so that it offers banks and government ministries data communication services with their branches.

(5) BCT has optical fiber connection to ICT Park so that companies in ICT Park can use good data services.

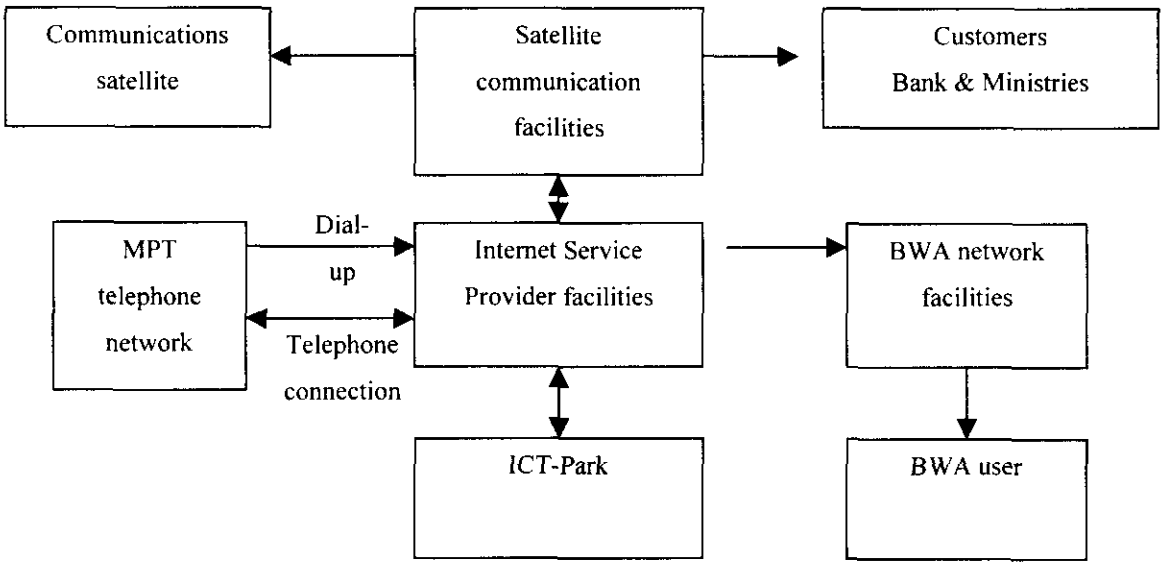
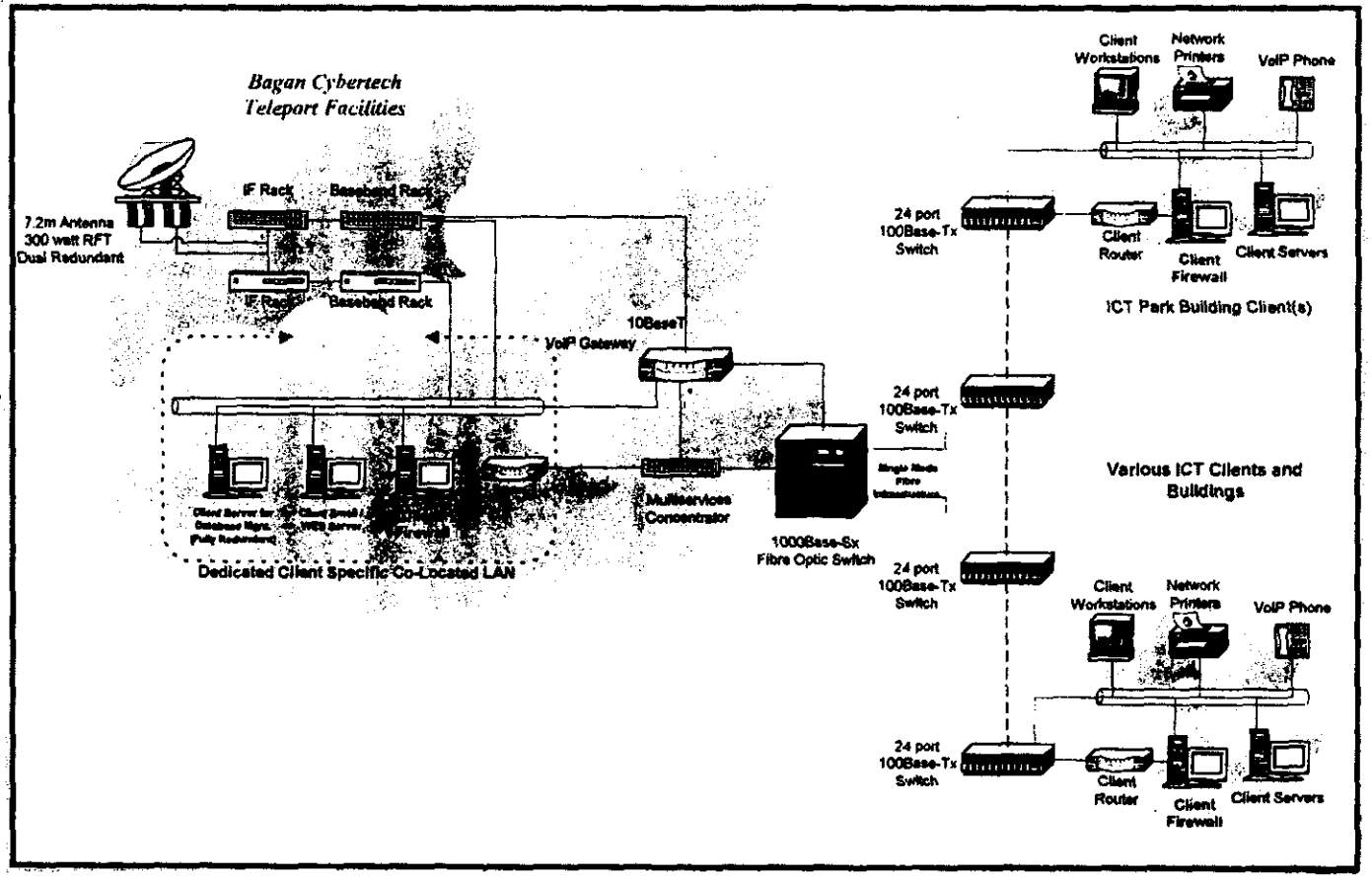


Fig. 3.1.2-2 BCT's network diagram

Fig. 3.1.2-3 Bagan Cybertech and ICT Park Connection



3.1.3 Quality of the Internet services

Quality of the Internet service is poor. It seems that the problems lie more in the telecommunication network than ISP facilities. The poor quality of the telecommunication network makes data transmission difficult. This is why the telecommunication is considered not only as the infrastructure of life but also as the infrastructure of IT.

Applicants may have to wait for a long time to get an Internet service because the government screens applicants. However, email applicants will use BCT's mail service within the same day as it is the case in other countries.

3.1.4 Tariff of the Internet services

3.1.4.1 Internet & email service tariff by MPT

Although the telephone directory shows only email service tariff, recently MPT has started the Internet service as an Internet service provider. Although MPT telephone directory mentions about email service only, MPT decided a tariff for the Internet service, which is shown Table 3.1.4.1-1 below.

Table 3.1.4.1-1 Internet and email tariff of MPT

Particulars	Rates in US$			Rates in Kyats		
	Email only	Internet only	Internet + Email	Email only	Internet only	Internet + Email
Initial fees	200	200	300	40,000	40,000	60,000
Annual fees	60	504	564	12,000	100,800	112,800
Usage fees	3 (1 hr)	65 (30 hr)	65 (30 hr)	600 (1 hr)	13,000 (30hr)	13,000 (30 hr)
Additional usage fees	-	2 (1 hr)	2 (1 hr)	-	400 (1 hr)	400 (1 hr)
Deposit	30	30	30	6,000	6,000	6,000

3.1.4.2 Internet & email service tariff by BCT

As stated earlier, another Internet service provider, BCT, started its service in January 2002. Its tariffs are shown below:

Table 3.1.4.2-1 Internet and email tariff for corporate dial-up account

Plan	Monthly fee (US$)	Free hours	Additional hours	Free email account	Concurrent log-ins
Basic	55	30	2 US$/hr	5	2
Deluxe	75	40	2 US$/hr	10	4
Premium	95	50	2 US$/hr	20	8
Unlimited	180	Unlimited	--	Unlimited	8

In addition to the above charges, corporate users have to pay: one-time installation fee of 500 US$ and annual fee of 300 US$, which includes domain name service, mail box and virtual server maintenance. The annual fee for corporate without domain name service is 250 US$ per annum. Domain names served are '.com.mm' and '.net.mm'. Email disk space, or maximum mailbox size, is normally limited to 3 MB / account, but it can be increased up to 100 MB at the cost of additional 2 US$ per MB per month.

Table 3.1.4.2-2 Internet and email tariff for corporate broadband account

Plan	Monthly fee (US$)	Free hours	Additional hours	Free email account
Executive	150	60	3 US$ / hr.	10
Unlimited	250	Unlimited	--	Unlimited

In addition to the above charges, corporate users have to pay one-time installation fee of 500 US$ and annual fee of 300 US$, which includes domain name service, mail box and virtual server maintenance. The annual fee for corporate without domain name service is 250 US$ per annum. Domain names served are '.com.mm' and '.net.mm'. Email disk space, or maximum mailbox size, is normally limited to 3 MB / account, but it can be increased up to 100 MB at the cost of additional 2 US$ per MB per month. The maximum download speed is 256 kbps.

3.1.4.3 Broadband wireless access tariff by BCT

BCT started broadband wireless access (BWA) service on 1 September 2002. The service connects to the users' premises with the wireless LAN system without going through MPT's telephone network. Table 3.1.4.3-1 and 2 show its tariff.

Table 3.1.4.3-1 BWA tariff (individual)

Plans	Speed	Monthly fee	Free hours	Additional hours	Email accounts
Standard 128	128 kbps	US$ 35	20 hrs	US$ 2.5/hr	1
Unlimited 128	128 kbps	US$ 70	Unlimited	--	1
Standard 256	256 kbps	US$ 50	25 hrs	US$ 3/hr	1
Unlimited 256	256 kbps	US$ 95	Unlimited	--	1

One-time activation fee : US$ 1,950

Voice usage fee : US$ 20/month (optional)

Table 3.1.4.3-2 BWA tariff (corporate)

Plans	Speed	Monthly fee	Free hours	Additional hours	Email accounts
Executive	256 kbps	US$ 150	60 hrs	US$ 3/hr	10
Unlimited	256 kbps	US$ 250	Unlimited	--	25

One-time activation fee : US$ 2,200

Voice usage fee : US$ 30/month (optional)

3.1.4.4 iPSTAR tariff by BCT

iPSTAR service has started since 20 September 2002. The service is a low priced satellite communications service. The following describes tariff.

Table 3.1.4.4-1 iPSTAR tariff

Plans	Speed	Monthly fee	Remark
Standard broadband	Up to 256 kbps (download speed)	US$ 150/ month	1 IP address 3 email addresses (additional email: US$ 2/account/month) Unlimited hours of use Free data-in download: up to 1 GB/month Additional data-in: US$ 0.25/MB Voice usage: US$ 40/month (optional)
Premium broadband	Up to 256 kbps (download speed)	US$ 350/ month	5 IP address 25 email addresses (additional email: US$ 2/account/month) Unlimited hours of use Free data-in download: up to 5 GB/month Additional data-in: US$ 0.25/MB Voice usage: US$ 40/month (optional)
Corporate VPN (without Internet)		US$ 250/ month/site	Unlimited data-in Unlimited usage hours Internet to be subscribed separately by HQ and shared by branches Free data-in download: up to 15 GB/month/site Voice usage: US$ 40/month (optional)

One-time installation and activation:

US$ 2,600 (with 1.2 m antenna)

US$ 2,800 (with 1.8 m antenna)

3.1.4.5 International comparison of Internet charges

In order to compare the Internet charges in Myanmar to those in neighbour countries, Internet charges are extracted from the Internet. The following ISPs were selected because they showed comparable charges on their web sites.

Table 3.1.4.5-1 Dial-up service charges of CamNet (in Cambodia)

Service	Registration Fee	Monthly Fee	Free Use	Usage Charge/hour
Option 1	$ 30	$ 9	3 h	$ 2.8
Option 2	$ 30	$ 90	45 h	$ 1.8
Option 3	$ 30	$ 180	100 h	$ 1.5
Email box		$ 2		

Table 3.1.4.5-2 Dial-up service charges of BiZNET (in Indonesia)

Service	Installation Fee	Monthly Fee	Free Use	Free Email
Silver	4.97	11.05	40 hr	4 accounts
Gold	8.29	27.63	100 hr	6 accounts
Platinum	49.7	49.73	200 hr	10 accounts
Diamond	99.45	193.38	Unlimited	15 accounts
SUPRA		54.7	Unlimited	1 account

Charges are translated from Rp in Indonesia to USD with an exchange rate of
1 Rp=0.0001105 USD as of 11 July 2002.

Table 3.1.4.5-3 Dial-up service charges of Internet Thailand (in Thailand)

Service	Block Hours	Fee	Free Email	Remark
Option 1	50 hrs	$ 18.25	Two mail accounts	Pay in advance for a block of hours. Valid for 1 year
Option 2	100 hrs	$ 34.07	Two mail accounts	
Option 3	300 hrs	$ 94.92	Two mail accounts	
Option 4	1000 hrs	$ 292.06	Two mail accounts	
Option 5	1500 hrs	$ 365.08	Two mail accounts	

Charges are translated from Baht in Thailand to USD with an exchange rate of
1 Baht=0.0243387 USD as of 11 July 2002.

Internet charges in Myanmar are expensive compared with some ASEAN countries. More advanced countries have more providers and more customers. Severe competition among providers makes Internet charges lower. To diffuse the Internet and email services, it is important to introduce competition among ISPs.

3.1.4.6 Observations

Tariff can be charged in US$ as shown in tables above. However, these tariffs should be competitive from viewpoint of international standard, or ASEAN countries standard. Provided US$ tariffs were more expensive than the other ASEAN countries, ICT would not vitalise Myanmar economy, but place burdens on Myanmar enterprises.

3.1.5 Latent demand of use

MPT started Internet and email services for governmental and private users in 2002. Users to these services are shown in Table 3.1.5-1.

Table 3.1.5-1 Internet and email subscribers

Particulars	2000	2001	2002 (19 June)
Internet subscribers	40	62	68
Email subscribers	1,860	3,925	5,062

Source: Data Communication Dept. of MPT

The number of subscribers to the Internet and email services does not show an actual demand. Because applicants have to wait for a long time to have their applications processed. Companies find email useful for their businesses. If the Internet service prices are lowered and all applicants are allowed the service, users will increase in great numbers.

Customers of BCT include banks, Ministry of Education, Ministry of Health, off-shore oil and gas mining companies, and software companies in Myanmar ICT Park. Its total customers amounts a few tens companies and organisation at present. BCT is now endeavouring to acquire more users such as Ministry of Interior, Ministry of Foreign Affairs, Ministry of Immigration and Population.

According to a PC density forecast, personal computers in Myanmar in 2011 will range from 780,000 to 1,550,000. Obviously, business users exceed residential use. Business users will be about 4 times more than residential users in 2012.

Concerning IT, Department of Relief of Ministry of Social Welfare, Relief and Resettlement tries to install GIS system, which can show places of fire stations and water pumps on displayed map of Yangon. The system is now being developed by MCC Ltd.

Department of Higher Education of Ministry of Education has already established 40 VSAT stations for e-Education.

Although IT systems were initially introduced in 2000, the department now has 304 VSAT stations. Additional 100 e-Education centres will be introduced in future, and e-Education centres will be 403 altogether finally. These e-education centres are also used for human resources development like Diploma CHIT. Lectures made in the studio are transmitted to MRTV in the neighbourhood by a microwave link. The lecture signals, then, transmitted to 304 e-Education learning centres equipped with VSAT receiving systems with 3-m diameter antennas via THAICOM 3 satellite using 6 MHz bandwidth. Questions are received at the distance university centre through telephones or emails. Distance University has 1 studio in Yangon at present.

Every university has already been connected by IT systems or LAN systems connected to VSAT systems and/or optical fibre WAN. For example, the Institute of Economics has an optical fibre LAN system and VSAT connection to the Internet. The universities and Institutes are now connected by optical fibre systems and/or VSAT systems. For example, an optical fibre cable connects LANs of Institute of Economics, Yangon University, University of Foreign Language, University of Distance Education, Department of Higher Education Yangon, University of Education, and Broadcasting Station, forming a WAN. This WAN goes out through a VSAT system installed at Department of Higher Education, excluding a link from University of Distance Education to the broadcasting station. As the THAICOM system is expensive, the department wants to change the present system to iPSTAR system, which serves at a more reasonable price.

Department of Medical Science of Ministry of Health (DMS) undertakes the education of medical students. In order to perform this undertaking efficiently and effectively, DMS started a 4-year plan for promotion of medical education by utilising IT technologies. The plan started in 2000 and will end in 2004. It aims at development of infrastructure among medical training institutes, and augmentation of trained people. Along with the plan, this Medical Resource Centre was opened recently. This Centre has an electronic library connected to other training institutes. Doctors in other training institutes can retrieve papers, CD-ROM materials through VSAT connections and can request to library personnel to send copied materials by normal mail or by email. DMS plans to introduce e-Nursery, e-Pharmacy, e-Medicine, etc., at proper timing.

The Centre has studio for distance education of doctors, nurses, etc. Lectures sent from the Centre via VSAT system had got a good reputation from the students.

Ministry of Health seems to plan to establish a medical database centre having accesses to necessary hospitals, but its details are not clear here.

Medical Resource Centre (MRC) was established as a medical education centre, a medical museum and an e-library. Institutes and training centres under DMS are altogether 13, all of which locate in Yangon or Mandalay, and additional 43 nursing and midwifery training schools in states and divisions. In relation to MRC establishment, LAN development and WAN development in related institutes were planned. Some of LANs have already been completed in 6 areas. For WAN, DMS plans to establish fibre optic cable installations and VSAT connections. Fibre optic cable WANs have already been almost installed in 2 areas in Yangon and 1 area in Mandalay, all of them connect DMS-related institutes and hospitals in neighbourhoods. DMS plans to connect these WANs and other necessary medical facilities by VSAT in near future, some VSAT connections have already been completed.

Myanmar Police Force (MPF) of Ministry of Interior has been utilising the Internet service and email service by dial-up connections for these 3 to 4 years. The headquarters and state and divisional centres can access to the Internet. They have their own intranet within their offices.

INTERPOL donated an X-400 packet switching system on 16 May 1998. MPF installed the donated system in the headquarters to get connected to INTERPOL worldwide network through SIDA Network. This system can transmit data and images. A regional centre to which MPF is connected is at Tokyo.

There is a plan to establish ASEANAPOL network among ASEAN countries. MPF plans to cooperate and participate in the project, if it starts.

MPF plans to establish a computer network among the headquarters and state and divisional centres by means of VSAT or iPSTAR.

Business owners or general managers of business strongly want to have better telecommunication services. Some of them want to have the Internet services at a reasonable cost and at a higher speed, although some of them seem necessary to get enlightened on benefits of IT services through seminars and so on.

If they are enlightened, there will be a considerable demand for IT services, like the Internet,

email, and if IT infrastructure can respond their needs, Myanmar economy will accelerate its growth. For this objective, some opine that competitive environment in telecommunications business is indispensable.

3.1.6 Broadband service and future plan

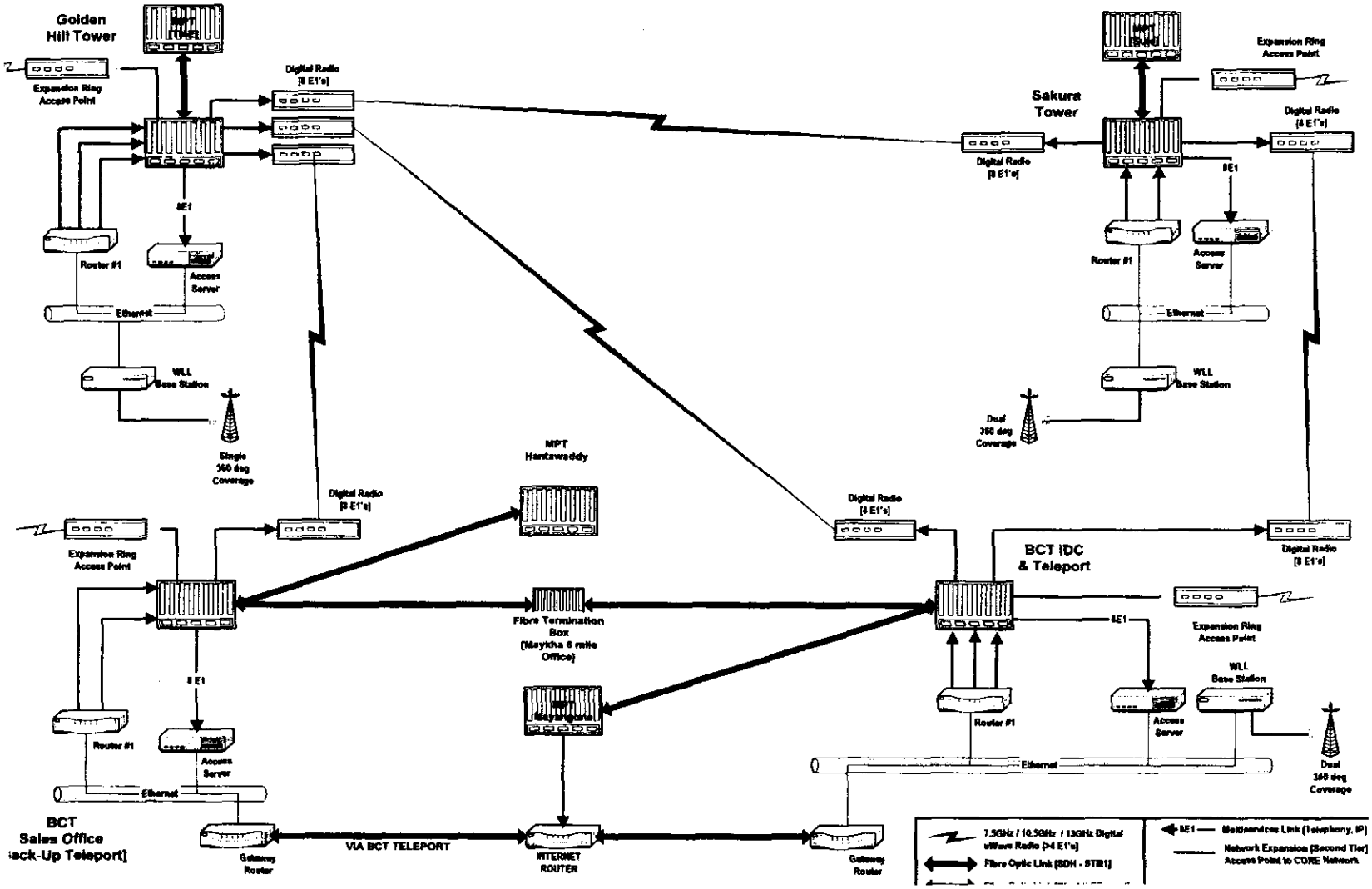
MPT does not have any plan for broadband service at present, but staff of MPT shows strong interests in radio IP routers or similar systems.

BCT launched BWA service at September 2002 by means of 2.4 GHz ISM band radio bridge made by BREEZECOM. At first, the service gives customers 128 kbps and 256 kbps transmission speeds, but the network infrastructure and wireless subscriber units are capable of providing speeds up to 2 Mbps for future services.

BCT expects about 1,000 customers in Yangon, Mandalay and major cities. BCT plans to establish networks of BREEZECOM systems first in business areas and second in whole municipal area of Yangon.

BCT introduced Broadband Satellite Data Service using iPSTAR by means of THAICOM 4 satellite on 20 September 2002. BCT leases a transponder and to provide as many as 5,000 users with 128 kbps to 2 Mbps connections. BCT expects 500 users within this year. BCT installs 11-m diameter antenna here in the IDC & Teleport and users install a satellite terminal with 1.2-m to 1.8-m diameter antenna, because BCT utilises Ku band for this service.

An access point to the Internet will be provided in Mandalay in addition to Yangon. Access points should be expanded to other areas so that people in those areas can access the Internet at a reasonable price. To connect access points easily, areas of special number service should be also expanded.


Golden Hill Tower
Expansion Ring Access Point
Digital Radio [8 E1's]
8E1
Router #1
Access Server
Ethernet
WLL Base Station
Single 360 deg Coverage
Sakura Tower
Expansion Ring Access Point
Digital Radio [8 E1's]
Digital Radio [8 E1's]
8E1
Router #1
Access Server
Ethernet
WLL Base Station
Dual 360 deg Coverage
MPT Hantawaddy
Digital Radio [8 E1's]
Digital Radio [8 E1's]
Expansion Ring Access Point
Digital Radio [8 E1's]
BCT IDC & Teleport
Fibre Termination Box (Maytha 6 mile Office)
8 E1
8E1
Expansion Ring Access Point
WLL Base Station
Router #1
Access Server
Ethernet
Dual 360 deg Coverage
BCT Sales Office ack-Up Teleport]
Ethernet
Gateway Router
VIA BCT TELEPORT
INTERNET ROUTER
Gateway Router
7.5GHz / 10.5GHz / 13GHz Digital uWave Radio [>4 E1's]
Fibre Optic Link [SDH - STM1]
8E1 — Multiservices Link [Telephony, IP]
Network Expansion [Second Tier] Access Point to CORE Network

3.2 Terminal equipment

3.2.1 Current usage of personal computers

According to ITU NEWS (No.4 May 2002), the number of estimated PCs in 2001 is 55 thousand. It estimates 0.11 sets per 100 inhabitants. This estimate equals that of the World Bank for 2000. Although the number is still low, the companies find PCs a useful business tool and schools teach students how to use them.

3.2.2 Utilisation trend of mobile telephones with the Internet access

MPT, a sole provider of mobile telephones, does not offer an Internet access or WAP service at present. However, MPT has little intention to provide WAP service through CDMA cellular phone system. Although MPT was compelled to introduce GSM system recently, because of possible roaming service with neighbouring countries.

BCT plans to introduce GMPCS (Global Mobile Personal Communications via Satellite) by joining ACES (Asian Cellular Satellite) of Indonesia, Thailand and Philippines. This system uses Garuda 1 geo-stationary satellite already launched by the consortium of Indonesia, Thailand, Philippines companies and Lockheed Martin of USA about 1 year ago.

BCT wants to use its terminal equipment as mobile terminals of the Internet service, too. The system uses L band, and handsets are of model R190 made by ERICSSON, with 2 W transmitting power and cost less than 1,000 US$. Users pay 25 cents per domestic call, here domestic means within above countries participated in the project, 75 cents per call to all Asia, and 1 to 1.5 US$ per call for Europe and America. However, all charges have to be in US$.

BCT plans to install a multiplexing system for this service in Myanmar. The multiplexing system is connected via an E1 system to International Telecommunication Maintenance Centre for calls to Myanmar PSTN. Other calls are directed to a gateway centre to be installed in one of the above 3 countries. In actuality, this project was originally for MPT, but MPT handed over it to BCT.

Satellite mobile communication services are not successful so far excluding INMARSAT systems, but, as the system is planned and implemented by ASEAN countries, it may have possibility of success.

3.2.3 Availability of computers and related equipment

Computers and related equipment have to be imported, but they are available in the Myanmar market. Local companies import computer parts and assemble them to make computers suitable for Myanmar people or according to customer orders. The price is less expensive. LAN equipment may be available, but as the demand is low, it might be imported when requested.

3.3 Human resources development

3.3.1 IT-related educational facilities

Myanmar is committed to use IT technologies for education. Myanmar has set the goal that every child leaving school should be familiar with computer and scientifically literate. The government has collaborated with the private sector and local communities, established multimedia classrooms and small computer laboratories in high schools. Ministry of Education has Data Broadcasting System, which is a distance learning project using satellite communication. Students go to one of 304 learning centres that receive programs. Universities and colleges use IT technology most. They have computer rooms, LANs, and even WANs.

Establishing Universities of Computer Studies (Yangon and Mandalay), Myanmar is really committed to IT education.

There are around 70 computer schools even only in Yangon. Most of the teachers in those private educational institutions are graduates from Yangon University of Computer Studies. Some of theses private educational institutions have a capability of developing IT-related systems such as data communication, database management, automatic billing systems of electricity, immigration systems, and geographic information systems for land management.

3.3.2 Present status of human resources development policies and its future plan

MPT has Telecommunications and Postal Training Centre (TPTC) that trains MPT staff advanced and modern communication technologies. It was established in 1968, and taught many engineers skills in their fields; telephone switching, radio & transmission, external plant, and telegraph & telex. But not only engineers' technical fields, it teaches ICT courses. General wing teaches PC Operating Course, PC for Office Application Course, Computer Programming Course (C++), Internet Course, and E-Mail Operating Course among other things. (See Table 3.3.2-1 ICT courses to be taught by General Wing) TPTC claims that it is conducting 63 ICT-related courses and 21 other courses.

It has 2 computer rooms where 12 computers are installed. As one class is as big as 24 trainees, 2 people have to share one computer. Each computer has a direct access line to the Internet. It has a library where several computers are installed.

TPTC teaches IT-related courses and training looks going well. TPTC wants to expand training courses into newer technologies such as broadband satellite communication, broadband IP switch, 3G-mobile communication, rural telecommunications, network planning and intelligent network.

It seems important to prepare for the change into IP networks and study technologies such as VoIP and IP broadband networks to create infrastructure for IT. In these fields, the technical cooperation like dispatch of an expert from such countries as Japan is needed by TPTC as well as is considered effective and useful for human resource development in Myanmar as a whole.

Table 3.3.2-1 ICT courses to be taught by General Wing

No.	Course Title	Duration (Week)
1	Basic Electronics Course	7
2	Basic Digital Electronics Course	6
3	Introduction to Electronics Course	4
4	PC Operating Course	5
5	PC for Office Applications Course (Windows)(0223)	6
6	PC for Office Applications Course (Windows)(0224)	6
7	PC for Office Applications Course (Windows)(Part Time)	6
8	PC for Office Applications Course (Advanced)	4
9	Computer Network Administration Course	4
10	Database Management Course	4
11	Computer Programming Course (C++)	4
12	Introduction to Internet Course	3
13	Fundamentals of Internet Course	3
14	E-Mail Operating Course	1

3.4 International cooperation

3.4.1 Cooperation projects with bi- and multi- cooperation organisations

Six international cooperation programs related to ICT are currently going on in Myanmar. They are;

(1) ICT Working Group, Myanmar-Japan Economic Structural Adjustment Project
(2) Framework of e-ASEAN Task Force
(3) IAI (Initiative for ASEAN Integration)—programme for Vietnam, Cambodia, Laos, and Myanmar
(4) Cooperation between the Development Corporation of MICT Park and Malaysia Information District Development Corporation. Smart School Project began in June in three schools in Yangon with the aid of PCs, LAN system, education materials, and experts.
(5) Memorandum of Understanding with Korean Government. Assistance for MPT based on this MOU.
(6) Cooperation between Myanmaer Computer Federation and Chamber of Commerce in India. Agreement of scholarship.

Myanmar will get a lot of fruitful results from these frameworks.. Further development of these projects and more efforts for other international cooperation projects will be necessary. There may be many ways for Myanmar to cooperate with the international society. It has long borders with many different countries. Friendly relations with neighbouring countries as well as developed countries will be the first step toward international cooperation.

3.4.2 Activities in ASEAN

Myanmar has become a member of ASEAN. Its biggest IT-related activity is that ASEAN has created the e-ASEAN Task Force to develop a broad and comprehensive action plan for an ASEAN e-Space and to develop competencies within ASEAN to compete in the global information economy. The Task Force will give effect to the ASEAN Heads of State/Government directive to establish an ASEAN Information Infrastructure. In developing the plan, the Task Force has been asked to examine the physical, legal, logistical, social, and economic infrastructure needed to create the basis for ASEAN's competitiveness in the 21st century. Myanmar has created e-National Task Force to cooperate with the e-ASEAN Task Force.

Part II

Telecommunication Case Studies

Table of Contents

Brief Description of Telecommunication Case Studies

1. Introduction

This report consists of four telecommunication case studies. They are; 1) Industrial Zone in Yangon, 2) Industrial Zone in Mandalay, 3) Bank Telecommunication Network, and 4) Rural Telecommunication Network. The fourth one does not assume the actual decided site, but is the virtual case study, based on the field trip to an agricultural village outside Yangon. In this virtual case study, the IP-based LAN system is examined, since it can provide the most efficient method to bridge the digital divide in rural areas in Myanmar.

Applicable telecommunication systems to this study are shown below. Among these alternatives, the most adequate combination is examined, considering the current environment in each case. They are:

(1) Traditional copper cable distribution
(2) Optical fiber and copper cable hybrid
(3) Wireless local loop (WLL)
(4) Mobile phone
(5) IP-based wireless LAN
(6) IP-based wired network (However, this alternative is not applicable because the network virtually does not exist at this moment in Myanmar. This alternative should be examined separately from these case studies.)

2. Case Study 1: industrial zone in Yangon

2.1 Telecommunication situation

The Working group chose South Dagon Industrial Zone for the study. The Zone consists of Zone (1), (2), and (3). The telecommunication demand is high. Telephone supply is low, although a telephone exchange is close to the zone. The zone is in the service area of Bagan Cybertech (BCT)'s broadband wireless access (BWA) service.

2.2 Conclusion of case study of Zone (1)

There are many large factories. Because of high telephone and data communication demand, the report recommends construction of a new base station for BWA with wireless LAN system. The construction cost of BWA is lower. However, the charge for use becomes higher, since the telephone charge by MPT is set in low level.

2.3 Conclusion of case study of Zone (2)

There are small factories. The area is small and close to a telephone exchange. Telephone demand is high, but email and Internet demand is low. The paper recommends telephone expansion with the copper cable distribution system.

2.4 Conclusion of Zone (3)

There are small factories and shops. The area is small and close to a telephone exchange. Telephone demand density is high, but email and Internet demand is low. The paper recommends telephone expansion with the copper cable distribution system.

3. Case study 2: industrial zone in Mandalay

3.1 Telecommunication situation

Mandalay Industrial Zone locates in the southern part of the city and is still expanding. Telephone exchange was newly built in the middle of the industrial zone. The telephone supply is not bad and telephone quality is good.

3.2 Conclusion of the case study

The area is small and close to a telephone exchange and telephone density is high. The paper recommends telephone expansion with the copper cable distribution system.

4. Case study 3: bank telecommunication network

4.1 Telecommunication situation

Telecommunication system of the local three banks are examined. They all use BCT's VSAT (very small aperture terminal (for satellite communication)) service. They use the service for sending/receiving customer information, email, and reporting among the head office and branches. One bank uses it for a credit card system. One bank has ATMs in Yangon which are connected to the head office with leased lines. The other banks say leased lines are prohibitively expensive. All the banks say VSAT service is expensive and not reliable. The consultants conducted case study using KBZ Bank's branches.

4.2 Conclusion of the case study

Because VSAT service is expensive and capacity is small, the paper tries to use leased lines instead of the VSAT service.

(1) Nationwide leased line bank telecommunication network is not possible because some branches are in the border areas and some transmission routes use analogue systems.
(2) The consultants conducted networking between the head office and branches in Yangon with the wireless LAN system. It works well.
(3) The consultants also tried networking with increasing the capacity of optical fiber junction transmission. It is also possible technically.

5. Case study virtual: rural telecommunication network with IP-based wireless LAN

5.1 Situation

Instead of applying telecommunication systems to the real site, a virtual rural model is examined, based on the short trip to a rural village and its vicinity in the northeast outskirt of Yangon. A village of 400 families, 5 acres/family, 3km×3km is assumed as a typical rural farming village in Myanmar.

5.2 Conclusion of the study

The IP-based wireless LAN system is expected to provide an important method to bridge the digital divide in rural areas in Myanmar where the legacy system of conventional telecommunication infrastructure hardly exists. It can be also economically more efficient in some cases since it can avoid the duplication of building telephone network and then, IP network. Wireless LAN system is good for networking places in a village and in several villages. Its transmission speed is high and it will open new communication opportunities.

5.3 Connection outside

The connection outside can be secured even in the remotest areas through VSAT and satellite broadband network. Connection with BCT's iPSTAR is available any remote areas and is also good for connecting wireless LAN, but rental charge of iPSTAR may have to be transferred to clients. Connection with the telephone network of MPT requires additional equipment such as gateway keeper and gateway router, because both systems use different protocols.

5.4 Location of pilot project

The location of the pilot project could be anywhere. Considering the rental charge of satellite, however, the first pilot project should locate in the vicinity of Yangon (for example, within 50km), where the connection to BCT, or MPT is made through radio. If the power supply is not available, diesel generator, or solar panel is needed.

5.5 Replication

The project should cover installation of appropriate infrastructure, development of applications, operation, training and study on the effects. The purpose of the project will be to develop a model which can be replicated in other villages in Myanmar.

1. Introduction

1.1 Background

This report is prepared by the Japanese side, based on the intensive research made mainly in September and October 2002, in cooperation with Myanmar counterpart and MPT, after another report, Analysis of Telecommunication Infrastructure (Part 1), made in June and July 2002. These case studies are expected to be exerted as useful examples for the actual, similar, or possible projects in Myanmar.

This report consists of four case studies;

(1) Case study 1: industrial zone in Yangon
(2) Case study 2: industrial zone in Mandalay
(3) Case study 3: bank telecommunication network
(4) Case study virtual 4: rural telecommunication network

The first two case studies are the analysis of two industrial zones in Yangon and Mandalay, regarding their telecommunication environment, demand of information traffic, and required telecommunication network. The third case study examines a bank telecommunication network indispensable for banking business and for the improvement of existing lagged data processing system.

The fourth case study does not assume the actual decided site, but is the virtual case study, based on the field trip to an agricultural village outside Yangon. Based on the survey of the village and a subsequent follow-up rural tour, the Japanese group decided to develop a virtual case study regarding a rural IP-based telecommunication network. The virtual case study means to conduct case studies without actually surveying sites in detail. It includes discussion on rural telecommunications networks with MPT employees and selection of possible networking systems in addition to the quick surveys noted.

(The village is only about 30 km northeast of downtown Yangon, but only one channel of cordless telephone link was installed six months ago by the new cordless pilot program of MPT, which eventually aims at covering rural areas adjacent to the backbone transmission network in Myanmar. All outskirts of Yangon are the similar situation, or worse.)

1.2 Applicable telecommunication systems

Before the paper describes each industrial zone, this section introduces applicable telecommunication systems that each case study uses.

1.2.1 Traditional copper cable distribution

This system connects a telephone switch with telephone sets in subscriber premises with pairs of copper wires. From a telephone exchange, a copper cable with a large number of pairs is laid down underground and divided into copper cables with a smaller number of pairs at a branching off point. About 10 to 50 pairs of copper wires of the cable are terminated at a distribution point. When an applicant gets a telephone, the telephone operator (MPT) installs a dropwire to connect a pair of terminals in the distribution point with the telephone set.

The merits of this system are:

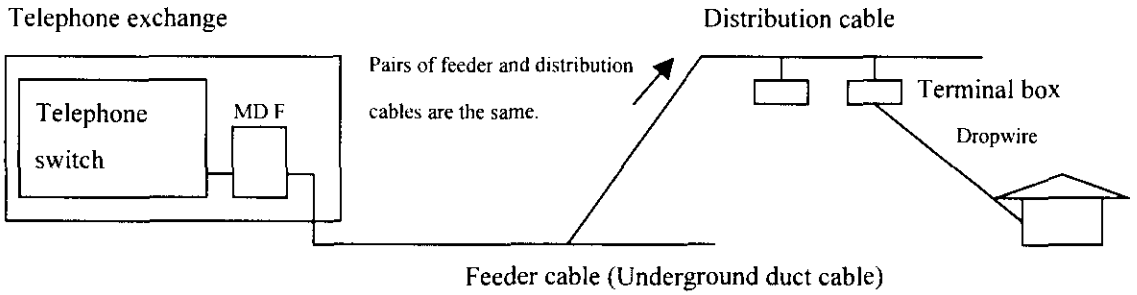
(1) The telephone switch supplies electric power to a subscriber's telephone set. There is no need for a subscriber to worry about electricity for the telephone.
(2) If the telephone density is high, this is the most economical method.
(3) Copper cable can be used for high-speed digital transmission with Digital Subscriber Line (DSL) technology.

The demerits of this system are:

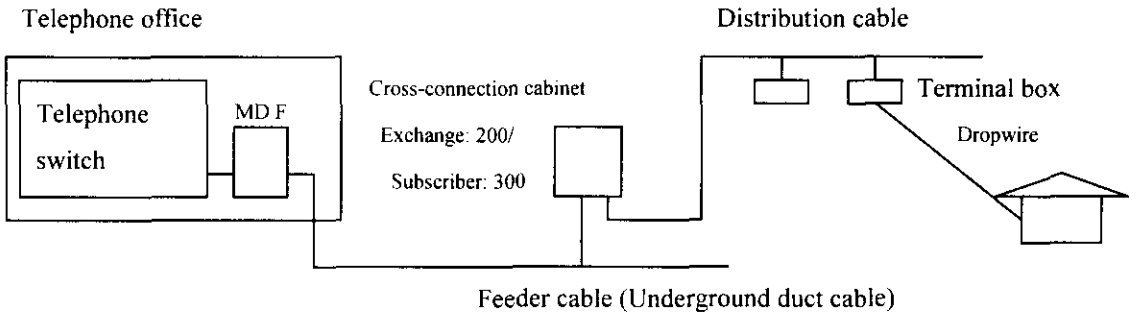
(1) Because a cable with a large number of pairs is laid down underground, the system requires a contractor to dig road and lay down pipes or a direct-buried cable. A cable with a smaller number of pairs can be installed overhead or underground. It requires to the contractor to build telephone poles on the road or dig to bury underground distribution cables.
(2) The system takes longer time to construct than others.
(3) The system lacks flexibility and cannot use cable pairs efficiently because cable pairs are allotted to each terminal box and cannot be used at other places. This causes that some terminal boxes have unused pairs and other terminal boxes are in short of pairs.

MPT adopts two distribution methods: direct distribution and cross-connection cabinet distribution. The direct distribution method is simple but low in efficiency in using cable pairs. It is the most suitable method in the area that is close to a telephone exchange. The cross-connection cabinet distribution method is developed to improve efficiency in cable use. Fig. 1.2.1-1 illustrates both distribution methods.

Fig. 1.2.1-1 Distribution methods



(a) Direct distribution method



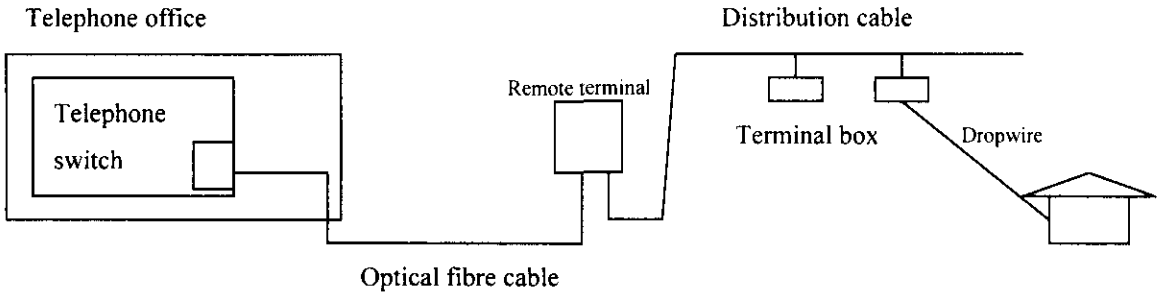
(b) Cross-connection cabinet distribution method

The sum of the number of the feeder cable pairs is smaller than that of the distribution cable pairs. Although efficiency of distribution cables is the same, the efficiency of the feeder cable increases.

1.2.2 Optical fibre and copper cable hybrid

This system consists of an optical fibre cable, remote terminals (RTs), and copper cables. The remote terminal has transmission equipment and subscriber terminals; It is like optical fibre cable extends a line terminal part of the switch to the remote terminal. The configuration of this system is similar to the cross-connection cabinet distribution method, using optical fibre cable as feeder cable and remote terminals as cross-connection cabinets. Fig. 1.2.2-1 illustrates the system.

Fig. 1.2.2-1 Optical and copper cable hybrid system



The advantages of this system are:

(1) Because it uses an optical fibre cable instead of a copper cable with a large number of pairs, it becomes economical when the cable is long and large.

(2) As the diameter of the optical fibre is small, cable ducts can be shared with other cables.

(3) Optical fibre cable improves the digital readiness because optical fibre enables high transmission speeds and can be used for advanced services too.

The disadvantages of this system are:

(1) Remote terminals need electricity. Even though they have batteries, they cannot last many hours. They require steady supply of electricity.

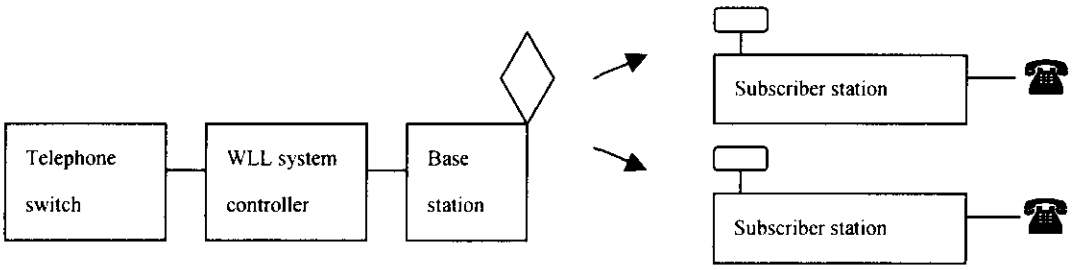
(2) Remote terminals are bigger than cross-connection cabinets. Although they are mounted in a case, they may need a hut.

(3) Remote terminals are expensive.

1.2.3 Wireless local loop (WLL)

This method uses radio between telephone switch and a subscriber telephone. Fig. 1.2.3-1 shows the network diagram.

Fig. 1.2.3-1 WLL network diagram



Pros of this system are:

(1) When the telephone density is low and the area is far from the exchange, this system costs less than the copper cable distribution system.
(2) The system uses radio and does not require digging the road to lay down cables or building poles.
(3) The construction period is shorter than the copper cable distribution system.

Cons of this system are:

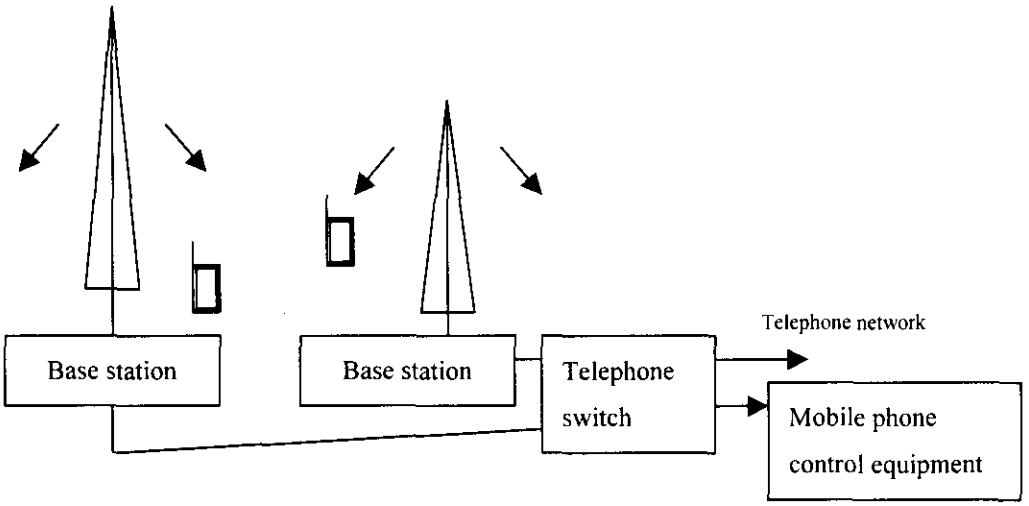
(1) The transmission speed of WLL using 1.9 GHz is up to 64 kbps and that of using other frequencies is slower than 64 kbps. As the medium for broadband transmission, the transmission speed is too low.
(2) The frequency of 1.9 GHz is also used for IMT 2000. Therefore, careful assignment of frequency bands is required.
(3) The subscriber station needs power supply. Because power consumption is not big, rechargeable batteries can be used.

1.2.4 Mobile phone

Mobile phones have gotten a popularity in many countries. The system uses radio as access lines to subscribers and so it does not need complicated subscriber line networks. There are several systems from analogue (first generation) and digital (second generation: GSM, CDMA, etc.), to IMT 2000 (third generation: not served in Myanmar).

Although one antenna can cover a wide area, if many cellular phones are used in a small area, many base stations need to be built.

Fig. 1.2.4-1 Mobile phone network diagram



The merits of this system are:

(1) Customers can carry mobile phones. They can communicate anywhere and anytime.

(2) Because it uses radio, construction period is short.

(3) Although data communication over mobile is not offered in Myanmar, in advanced countries, mobile phones can send email and browse the Internet. The third generation IMT 2000 system can even enable 2 Mbps data communication.

The demerits of this system are:

(1) Mobile phones are expensive compared to an analogue telephone.

(2) Mobile phones use batteries, although power consumption is small.

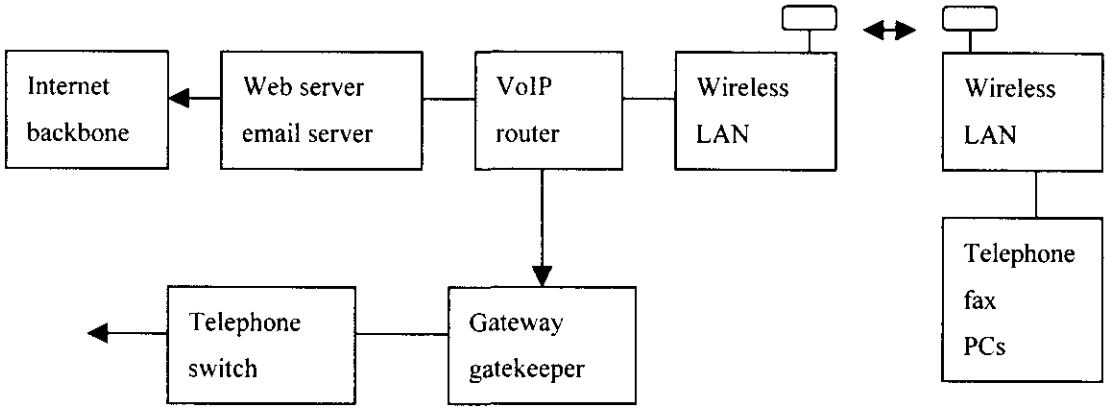
(3) Voice is not as good as ordinary telephones and generally speaking, it is not good for data and fax communication.

1.2.5 IP-based wireless LAN

This system uses IP protocol and wireless technology. It forms a local area network (LAN), which easily connects to IP networks, such as Internet and email networks. The network is mainly for data communication, but it also offers telephone services. The IP network can be connected to the telephone network through a gateway and a gatekeeper. (See Fig. 1.2.5-1)

The telecommunication network uses telephone switches whereas the IP network uses routers. The IP network is more efficient in data transmission than the telephone network. The IP network can be built at a lower cost than the telephone network because its key components, routers, are a lot cheaper than telephone switches. In the future, the IP network may replace the telephone network.

Fig. 1.2.5-1 Wireless LAN diagram



The merits of this system are:

(1) It can send data at the speed of 10 Mbps and is suitable for high-speed transmission.

(2) The wireless wave reaches about 5 km and, by using directional antennas, it reaches up to 15 km. Because it does not use wired distribution, the construction period is short.

(3) Installation of a network is easy and inexpensive.

The demerits of this system are:

(1) The prices of wireless LAN equipment and adapters for a telephone and a fax are expensive.

(2) LAN equipment needs electric power.

(3) Although connection with the IP network is easy, connection with the telephone network is not easy, necessitating a gateway and a gatekeeper.

1.2.6 IP-based wired network

This network uses IP technology and wired media, such as optical fibre cable and copper cable. In advanced countries, IP networks are developed and Internet service providers (ISPs) offer telephone service at low prices to attract customers.

The situation is different in Myanmar. The IP-based wired network does not virtually exist. Both MPT and BCT have Internet and email servers, but users connect to them through the telephone network, using a dial-up service. It is difficult to apply this network to the case study, and so the paper does not consider this network any further.

Building an IP-based telephone network may be considered at another opportunity.