STUDY OF GROWTH PATTERN OF TELECOMMUNICATIONS SERVICES AND POLICY SUPPORT IN BANGLADESH

BY

S.M. MAHAMUD

A thesis submitted to the Department of Industrial and Production Engineering, Bangladesh University of Engineering and Technology (BUET), in partial fulfillment of the requirements for the degree of Master of Advanced Engineering Management (AEM).

DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING
BANGLADESH UNIVERSITY OF ENGINEERING & TECHNOLOGY
DHAKA, BANGLADESH

FEBRUARY 2006

CERTIFICATE OF APPROVAL

The thesis titled "Study of Growth Pattern of Telecommunications Services and Policy Support in Bangladesh" submitted by S.M. Mahamud, Roll No. 100108134(P), Session: October, 2001 has been accepted as satisfactory in partial fulfillment of the requirements for the degree of **Master of Advanced Engineering Management** on February 27, 2006.

Approved as to the style and content by:

1. _____ Chairman (Superviser)
Dr. M. Ahsan Akhtar Hasin
Professor,
Department of Industrial & Production Engineering
BUET, Dhaka.

2. _____ Member
Dr. A.K.M. Masud
Assistant Professor
Department of Industrial & Production Engineering
BUET, Dhaka.

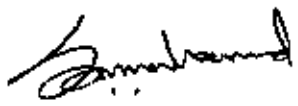
3. _____ Member
Md. Rezaul Quader
Director,
Department of Systems and Services
BTRC, Dhaka.

February 2006

DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING
BANGLADESH UNIVERSITY OF ENGINEERING & TECHNOLOGY
DHAKA, BANGLADESH

DECLARATION OF THE CANDIDATE

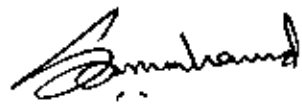
It is hereby declared that this thesis/project or any part of it has been submitted elsewhere for the award of any degree or diploma.



(S.M. Mahamud)

CERTIFICATE OF RESEARCH

This is to certify that the work presented in this thesis is the outcome of the investigations carried out by the candidate under the supervision of Dr. M. Ahsan Akthar Hasin, Professor, Department of Industrial & Production Engineering, BUET, Dhaka-1000.



Supervisor

Candidate

ACKNOWLEDGEMENT

I acknowledge my profound indebtedness and express sincere gratitude to my supervisor Dr. M. Ahsan Akhtar Hasin, Professor, Department of Industrial & Production Engineering (IPE), BUET, Dhaka. He provided guidance, supervision and valuable suggestions at all stages to carry out this research work. I am proud to have him as my supervisor for Master's thesis.

I also express my heartfelt gratitude to Dr. A.K.M. Masud, Assistant Professor, Department of IPE, BUET and Mr. Md. Rezaul Quader, Director, Department of Systems and Services, BTRC for their pragmatic suggestions on this work.

I extended my sincere appreciation to Mr. Abdur Rashid Sikder, Director, Bangladesh Bureau of Statistics. Without his help and kind support this study could not be carried out smoothly.

I would like to thank Mr. Amarendra Narayan, Executive Director, Asia Pacific Telecommunity, Bangkok, Thailand for his friendly help and suggestions. I also acknowledge the help and cooperation extended by Mr. F.Q.M. Farooq, Telecommunication Consultant and former Vice-Chairman of BTRC.

I wish to thank the authority of BTRC for allowing me to study on their telecommunication data base, specially the Systems and Services Department for continuous support during the entire period of my study.

Finally, I wish to express my heartiest gratitude to my respected teachers at the Department of Industrial & Production Engineering, BUET and to all my colleagues, friends and family members who directly or indirectly helped me in this work.

(S.M. Mahamud)

ABSTRACT

The term forecasting can be defined as the process of estimating the reverent event of future based on the analysis of their past & present behavior. This definition of forecasting gives rise to three essential characteristics of forecasting. Firstly, forecasting relates to future events. It is the estimation of what will happen in future secondly, forces are made by analyzing the past & present events which are relevant. Anything predicted of the future can't be termed as forecasting. It requires proper analyzing of past & present event requires certain statistical & mathematical tools.

Telecommunication is one of the basic physical infrastructures for economic development and plays a vital role in stimulating economic growth and improving the quality of life. It is both an industry and an infrastructure which also acts a catalyst for other infrastructures to grow. With the fast development of technologies, introduction of new services and facilities, recent shift in the activities to information communication technology, it is now a driving force to determine national strategies, objectives and goals. So, it has become more important as the development of this sector is lagging behind compare to neighboring countries.

This study explains that cellular mobile telephone market has achieved exceptional growth during 2004-05 of 141 per cent in its subscriber base and 148 per cent during 2004-05. Recent growth in the Bangladesh telecommunication market due to some factors such as the deregulation of the telecommunication sector, low levels of tele-density, inadequate fixed phone infrastructure, and high competition following the entry of two new operators (Banglalink and Teletalk).

The purpose of this study is to measure the growth pattern of existing fixed and cellular mobile subscribers. Considering this growth pattern, the subscriber growth rate has been determined using least square method for the next five years and this forecasted growth rate has been compared with the household income level. Moreover, the revenue income from fees and charges by the mobile operators has been investigated and then analyzed its effect on foreign currency reserve in Bangladesh Bank.

CONTENTS

CHAPTER 1

INTRODUCTION

1.1 OVERVIEW

Telecommunications service is considered one of the important human needs in the present world. The penetration rate of fixed line telephones (teledensity 0.63 per 100 population as on 30 April 2005) is not satisfactory compared to the low level of economic development in Bangladesh. However, there has been phenomenal growth in mobile subscribers and every year it is doubling (for year 2002-03 it was 13,64,912, for year 2003-04 it was 27,81,506 and year 2004-05 (up to April), it was 51,39,281). For the year 2004-05 (up to 30 April), the teledensity is 4.3 per 100 population considering both mobile and fixed line subscribers, whereas for the last fiscal year of 2003-04, it was about 2.1 per 100 population. The main growth is on voice communications using cellular mobile phones. Moreover, as on June 2004, about 78% of mobile subscribers do not have PSTN access at all due to the lack of interconnection facilities with BTTB. But demand for this type of services is increasing rapidly, because of the availability and having pre-paid facilities. In spite of lot of demand on fixed lines, the Government owned operator, BTTB is not able to meet the present and growing future demand. As such, fifteen private operators have been issued licences to provide fixed line telecom services in different specified zones under open licensing regime and few of them are in the process of providing services very soon.

Two types of services are mainly used in telecommunications, which are known as wireless and wireline communication. In wireless communication GSM (Global System for Mobile communication), CDMA (Code Division Multiple Access) and WLL (Wireless Local Loop) are widely used technologies. For wireline communication PSTN (Public Switched Telephone Network) technology is mainly used. WLL technology is used to provide fixed phone services especially in sparsely populated area, hilly area and some areas where laying out of cable is not feasible and economic. For any type of

services, terminal equipment is one of the major issues to deploy and expand telecom services in an economy. Moreover, management policy influences the expansion of telecommunications services in the country. It also depends on the Government policy and regulatory environment

Under these circumstances, the purpose of this project is to study the growth pattern of telecommunications services to meet the present unmet and future growing demand considering technological development in this sector.

1.2 OBJECTIVES

The study of telecommunications in Bangladesh and its trends will basically be concentrated on:

i. present telecommunications scenario in Bangladesh
ii. future demand pattern using Least Square method
iii. financial analysis of revenue sharing pattern.

1.3 METHODOLOGY

The study will be carried on:

i. brief description of available telecom services in Bangladesh
ii. analyzing historical data of subscriber growth for both fixed and mobile telephone services and evaluating future demand by Least Square method
iii. comparing this demand with economic condition
iv. financial analysis of revenue sharing based on collected airtime charges and fees and its impact on foreign currency reserve of Bangladesh Bank
v. frequency utilization of different technologies and available frequency for future uses
vi. associate policy support for telecom services.

CHAPTER 2

TELECOMMUNICATION IN BANGLADESH

2.1 TELECOMMUNICATION

As the word 'telecommunication' implies, we are talking about technology that allows us to communicate over distances. Telecommunication has evolved from a stage when signs, drum beats and semaphores were used for long distance communication to electrical, radio and electro-optical signals. Telecommunication signals carry information among entities which are geographically apart. An entity may be a computer, a human being, a facsimile machine, a tele-printer, a data terminal, etc. Historically, transmission of telegraphic signal over wires was the first technological development in the field of modern telecommunication. The telegraphy was introduced in 1837 in Great Britain and in 1845 in France. In 1876, Alexander Graham Bell presented his telephone set showing possibility of long distance voice transmission.

Telecommunication services are considered one of the important human needs in the present world. The world has observed a phenomenal growth in telecommunication for the last decade due to liberalization of telecommunication markets and introduction of competition. It is one of the basic physical infrastructures for economic development and plays a vital role in stimulating the economic growth and improving the quality of life. It acts as a catalyst for other infrastructure to grow.

2.2 HISTORY

Telecommunication service was first introduced in this country through Post and Telegraph Department with Morse telegraphy during British India in 1853. It was continued along with telephone and wireless services till 1962 before the bifurcation of the Department into Postal Department and Telegraph & Telephone Department. After independence of The People's Republic of Bangladesh in 1971, Bangladesh Telegraph & Telephone Department was created under the Ministry of Posts & Telecommunications with a view to run the telecommunication services on commercial basis. The Bangladesh

T & T Department was converted into a corporate body in 1976. In pursuance of Ordinance No. XII promulgated by the President of the People's Republic of Bangladesh on 24th February, 1979 the Bangladesh Telegraph & Telephone Board (BTTB) came into existence, which enjoyed as a monopoly service provider.

The fixed line service was opened in private sector for quite some time. Initially, the service was allowed to be operated in non-urban areas only. In 1989, the Government of Bangladesh (GoB) issued a PSTN license directly to Bangladesh Rural Telecom Authority (BRTA) to provide telecommunications services in rural areas with exclusivity of 30 years. Subsequently, the BRTA license was modified in 1993 to cover 199 upazilas in the northern region of Bangladesh and the exclusivity was reduced to 25 years.

In 1994, second PSTN license was awarded to Sheba Telecom (Pvt.) Ltd to provide services in rural areas covering 191 upazilas in the southern region of Bangladesh for a period of 25 years.

In 1989, one private operator, Bangladesh Telecom Ltd (BTL) was given permission to provide cellular mobile, paging and radio trunking services. The cellular service was later transferred first to Hutchison Bangladesh Telecom Ltd (HBTL) and then Pacific Bangladesh Telecom Ltd (PBTL). At present, BTL is authorized to provide paging and radio trunking services. Moreover, in 1996, three more private operators, Grameen Phone (GP), TM International Bangladesh (TMIB) and Sheba Telecom (Pvt.) Ltd were given licenses for cellular services through competitive bidding process.

Another private PSTN operator, WorldTel was awarded a tender to install and operate 300,000 fixed lines in Dhaka Metropolitan Exchange Area. An MOU between GoB and WorldTel was signed in August 2001 with an exclusivity right of four years to operate in Dhaka MEA. But the the Commission was issued license without exclusivity right on April 2004, though it was not agreed upon by WorldTel and went to the court. In August 2005, Hon' able Supreme Court declared to issue license to WorldTel without exclusivity right.

In 2004, the licensing procedure for PSTN services has been relaxed and eased to facilitate private sector participation through a regulation published by BTRC and it has adopted open licensing regime having no restriction on the number of operators. There are five PSTN zones, namely North-East, North-West, South-East, South-West and Central, for which separate license is required for each zone. Also national license covering the entire country is also allowed. Under open licensing regime, two owners of BRTA took two different PSTN licenses in January 2005 for four zones and since then BRTA has become no longer exist.

In September 2004, another cellular mobile operator, TeleTalk was directly awarded cellular mobile service license as GoB approved Bangladesh Telegraph and Telephone Board (BTTB) to implement a project for providing cellular mobile service to the subscribers.

2.3 GOVERNMENT DEPARTMENT

Till June 1995 the regulatory affairs were handled by Bangladesh Telegraph and Telephone Board (BTTB), the state owned operator as per provision of Telegraph Act 1885 and Wireless Telegraphy Act 1933. The Ministry of Posts and Telecommunications (MOPT) taken over the regulatory functions and became the regulator from July 1995 to January 2002 before the establishment of regulatory commission.

2.3.1 Functions of the Ministry

The functions of the Ministry are to determine the general policy of the Government in the telecommunication sector and to encourage the development of this sector in Bangladesh.

2.3.2 Regulatory Authority

With the promulgation of Bangladesh Telecommunication Act 2001, Bangladesh Telecommunication Regulatory Commission (BTRC) was formed and started its activities from 31 January 2002. Since then the regulatory functions have been transferred to BTRC, with the primary objective of liberalizing and creating competitive environment for the growth of telecommunication sector.

2.3.3 Board objectives of BTRC

1. To encourage the orderly development of a telecommunications system that enhances and strengthens the social and economic welfare of Bangladesh;
2. To ensure, in keeping with the prevalent social and economic realities of Bangladesh, access to reliable, reasonably priced and modern telecommunications services and Internet services for the greatest number of people, as far as practicable;
3. To ensure the efficiency of the national telecommunications system and its capability to compete in both the national and international spheres;
4. To prevent and abolish discrimination in providing telecommunications services, to progressively effect reliance on competitive and market oriented system, in keeping with these objectives, to ensure effective control of the Commission;
5. To encourage the introduction of new services and to create a favorable atmosphere for the local and foreign investors who intend to invest in the telecommunications sector in Bangladesh.

2.3.4 Major functions and duties of BTRC

1. To regulate the establishment, operation and maintenance of telecommunication services in Bangladesh;

2. To protect the interests of the local consumers in respect of the charges imposed on them, and their access to telecommunication services, and the quality and variety of such services;
3. To encourage research and development activities in telecommunication, and innovative activities and investment in providing telecommunication services;
4. To protect the social and economic interests of the consumers, to respond to their needs, and to control and abolish the existing and probable oppressive or discriminatory conduct or activities of the telecommunication service providers;
5. To maintain and promote competition among the service providers in order to ensure high-quality telecommunication services;
6. To ensure protection of the privacy of telecommunication;
7. To collect, from within and outside Bangladesh, information on telecommunication and internet and to analyse and assess their impact on Bangladesh and to take necessary action or, as the case may be, to make necessary recommendations to the Government;
8. To frame a national scheme of numbering plan to be followed in telecommunication and to modify it whenever necessary.

2.3.5 Telecom Policy

The National Telecommunication Policy acts as a catalyst towards the growth and development of telecommunications in the country to produce a modern, balanced and dynamic society. The policy issues are designed to achieve a range of benefits which are included but not necessarily limited to the tasks of increasing the number of telephones in a systematic and comprehensive manner. Such few steps are outlined below:

- Public and private operators are to work as partners to develop telecommunication sector in the country.
- Protection of user's interests are to be ensured regarding the services provided, facilities offered, technology used and prices charged.

- Access to and delivery of the full range of modern, sophisticated, efficient and cost effective services of basic as well as value added telecommunication are to be provided in rural areas to ensure universal access.
- Restructuring of the Government owned telecommunication service provider, namely BTTB (Bangladesh Telegraph and Telephone Board).

2.4 OVERVIEW OF TELECOMMUNICATION STATUS

2.4.1 Background

The strategic vision of the Government is to facilitate telecommunication services throughout the country and where there is a demand. The Government has already opened the telecommunication market to private sector, because it realizes that telecommunication services will be affordable, reliable and achievable only through reforming the sector to encourage a plurality of private and public sector participation. In order to make this environment healthy, interconnection and revenue sharing will be clear and fair to all service providers and their subscribers.

2.4.2 Development Objectives

The main objectives of telecommunication development are outlined below:

- Replace of all analog switching and transmission equipment for both basic and value added services to improve the quality and reliability of telecommunication infrastructure.
- Telecommunication services are to be efficiently and cost-effectively provided in particular fields, to be decided by establishing market oriented regime, appropriate sets of regulations, standards, procedures, conditions and investment climate and competition.
- Development of telecommunication facilities and services shall be user friendly. The users shall have multiple choices for access to networks and markets of different services, systems and carriers at a competitive and reasonable price.

- Tariff policies are to be liberalized to encourage extension of maximum services at minimum cost.
- The absorption of new technology and to upgrade the facilities and services in telecommunication are to be encouraged. Continuous updating of information on new and latest technology and transfer of the same for benefit of the users are to be encouraged.
- The role of the private sector has been recognized as a predominant one. Except reserved sectors, private sector investment has been kept open without any ceiling. Private investment both local and foreign or joint venture between local and foreign or with public sector is allowed.
- Foreign investors are encouraged to demonstrate their commitment to Bangladesh by forming joint ventures with local companies and within the telecommunications sector. The Government will make all endeavors to remove all procedural and other impediments for quick implementation of the projects including investment proposals from foreign investors in the telecom sector to meet the growing and unmet demands of telephones in the country.

2.4.3 Main challenges in the telecommunication development

The financial capabilities, educational levels and skilled human resources are the main challenges for development of telecommunication in Bangladesh. People in this economy are very happy if they can talk. So the telecommunication service providers are mainly concentrating on voice communication.

2.4.4 Services market

Cellular mobile service providers mainly use Ericsson switches for switching networks, Ericsson and Huawei equipments are used for access networks and Siemens equipments are used in for high capacity terrestrial microwave networks. The telephone exchanges for fixed line are mainly supplied and installed by NEC, Alcatel, Ericsson, Italtel, ZTE, etc.

2.4.4 Telecommunication industry trends

In order to meet the unmet demand and to resolve long waiting time, expansion of capacity of the telecommunication networks is one of the main issues in Bangladesh. The telecommunication industry trend is to establish digital networks providing greater capacity as well as better quality of services to the subscribers.

2.4.5 Market conditions/competition

The current Bangladesh telecommunication market is characterized by low penetration, significant unmet demand and generally poor quality of service. There has, however, been rapid development of cellular services in the country during the last three years. But the majority of the subscribers of these cellular services are constrained by lack of interconnection with the incumbent fixed service provider, namely BTTB.

BTTB has not been able to meet the existing and continuously growing demand for PSTN services, though it has full monopoly on international voice traffic and VoIP services. In order to introduce competition and meet unmet demand in rural areas, two private operators were licensed e.g. BRTA and Sheba Telecom (Pvt.) Ltd to provide services in rural areas, but their performances are dissatisfactory. In these circumstances, the Commission decided to open the PSTN services in private sector under open licensing regime with certain terms and conditions. Under open licensing regime 15 operators have been issued 36 zonal licenses.

Five mobile operators e.g. GP, TMIB, Sheba Telecom, PBTL and Tele Talk were licensed to provide mobile services all over the country. Among these operators, GP has been very aggressive to build the network and provide services. As a result, it has become the top service providers. Other operators are building their infrastructures to cover the entire country to grab the market as much as possible.

2.4.6 Market structure and trends

BTTB is providing PSTN services all over the country. It is working as a cash cow for the Government. Long waiting time, limited network capacity, using of old and outdated technology and long time delay for approval of project are major constraints to meet the present and growing future demand. On the other hand, cellular mobile phones are increasing quite sharply for the last few years due to easy deployment of network and availability of mobile phones.

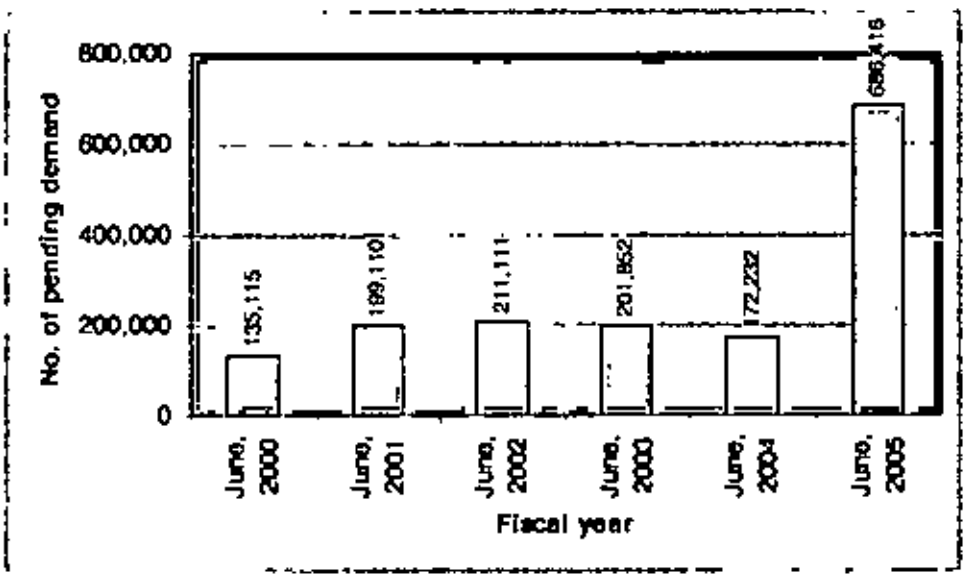


Figure 2.1: Pending demand for fixed lines

In the year of June 2005, the main PSTN operator had 68% pending demand of total capacity and 80% pending demand of total connection, whereas there was no pending demand for mobile operators.

2.4.7 Tariff structure and trends

As per Section 48(1) of the Bangladesh Telecommunication Act, 2001, an operator shall submit to the Commission a tariff containing maximum and minimum charges before providing the services and until the tariff is approved by the Commission, the operator shall not start providing services.

The tariff is determined in two ways:

a) cost based tariff. and

b) market competition based tariff.

Table 2.1: Cellular mobile call charge as on October 2005

S/N	Operator	Prepaid (per minute in taka)		Post paid (per minute in taka)	
		On net	Off net	On net	Off net
1.	Teletalk	3.60	3.60	3.00	3.00
2.	GP	4.40/3.00/2.00	4.80/3.00	4.00/3.00/2.00	4.00/3.00/2.00
3.	TMIB	4.30/4.00/2.00	4.90/4.90/2.50	3.50/2.50/1.50	4.00/3.00/2.00
4.	Sheba	2.50/2.50	4.50/4.50	3.48/2.27/0.96	3.48/2.27/1.48
5.	PBTL	3.00/3.00/2.00	4.00/4.00/2.00	3.00/2.00/1.00	4.00/3.00/1.50

In Bangladesh market competition based tariff is followed so that the operators can not increase their tariff from their present offered tariff. Due to competition in mobile services, the tariff has come down to taka 4.90 per minute from taka 16.00 per minute which was offered in October 2001. Also at present BTTB is providing non-toll quality ISD voice service (VOIP) to 25 countries at reduced price of taka 7.50 per minute.

2.4.8 Key players

The key player is mainly depends on market share in the telecommunication networks, based on either number of subscribers or revenue earning or both for fixed lines and mobile services. Sometimes quality of services is also considered to indicate the significant market players.

Table 2.2: Market share of major operators

Name of the Operator	Market share based on subscribers	Position based on subscribers	Market share based on revenue earning	Position based on revenue earning
Grameen Phone	53%	01	39%	01
TMIB/Aktel	22%	02	17%	03
PBTL/ Citycell	5%	05	4%	05
Sheba Telecom / Banglalink	7%	04	9%	04
TeleTalk	1%	06	~0%	06
BTTB	12%	03	31%	02

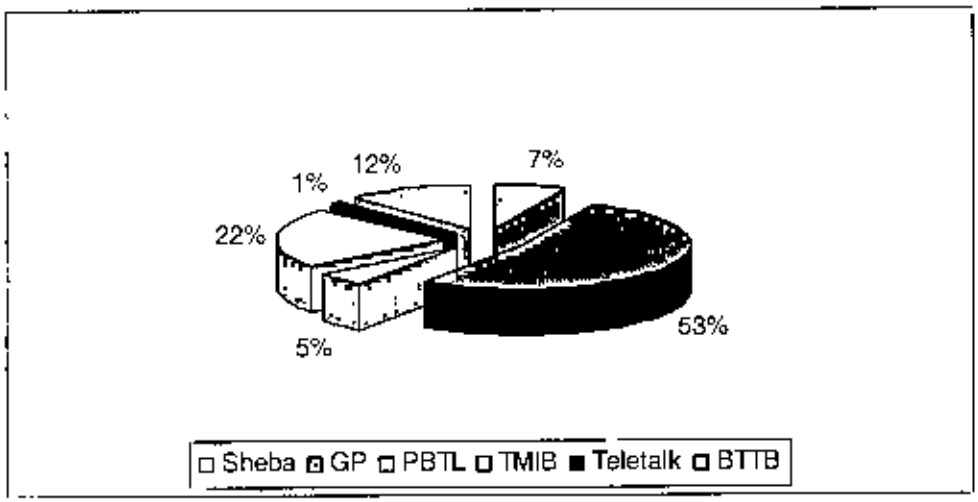


Figure 2.2: Telecommunication market share based on subscribers

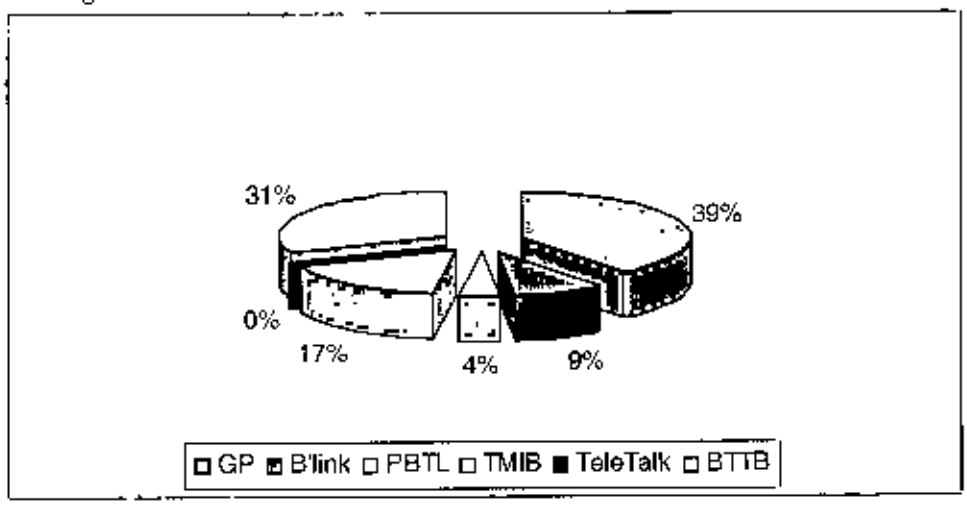


Figure 2.3: Telecommunication market share based on revenue

Grameen Phone (GP) had the highest market share for the year 2004-2005. At present all telecom operators are expanding their networks. But GP is strongly developing its own infrastructure and facilities to cover the whole country as soon as possible with advanced data communication facilities.

2.5 REGULATORY ENVIRONMENT / OVERVIEW OF THE REGULATORY SYSTEM

2.5.1 Regulations

The legal status governing the telecommunication sectors in Bangladesh are:

i. The Bangladesh Telecommunication Act, 2001
ii. The Wireless Telegraphy Act, 1933 and the Telegraph Act, 1885 for matters that are not covered in the Bangladesh Telecommunication Act, 2001.

As per Bangladesh Telecommunication Act, 2001, BTRC is authorized to produce regulations. In Section 99(1), it is stated that "For carrying out the purposes of this Act, the Commission may, by notification in the Gazette, make regulations consistent with this Act and the rules made by the Government".

It is also mentioned in Section 99(2) of the Act that "Within 7 (seven) days of the publication of the regulations in the official Gazette, the Commission shall send to the Ministry, a copy of such regulations and the Ministry may, upon examination of the consistency of the regulations with this Act and the rules, direct necessary amendments to the regulation. and the Commission shall take necessary steps accordingly".

The following two regulations were published in the official Gazette:

a. Licencing Procedure Regulations, 2004 and
b. Interconnection Regulations, 2004.

2.5.2 Licensing Procedure Regulations, 2004

As per Section 36(6) of the Bangladesh Telecommunication Act, 2001, the Commission shall issue license through competitive bidding procedure. But it is also mentioned that the Commission may identify certain services for which licenses may be issued without tender notice. The Commission has identified that following services are required licensed:

I. Public Switched Telephone Network (PSTN) Service
II. Cellular Mobile Telephone (CMT) Service
III. Satellite Mobile Phone Service (GMPCS)
IV. National Long Distance (NLD) Service
V. Overseas Telecommunication (ILD) Service
VI. ISP Services
VII. Domestic Data Communication Services
VIII. VSAT Service
IX. Paging Service
X. Radio Trunking Service

The main objective of the Licensing Procedure Regulations, 2004 to issue licenses under open licensing regime, where spectrum allocation is not the major issue. Considering this objective, licenses have been divided into the following categories:

Table 2.3: Awarding procedure of different types of licenses

Competitive Bidding Procedure	Open Licensing Procedure
Cellular Mobile Telephone Service	Public Switched Telephone Service
Satellite Mobile Phone Service	National Long Distance Service
Overseas Telecommunication Service	ISP Service
Paging Service	VSAT Service
Radio Trunking Service	Domestic Data Communication Service

But the Commission has not published any gazette notification regarding issue of license through auction, where spectrum is limited but demand is very high.

2.5.3 Interconnection Regulations, 2004

The main purpose of Interconnection Regulations, 2004 is to encourage orderly and faster development of telecommunication services. It is mandatory for all operators to ensure any to any connectivity for the communication of the subscribers/consumers of one operator with the subscribers/consumers of the others, as and when required. The dominant operator shall publish and provide to the requesting party a Reference

Interconnection Offer (RIO) containing all terms and conditions required for the other operators to interconnect, including a full list of interconnection circuits, facilities and the associated charges. Charges should be sufficiently unbundled so that the operators only pay for the services they request and costs not directly related to the interconnection should be omitted from the overall cost.

As per Section 47(2)(a) of the Bangladesh Telecommunication Act, 2001, interconnection agreements shall be executed within three months from the first day on which the new operator starts providing telecommunication services. If the operators can not agree on the terms and conditions of the interconnection agreement within three months, then any of them may present the matter to the Commission or the Commission may take up the matter on its own motion, can determine the terms and conditions of the agreement as it considers appropriate by taking assistance of technical, financial and legal experts at the cost of disputing parties. After completing the investigation and assessment of the dispute, the Commission will give its decisions and final determination, which will be the final and binding upon the disputing parties. If any operator fails to comply interconnection obligations, resort to call blocking or any anti competitive activities or does not follow the instructions/directives issued by the Commission, then the operator may be penalized by cancellation and suspension of license as per Section 46 of the Act.

2.5.4 Liberalization

The Government opened the telecommunication market to private sector, after realizing that telecommunication services will be affordable, reliable and achievable and it is only possible through private and public sector participation making the environment competitive and healthy. The first step was taken to liberalization in 1989. In July 1989, a private operator, Bangladesh Telecom Ltd. was given permission to provide cellular mobile, paging and radio trunking services. The cellular mobile service was later transferred to Pacific Bangladesh Telecom Ltd. (PBTL). In October 1989, Bangladesh Rural Telecom Authority (BRTA) was given license to build, own and operate in 199 upazilas to provide telecom services only in rural areas. Also in June 1994, Sheba Telecom was given license for rural telecom services in 191 upazilas. After that, in

November 1996, three more private operators. e.g. Grameen Phone, TM International Bangladesh (TMIB) and Sheba Telecom. were given licenses to provide GSM cellular mobile services throughout the country.

In order to encourage the ICT sector to spread out throughout the country, the procedures for granting ISP and VSAT licenses have been made simple and easy. Any person having sufficient technical and financial capabilities shall be eligible to get these types of licenses through an open licensing procedure with no limit on the number of the entry, unless disqualified for the grounds mentioned in Section 36(3) of the Act.

The Commission has started to accept application on 17 February 2004 to grant license for PSTN services through open licensing procedure into different zones of the country to encourage the new entrants by ensuring competition in level playing field. There is no limit of the number of licenses of this category unless for sufficient reasons the Commission decides to suspend issuing such license for certain period of time or certain areas. After declaration. 36 zonal licenses to 15 private companies have been issued so far for operational period of 20 years.

2.5.6 Licensing

Generally two types of licenses are required for establishment of telecommunication services, which are outlined below:

i. Service License and
ii. Frequency License.

Service licenses can be issued through competitive bidding license procedure or open licensing procedure. In case of open licensing procedure, the Commission shall specify the criteria and conditions of the applicants and these criteria and conditions have to fulfill in order to be eligible for getting license. The Commission also determines and fixes the license fee, application fee. evaluation fee and other charges. But there is no

regulation for open auction licensing procedure, which is considering one of the transparent methods for issuing service license.

There are different methods of issuing spectrum license, such as sealed tender, open auction, beauty contest, etc. In beauty contest, the applicant declares his technology for which spectrum is needed and the Commission examines the technology and availability of spectrum as well as actual need of spectrum. After that, spectrum is allocated to the applicant on first come first serve basis.

2.5.7 License fees and charges

The license fee is a fee paid to the Government for the right to operate a network and provide services. The fees related to licenses for different services are as follow:

Table 2.4: License fees and charges for PSTN services

Zone	Application fee (Tk.)	Entry fee (Tk.)	Annual licence fee (Tk.)	
			Fixed	Variable
Zonal (NE, NW, SE & SW)	0.6 million	20 million	3 million	2% of annual gross revenue
Central (Dhaka MEA)	1.2 million	50 million	10 million	2% of annual gross revenue
National	3.0 million	120 million	20 million	2% of annual gross revenue

Table 2.5: **License fees and charges for different mobile operators**

Name of the licensee	Application fee (Tk.)	Entry fee (Tk./US$)	Annual licence fee (Tk./US$)	
			Fixed	Variable
Grameen Phone	-	-	1st 5 yrs: 400,000 US$ 2nd 5 yrs: 800,000 US$ 3rd 5 yrs: 1,600,000 US$	1% of collected rent and call charges
TMIB	-	-	1st 5 yrs: 400,000 US$ 2nd 5 yrs: 800,000 US$ 3rd 5 yrs: 1,600,000 US$	1% of collected rent and call charges
Sheba Telecom	-	-	1st 5 yrs: 400,000 US$ 2nd 5 yrs: 800,000 US$ 3rd 5 yrs: 1,600,000 US$	1% of collected rent and call charges
PBTL	-	-	1st 5 yrs: 400,000 US$ 2nd 5 yrs: 800,000 US$ 3rd 5 yrs: 1,600,000 US$	1% of collected rent and call charges
Teletalk	-	-	1st 5 yrs: 400,000 US$ 2nd 5 yrs: 800,000 US$ 3rd 5 yrs: 1,600,000 US$	1% of collected rent and call charges
Warid Telecom	20 million taka	50 million US$	1st 5 yrs: 400,000 US$ 2nd 5 yrs: 800,000 US$ 3rd 5 yrs: 1,600,000 US$	1% of collected rent and call charges

2.5.8 Frequency allocations activities

The Commission is responsible for spectrum management including issuance of spectrum licenses and radio station licenses for the Government, private operators, security and

non-security agencies. The methodology for allocation of frequency is based on beauty contest. Spectrum license fee is mainly based on per kHz frequency usage and output power. At present, the assignment or allocation of frequency, followed by BTRC, is executed using Radio Regulation (RR) of ITU.

BTRC is in the advance stage of preparing National Frequency Allocation Plan (NFAP) through "Spectrum Management Consultancy", which is part of the project of World Bank named "Strengthening the Regulatory Capacity of BTRC". The successful bidder (consultant), InterConnect Communications Ltd., UK started the work on 03 October 2004 after signing agreement on 23 September 2004. A public consultation on draft NFAP was held on 22 June 2005. Considering the suggestions of the public consultation, the consultant submitted the draft final report on 10 September 2005 to the Commission for further necessary action.

A project for national frequency allocation plan, spectrum management and monitoring facilities have been undertaken through World Bank financial support as loan to perform these activities efficiently and effectively.

2.5.9 Interconnection

At present, telecommunication operators are expanding their network vary fast and offering a wide range of services including value added services. In multi-operator and multi-service scenario under competitive environment, operators are needed to interconnect with each other as a single operator can not survive by selling its own services to the consumers. The operators are inter connected with each other directly by bilateral agreement.

Table 2.6: Number of E1 among mobile operators and BTTB.

Name of Operators	BTTB			GP	TMIB	PBTL	Sheba GSM	ATOB Tandem
	Tandem	TAX	ITX					
GP	61	12	38	[redacted]	233	232	22	40
TMIB	46	12	26	233	[redacted]	56	5	40
PBTL	50	7	10	232	67	[redacted]	5	30
Sheba	22	2	2	22	5	5	[redacted]	40

As per BTRC Interconnection Regulation, 2004, interconnection is mandatory to ensure any to any connectivity within telecom operators and access providers. The dominant operator shall provide to the requesting party and publish a Reference Interconnection Offer (RIO), containing all the terms and conditions required for interconnection including a full list of interconnection circuits, facilities and the associated charges. Charges should be unbundled and costs not directly related to the interconnection should be omitted from the overall cost. The non-dominant operators may arrange their own interconnection into mutual non-discloser agreement and submit the same to the Commission for approval prior to the commencement.

If there is any dispute on interconnection, the Commission may take the assistance of technical, financial and legal experts at the cost of disputing parties. After completing the investigation and assessment of the dispute, the Commission will give its decisions and final determination, which will be the final and binding upon the disputing parties.

2.5.10 Concessions

There is no compulsion to provide concession to the telecommunication operators from the Commission. But the operators offer various types of tariff to the subscribers as concession, e g. certain amount of air time free for new subscription, reduced tariff during off peak hour, special tariff offer in three members group within the network for all times in a day, and so on.

2.5.11 Universal Service Obligation (USO)

As depicted in the new PSTN license, each Licensee shall install at least 5% of its capacity in rural and sparsely populated areas in order to provide services to people in those areas. Rural and sparsely populated areas shall be all areas outside upazila headquarters and/or urban areas, as published by the Bangladesh Bureau of Statistics. The Licensee shall in addition comply with any of the USO including USF that may be imposed by the Commission.

2.6 INFRASTRUCTURE

The existing telecommunication infrastructure in Bangladesh consists of terrestrial microwave network, terrestrial fiber optic network and satellite telecommunication & earth station.

2.6.1 Terrestrial microwave network

In Bangladesh, long distance transmission systems are mainly composed of microwave, VHF and UHF radio links. Frequency band of 6, 7, 8 and 11 GHz are mainly used for microwave backbone network. Among these frequencies, BTTB is using 6 & 7 GHz, GP 7, 8 & 11 GHz, TMIB 7 GHz, PBTL 8 GHz and Sheba Telecom 7 GHz.

2.6.2 Terrestrial fiber optic network

Terrestrial fiber optic network, both overhead and under ground, are becoming popular day by day because of its high capacity of bandwidth. At present BTTB has its own fiber optic network and GP is using Bangladesh Railway's optical fiber network. Another organization, Power Grid Company of Bangladesh (PGCB) is laying out its optical fiber network into ground cables of high voltage transmission lines. About 5% of total capacity will be reserved only for its own purpose and rest of the capacity will be leased out to public and private telecommunication operators.

2.6.3 Satellite Telecommunication & Earth Station

BTTB is the only operator to provide overseas incoming and outgoing call services through satellite. At present BTTB have four earth stations. These earth stations are working with different INTELSAT satellites located in the Indian Ocean Region.

Table 2.7: Statistics on satellite telecommunication and earth station

Name of E/S	Year of Estab.	Standard	International Circuits				Connecting Countries	Carrier	Working with INTELSAT
			Voice	VFT	Data	Total			
Betbunia	1975	A	718	2	6	726	UAE, Bahrain, HK, India, Japan, Kuwait, Oman, Pakistan	IDR	60° E IOR
Talibabad	1982	B	358	0	3	361	USA, UK	IDR	60° E IOR
Mohakhali	1994	A	4772	4	10	4786	USA, UK, UAE, Thailand, Sri Lanka, Saudi Arab, Singapore, Netherland, Malaysia, S Korea, Japan, Italy, Indonesia, HK, Germany, France, China, Canada, Australia		64° E IOR
Sylhet	1995	F3	120	0	0	120	UK	IDR	62° E IOR

Besides this, INMARSAT is providing mobile satellite communication services for ships and aircrafts. In Bangladesh, BTTB is responsible for this type of services. It has five INMARSAT-A terminal, which are operating through one LES (Land Earth Station) located in Jeddah.

2.7 BASIC TELEPHONY

2.7.1 PSTN zonal license

Few days ago basic telephony services were being provided by three operators, BTTB, BRTA and Sheba Phone, of which BRTA and Sheba Phone providing their services only in rural areas. As BTTB is unable to meet growing present and future demand of fixed lines. BTRC decided to open the basic telephony services to private operators under open licensing regime. In this licensing regime, the whole country is divided into five zones and following zonal licenses are offering in addition to the national license:

- Central Zone
- South-East Zone
- South-West Zone
- North-East Zone and
- North-West Zone.

Mainly two considerations are comprised for defining the licensing zones. The main consideration is to ensure the estimated demand of PSTN services in a licensing area is economically sufficient to sustain at least two new operators. Moreover, the boundary of a licensing zone is made to coincide more or less with one or more of the existing BTTB operational regions so that operational interaction and processes can be minimized and simplified.

Table 2.8: Distribution of areas into zone

Central Zone	South-East Zone	North-East Zone	South-West Zone	North-West Zone
Dhaka City, Zinzira & Savar	Brahmanbaria	Sunamganj	Kushtia	Dinajpur
Narayanganj District H/Q	Comilla	Sylhet	Chuadanga	Panchagarh
Gazipur District H/Q & Tongi	Chandpur	Habiganj	Meherpur	Thakurgaon
	Lakshmipur	Moulvi Bazar	Jhenaidah	Nilphamari
	Noakhali	Sherpur	Magura	Lalmonirhat
	Feni	Jamalpur	Jessore	Kurigram
	Chittagong	Netrokona	Narail	Rangpur
	Cox's Bazar	Mymensingh	Khulna	Gaibandha
	Khagrachari	Kishoreganj	Satkhira	Bogra
	Rangamati	Tangail	Bagerhat	Joipurhat
	Bandarban	Munshiganj	Barisal	Rajshahi
		Manikganj	Bhola	Natore
		Narayanganj excl. District H/Q	Jhalakathi	Nangaon
		Gazipur excl. District H/Q & Tangi	Pirojpur	Nawabganj
		Dhaka excl. Dhaka City, Zinzira & Savar	Barguna	Pabna
			Patuakhali	Sirajganj
			Rajbari	
			Faridpur	
			Gopalgonj	
			Madaripur	
			Shariatpur	

After inviting application for new PSTN license, 15 operators have been issued 37 zonal licenses. So, present PSTN operators are outlined in the next page:

Table 2.9: PSTN zonal licenses

Name of Operator	Type of Service	Licensing Area/Zones					Date of License Issue	Commencement of Service	License Period
		NE	NW	SE	SW	CEN			
Bangladesh Telegraph and Telephone Board (BTTB)	Fixed Telephone, Internet, Telex, NLD, ILD, Telegraph, Telegram	√	√	√	√	√	Though Govt operator, but license was given on January 29, 2004	Incumbent operator	20 years
Bashundhara Communication & Networks Limited	Fixed Telephone & WLL	√	√	√	√		May-04	Feb-06	20 years
Ranks Telecom Limited	Fixed Telephone & WLL	√	√	√	√		June-04 (NE & SE) January-05 (NW & SW)	May-05	20 years
Bangla Phone Limited	Fixed Telephone & WLL	√					June-04	Feb-06	20 years
Jalalabad Telecom Limited	Fixed Telephone & WLL	√					June-04	Jun-05	20 years
Westec Limited (Bay Phone)	Fixed Telephone & WLL			√			July-04	Feb-06	20 years
Tele Barta Limited	Fixed Telephone & WLL	√	√	√	√		August-04	Feb-06	20 years
Dominox Technologies Limited	Fixed Telephone & WLL			√			August-04	Feb-06	20 years
GEP Telecom Limited	Fixed Telephone & WLL	√		√			August-04	Feb-06	20 years
OneTel Communication Limited	Fixed Telephone & WLL		√				September-04	September-05	20 years
Dhaka Telephone Company Limited	Fixed Telephone & WLL	√	√	√	√		October-04	Feb-06	20 years
Square Informativ Limited	Fixed Telephone & WLL	√	√	√	√		January-05	Feb-06	20 years
National Telecom Limited	Fixed Telephone & WLL	√	√	√	√		January-05	January-05	20 years
Peoples Telecommunication and Information Service Limited	Fixed Telephone & WLL	√	√	√	√		January-05 (NE & NW) March-05 (SE & SW)	January-05	20 years
S. A. Telecom System Limited	Fixed Telephone & WLL			√			March-05	Feb-06	20 years
Nextel Telecom Limited	Fixed Telephone & WLL			√			April 05	Feb-06	20 years
WorldTel Limited	Fixed Telephone & WLL					√	April-04	Mar-06	25 years
Integrated Services Limited (Sheba Phone)	Fixed Telephone & WLL in rural area	191 Upazilas in southern region of Bangladesh					1994	1995	25 years

2.7.2 Growth of main lines

Sheba Phone is licensed to provide its services in 191 upazilas, but it has failed to provide services half of its areas. Now it has only 5,000 subscribers.

The exchange capacity and number of connected subscribers are increasing gradually for BTTB. But it is not sufficient compare to pending demand. Constraints in Government Annual Development Project, limitations in administrative & financial authorities are the main obstacles in the development of exchange capacity.

Table 2.10: Growth of main lines

Subject	Operators	Items	July '00 to June '01	July '01 to June '02	July '02 to June '03	July '03 to June '04	July '04 to June '05
Fixed line subscribers	BTTB	No of exchanges	662	668	652	638	671
		Capacity	688,920	746,078	920,993	945,281	1,010,009
		Connections	564,880	605,931	761,721	806,158	857,358
	Sheba Phone	No of exchanges	-	9	9	9	9
		Capacity	-	5,096	5,120	5,000	5,000
		Connections	-	2,539	2,923	3,047	3,000

2.7.3 Facilities based licensees

As per Section 40 of the Bangladesh Telecommunication Act, 2001 without a permit issued by the Commission, the operator shall not allow a third party to share or use the telecommunication systems, installation, apparatus or facilities on commercial basis or in lieu of fees, prices or other consideration. To install new PSTN network, no permit is required from the Commission for sharing of space (land and / or building), tower, mast, pole, duct, tunnels and manholes, power supply or any other ancillary facilities.

In the new PSTN license, franchising is allowed by the Licensee. In this case, the Licensee shall provide all relevant information to the Commission on proposed franchisees including the proposed franchising area, systems and services to be franchised, the background, financial standing and experience of the franchisee, at least 6 weeks prior to their appointment or engagement. The Commission may review such information, issue directions and/or disallow the appointment of the franchisee by the

Licensee. Also the Licensee shall ensure that its franchisees shall comply fully with all the conditions of the PSTN license and all applicable laws. In order to develop of telecommunication sector and to make telecommunication services cost effective & competitive, the Commission is considering on the issues of Interconnection Access Provider, Nationwide Optical Fiber Network, Network Facilities Provider, International Gateway, etc.

2.7.4 Competitive landscape in basic telephony

In accordance to the National Telecommunications Policy 1998 more service areas were opened up for private participation in basic telephony and long distance networks after 2000. But international services will be operated exclusively by the Government through BTTB or its lawful successor. It will be opened up for private participation after the year of 2010 and if needed, this can be opened up earlier than the year 2010.

2.8 MOBILE COMMUNICATIONS

Among five mobile operators, GP, TMIB, Sheba Telecom and Teletalk are providing GSM cellular services and PBTL is providing CDMA cellular services throughout the country. Another operator, Warid Telecom have been issued license on 20 December 2005 for countrywide GSM cellular services. Among these operators, GP is in advance stages to provide services.

Table 2.11: Status of present cellular mobile operators

Name of Operator	Type of Service	Service Area	License Issue	Commencement of Service	License Period
Grameen Phone Ltd.	GSM Cellular Service	Nationwide	November-96	March-97	15 years
Pacific Bangladesh Telecom Ltd.	AMPS & CDMA Cellular Service	Nationwide	July-89	March-93	20 years
TM International Bangladesh Ltd.	GSM Cellular Service	Nationwide	November-96	October-97	15 years
Sheba Telecom (Pvt.) Ltd. (Banglalink)	GSM Cellular Service	Nationwide	November-96	September-98	15 years
Teletalk Bangladesh Ltd.	GSM Cellular Service	Nationwide	September-04	March-05	15 years
Warid Telecom Ltd.	GSM Cellular Service	Nationwide	Dec-05		15 years

2.8.1 Mobile communication market

There has been phenomenal growth in mobile services and the number of mobile subscribers is almost doubling each year. Now the teledensity in mobile communication is about 4.36 per 100 population as on June 2005.

Table 2.12: Different types of subscribers of cellular mobile operators

Operators	Type of subscribers	July '00 to June '01	July '01 to June '02	July '02 to June '03	July '03 to June '04	July '04 to June '05
Sheba	Prepaid	0	0	0	0	423,079
	Postpaid	27,460	35,000	49,710	58,893	62,135
	Total	**27,460**	**35,000**	**49,710**	**58,893**	**485,214**
GP	Prepaid	286,000	575,000	725,682	1,545,000	3,370,000
	Postpaid	185,000	199,000	213,386	286,634	329,000
	Total	**471,000**	**774,000**	**939,068**	**1,831,634**	**3,699,000**
PBTL	Prepaid	0	46,869	93,264	143,249	202,686
	Postpaid	54,399	56,754	73,721	67,628	123,052
	Total	**54,399**	**103,623**	**166,985**	**210,877**	**325,738**
TMIB	Prepaid	11,195	60,021	99,149	528,406	1,442,969
	Postpaid	69,171	101,244	110,000	151,750	85,383
	Total	**80,366**	**161,265**	**209,149**	**680,156**	**1,528,352**
Teletalk	Prepaid	0	0	0	0	69,642
	Postpaid	0	0	0	0	0
	Total	**0**	**0**	**0**	**0**	**69,642**
All Operators	Prepaid	297,195	681,890	918,095	2,216,655	5,508,376
	Postpaid	336,030	391,998	446,817	564,905	599,570
	Total	633,225	1,073,888	1,364,912	2,781,560	6,107,946
Overall	% Prepaid	47	63	67	80	90
	% Postpaid	53	37	33	20	10

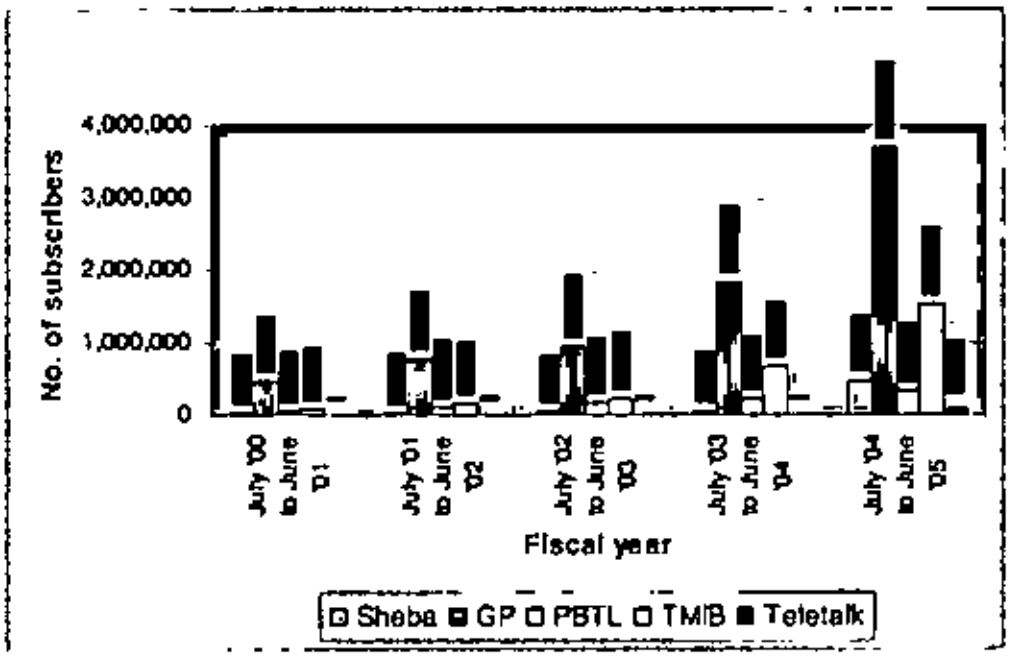


Figure 2.4: Growth of mobile subscriber based on operators

2.8.2 Market structure and trends

The cellular mobile operators are occupying 88% of telecommunication subscribers and among the mobile operators; GP is holding 61% of total mobile subscribers.

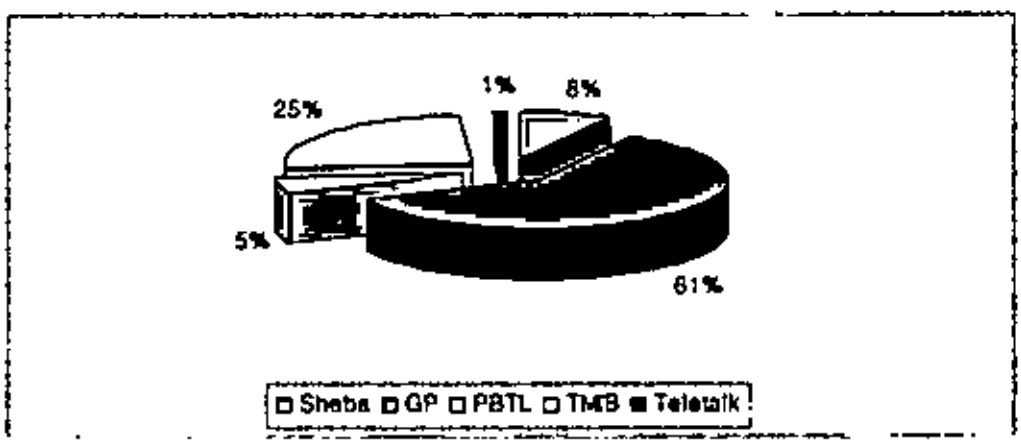


Figure 2.5: Market share of mobile operators based on subscribers

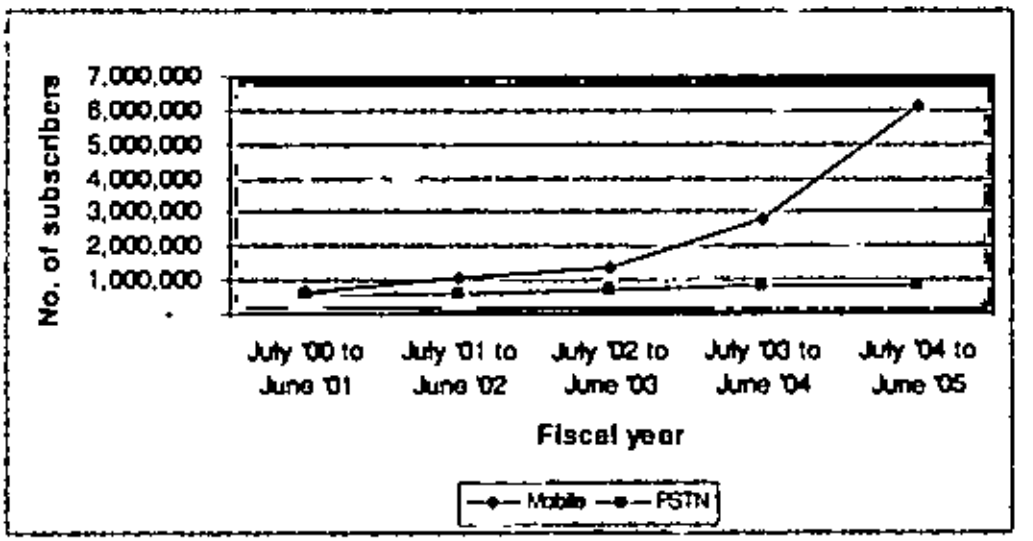


Figure 2.6: Comparison of mobile and PSTN subscriber growth

The mobile subscribers are facing problems not to get connectivity with PSTN subscribers as BTTB has not enough interconnection facilities to supply interconnection to mobile operators. As a result, subscribers with having connection facilities only between mobile operators are increasing day by day because of availability, no waiting time and having pre-paid facilities.

2.8.3 Overview of mobile data services and adoption

The mobile operators have started to provide data services to the subscribers. If data services are cost effective and good in performance, people will think to adopt those services; otherwise people will be confined mainly on voice communication.

2.9 OTHER SERVICES

2.9.1 Telex and Telegraph services

At present, only BTTB is providing these services and new PSTN operators are allowed to give the same. With introduction of fax and Internet, the demand for these services has gone down significantly.

2.9.2 Paging service

Bangladesh Telecom Ltd. (BTL) started with this service from 1989. Initially it gained some popularity and the subscribers rose to about 5,000 in 4 big towns. Decreasing the quality of services and with the spread of cellular mobile services, the subscribers have come down nearly zero.

2.9.3 Radio Trunking service

BTL also started with this service in 1989. But it could not get momentum due to technical limitations and standard & quality of the service. Now the subscribers have come down significantly.

2.9.4 Pay phone service

BTTB in conjunction with 'Telephone Shilpa Sangstha' has been offering this service throughout the country since 1994. Two types of card are using in the country, e.g. magnetic type and chip type. About 1550 card phone booths have been set up in the country, of which half of them are in operation, as the standard of service has deteriorated in recent times.

2.9.5 Internet service

As on June 2004, in private sector about 178 companies have been given ISP licenses in 5 district towns at Dhaka, Chittagong, Khulna, Sylhet and Rangpur. Total users of ISPs are about 300,000. Under DDCSP license, point to point domestic data services are only allowed.

Table 2.13: Internet service licenses issued under open licensing regime

License	July '00 to June 01	July '01 to June 02	July '02 to June 03	July '03 to June 04	July '04 to June 05
ISP	16	52	137	178	181
VSAT-User	7	18	52	78	85
VSAT-Provider	3	6	27	30	31
VSAT-Hub	-	1	3	4	4
DDCSP	-	-	14	21	24

2.9.6 E-commerce

Bangladesh is in the initial stage of e-commerce. Dhaka Stock Exchange and Chittagong Stock Exchange are trading their shares through online. Also few private banks are offering online banking.

CHAPTER 3

THE TELECOMMUNICATION WORLD

3.1 LEGAL STATUS OF TELECOMMUNICATION

Four words sum up today's telecommunication market: private, competitive, mobile and global. The pace at which these trends are taking shape is remarkable. In fact, events are moving so quickly, that calls to reform the sector are missing the point. It has already happened. Most countries have initiated a reform process. Still, much fine-tuning remains to be done.

At the beginning of 2002, more than half the countries in the world have fully or partially privatized their incumbent telecommunication operator. Even in countries that have not yet done so, the private sector accounts for an ever greater share of the market. One notable trend is the rise of new private mobile operators, created through licensing, not privatization. Countries with a privately-owned incumbent operator account for 85 per cent of the world market by revenue. Those with fully state-owned operators, in mobile as well as fixed-lines, account for just two per cent (Figure 3.1).

Competition has spread widely, although a majority of countries still retain monopolies in fixed-line services, such as local and long distance calls. However, an overwhelming majority of countries now allows competition in the mobile and Internet market segments, which increasingly substitute for fixed-line voice (Figure 3.2). The provision of mobile service by an operator other than the incumbent introduces competition, and a growing number of developing countries now have more mobile than fixed subscribers. In countries that do not legally allow multiple service operators for international calling, an indirect level of competition exists through call-back, calling cards, cellular roaming and voice over the Internet Protocol (VoIP).

Telecommunication services are increasingly mobile, that is, delivered by the medium of radio waves rather than over a fixed-line network. Until about 50 years ago, the majority of international telephone calls were delivered over short-wave radio, and people tuned

into the radio for the latest news. Looking ahead into the future, the majority of international calls may be made from, and delivered to, handheld devices. Those same devices will receive updates from websites and real-time video streams from multiple sources around the globe. Radio is now being increasingly used to provide access networks, while wired networks provide the long-distance component.

Globalization has affected the telecommunication sector in three ways. First, global operations. Many major telecommunication operators have holdings in operators in other nations. It is increasingly rare to find a country that does not have a strategic foreign investor. Second, regional and multilateral agreements. Governments have increasingly chosen to enshrine their market liberalizing moves in treaty-level commitments, notably in the context of the WTO's basic telecommunications agreement. Third, new global services. These include mobile cellular roaming, global satellite systems, calling cards and others that allow customers to continue to use a service while away from their home country. Future third-generation (3G) mobile services have been designed from the start to be global, rather than national, in scope.

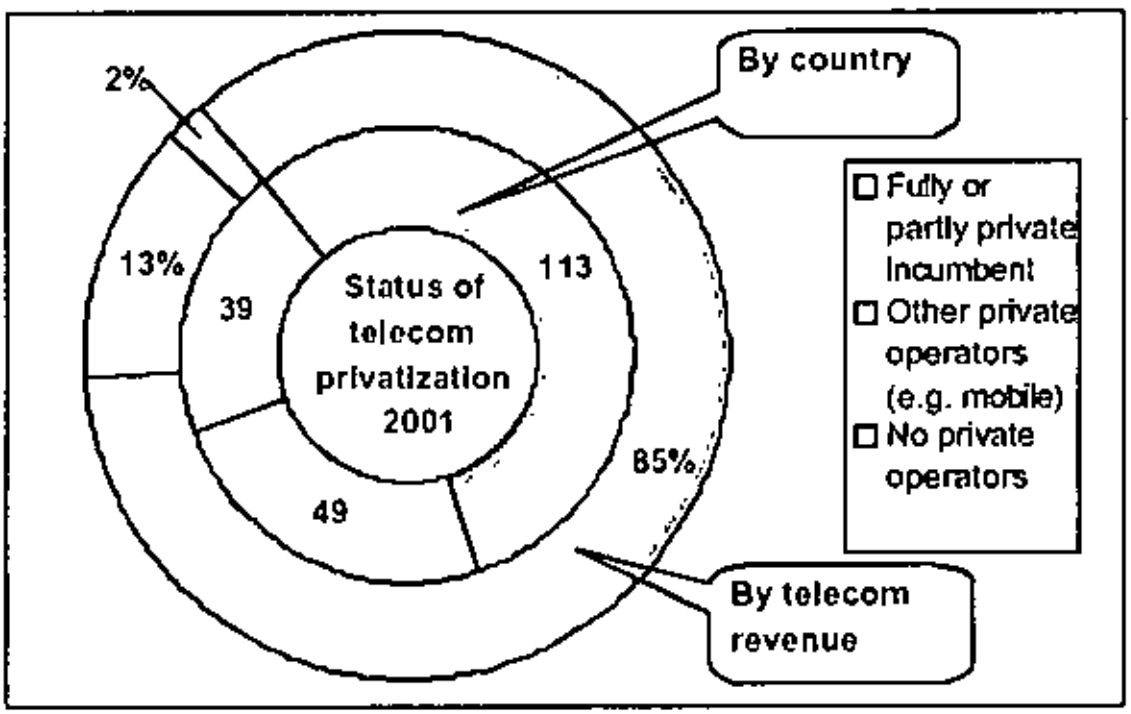


Figure 3.1: Status of telecom privatization, by country and by share of global revenue

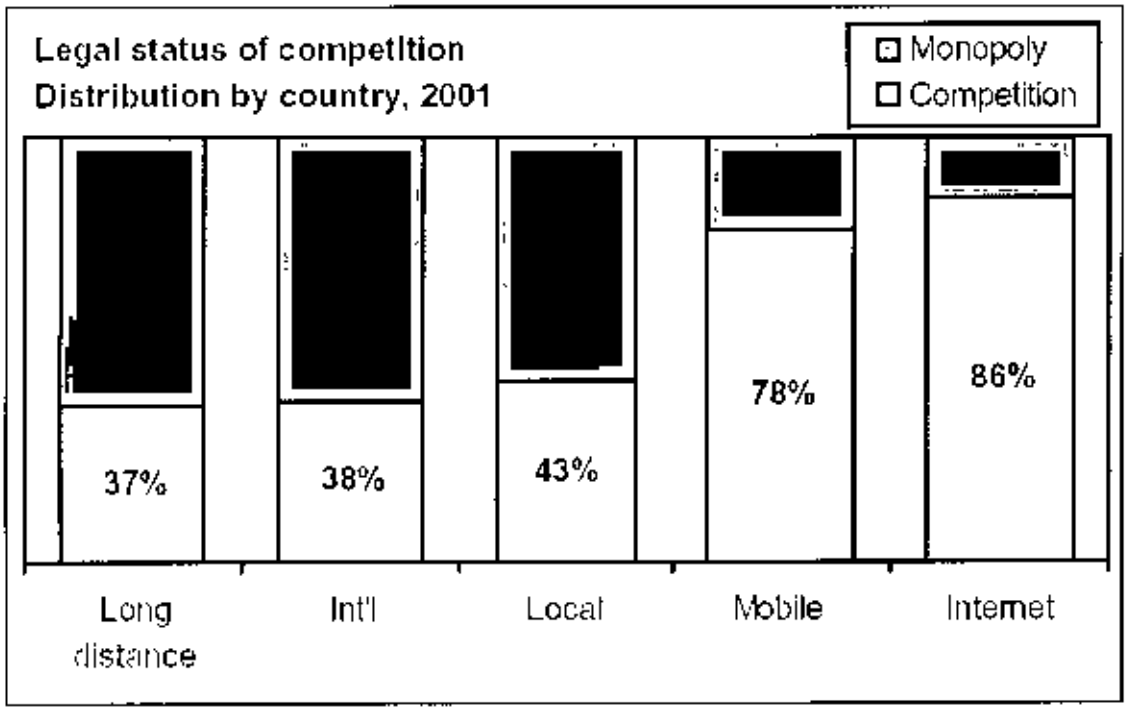


Figure 3.2: Legal status of telecommunication competition, by country

3.2 AS ONE GAP CLOSES, ANOTHER OPENS UP

Much policy attention has been focused on the gap between developed and developing nations in terms of their access to information and communication technologies (ICTs); the so-called 'digital divide'. Recent initiatives have included the G8 Digital Opportunity Task Force (DOT Force), the United Nations ICT Task Force and the UNDP/Markle Foundation Digital Opportunities Initiative. But how do you measure the gap? Has it grown or narrowed over the last decade? Certainly in terms of basic telephone access, there are encouraging signs of a reduction in disparity.

In 1991, *total* telephone penetration (fixed-line plus mobile telephones) stood at 49.0 in developed nations, 3.3 in emerging nations and just 0.3 in the least developed countries (LDCs). A decade later, the corresponding levels stood at 121.1, 18.7 and 1.1. The ratio between developed and emerging nations dropped by more than half from 15:1 to 6:1. However, the gap between emerging nations and LDCs grew, from 12:1 to 17:1 (Figure 3.3). In fact, emerging nations, like China and Viet Nam, have done particularly well.

The new digital divide is expressed in the growing gap between these countries and the LDCs, especially in terms of access to Internet (Figure 3.4). However, one bright note is that the growth rate in LDCs' telephone networks has been accelerating and was the highest of all three groups of countries in 2001.

At last some overused clichés can now be put to rest. It was often said, for example, that "Tokyo has more telephones than the whole of the African continent." While this may have been true some 20 years ago, when the Maitland Commission drafted its report, today there are more than twice as many main telephone lines in Africa as in Tokyo. Similarly, the story which ITU reported in the 1997 Report, that there were "more mobile phones in Bangkok than in Africa," proved to be short lived. Africa now has more than 20 million mobile users, more than the total population of Bangkok. By the end of 2001, twenty-eight African nations—or over half the region's countries—had more mobile than fixed subscribers; a higher percentage than any other continent.

But new gaps are emerging, notably in terms of access to the Internet. These are harder to measure because they are not just about access, but also about the *quality* of the experience. For instance, international Internet bandwidth (or IP connectivity) is a good measure of users' experience with the Internet. The greater the bandwidth, the quicker the response times. The 400'000 citizens of Luxembourg between them share more international Internet bandwidth than Africa's 760 million citizens. Thus, even though Africa has some five million Internet users, many of them may be restricted to using just e-mail and may not be able to browse the World Wide Web. The reality is that highspeed Internet access, which has become fashionable in many parts of the developed world, such as the Republic of Korea and North America, is still a long way off in most developing countries. The new digital divide is about quality, not just quantity.

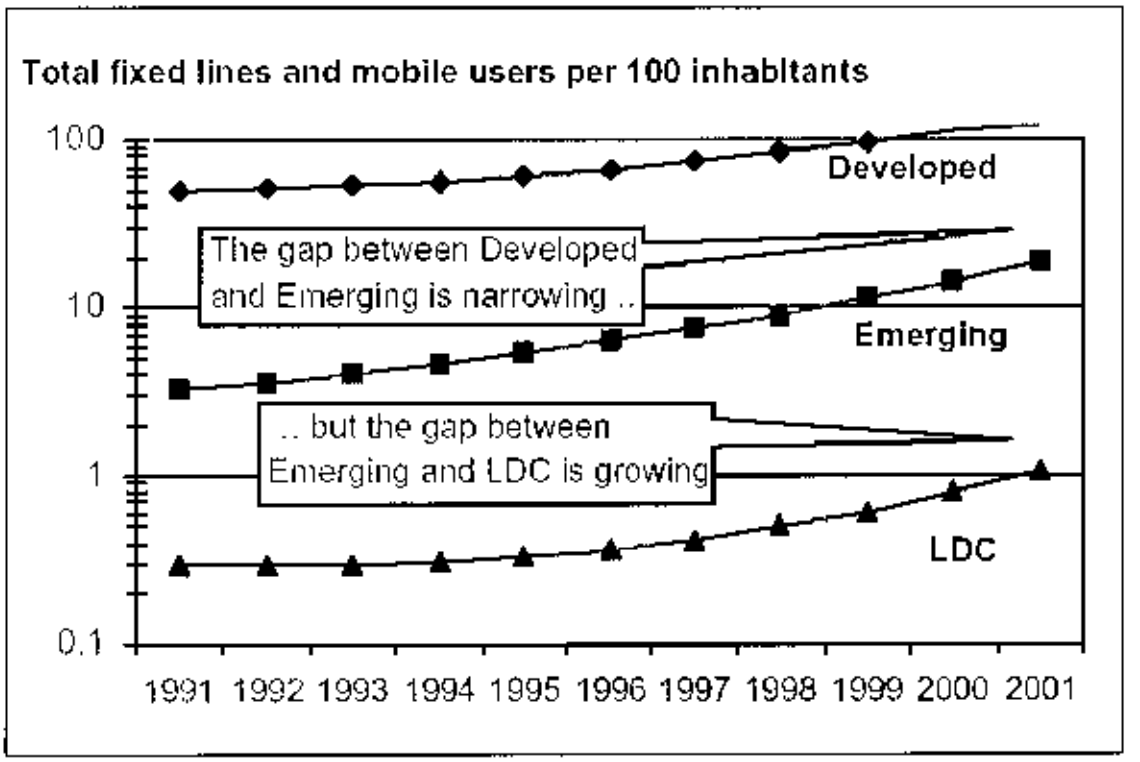


Figure 3.3: The telephone gap shrinks

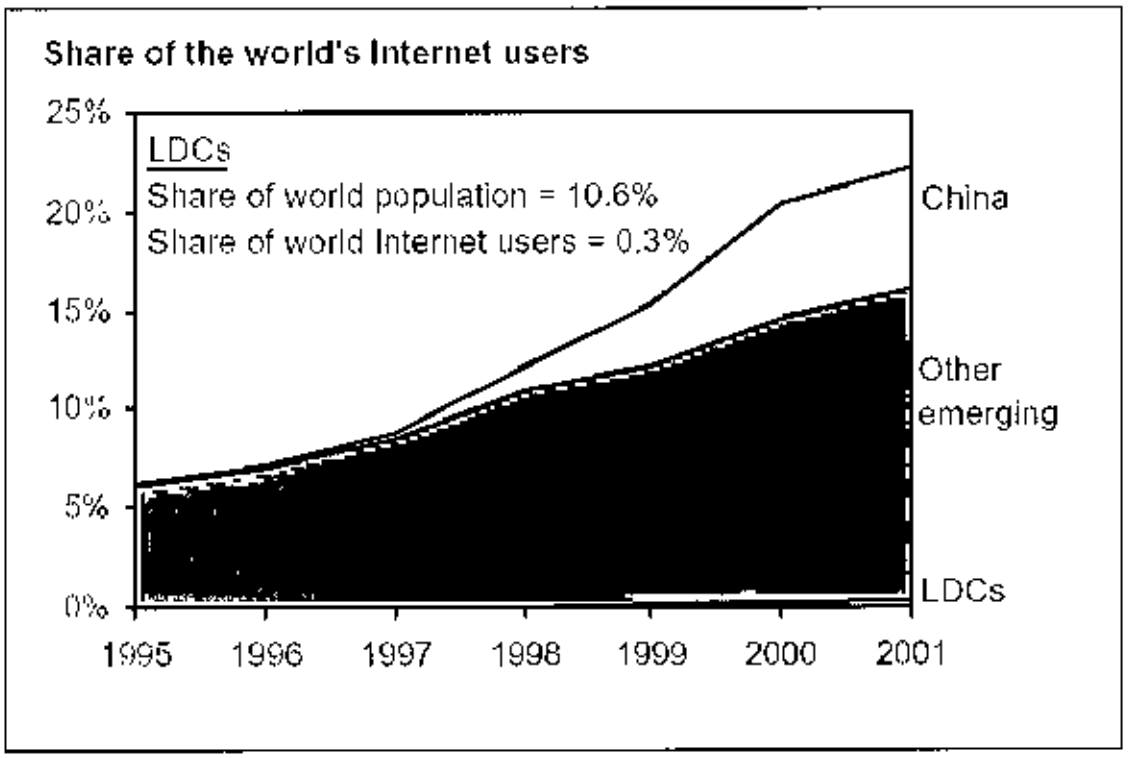


Figure 3.4: The Internet gap grows

Note: Developed refers to the European Union, Iceland, Norway, Switzerland, Canada, United States, Japan, Australia, New Zealand, Hong Kong SAR, the Republic of Korea, Singapore and Taiwan-China. LDC refers to the 49 least developed countries. Emerging refers to all other countries.

3.3 THE MISSING LINK: IT'S MOBILE COMMUNICATIONS

With just short of one billion subscribers at the end of 2001, mobile is poised to take over from fixed-lines in the early part of 2002 as the network with the most users (Figure 3.5). It may be hard to believe, but less than one per cent of the world's inhabitants had access to a mobile phone in 1991 and only one third of countries had a cellular network. By the end of 2001, over 90 per cent of countries had a mobile network, almost one in every six of the world's inhabitants had a mobile phone and almost 100 countries had more mobile than fixed telephone subscribers. Mobile has raised access to communications to new levels. In developing nations, and particularly in the LDCs, mobile is increasing telephone access in a surprisingly quick time. In developed countries, mobile penetration rates continually surpass industry forecasts.

Uganda epitomizes the revolution that mobile has created among the LDCs. This East African country licensed a second nationwide operator (MTN Uganda) in 1998. MTN focused on prepaid mobile, with great success. Wireless networks are quick to install and while most Ugandans would not meet the financial criteria for subscription-based service, prepaid brought communication to the masses. The results were dramatic. Uganda's overall telephone density quadrupled between 1998 and 2001, rising from 0.41 telephone subscribers per 100 people to 1.72. In a little over one year, MTN emerged as the nation's largest operator. Since then, it has not rested on its laurels. It has been aggressive in expanding the network into what Ugandans refer to as "up-country," that is the rural part of the nation. Over 50 per cent of the population is now covered by mobile cellular and some 80 towns have service. The Uganda recipe is being replicated successfully in a growing number of LDCs.

But what about the developed world? Anyone looking to see what the future of the mobile society might look like needs to look no further than Finland, the world trendsetter in all things mobile. It was the first country to launch a digital cellular network, the second (after Cambodia), where the number of mobile subscriptions surpassed fixed, and the first to license third-generation mobile networks. Today, some 90 per cent of all

adults have a mobile phone in Finland. The mobile industry dominates, accounting for around 60 per cent of industry telephone revenues.

But perhaps more interesting is how mobiles are becoming a substitute to fixed-line telephones, even in a developed country such as Finland. The number of Finnish households with a fixed-line telephone has been falling since 1990, when it peaked at 94 per cent. Some 19 per cent of Finnish households now have a mobile telephone but no fixed-line telephone (only two per cent have no phone at all). Those with a preference for a mobile phone as a substitute for a fixed-line telephone fall into four categories: students, the unemployed, singleperson households or those frequently moving residence. With the possible exception of the last category, all these are at the low end of the income scale. For them, mobile phones, not fixed-lines, are now providing universal service. The example of Finland has serious implications for the way universal access to telecommunications sector as a whole is being regulated. It shows that policy-makers and regulators must overcome their fixation with fixedlines and look to mobile as a way of achieving social policy goals.

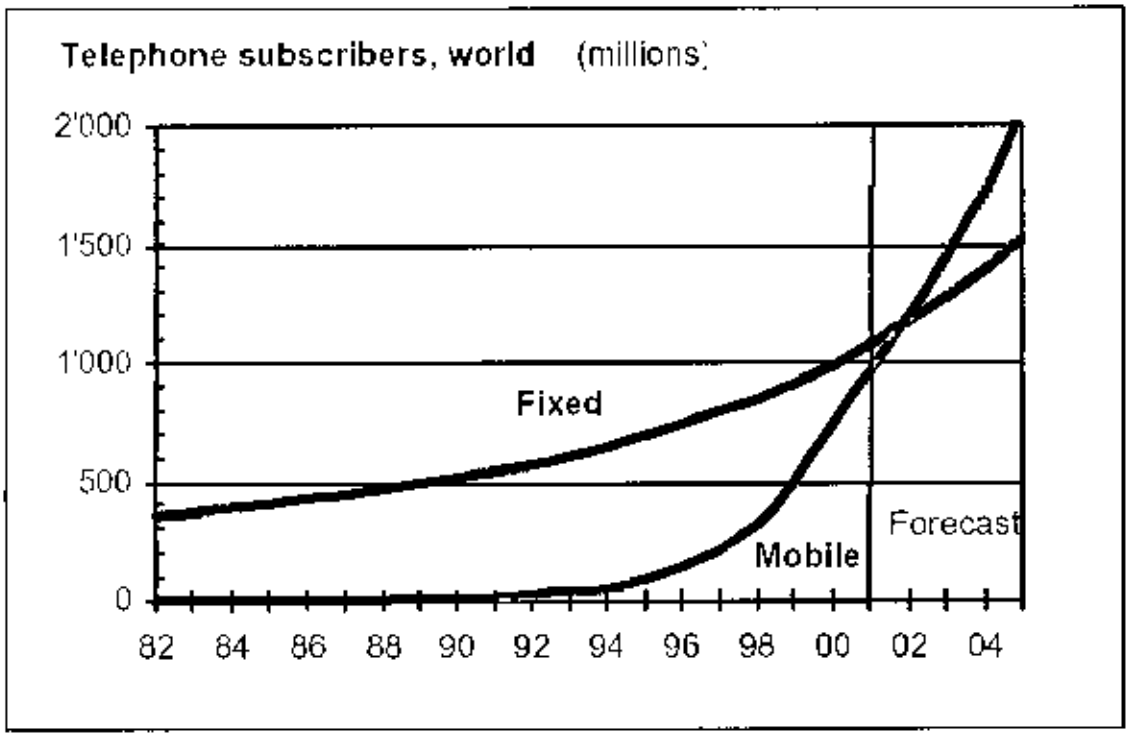


Figure 3.5: Mobile and fixed telephone subscribers worldwide, 1982 - 2005

3.4 LDCS LEAPING AHEAD WITH MOBILE

The combination of mobile communications, competition and prepaid cards has been a blessing for the world's LDCs, many of which are experiencing unprecedented growth in telephone access. The main reasons are:

• Competition stimulates rapid growth. There is a direct link between the number of operators and network growth. Almost all LDCs that have managed to expand their mobile networks rapidly have done so with multiple operators.

• Mobile penetration does not appear to be heavily dependent on income in the early stages of development. Instead there is a strong desire for communications and perhaps also significant hidden wealth that does not show up in official statistics. Prepaid cards help those that would not qualify for a post-paid subscription. Thus LDCs do not need to be mired in telecommunication poverty.

• Mobile is helping to eliminate waiting lists. For the fixed-line network, potential users have to wait for the incumbent to lay copper in the ground to reach them. With a mobile network, consumers can just buy a mobile phone and start using it as soon as the first base stations are in place. The investment burden shifts from the state to the consumer.

These lessons are being widely applied. By the end of 2001, twenty-two out of 49 LDCs had more mobile than fixed subscribers. In many cases, the transition took only a couple years. There is no longer any reason why an LDC, with sufficient political will, cannot replicate this.

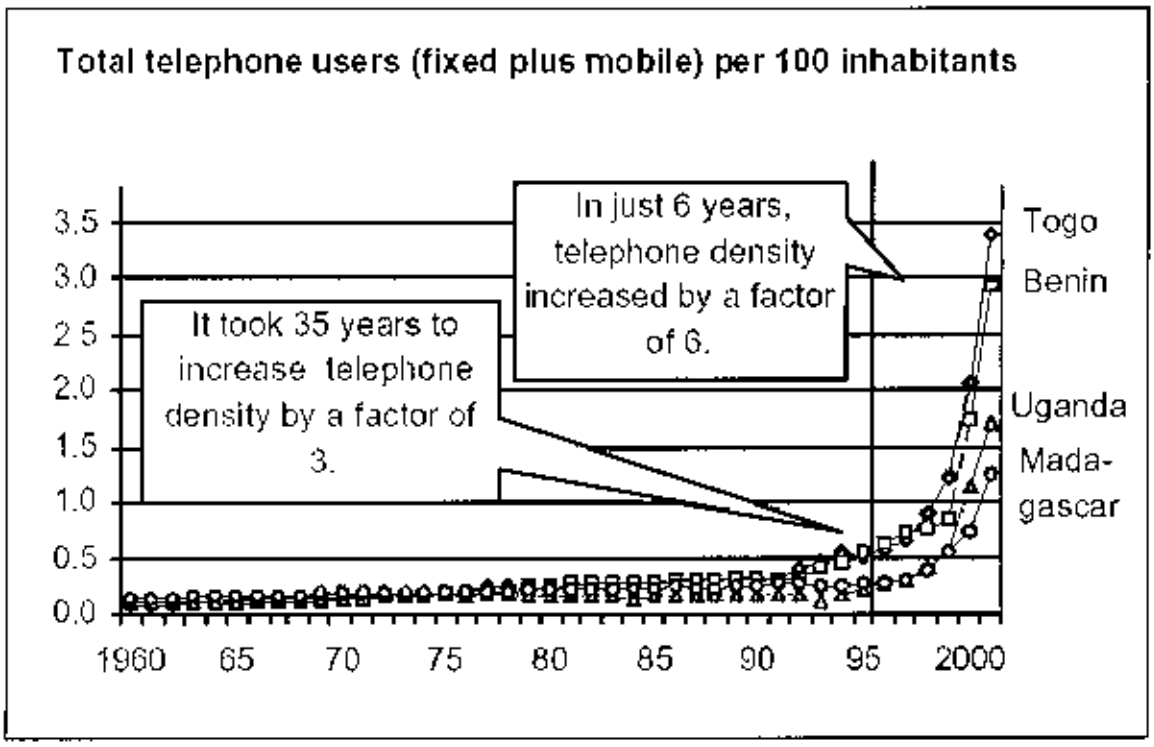


Figure 3.6: Network doublers

3.5 NUMBER ONE IN MOBILE

After several years of being top dog in mobile communications, Finland recently lost its title, rather surprisingly, to the Grand Duchy of Luxembourg. By December 2001, Luxembourg had almost cracked the 100 per cent mobile penetration level, meaning it will soon have more mobile phones than citizens. Part of this is explained by the estimated 70'000 *'frontaliers'* that commute to work in Luxembourg from bordering countries. Mobile has grown rapidly in Luxembourg since it introduced competition in May 1998, the last European Union member to do so. At the end of 2001, Finland only ranked ninth in mobile penetration. Why the slide? The answer is prepaid. Finland has very few prepaid mobile subscribers, only around two per cent of the total in 2000. If prepaid subscriptions were stripped out, Finland would be ranked second. Prepaid subscriptions can distort mobile cellular numbers. That is because some operators continue to count prepaid subscribers who have not used the network for months. Users may also have multiple accounts, allowing them to take advantage of each operator's special offers.

Ultimately, it is only a matter of pride as to who is number one. However mobile penetration rates are measured, the current level of mobile penetration in developed countries would have been unimaginable a few years ago. If we consider that these are *per capita* figures, including children, then we can safely assume that in most developed markets, the adult segment is reaching saturation in terms of mobile phones. That also provides an indication of where penetration is heading in the developing world. But it is difficult to determine what happens next, after saturation. Will subscriber growth continue? One scenario is that, with the advent of the mobile Internet, a typical user may purchase subscriptions for several different devices, including for their car and their home computer, as well as for their mobile phone. Another scenario is that users may purchase several different mobile phones in the same way that today they might buy several different watches or radios, to match their lifestyle. One thing is certain: mobile equipment manufacturers are busy dreaming up new ways to sell us more mobile phones.

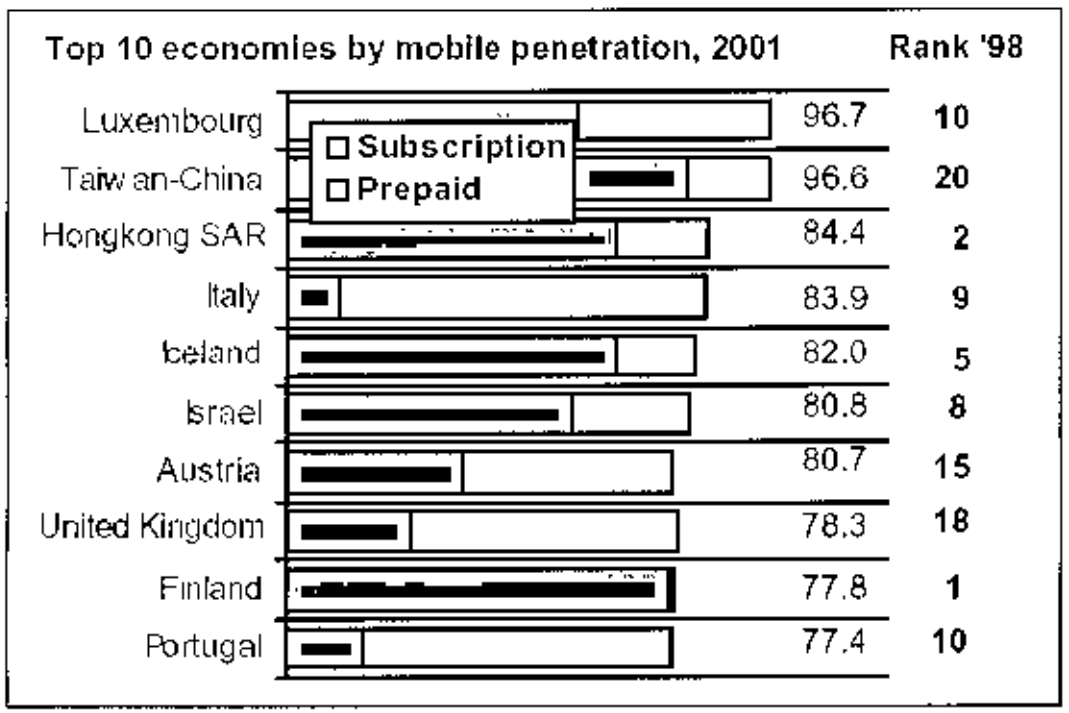


Figure 3.7: Top mobile markets

3.6 THE NEW MISSING LINK: THE DIGITAL DIVIDE

The idea that access to information opens doors to wider economic and social development opportunities is not new. In 1984, the Commission for Worldwide Telecommunications Development, headed by Sir Donald Maitland, published the *Missing Link* Report. The Report pointed to the fact that the lack of telecommunication infrastructure in developing countries impedes economic growth. But its scope was limited in that it was mainly concerned with access to telephones rather than today's wider concept of information and communications technologies (ICTs).

In 1996, Dr Pekka Tarjanne, then Secretary-General of ITU, initiated a United Nations interagency project for the "Right to Communicate," aimed at providing access to basic ICTs for all. The motivation behind the project was to help reduce information poverty for developing countries. This goal is now at the heart of plans to hold a World Summit on the Information Society (WSIS), in Geneva in 2003 and Tunis in 2005, to focus global attention on this issue.

Today, the 'missing link' is referred to as the 'digital divide'. The term is commonly taken to apply to differences in access to the Internet, which is much less evenly distributed than telephone access (Figure 3.8). The divide exists between countries at different levels of development, and within a country, for instance between urban and rural areas, between men and women, between the educated and the unschooled or between the young and the elderly. It is a result of socio-economic disparities and thus little different from other income, health and education divides. The root cause of these disparities is poverty. The less money a country's citizens have, the less likely they are to use ICTs. (Figure 3.9).

But equating the digital divide to Internet access alone is too narrow a definition. The Internet is of little use to people who are not able to exploit electronic access to information to improve their lives. Access to information is a measure of power in society, and thus the digital divide reflects how power is distributed. There is a shortage of conclusive research and examples of how ICT's can transform the development process.

To be used more widely, ICTs have to be relevant, easy-to-use and addictive. Training and locally relevant content will therefore be key factors in bridging the divide.

There is evidence that the divide in access to ICTs is shrinking. Developing nations have raised their share of the world's Internet users from two per cent in 1991 to 23 per cent of the half a billion or so users around the world in 2001. But the nature of the divide is shifting: from basic to advanced communications, and from quantity to quality (see Box 1). The developed world has launched a number of initiatives to study the problem. Thus far, there has been much talk and hand-wringing but little action. Effective solutions will require a triumvirate pact between governments, development agencies and the private sector. The developed world can do much to help, for example by funding innovative grass-roots projects that harness ICTs to improve the livelihoods of local communities, incubating developing nation dot.coms and facilitating international connectivity to the Internet, especially among the least developed countries. Developing country governments must also play their part. This includes adopting appropriate national ICT strategies—based around private sector participation, market liberalization and independent regulation—and developing ambitious universal access policies.

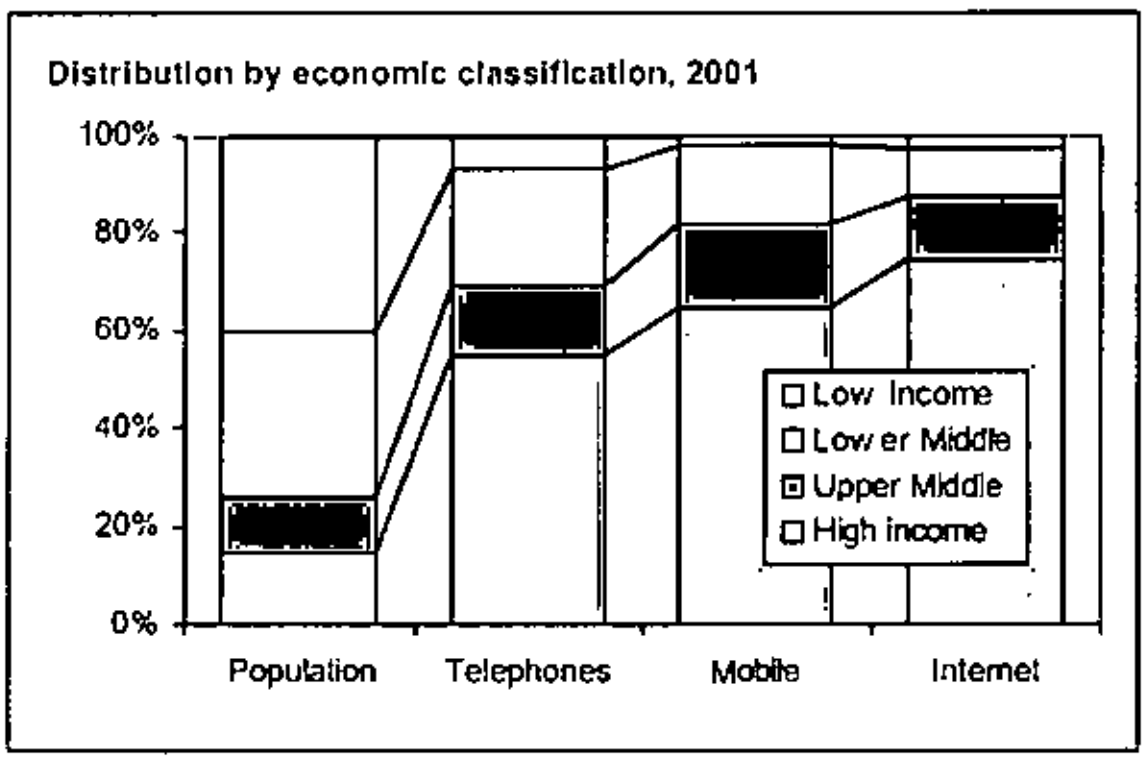


Figure 3.8: The digital divide is an economic divide

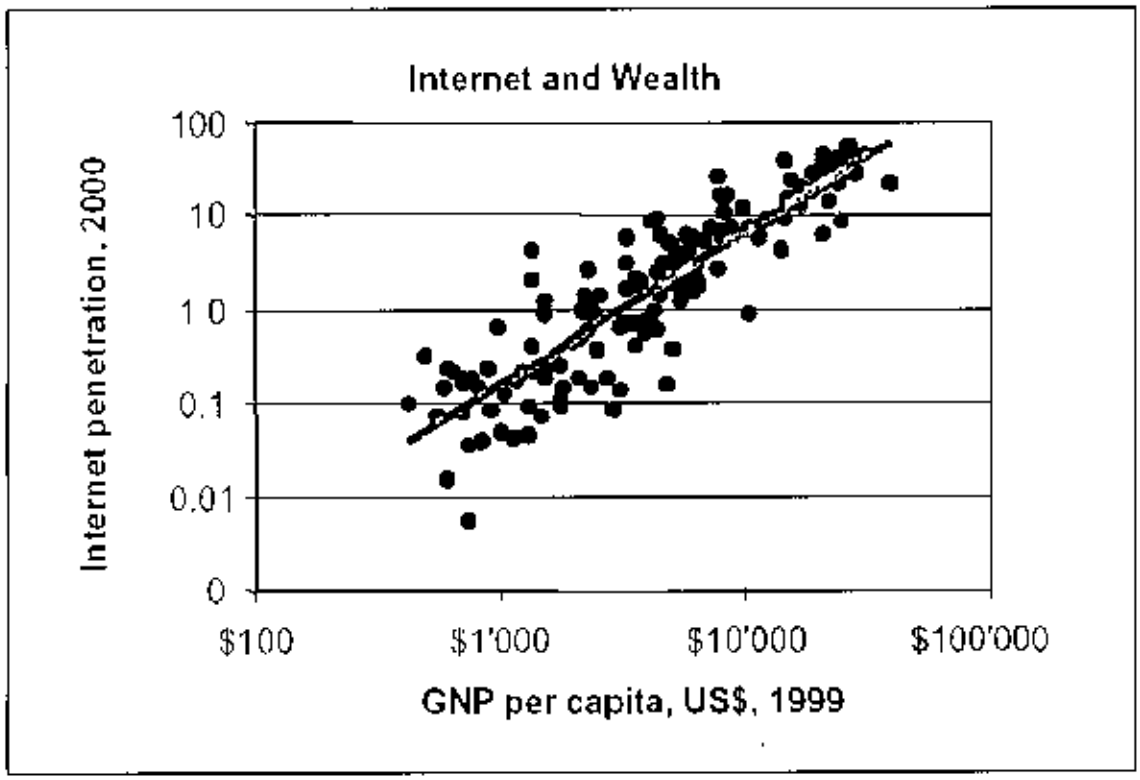


Figure 3.9: Relationship between Internet (users per 100 inhabitants) and wealth (GNP per capita)

3.7 TELECOMS REFORM

The year 2002 marks the twentieth anniversary of the first steps taken towards telecom sector reform, which can be dated quite precisely to 8 January, 1982: This was when AT&T agreed to the break-up of the Bell system monopoly. Since then, most countries around the world have embarked upon a process of reform, albeit using very different recipes. Once started, reform tends to be irreversible. And most countries have followed recipes that include three basic ingredients: private sector participation, market competition and creation of an independent regulatory body.

The acceleration in growth rates in the telecommunications sector in the final years of the twentieth century is a vindication that the basic recipe for reform was right. But what made the difference between fast and super-fast growth? One factor seems to have been a commitment to move swiftly, and not to miss out important steps. Both Chile and

Argentina privatized their telecommunication operators around the same time. But whereas Chile moved ahead with competition, Argentina hesitated, allowing the incumbent a seven-year exclusivity period, later extended by three years. As a result, Chile's fixed-line teledensity, which stood at only half that of Argentina's at the time of privatization, had overtaken it by the time Argentina first introduced competition (Figure 3.10).

A similar pattern emerges in mobile communications. Both Hong Kong SAR and Singapore seem ideally suited to this service, having young, urban populations who spend their day on the move. But whereas Hong Kong introduced competition at an early stage, with a duopoly in 1988 and full competition in 1993, Singapore hesitated, delaying competition until April 1997. Consequently, Hong Kong gained a lead over its regional neighbour of around 18 months. After it had introduced competition, Singapore subsequently reduced this gap, but has not eliminated it (Figure 3.11).

How can success and failure be measured, when all have succeeded, to a greater or lesser degree? One way is to look at the change in rankings over time. Table 1 shows those countries that experienced the greatest change in ranking (up or down) for total teledensity (the sum of fixedlines and mobile users per 100 inhabitants) between 1990 and 2000. Among those that succeeded in improving their status during the decade are many countries that embarked on a process of reform early in the decade, like Chile, Hungary or the Philippines, as well as several that started more recently, like Botswana or Morocco. The stand-out cases are China and Viet Nam, which both followed a strategy of encouraging competition between different government ministries as well as private sector investment in their mobile sectors. When a government is truly committed to telecommunications investment, it can make a big difference relatively quickly.

Among those that did not fare so well during the decade are several countries that have suffered from civil war and many that have retained state-controlled incumbents. But why does Canada feature in the list? Despite doing most things right from the policy

viewpoint. Canadians, like their southern neighbours, never really seemed to embrace mobile communications as willingly as Europeans. But there's still time...

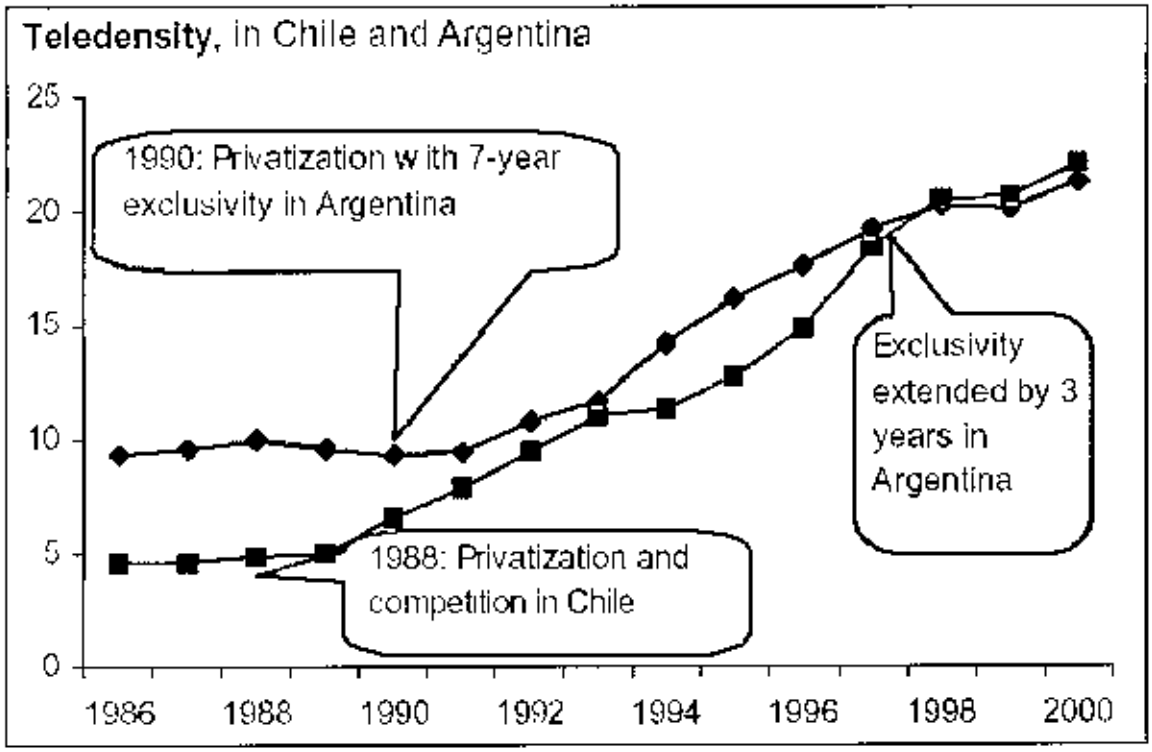


Figure 3.10: Growth in fixed-line teledensity, Chile and Argentina, 1986-2000

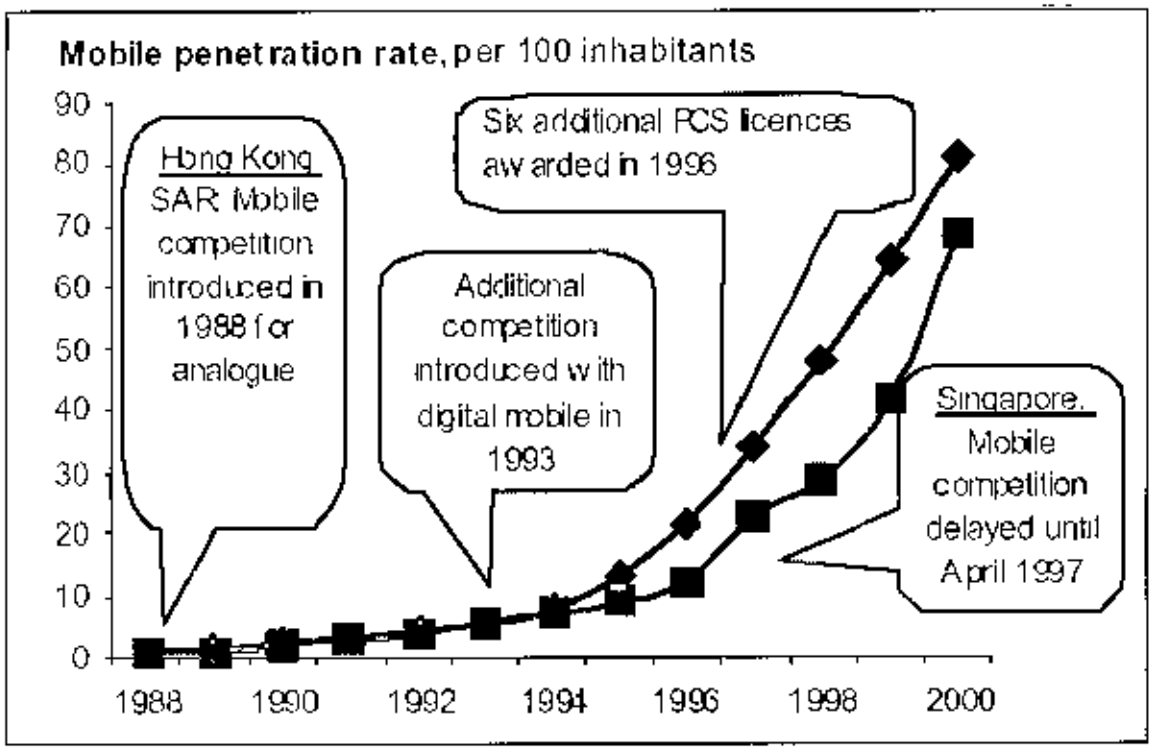


Figure 3.11: Growth in mobile teledensity, Hong Kong SAR and Singapore, 1988-2000

Table 3.1: Winners and losers

Economies with rising rank

Country	2000	1990	Rank 2000	Rank 1990	Change
China	17.8	0.6	95	159	+64
Viet Nam	4.2	0.1	141	189	+48
Botswana	21.6	2.1	91	129	+38
El Salvador	21.8	2.4	90	125	+35
Jamaica	34.1	4.5	71	106	+35
Hungary	67.4	9.6	43	78	+35
Mauritius	38.6	5.4	67	100	+33
Chile	44.4	6.7	61	93	+32
Philippines	12.4	1.0	112	143	+31
Morocco	13.3	1.6	107	136	+29
Paraguay	20.7	2.7	92	120	+28
Cambodia	1.2	0.0	167	194	+27
Cape Verde	17.2	2.4	98	125	27
Taiwan-China	137.0	31.4	5	31	+26
Poland	45.6	8.6	60	85	+25

Economies with falling rank

Country	2000	1990	Rank 2000	Rank 1990	Change
Armenia	15.6	15.7	102	60	-42
Iraq	2.9	3.9	149	109	-40
Tajikistan	3.6	4.5	143	105	-38
Uzbekistan	6.9	6.9	128	92	-36
Kyrgyzstan	7.9	7.2	125	90	-35
Angola	0.7	0.8	177	146	-31
Liberia	0.2	0.4	190	162	-28
DPR Korea	4.6	3.8	138	111	-27
Canada	96.1	58.6	33	6	-27
Turkmenistan	8.4	6.0	123	97	-26
Cuba	4.4	3.1	140	115	-25
Moldova	16.5	10.6	99	74	-25
Kazakhstan	12.5	8.0	111	87	-24
Comoros	1.0	0.8	171	149	-22
Ukraine	22.7	13.6	87	66	-21

3.8 REINVENTING TELECOMS

The telecommunication industry has undergone a major transformation over the last two decades. Convergence has pushed traditional telecommunication operators into new areas such as Internet and broadcasting. New technologies, such as mobile communications, and service innovations, such as prepaid cards, have changed the economics of network roll-out, especially in developing countries. The new telecom players are global in nature, with interests that cut across different sectors. The industry in 2000 was worth almost a trillion US dollars in terms of service revenues, and the top ten operators alone generated profits of almost US$ 50 billion. So why the pessimism?

During calendar year 2001, more than 470'000 job losses were announced. Share prices plummeted and several bold ventures—to surround the planet with satellites (Iridium) or with fibre optic cable (Global Crossing)—ended in bankruptcy. Internet, the mere mention of which was sufficient to create a scramble for share options in the 1990s, became a dirty word in the new century as dot.com turned to dot.bomb. What went wrong?

As ever, it pays to take a historical perspective. For most of the period since the Second World War, the industry has bumbled along with comfortable network growth rates of between five and seven per cent per year. But things changed around the mid-1990s when growth rates started to go up and up, peaking at a heady 28 per cent in 2000. Underlying these statistics is a period of high and sustained investment. Much money was spent in acquiring shares in telecommunication companies (e.g., through privatizations, which raised more than US$ 100 million in the last years of the twentieth century) and acquiring licences to provide services (which cost approximately the same sum in the first years of the twenty-first century). But the main investment was in creating new networks and extending old ones. In 2000, more than US$ 200 billion was invested, just by traditional telecommunication operators. This is almost twice the level of a decade earlier.

Given that a user's capacity to make and receive telephone calls or browse the Internet is

finite, and that competition has succeeded in doing its job of reducing prices, and thereby profit margins, something had to give. What finally did break was investor confidence. It is now much harder to raise venture capital to build new networks, at least in the already wellsupplied countries of the developed world. Only in the emerging nations, where consumers' appetite is still far from being satisfied, do speculative investments still seem a good bet.

What happened in the late 1990s is the sort of radical shift that usually only happens every fifty years or so. Economists call it a "kondratieff long wave"; journalists call it a "feeding frenzy". It is generally caused by the confluence of rapid technological change with a shift in market expectations, in this particular case associated with mobile overtaking fixed-line networks, and with data overtaking voice. Add to this rich mix the fact that the process of sector reform, begun in the 1980s, was finally bearing fruit, and the results are evident. We may not see its like again. But it was fun while it lasted.

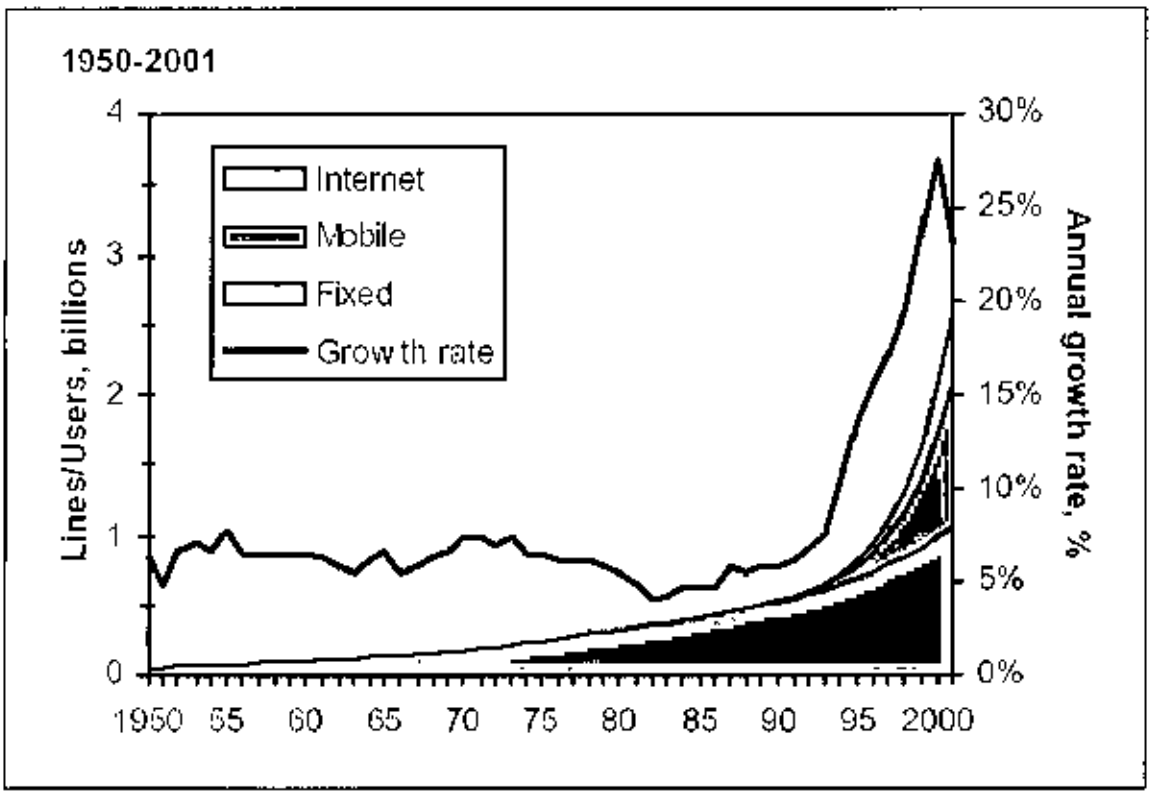


Figure 3.12: Fixed-lines, mobile phones & Internet users (in billions), and annual growth

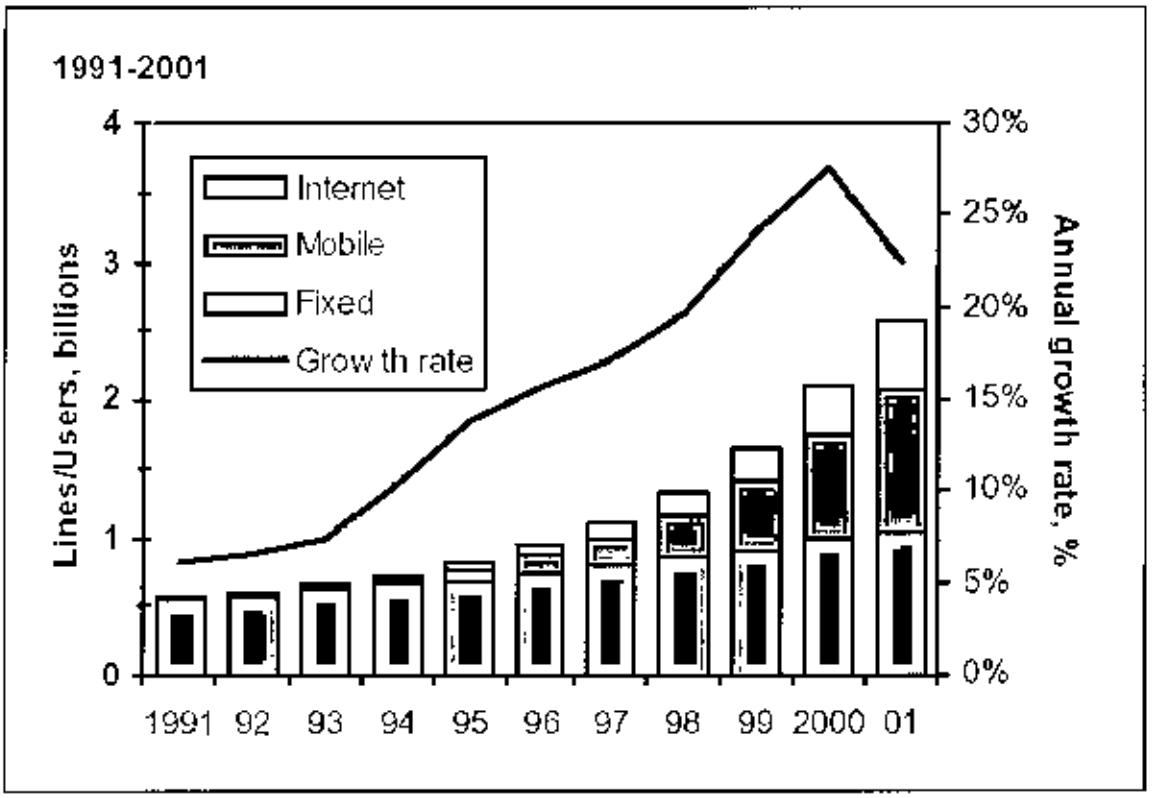


Figure 3.13: Fixed-lines, mobile phones and Internet users (in billions), and annual growth

3.9 REINVENTING TARGETS

The Maitland Report ended with a plea that all of humanity be brought into the reach of a telephone by the end of the century. That rather abstract target was always difficult to measure. It has also become a bit outdated, now that we have mobile phones and the Internet.

The beginning of a new century is an opportune time to reinvent measurable targets for ICT access. It is important to distinguish between *Universal Service* and *Universal Access*. Universal Service refers to a high level of ICT penetration at the household level and is more suitable for high and upper middle income countries. Universal Access refers to a high level of ICT availability. This can be provided via homes, work, schools and public access locations and this measure is more appropriate for lower-middle and low income developing nations.

The Universal Service ICT targets include a mix of telephone lines, personal computers and Internet access, the common essentials for plugging into the online age. One problem with Universal ICT Service is that households should not be forced to adopt computers or the Internet if they do not want to. Nonetheless, if the benefits of ICTs were clearly understood, then it seems that a high percentage of homes would use them. Targets for Universal ICT Service are set at levels reached by high achievers. This includes a telephone penetration rate of above 90 and personal computer and Internet subscription rates at over 50, to be achieved by 2006. These may need to be re-examined in the future, particularly in light of broadband and mobile Internet access developments. Every country in the high and upper-middle income category should try to gather these statistics in order to gauge the level of ICT availability in their nations.

Table 3.2: Telecommunication targets to be achieved by 2006

High and upper middle economies	Household telephone penetration > 90 % Household PC Penetration > 50 % Household Internet Penetration > 50 %
Lower-middle & low income economies	Mobile population coverage > 90 %

Mobile is the largest telecommunication network in many countries, particularly lower income nations. It seems appropriate that it be included in universal access determination. Furthermore, mobile cellular has the added feature that accessibility to the network is easy to measure. It would be defined as the percentage of the population within the reach of a terrestrial mobile cellular signal, regardless of whether they are subscribers. This is the first comparable measure that allows tracking of the Maitland Report recommendation that all of humanity be brought into reach of a telephone. Most developed nations, and some developing ones, have mobile population coverage rates of close to 100 per cent. Considering the critical importance of telecommunications, governments should encourage their mobile operators to achieve a coverage rate of at least 90 per cent by 2006. All developing countries should strive to collect this key indicator of telecommunication accessibility.

CHAPTER 4

STATISTICAL ANALYSIS OF GROWTH PATTERN

4.1 INTRODUCTION OF FORECASTING

The growing competition, rapidity of change in circumstances and the trend towards automation demand that decisions in business are not based purely on guesses rather on a careful analysis of data concerning the future course of events. When estimates of future conditions are made on a systematic basis, the process is referred to as forecasting and the figure or statement obtained is known as a forecast. Forecasting is a service whose purpose is to offer the best available basis for management expectations of the future and to help management understand the implications for the firm's future of the alternative courses of action to them at present. In a world where the future is not known with certainty, virtually every business and economic decision rests upon a forecast of future condition. Forecasting aims at reducing the area of uncertainty that surrounds management decision making with respect to costs, profits, sales, production, pricing, capital investment and so on. If future were known with certainty, forecasting would be unnecessary. But uncertainty does exist, future outcomes are rarely assured and, therefore, organized system of forecasting is necessary.

4.1.1 Objectives of forecasting

It is obvious that forecasts intelligently used may serve the function of both lighthouse and compass. However, the object of business forecasting is to determine a curve or series of figures that will tell exactly what will happen, but it is to make analysis based on definite statistical data, which will enable an executive to take advantage of future conditions to a greater extent than he could do without them. In many respects the future tends to move like the past. This is a good thing, since without some element of continuity between past, present and future, there would be little possibility of successful prediction. But history is not likely to repeat itself and we would hardly expect economic conditions next year or over the next ten years to follow a clear-cut pattern. Yet,

frequently. past patterns prevail sufficiently to justify using the past as a basis for prediction of future.

4.1.2 Task of forecasting

Forecasting is concerned with two main tasks: first, the determination of the best basis available for the formation of intelligent managerial expectations and second, the handling of uncertainty about the future. so that the implications of decisions become explicit. The following are main functions of forecasting:

1. The creation of plans of action. It is impossible to evolve a worthwhile system of business, control without one acceptable system of forecasting.
2. The second general use of forecasting is to found in monitoring the continuing progress of plans based on forecasts. Forecasts serve the function of lighthouses to shipmasters at night, reference points for course and speed requiring action/ no action decisions.
3. The forecast provides a warning system of the critical factors to be monitored regularly because they might drastically affect the performance of the plan.

4.1.3 Type of forecasting

Not only is forecasting increasingly important, but quantitative models are playing an important role in forecasting function. There is clearly a steady increase in the use of quantitative forecasting models at many levels in industry and government. An conspicuous example is the widespread use of inventory control programs that include a forecasting subroutine.

There are numerous ways to classify forecasting models and the terminology varies with the classification. For example, one can refer to long-range, medium-range and short-range models. There are regression models, extrapolation models and conditional or precedent-based models as well as nearest-neighbor models. The major distinction we employ will be between quantitative and qualitative forecasting techniques.

4.1.4 Qualitative forecasting

A qualitative, naturalistic approach is used when observing and interpreting reality. For this reason, this style of is most often used when studying human relations. When measuring people's perceptions of a situation, such as an organization's culture, or in order to understand an organization's behavior, the qualitative approach will allow the researcher to guide the research toward unearthing the underlying causes of human behavior in addition to simply measuring the human behavior. This research method is used when the researchers need to / want to develop a theory that will explain what was experienced.

4.1.5 Quantitative forecasting

Quantitative forecasting projects history into the future. In other words, it tries to understand what happened in the past and use that to predict the future. Quantitative forecasting models possess two important and attractive features:

1. They are expressed in notation. Thus, they establish an unambiguous record of how the forecast is made.
2. With the use of spreadsheets and computers, quantitative models can be based on an amazing quantity of data.

So, the quantitative forecasting involves two steps:

1. Modeling the past and
2. Using the model to predict the future.

There are mainly two approaches of quantitative forecasting: casual forecasting models and time-series forecasting models. In our analysis we will discuss casual forecasting models with curve fitting of least squares fits.

4.2 CASUAL FORECASTING MODEL

In a casual forecasting model, the forecast for the quantity depends on another quantity or set of quantities. Let, y denote the true value for some variable of interest and let $\tilde{y}$ denote a prediction or forecast value for that variable. Then in a casual model,

$$\tilde{y} = f(x_1, x_2 \ldots\ldots\ldots x_n)$$

where f is a forecasting rule or function, and $x_1, x_2 \ldots\ldots\ldots x_n$ is a set of variables. In this representation, the x variables are often called independent variables, whereas $\tilde{y}$ is the dependent or response variable. The notion is that we know the independent variables and use them in the forecasting model to forecast the dependent variable. To use a casual forecasting model, two conditions are required:

1. There must be a relationship between values of the independent and dependent variables such that the former provides information about the later.
2. The values for the independent variables must be known and available to the forecaster at the time the forecast must be made.

One commonly used approach is creating a casual forecasting model is called curve fitting. The fundamental ideas of curve fitting are easily illustrated by a model in which one independent variable is used to predict the value of the dependent variable. In this way, the method of least squares is a formal procedure for curve fitting. It is a two step process:

1. To select a specific function form (e.g., a straight line or a quadratic curve)
2. Within the set of functions specified in step 1, to choose the specific function that minimizes the sum of the squared deviations between the data points and the function values.

4.3 PSTN SUBSCRIBERS GROWTH FORECASTING

Table 4.1: BTTB subscriber growth statement

Year	Capacity	Connection	Pending Demand
June, 1995	314,980	286,605	154,037
June, 1996	387,769	316,081	155,222
June, 1997	440,491	368,017	127,438
June, 1998	462,573	412,607	135,420
June, 1999	474,322	432,968	172,096
June, 2000	579,794	491,303	135,115
June, 2001	688,920	564,880	199,110
June, 2002	746,078	605,931	211,111
June, 2003	920,993	716,721	201,852
June, 2004	966,349	810,158	172,232
June, 2005	1,010,009	857,358	686,416

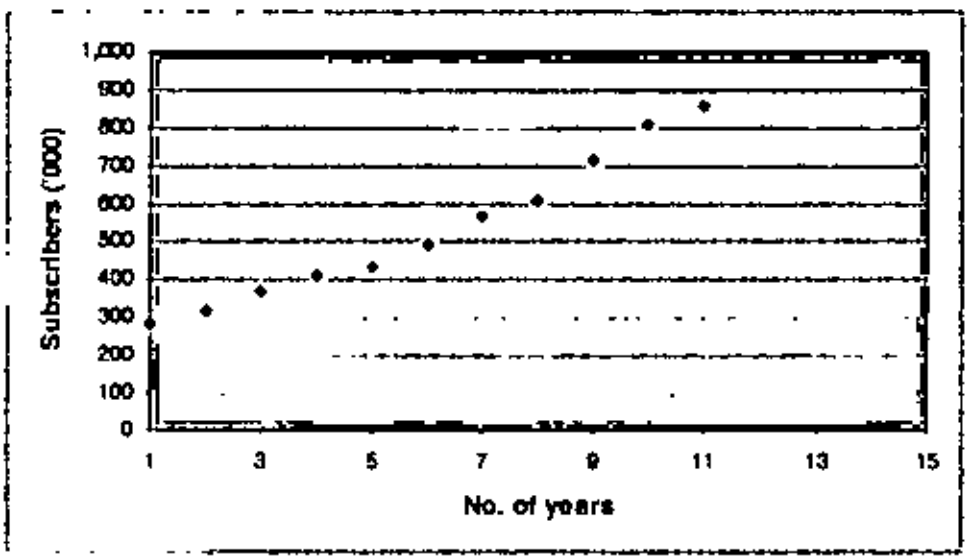


Figure 4.1: Fixed phone subscriber growth rate

Table 4.2: Yearly statement of BTTB connection

Year	Year serial no.	Connection ('000)
June, 1995	1	287
June, 1996	2	316
June, 1997	3	368
June, 1998	4	413
June, 1999	5	433
June, 2000	6	491
June, 2001	7	565
June, 2002	8	606
June, 2003	9	717
June, 2004	10	810
June, 2005	11	857

Table 4.3: Different values to calculate a & b

x	y	xy	x^2
1	287	287	1
2	316	632	4
3	368	1104	9
4	413	1650	16
5	433	2165	25
6	491	2948	36
7	565	3954	49
8	606	4847	64
9	717	6450	81
10	810	8102	100
11	857	9431	121
65	5576	41284	505

The equation is,

$y=a+bx$

$\sum y=an+b\sum x$ ----------(i)

Again, $xy=ax+bx^2$

$\sum xy=a\sum x+b\sum x^2$ --------(ii)

Solving (i) and (ii) for a and b,

$$a = \frac{\sum x \sum xy - \sum x^2 \sum y}{(\sum x)^2 - n\sum x^2}$$

$$b = \frac{\sum x \sum y - n\sum xy}{(\sum x)^2 - n\sum x^2}$$

So, the values are:

$$a = 99.6 \ \& \ b = 68.9$$

So, the equation is,

$$y = 99.6 + 68.9x$$

Using regression analysis to find out the value of a and b, we get,

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.984774412
R Square	0.969780642
Adjusted R Square	0.966422936
Standard Error	35.87661769
Observations	11

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	371752.3965	371752.4	288.8223	3.79755E-08
Residual	9	11584.18527	1287.132		
Total	10	383336.5818			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	184.162	23.20032485	7.937906	2.36E-05	131.6792191	236.6448
X Variable 1	58.13404545	3.42070128	16.99477	3.8E-08	50.39588157	65.87221

So, according to the regression analysis, the values are

$$a = 184.2 \ \& \ b = 58.1$$

And, the equation is,

$$y=184.2+58.1x$$

Using these two equations, the subscriber growth rate for the next five years are shown in the follow table:

Table 4.4: Comparison of calculated and estimated forecast

Year	Calculated forecasted subscribers (as per equation)	Estimated forecasted subscribers (as per regression analysis)	Difference
July '05 to June '06	926,400	881,400	45,000
July '06 to June '07	995,300	939,500	55,800
July '07 to June '08	1,064,200	997,600	66,600
July '08 to June '09	1,133,100	1,055,700	77,400
July '09 to June '10	1,202,000	1,113,800	88,200

4.4 MOBILE SUBSCRIBERS GROWTH FORECASTING

Table 4.5: Yearly subscriber statement for mobile operators

Operators	Type of subscribers	July '00 to June '01	July '01 to June '02	July '02 to June '03	July '03 to June '04	July '04 to June '05
Sheba	Prepaid	0	0	0	0	423,079
	Postpaid	27,460	35,000	49,710	58,893	62,135
	Total	**27,460**	**35,000**	**49,710**	**58,893**	**485,214**
GP	Prepaid	286,000	575,000	725,682	1,545,000	3,370,000
	Postpaid	185,000	199,000	213,386	286,634	329,000
	Total	**471,000**	**774,000**	**939,068**	**1,831,634**	**3,699,000**
PBTL	Prepaid	0	46,869	93,264	143,249	202,686
	Postpaid	54,399	56,754	73,721	67,628	123,052
	Total	**54,399**	**103,623**	**166,985**	**210,877**	**325,738**
TMIB	Prepaid	11,195	60,021	99,149	528,406	1,442,969
	Postpaid	69,171	101,244	110,000	151,750	85,383
	Total	**80,366**	**161,265**	**209,149**	**680,156**	**1,528,352**
Teletalk	Prepaid	0	0	0	0	69,642
	Postpaid	0	0	0	0	0
	Total	**0**	**0**	**0**	**0**	**69,642**
All Operators	Prepaid	297,195	681,890	918,095	2,216,655	5,508,376
	Postpaid	336,030	391,998	446,817	564,905	599,570
	Total	633,225	1,073,888	1,364,912	2,781,560	6,107,946

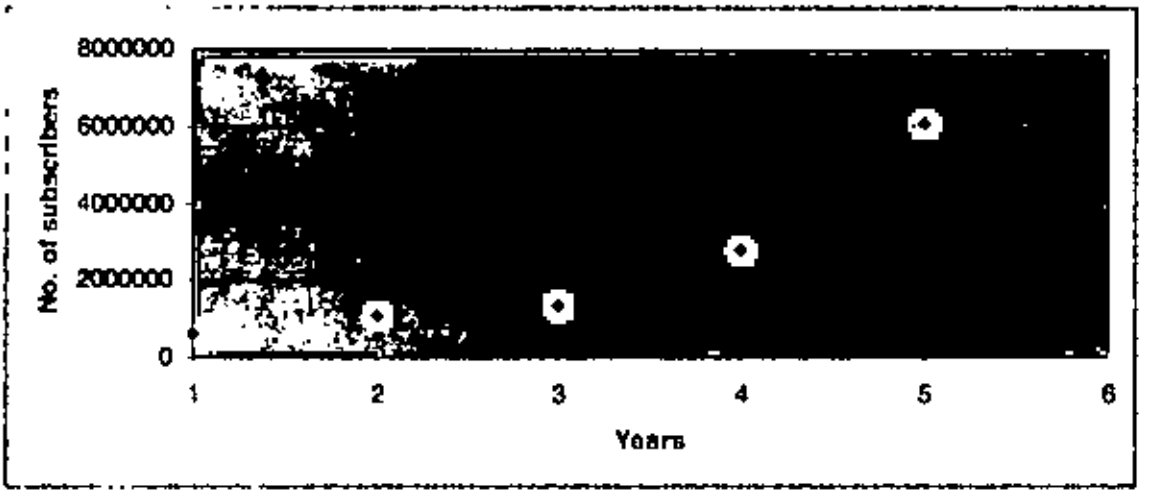


Figure 4.2: Mobile subscriber growth rate

Table 4.6: Yearly statement of mobile subscribers

Year	Year serial no.	Connection ('000)
June, 2001	1	633
June, 2002	2	1074
June, 2003	3	1365
June, 2004	4	2782
June, 2005	5	6108

The equation is,

$y=a+bx$

$\sum y=an+b\sum x$ ----------(iii)

Again, $xy=ax+bx^2$

$\sum xy=n\sum x+b\sum x^2$ --------(iv)

Solving (iii) and (iv) for a and b,

$$a = \frac{\sum x\sum xy - \sum x^2\sum y}{(\sum x)^2 - n\sum x^2}$$

$$b = \frac{\sum x\sum y - n\sum xy}{(\sum x)^2 - n\sum x^2}$$

Table 4.7: Different values to calculate a & b

x	y	xy	x^2
1	633	633	1
2	1,074	2148	4
3	1,365	4095	9
4	2,782	11126	16
5	6,108	30540	25
15	11962	48542	55

So, the values are:

$$a = -1404.8$$

$$b = 1265.7$$

And the equation is.

$$y = -1404.8+1265.7x$$

Using regression analysis to find out the value of a and b, we get,

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.898467
R Square	0.807243
Adjusted R Square	0.742991
Standard Error	1129.215
Observations	5

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	16020253	16020253	12.56367	0.038239818
Residual	3	3825376	1275125		
Total	4	19845630			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-1404 8	1184.33	-1.18618	0.320935	-5173.895169	2364.239
X Variable 1	1265 7	357.089	3.544527	0.03824	129.2948899	2402.128

So, the values are:

$$a = -1404.8$$

$$b = 1265.7$$

And, the equation is,

$$y = -1408.8+1265.7x$$

Using these two equations, the subscriber growth rate for the next five years are shown in the following table:

Table 4.8: Comparison of calculated and estimated forecast

Year	Calculated forecasted subscribers (as per equation)	Estimated forecasted subscribers (as per regression analysis)	Difference
July '05 to June '06	6189.4	6189.4	0
July '06 to June '07	7455.1	7455.1	0
July '07 to June '08	8720.8	8720.8	0
July '08 to June '09	9986.5	9986.5	0
July '09 to June '10	11252.2	11252.2	0

4.4.1 Prepaid mobile subscribers growth forecasting

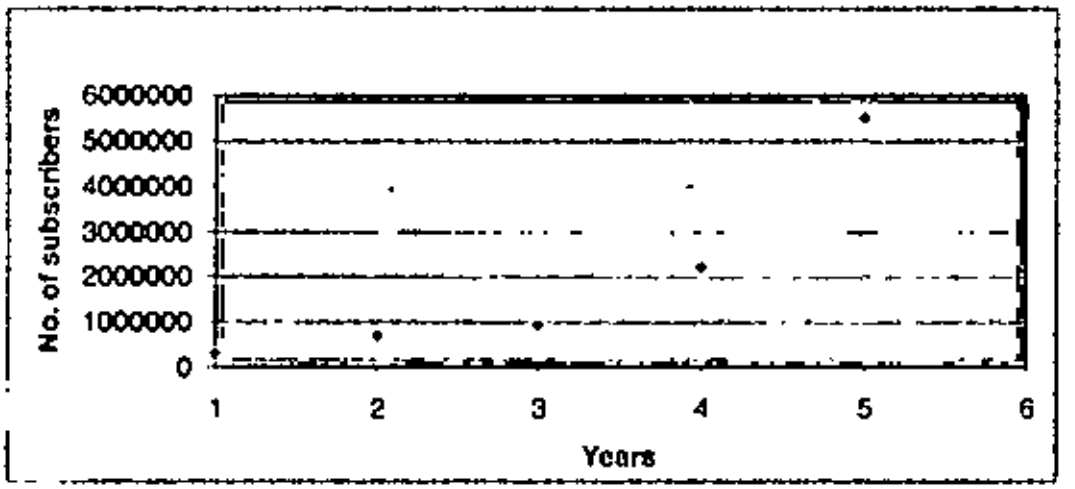


Figure 4.3: Prepaid mobile subscriber growth rate

Table 4.9: Yearly statement of mobile subscribers

Year	Year serial no.	Connection ('000)
June, 2001	1	297
June, 2002	2	682
June, 2003	3	918
June. 2004	4	2,217
June. 2005	5	5,508

The equation is,

$$y=a+bx$$

$$\sum y=an+b\sum x \text{ ----------(v)}$$

Again, $xy=ax+bx^2$

$$\sum xy=a\sum x+b\sum x^2 \text{ --------(vi)}$$

Solving (v) and (vi) for a and b,

$$a = \frac{\sum x\sum xy - \sum x^2\sum y}{(\sum x)^2 - n\sum x^2}$$

$$b = \frac{\sum x\sum y - n\sum xy}{(\sum x)^2 - n\sum x^2}$$

Table 4.10: Different values to calculate a & b

x	y	xy	x^2
1	297	297.195	1
2	682	1363.78	4
3	918	2754.285	9
4	2,217	8866.62	16
5	5,508	27541.88	25
15	**9622.211**	**40823.76**	**55**

So, the values are:

$$a = -1662.7$$

$$b = 1195.7$$

And the equation is,

$$y = -1662.7+1195.7x$$

Using regression analysis to find out the value of a & b, we get,

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.887919
R Square	0.788399
Adjusted R Square	0.717866
Standard Error	1130.971
Observations	5

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	14297289	14297289	11.177659	0.044278667
Residual	3	3837285	1279095		
Total	4	18134574			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-1662.7	1186.172	-1.40173	0.2555419	-5437.625399	2112.2336
X Variable 1	1195.7	357.6444	3.343301	0.0442787	57.52863118	2333.89677

So, the values are:

$$a = -1662.7$$

$$b = 1195.7$$

And the equation is,

$$y = -1662.7+1195.7x$$

Table 4.11: Comparison of calculated and estimated forecast

Year	Calculated forecasted subscribers (as per equation)	Estimated forecasted subscribers (as per regression analysis)	Difference
July '05 to June '06	5511.5	5511.5	0
July '06 to June '07	6707.2	6707 2	0
July '07 to June '08	7902.9	7902 9	0
July '08 to June '09	9098.6	9098.6	0
July '09 to June '10	10294.3	10294.3	0

4.5 FORECASTING RESULTS OF PSTN, MOBILE AND PREPAID MOBILE SUBSCRIBERS

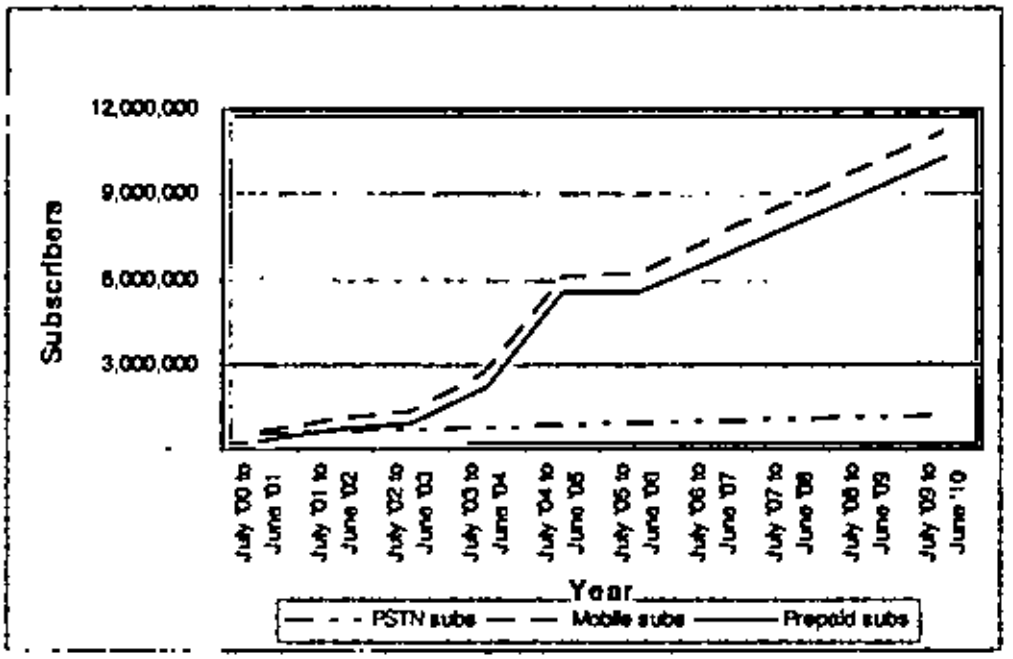


Figure 4.4: Different types of telecom subscriber growth rate

Table 4.12: Different types of telecom subscriber growth rate

Type of subscribers	Items	July '00 to June '01	July '01 to June '02	July '02 to June '03	July '03 to June '04	July '04 to June '05	July '05 to June '06	July '06 to June '07	July '07 to June '08	July '08 to June '09	July '09 to June '10
PSTN subscribers	Total subscribers	564,880	605,931	716,721	810,158	857,358	926,400	995,300	1,064,200	1,133,100	1,202,000
	Growth rate	-	7%	18%	13%	6%	8%	7%	7%	6%	6%
Mobile subscribers	Total mobile subscribers	633,225	1,073,888	1,364,912	2,781,560	6,107,946	6,189,400	7,455,100	8,720,800	9,986,500	11,252,200
	Growth rate	-	70%	27%	104%	120%	1%	20%	17%	15%	13%
	Prepaid subscribers	297,195	681,890	918,095	2,216,655	5,508,376	5,511,500	6,707,200	7,902,900	9,098,600	10,294,300
	Growth rate	-	129%	35%	141%	148%	0%	22%	18%	15%	13%

Between June 2001 and June 2005, the number of cellular mobile subscribers increased exponentially and the forecast from June 2006 to June 2010 also indicate increasing growth rate. The forecasted growth rate is not phenomenal as straight line method is used rather than exponential method.

4.6 ECONOMIC COMPARISON OF GROWTH RATE

Household incomes are still low in Bangladesh especially in rural areas. There are five mobile operators providing equivalent services throughout the country. The cost of initial investment for getting a mobile phone is still high and call charge for usage of mobile phones are not going down sharply. So, a certain proportion of new mobile subscribers will find that the service is beyond their means.

Table 4.13: Cellular mobile subscribers by region, in million

Region	2001	2002	2003	2004	2005
Africa	29.00	48.20	67 40	84.50	101.60
Americas	98.70	140.60	181.30	214.70	240.50
Asia-Pacific	330.90	444.50	564.20	678.20	780.90
Eastern Europe	44 50	60.30	75.80	89.90	102.30
Western Europe	367.20	494.10	607.50	694.40	754.50
Middle East	14.90	20.90	29.00	38.60	48.50
USA/Canada	139.90	165.20	191.60	216.70	239.70
World	**1025.10**	**1373.80**	**1716.80**	**2017.00**	**2268.00**

Table 4.14: Annual growth rate of cellular mobile subscribers

Region	2001	2002	2003	2004	2005
Africa		66%	40%	25%	20%
Americas		42%	29%	18%	12%
Asia-Pacific		34%	27%	20%	15%
Eastern Europe		36%	26%	19%	14%
Western Europe		35%	23%	14%	9%
Middle East		40%	39%	33%	26%
USA/Canada		18%	16%	13%	11%
World		34%	25%	17%	12%

Moreover, mobile penetration trends experienced by other countries indicate that the exponential growth experienced during first few years is followed by lower growth rate and eventually by minimal growth after saturation is achieved.

Table 4.15: Household income and expenditure survey – 2000 by BBS

Household monthly income in taka	Urban		Rural		National	
	No. of household	% of household	No. of household	% of household	No. of household	% of household
<750	31,779	0.64%	403,543	2.08%	435,322	1.79%
750-999	23,424	0.47%	392,889	2.02%	416,313	1.71%
1000-1249	46,840	0.95%	560,834	2.89%	607,674	2.50%
1250-1499	57,237	1.16%	670,413	3.45%	727,651	2.99%
1500-1999	151,304	3.07%	2,094,241	10.79%	2,245,545	9.22%
2000-2499	238,876	4.84%	2,287,504	11.78%	2,526,380	10.38%
2500-2999	309,554	6.27%	2,257,566	11.63%	2,567,121	10.54%
3000-3999	596,049	12.08%	3,275,620	16.87%	3,871,670	15.90%
4000-4999	567,810	11.51%	2,187,370	11.27%	2,755,180	11.32%
5000-5999	512,818	10.39%	1,527,705	7.87%	2,040,524	8.38%
6000-6999	432,408	8.76%	898,964	4.63%	1,331,372	5.47%
7000-7999	301,104	6.10%	624,973	3.22%	926,077	3.80%
8000-8999	239,287	4.85%	533,350	2.75%	772,638	3.17%
9000-9999	209,386	4.24%	375,988	1.94%	585,374	2.40%
10000-12499	356,714	7.23%	544,064	2.80%	900,778	3.70%
12500-14999	208,930	4.23%	281,640	1.45%	490,571	2.01%
15000-17499	146,309	2.96%	141,098	0.73%	287,407	1.18%
17500-19999	94,441	1.91%	86,605	0.45%	181,046	0.74%
20000+	410,298	8.31%	268,206	1.38%	678,504	2.79%
All groups	4,934,568	100.00%	19,412,573	100.00%	24,347,147	100.00%

To forecast the cellular mobile growth rate by 2010, we have made the following assumptions:

1. The monthly household income needed to afford a mobile phone is 6,000 taka per month.
2. Average growth rate of household per year is 2%.
3. 100% households in urban area and 90% households in rural area are covered by cellular network coverage.

Table 4.16: Household income and expenditure survey – 2010 by BBS

Household monthly income in taka	Urban		Rural		National	
	No. of household	% of household	No. of household	% of household	No. of household	% of household
<750	38736	0.64%	491917	2.08%	530655	1.79%
750-999	28554	0.47%	478929	2.02%	507483	1.71%
1000-1249	57098	0.95%	683654	2.89%	740751	2.50%
1250-1499	69772	1.16%	817230	3.45%	887003	2.99%
1500-1999	184439	3.07%	2552868	10.79%	2737307	9.22%
2000-2499	291189	4.84%	2788455	11.78%	3079643	10.38%
2500-2999	377345	6.27%	2751960	11.63%	3129306	10.54%
3000-3999	726580	12.08%	3992963	16.87%	4719544	15.90%
4000-4999	692157	11.51%	2666392	11.27%	3358549	11.32%
5000-5999	625122	10.39%	1862264	7 87%	2487387	8.38%
6000-6999	527103	8.76%	1095832	4.63%	1622935	5.47%
7000-7999	367044	6.10%	761839	3.22%	1128883	3.80%
8000-8999	291690	4.85%	650151	2.75%	941841	3.17%
9000-9999	255240	4.24%	458327	1.94%	713568	2.40%
10000-12499	434832	7.23%	663211	2.80%	1098043	3.70%
12500-14999	254685	4.23%	343318	1.45%	598003	2.01%
15000-17499	178350	2.96%	171998	0.73%	350348	1.18%
17500-19999	115123	1 91%	105571	0.45%	220694	0.74%
20000+	500151	8.31%	326942	1.38%	827093	2.79%
All groups	6015211	100.00%	23663818	100.00%	29679036	100.00%

Table 4.17: Potential mobile subscribers in 2010

Item	Urban household	Rural household
Total households	6,015,211	23,663,818
Total households that can afford mobile phones	2,924,218	4,577,188
Network coverage	100%	90%
Total households that are under network coverage and can afford mobile phones	2,924,218	4,119,469
% of additional business mobile phones	20%	10%
Additional business phones	584,844	411,947
Total	3,509,061	4,531,416
Grand total (Urban + Rural)		8,040,477
% penetration in total household		27%

The total number of mobile subscribers forecasted for 2010 are 11,252,200 but the affordable subscribers for mobile services are 8,040,477. It indicates that before 2010, market saturation will come, if initial investment cost to get a mobile phone, call charges, etc., are not reduced.

4.7 REVENUE SHARING OF DIFFERENT MOBILE OPERATORS

The mobile operators are earning huge amount of revenue for providing mobile services. As per license condition, the mobile operators are giving 1% of collected revenue from air time charges as variable part of license fees. To attract more foreign investment, the Government allows foreign investment with 100% foreign equity and foreign investors can take their full profit from this country.

Table 4.18: Revenue collection in 2004-05 and their distribution

Company Name	Investment (%)		Investor		Total revenue (Tk) for the year of 2004-05	Revenue distribution	
	Foreign	Local	Foreign	Local		Foreign	Local
GP	62	38	Telenor	Grameen Telecom	17,798,583,056	11,035,121,495	6,763,461,561
B'link	100	0	Orascom		3,849,952,100	3,849,952.100	-
PBTL	45	55	Sing'Tel	Pacific group	1,693,327,400	761,997.330	931,330,070
TMIB	70	30	Telecom Malaysia	A K Khan & Company Ltd.	7,401.982,900	5,181,388,030	2,220.594,870
TelcTalk	0	100		GoB	183,516	0	183,516
Total					30,744.028,972	20,828,458,955	9,915,570,017
% of sharing					100	68	32
Revenue (in US$)					472,985,061	320,437,830	152,547,231

10 % subscribers with postpaid facilities are giving 250.00 taka each as monthly line rent.

Table 4.19: Revenue from monthly line rent

No of subscribers	Monthly rent (Tk)	Total amount (Tk)	Total amount (US$)	Foreign (US$)	Local (US$)
599,570	250	1,798,710,000	27,672,462	18,817,274	8,855,188

Table 4.20: Impact on foreign currency reserve

Reserve in Bangladesh Bank is about (In US$)	3,000,000,000
Total amount that operators can draw from BB in foreign currency (US$)	339,255,104
% of transfer from Bangladesh Bank is	11

In 2004-05, the mobile operators earned about 49.9 million USD and as per share agreement 68% of total revenue can be transferred outside the country. As a result 11% of foreign reserve can be drawn by the mobile operators, which are quite high and can affect economy of Bangladesh.

CHAPTER 5

FREQUENCY ALLOCATION

5.1 REVIEW OF FREQUENCY ALLOCATION

Prior to the establishment of Bangladesh Telecommunication Regulatory Commission (BTRC) on February 1, 2002 management of radio frequency spectrum was the responsibility of the Ministry of Post and Telecommunications. The Bangladesh Telegraph and Telephone Board (BTTB) had performed these functions until 1995.

At present there are five cellular mobile operators in Bangladesh, who are authorized to provide cellular mobile services all over the country. Among them, Grameen Phone (GP), TM International Bangladesh (TMIB), Sheba Telecom and Teletalk are using GSM technology and City Cell (Pacific Bangladesh Telecom Ltd, PBTL) is using CDMA technology. Also, Sheba rural (STL Phone) is authorized to provide services in 191 upazillas of southern areas of Bangladesh in competition with BTTB especially in rural areas. But its performances are not satisfactory.

Moreover, 15 operators have been issued 36 zonal licenses for PSTN services. Some of these operators are using CDMA technology with WLL system.

5.2 800 AND 1900 MHZ BAND : CDMA SCENARIO

CDMA (IS-95A/B and IS-2000 Spreading Rate 1) is a broadband technology which utilizes 1.2288 MHz bandwidth per CDMA Channel (this is often rounded off to 1.23 MHz). In order to deploy an initial CDMA channel, spectrum must be allocated for the CDMA channel and the guard bands that are required on each side of the channel. In order to deploy a second CDMA channel, the channel spacing between the CDMA channels must be determined. Prior to deploying the first CDMA channel, long term spectrum planning should be performed in order to maximize the capacity of a multiple

carrier CDMA block of spectrum. This section provides information on CDMA channel spacing, multiple carrier guidelines, and guard band considerations.

As the number of the CDMA subscribers increases, there may be a need to add additional CDMA carrier frequencies to the system. If the first and second carrier frequencies are to be adjacent to one another, then the channel spacing between CDMA carriers (center to center) needs to be determined. For 800 MHz IS-95A/B and IS-2000 based systems with a 30 kHz channel increment, the minimum recommended channel spacing separation between CDMA channels is 1.23 MHz.

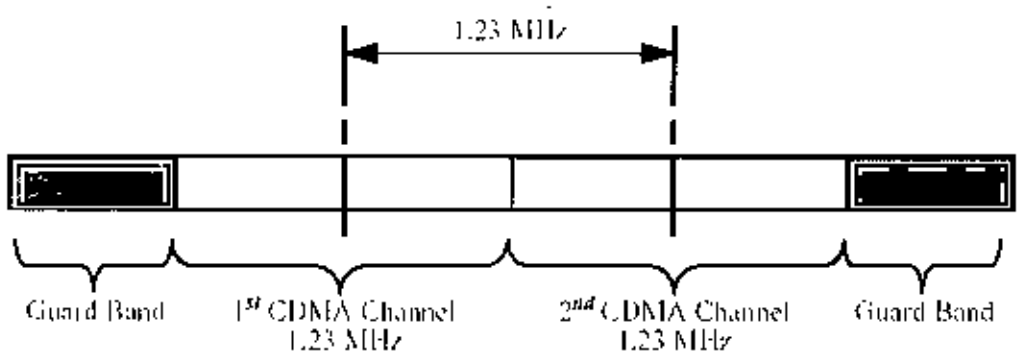


Figure 5.1: Minimum spacing between 800 MHz CDMA channel

For 1900 MHz IS-95A/B and IS-2000 based systems with a 50 kHz channel increment, the minimum recommended channel spacing separation between CDMA channels is 1.25 MHz.

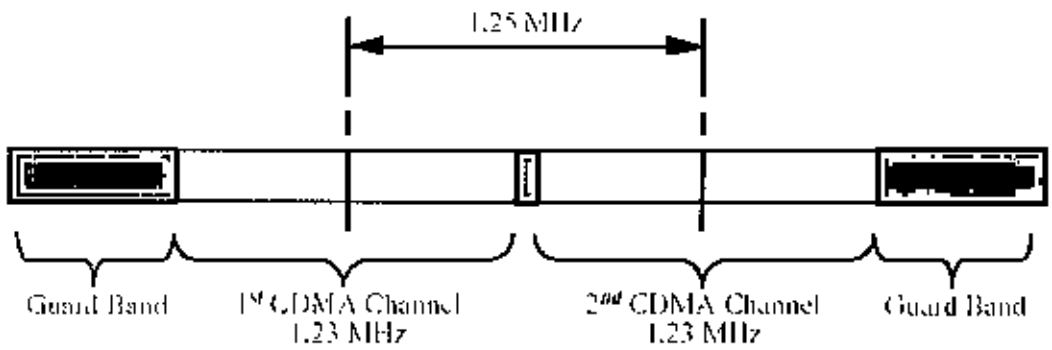


Figure 5.2: Minimum spacing between 1900 MHz CDMA channel

The minimum channel spacing places the broadband carriers adjacent to one another and allows the sidebands of each to intrude into the band of the other. The adjacent channel interference for this minimum channel separation will slightly reduce the capacity of both

CDMA carriers. A CDMA channel with adjacent CDMA channels on both sides will have an even greater reduction in capacity. If system noise, non-linearities, or other imperfections increase the energy in the skirts of the carriers, then an increased capacity reduction may be experienced.

Table 5.1: Allocation of 800 MHz band to different CDMA operators

Name of the Operator	Up Link/ Reverse Link (MHz)	Down Link/ Forward Link (MHz)	Bandwidth (MHz)
PBTL (Only Dhaka), Bangla Phone (N-E),Dhaka Telecom	825.27-826.53	870.27-871.53	1.26
PBTL (Only Dhaka), BCNL	826.53-827.79	871.53-872.79	1.26
PBTL	827.79-829.05	872.79-874.05	1.26
PBTL	829.05-830.31	874.05-875.31	1.26
PBTL	830.31-831.57	875.31-876.57	1.26
PBTL	831.57-832.83	876.57-877.83	1.26
PBTL	832.83-834.09	877.83-879.09	1.26
ISL(S-E,S-W),BCNL	834.10-835.5	879.1-880.5	1.4
ISL(S-E,S-W)	835.5-836.76	880.5-881.76	1.26
ISL (S-E,S-W), One Tel (N-W),	836.76-838.02	881.76-883.02	1 26
ISL (S-E,S-W), Jalalabad Tel (N-E),	838.02-839.28	883.02-884.28	1.26
ISL(S-E,S-W),RANKS	839.28-840.54	884.28-885.54	1.26
BCNL	840.54-841.8	885.54-886.8	1.26
Ranks Telecom	841.8-843.06	886.8-888.06	1.26
Dhaka Telecom	843 06-844.32	888.06-889.32	1.26

As per National Frequency Allocation Plan (NFAP), 825 - 845 MHz frequency is used for reverse link and 870 – 890 MHz frequency is used for forward link in CDMA technology. So no additional frequency is available for new operators or any future use.

Table 5.2: Allocation of 1900 MHz band to different CDMA operators

Name of the Operator	Up Link/ Reverse Link (MHz)	Down Link/ Forward Link (MHz)	Bandwidth (MHz)
Telebarta	1860.6-1861.9	1940.6-1941.9	1.3
Telebarta	1861.9-1863.2	1941.9-1943.2	1.3
Square	1863.2-1864.5	1943.2-1944.5	1.3
Square	1864.5-1865.8	1944.5-1945.8	1 3
GEP(S-E,N-E)	1866.2-1867.5	1946.2-1947.5	1.3
GEP(S-E,N-E)	1867.5-1868.8	1947.5-1948.8	1 3
S A Telecom(S-E)	1868 8-1870.1	1948.8-1950.1	1.3
S A Telecom(S-E)	1870.1-1871.4	1950 1-1951.4	1.3
Dominox(S-E)	1871 4-1872.7	1951.4-1952.7	1.3
Bangla Phone(N-E),Dominox(S-E)	1872.7-1874	1952.7-1954	1.3
NTC	1874-1875 3	1954-1955.3	1.3
Ranks	1875.3-1876.6	1955.3-1956.6	1.3
Dhaka Telecom	1876.6-1877.9	1956.6-1957.9	1.3
westecs	1877.9-1879.2	1957.9-1959.2	1.3

Again, in NFAP the available frequency for 1900 MHz band is 1860 – 1880 MHz for reverse link and 1940 – 1960 MHz for forward link in CDMA technology. So, only 0.8 MHz is available, which is not sufficient for a new assignment as at least 1.3 MHz band is required for new assignment. But re-allocation of frequencies in different zones are possible both for 800 and 1900 MHz.

5.3 900 AND 1800 MHZ BAND : GSM SCENARIO

The system specifications for GSM 900 are as follow:

Frequency band	Uplink 890-915 MHz
	Downlink 935-960 MHz
Extended GSM900	Including 880-890 MHz for uplink
	and 925-935 MHz for downlink
Duplex distance	45 MHz
Carrier separation	200 kHz

Table 5.3: Allocation of 900 MHz band to different GSM operators

Name of the Operator	Up link (MHz)	Down Link (MHz)	Band (MHz)
Tele Talk	890-895.2	935-940.2	5.2
Sheba Telecom	895.2-900.2	940.2-945.2	5.0
TMIB	900.2-907.6	945.2-952.6	7.4
GP	907.6-915	952.6-960	7.4

As per NFAP, 890 – 915 MHz band is used for uplink frequency and 935 – 960 MHz band is used for down link frequency. So no frequency is available for new or future assignment.

Again, the system specifications for GSM1800 are:

Frequency band	Uplink 1710-1785 MHz
	Downlink 1805-1880 MHz
Duplex distance	45 MHz
Carrier separation	200kHz

Table 5.4: Allocation of 1800 MHz band to different GSM operators

Name of the Operator	Up Link (MHz)	Down Link (MHz)	Bandwidth(MHz)
Tele Talk Ltd	1710-1715.4	1805-1810.4	5.4
Tele Talk Ltd	1715.4-1720	1810.4-1815	4.6
GP	1720-1727.2	1815-1822.2	7.2
TMIB	1727.2-1732.6	1822.2-1827.6	5.4
New Operator (Reserved)	1732.6-1750	1827.6-1845	17.4
World Tel	1750-1757.5	1845-1852.5	7.5
Sheba Telecom	1757.5-1765	1852 5-1860	7.5

As per NFAP, 1710 -1765 MHz band is used for uplink and 1805 – 1860 MHz band is used for GSM technology. Within this frequency band, 17.4 MHz band is available for new assignment.

CHAPTER 6

RELATED POLICY ISSUES

6.1 THE RATIONALE FOR COMPETITION POLICY

When competition exists in market-based economies, two or more different suppliers contend with each other to sell their goods or services to customers. Competitive suppliers may offer lower prices, more or better quantities, and packages or qualities of service to attract customers. Competition serves the public interest by inducing suppliers to become more efficient and to offer a greater choice of products and services at lower prices.

In a competitive market, individual suppliers lack "market power". They cannot dictate market terms, but must respond to the rivalry of their competitors in order to stay in business. Market power is generally defined as the power to unilaterally set and maintain prices or other key terms and conditions of sales; that is without reference to the market or to the actions of competitors.

6.1.1 Imperfect competition

In a perfectly competitive market, there would be little or no reason for government intervention to implement competition policy. Such a market would ideally consist of a large number of suppliers of products or services, as well as a large number of consumers. Consumers would have complete information and freedom to deal with any chosen supplier. There would be no negative external factors associated with supplier or consumer behaviour. No single supplier would be able to distort the efficient operation of the market or the setting of prices or supply conditions.

However, no markets are perfectly competitive. Many markets are not truly competitive, but are dominated by a small number of large or well-established firms. Producers or suppliers in such markets often have market power that can be exercised to the detriment of consumer welfare and overall industry performance.

6.1.2 Monopoly

Monopoly can be the result of market failure. A monopolistic market is often associated with excessively high product prices, reduced supply levels or other behaviour that reduces consumer welfare. Collusive agreements among suppliers are another example of market failure. Supplier collusion can be directed to increasing prices or restricting output, behaviour that is similar to the exercise of monopoly power.

Telecommunications has, in most jurisdictions, developed in a monopoly environment. As competition is introduced into telecommunications markets, there are typically concerns about the continuing exercise of market power by the incumbent operator. This exercise of market power constitutes a special form of market failure that must be addressed by regulators and competition authorities in many countries.

Public intervention can have other objectives. For example, a government may adopt rules and policies that limit the participation of foreign capital or companies in order to create or cultivate a domestic industry. Such intervention may deliberately limit competition and compromise economic efficiency in favour of other public interests.

Competition policy is generally applied through two different types of government intervention.

The first type is behavioural. In this type of intervention, a public authority attempts to modify the behaviour of a particular firm or group of firms through regulation of their behaviour. Price regulation is an example of behavioural intervention. Other examples are orders prohibiting collusive practices or agreements, and orders requiring interconnection of competitors' networks.

A second form of intervention is structural. Such intervention affects the market structure of the industry. For example, governments may intervene to prevent a merger of the two major telecom network operators in a market. Similarly, a dominant supplier might be required to separate its operations into distinct corporate entities, or to divest itself of

lines of business entirely. The 1984 AT&T divestiture in the United States provides a well-known example of the latter.

6.1.3 Flexibility

Government intervention in markets generally requires flexibility and an ability to tailor rules and principles to specific circumstances. In some instances, competition rules can be formulated as outright prohibitions (for example, against price fixing agreements). In many situations, however, pro-competitive rules are formulated so that there is discretion in their application. For example, price discrimination is not always inappropriate; only anticompetitive or otherwise harmful forms of price discrimination are generally prohibited.

Competition policy is applied to curb abuses of market power and to prevent a powerful firm from forcing competitors out of the market. However, there is a tension between the objective of protecting competition and the more problematic practice of protecting individual competitors. This tension is particularly evident in the regulation of the telecommunications industry during the transition period from the introduction of competition to the time competition becomes self-sustaining.

Competition policies generally have no iron-clad rules that must be rigourously applied in all circumstances. The policies must be applied flexibly to suit the circumstances of different markets.

6.2 THE TRANSITION FROM MONOPOLY TO COMPETITION IN TELECOM

An effective competition policy must take into account the specific characteristics of the market to which it is applied. Telecommunications network service markets raise unique challenges for the application of competition policy. These challenges arise from the specific manner in which some incumbent network operators are able to continue to dominate their markets after the introduction of competition.

It is generally desirable to minimize government intervention in competitive markets. However, there is a general consensus that regulatory intervention is required to implement a successful transition from monopoly to competitive telecommunications markets. The introduction of effective competition into telecommunications markets around the world has generally been more difficult and intrusive than in the case of most other markets.

6.2.1 Advantages of incumbent operators

The nature of telecommunications networks provides strong advantages to well-established network operators. These advantages often call for pro-competitive measures that are relatively unique to the telecommunications sector.

6.2.2 Control of essential facilities

Incumbent operators often own "essential facilities" that were built and paid for under a regime of government ownership or guaranteed rate-of-return regulation. In telecommunications network markets, essential facilities may include public rights-of-ways, support structures such as poles and conduits, local loops, telephone numbers and frequency spectrum. New entrants typically require access to these facilities in order for competition to be feasible. Duplication of these facilities may be either technically difficult, or more often, economically inefficient.

Control of essential facilities can give an incumbent numerous advantages over new entrants, particularly in the absence of strong pro-competitive regulation. For example, an incumbent can use its control over essential facilities to increase a competitor's costs, and make its services less attractive to customers. The competitors' costs can be increased by increased prices of essential facilities. The incumbent may be able to shield its own customers from the impacts of such higher essential facility prices, either by not "charging itself those price increases, or offsetting them with cross-subsidies from its monopoly or less-competitive services.

An incumbent can also discriminate in the provision of essential facilities to make its competitors' services less attractive to end-customers. In the extreme case, it can simply refuse to supply essential facilities to competitors. It can also discriminate by providing inferior quality essential facilities to competitors, as compared to itself. For example, it can provision local loops to its own customers within a week, but delay provisioning of local loops to customers of competitors for months.

6.2.3 Economies of established national networks

As a related matter, incumbent network operators might enjoy "economies of scale and scope" that cannot be matched by new entrants for many years (or decades). For some network elements (e.g. a national local access (loop) network), the cost of duplicating an incumbent's facility may be prohibitively high. At the same time, the facility may have a large enough capacity that one or more competitors may be able to share use of the facility with the incumbent without imposing any congestion costs.

In addition, many established telecommunications operators have a long history of providing local access service at subsidized rates. This provides the incumbent with advantages in terms of economies of density, scale and scope. In competing for a new customer, an incumbent can often set a relatively low price, which reflects a lower long-run "total service" incremental cost than new entrants, and spreads its "joint and common costs" across a large established customer base. A new entrant must often cover a much higher long-run total-service incremental cost, since this must be recovered from a smaller customer base.

6.2.4 Vertical economies

Many incumbents have "vertically integrated" upstream and downstream production facilities. For example, they may operate local access networks, national long-distance networks and international networks. These incumbents would usually enjoy vertical economies. For example, it is less expensive to co-ordinate local, long distance and international telecommunications within a single firm than through arm's-length

negotiations and transactions with different (often competing) operators. Incumbents may also enjoy vertical economies related to integrated network planning, construction, operations (e.g. traffic aggregation) and maintenance.

6.2.5 Control over network standards and development

An incumbent usually has a significant advantage in that its existing technologies and network architecture have become de facto network standards to which all competitors must adapt their networks. Unless competitors are notified well in advance, the incumbent may obtain a substantial head-start in the deployment of new network services or features that rely on switching, transmission or software upgrades installed by the incumbents.

6.2.6 Cross-subsidies

Incumbent operators are often able to cross-subsidize some services from others. Many different forms of cross-subsidy are possible. In most countries, local access services have traditionally been cross-subsidized by international services. Profits from the latter were used to maintain below-cost tariffs in the former. New entrants typically do not have a similar range of services to cross-subsidize. Some incumbents have engaged in anti-competitive practices by which competitive services (e.g. mobile telephone services or Internet access services) are priced below costs and effectively subsidized by monopoly or less-competitive services, such as international services.

6.2.7 Customer inertia

Telecommunications network markets are often characterized by a high degree of customer inertia. New entrants may find it very difficult to persuade customers to switch from an incumbent that has served them for many years. This is particularly true for lower-volume users (e.g. residential customers) when marketing costs and customer-switching costs and inconveniences can be high (e.g. dialing extra digits to reach a new entrant's network, dealing with two telephone bills, changing telephone numbers, etc.). In

some cases, incumbents may intentionally take actions to "lock in" their customers, and to make switching to competitors more difficult and costly.

6.3 BASIC CONCEPTS OF COMPETITION POLICY

6.3.1 Market definition

The definition of a market is a key issue in competition policy and analysis. It is necessary to define a "relevant market" in order to establish whether a firm has a dominant position in that market. Similarly, in analyzing whether a restrictive agreement among firms has an appreciable effect on reducing competition in a market, it is necessary to define the relevant market and then to evaluate the impact of the agreement in that market. Market definition is an initial step in competition analysis. It provides the context in which to evaluate the level of competition and the impact of anti-competitive conduct.

There are two aspects to the definition of a market -the product, including a service, and the geographic area in which the product is sold. In defining the product, close substitutes are normally included. The analysis of substitutability is generally conducted from the demand side that is from the perspective of buyers of the product.

For example, the definition of the market for international telephone service in a country could include IP Telephony services that are available through the PSTN, by dialing a specific access number or code. However, the definition would generally exclude "computer-to-computer" IP Telephony services that require special software, computers at both ends of a call, and pre-arranged calling times, etc. to the average buyer of international telephone services, such "computer to computer" services would not be a close substitute for international telephone service.

6.3.2 The product market

A widely accepted approach to market definition begins with the assumption that there is a monopolist in the relevant product market. The question is then asked: could the hypothetical monopolist raise the price of the product by a small but significant amount and for a non-transitory period? If a sufficient number of buyers would switch to other products so as to make the price increase unprofitable for the monopolist, those substitutes would be included in a new definition of the market. This analysis will be repeated until the boundaries are set so that substitution does not make the price increase an unprofitable strategy.

6.3.3 The geographic market

The second dimension is the definition of the geographic scope of the market. In defining the geographic boundaries of a product market, the aim is to identify the extent to which the proximity of rival suppliers can impose competitive constraints on the hypothetical monopolist or actual market participant. Again, the definition of the geographic scope of the market is based on an assessment of substitutability in response to product price changes.

Geographic areas are more important in defining some telecommunications markets than others. For example, the market for local access in Mumbai is not affected by the degree of competition in the Johannesburg local access market. These are clearly separate markets. However, geography is increasingly less important in defining the level of competition in markets for Internet Service Providers (ISPs), E-mail providers or even international long distance services. The markets for these products are rapidly becoming global markets. It would be difficult, if not impossible, for an E-mail service provider in Mumbai to raise the price of its E-mail service if customers in Mumbai have local access to substitute E-mail service providers (e.g. Hotmail) that are based in other geographic areas.

Having said that, the definition of product and geographic markets remains very relevant for the services that remain most subject to market dominance, particularly local and national long distance services.

6.4 BARRIERS TO ENTRY

The evaluation of competitive markets and market behaviour often focuses on the extent to which one or more firms can introduce and sustain price increases. If it is easy for a new supplier to enter a market and provide a substitute product, then established suppliers will be reluctant to implement significant long-term price increases. Such price increases would invite market entry, which will increase competition.

The existence of barriers to market entry will limit this competitive response. There are many types of barriers to entry in different markets. Among the most commonly recognized barriers are:

- government restrictions such as monopoly franchises or restrictive licensing practices;
- economies of scale (i.e., where per unit production costs fall as output increases, a large established supplier can produce at a lower per unit cost than new entrants);
- high fixed/capital costs; and
- intellectual property rights such as copyright and patent protection (which may affect the availability to a competing supplier of key inputs or outputs).

Multiple barriers to entry may exist in a single telecommunications market. For example, local networks are typically regarded as being characterized by economies of scale. The establishment of a local facilities-based network also requires a large investment in fixed costs. Local telecommunications operators often require government licences, which may be granted on an exclusive or otherwise restrictive basis. Entry into wireless local networks is also restricted by spectrum scarcity. Certain local telecommunications services may operate on network platforms which have patent or copyright protection (complicating or preventing the launch of a competing service).

In addition to these barriers to entry, it is also possible for a dominant firm to engage in conduct that establishes additional barriers to entry. Refusal to supply essential facilities and refusal to interconnect networks are two classic examples of anti-competitive conduct that an incumbent operator may engage in to discourage or prevent new entry.

6.4.1 Market power and dominance

As a practical matter, most of the concern of competition authorities (and telecommunications regulators promoting competitive markets) is focussed on established telecommunications operators that have market power. Firms without market power are simply not able to cause serious problems in the economy or in the sector. If they raise their prices above market levels, for example, they will simply lose customers and profits.

6.4.2 Market power defined

In general, market power is defined as the ability of a firm to independently raise prices above market levels for a non-transitory period without losing sales to such a degree as to make this behaviour unprofitable.

Factors frequently considered in determining whether a firm has market power include:

- market share;
- barriers to market entry;
- pricing behaviour;
- profitability, and
- vertical integration.

Market share can be measured in several ways, including monetary value, units of sales, units of production and production capacity. Market share alone can be an inaccurate measure of market power. However, it is unlikely that a firm without significant market share will have sufficient market power to behave anti-competitively on its own.

Therefore, market share is usually a starting point in determining market power.

Assessment of barriers to entry is also important. The extent to which established suppliers are constrained by the prospect of new market entry is a key factor in whether the established suppliers have market power.

Pricing and profitability are other factors relevant to a determination of market power. The existence of true price rivalry is inconsistent with a finding of market power. Price competition, which consists of "follow the leader" behaviour is consistent with the exercise of market power by the price leader.

The profitability of existing suppliers in a market can also be indicative of the extent of true price competition. Excessive profitability typically indicates insufficient price competition and the exercise of market power in setting prices.

Finally, vertical integration is relevant to an assessment of whether a firm which enjoys market power in one market is able to extend its power into upstream or downstream markets. In telecommunications, incumbent operators that are vertically integrated (e.g. that provide local access as well as long distance or international services) can often use their market power in the local access market to competitive advantage in the long distance and international markets. They may abuse their market power, for example, by inflating local access prices (including interconnection prices) and using the surplus revenues to subsidize rate cuts to their competitive long distance or international services.

6.4.3 Significant market power

An organization shall be presumed to have significant market power (SMP) when it has a share of more than 25% of a particular telecommunications market. It is also an obligation on organizations with SMP to meet all reasonable requests for access to the network including access at points other than the network termination points offered to the majority of end-users.

The 25% SMP threshold is not fixed in stone. The Directive permits national regulatory authorities to determine that organizations with less than 25% market share have significant market power; and to determine that organizations with market share greater than 25% do not have significant market power. In making such determinations, regulators are directed to take into account factors such as:

- the organization's ability to influence market conditions;
- turnover relative to the size of the market;
- control of means of access to end-users;
- access to financial resources; and
- experience in providing products and services in the market.

Characterization of an organization as having SMP does not necessarily lead to a finding of market power or dominance on the part of that organization. The SMP designation is simply a trigger for the application of additional obligations.

6.4.4 Market dominance

Market dominance is a more extreme form of market power. The definition of market dominance varies significantly in the laws and regulations of different countries. In general, however, two factors are key in the determination of market dominance. First there must usually be a relatively high market share (usually no less than 35%, often 50% or more). Second, there must normally be significant barriers to entry into the relevant markets occupied by the dominant firm.

6.4.5 Essential facilities

The concept of essential facilities is important to the application of competition law in the telecommunications sector. In the sector, an essential facility is generally defined as one which has the following characteristics:

- it is supplied on a monopoly basis or is subject to some degree of monopoly

control;

- it is required by competitors (e.g. interconnecting operators) in order to compete; and
- it cannot be practically duplicated by competitors for technical or economic reasons.

Common examples of essential facilities are network access lines (local loops) and local exchange switching. Local loops are the circuits between a customer's premises and the first "node" or exchange which connects the customer with the PSTN. It can be seen that in many countries, local loops fall within the definition of essential facilities because they are:

- required by competitors in order to compete for the business of end customers;
- predominantly supplied by the incumbent. and
- technically or economically difficult to substitute, at least on a widespread basis.

A telecommunications operator that controls an essential facility often has both the incentive and the means to limit access to the facility by competitors. It becomes a matter of public interest to ensure that essential facilities are available to competitors on reasonable terms. Without such access, competition will suffer, and the sector will operate less efficiently than it could.

6.5 REMEDIES FOR ANTI-COMPETITIVE CONDUCT

6.5.1 Abuse of dominance

Abuse of Dominance by a Telecommunications Operator:

- Refusal or delay in providing essential facilities to competitors;
- Providing services or facilities to competitors at excessive prices or on discriminatory terms;
- Predatory pricing and/or cross-subsidization of competitive services with revenues obtained from services which are subject to less competition;

- Bundling of services designed to provide the dominant firm with exclusive advantages in subscriber markets or require a competitor to obtain services or facilities which it does not truly need.

Abuse of Dominance – Remedies:Some Powers to Remedy Abuse of Dominance

- Power to issue enforceable orders against the dominant entity,
    - to cease abusive behaviour; or
    - to prescribe specific changes in its behaviour to limit the abusive aspects
- Power to revoke the licence of the dominant entity (NB. In practice, this has limited applications since no regulator wants to deny service to the public)
- Power to fine the dominant entity and the individual persons responsible for the abusive conduct
- Power to order compensation (damages) to be paid to subscribers or competitors injured by the abusive conduct
- Power to restructure the dominant entity (such as the divestiture of some lines of business or structural separation of those lines into a separate but affiliated company)
- Power to facilitate and approve informal settlements in cases of abuse of dominance (e.g. to pay compensation, restructure, voluntarily cease or change conduct)

6.5.2 Refusal to supply essential facilities

Abuse of dominance can be made out where a network operator refuses access to its network, withdraws access or provides access subject to unjustifiable delays or excessive prices. The Commission identifies other conduct which may be abusive, including tying or bundling network elements without adequate justification, configuring a network so that access by competitors becomes more difficult, unjustly discriminating in the terms of access offered to competing operators or pricing access so as to "squeeze" competitors' profit margins.

6.5.3 Cross-subsidization

In some key telecommunications markets, there is a concern that incumbent telecommunications operators will abuse their dominant position by engaging in anti-competitive cross-subsidization. The concern is that an operator that dominates one market may increase or maintain its prices above costs in that market. It can then use its excess revenues from the dominant market to subsidize lower prices in other more competitive markets. As a result, a disproportionately large share of the costs of the operator's entire business can be recovered from the markets the operator dominates.

This results in a "cross-subsidy" between services and subscriber groups. The more competitive services are subsidized by the less competitive services. Such cross-subsidies can be significant barriers to competition.

Without the ability to cross-subsidize its own competitive services, a new entrant may not be able to match the incumbent's low prices in competitive markets. This may prevent new entry into the incumbent's less competitive markets. Alternatively, it may drive new entrants out of business or prevent them from raising enough capital to expand into the incumbent's dominant markets.

Regulatory treatment of anti-competitive cross-subsidies in telecommunications markets is complicated due to the patterns of "social" cross-subsidies which characterized the monopoly era of telecommunications services in many jurisdictions.

In the monopoly era, governments typically authorized the cross-subsidization of local, residential and rural services by other services, such as international, long distance and business services. Whatever the benefits of social cross-subsidies in the monopoly era, there is now a widespread recognition that they should be abolished. These cross-subsidies are gradually being eliminated by the implementation of rate rebalancing policies. Rate rebalancing policies are aimed at aligning prices of different services more closely with their costs. Rebalanced rates are closer to the types of "efficient" pricing found in competitive markets.

6.5.4 Accounting separations

Accounting separations can be used to determine the existence of cross-subsidization. Regulators have developed accounting separations, or have required incumbents to do so, in a number of jurisdictions. The goal of accounting separations is to divide the costs of an operator between the different services it offers in order to determine the costs of providing each service. The costs of each service are then compared to the revenues generated by that service to determine whether the service recovers its costs or loses money. Services that do not cover their costs are considered to be subsidized by other services with revenues that exceed their costs.

In effect, accounting separations require an operator to account for different services as if they were stand-alone operations. Since telecommunications operators provide a wide range of services, many accounting separations undertaken for regulatory purposes do not attempt to separate the costs of each individual service. Rather, they separate the costs of broad categories of service.

6.5.5 Accounting separations - cost & revenue categories

Determination of which accounting categories should be established will depend on the state of competition in a national telecommunications market. In general, the more competitive the market, the more difficult the accounting separation process.

Once all segments of a market become workably competitive, it will no longer be necessary to establish accounting separations, or worry about cross-subsidies. At that point, no firm would retain a dominant position in any market segment. Accordingly, it could not raise prices above competitive levels and use the excess profits to cross-subsidize more competitive areas.

The following is simplified illustration of possible accounting separation that is used in International Telecommunication Union (ITU).

Table 6.1: Table: Accounting separation – Revenue categories (in millions taka)

ID	Item	2000 - 01	2001 - 02	2002 - 03	2003 - 04	2004 - 05
a	Total revenue from all telecom service (b+c+d+e)	341.17	468.97	630.34	514.84	995.70
b	Revenue form telphone service:	335.34	461.74	605.08	479.46	904.69
	Income from telephone connection charge	224.92	129.19	134.09	2.37	70.91
	Income from telephone subscription charge	41.95	102.48	126.90	119.69	96.73
	Income from local calls	56.68	190.46	248.84	295.86	596.00
	Income from long national distance calls	7.21	24.21	36.21	37.61	84.33
	Income from international calls	4.58	15.40	23.04	23.93	56.72
c	Income from data transmission	-	-	0.85	0.59	7.65
d	Income from leased circuit	-	-	-	-	-
e	Other income (facsimile, videotex, Internet etc.)	5.83	7.23	24.40	34.78	83.35
f	Revenue from mobile communications	341.17	468.97	630.34	514.84	995.71

Table 6.2: Accounting separation – Cost categories (in millions taka)

ID	Item	2000 - 01	2001 - 02	2002 - 03	2003 - 04	2004 - 05
1	Annual Investment in telecom (incl. land & building)	136.16	224.19	272.35	83.71	4968.24
2	Annual investment for telephone service	-	-	-	-	-
3	Mobile communication investment	136.16	224.19	272.35	83.71	4968.24

6.5.6 Vertical price squeezing

Vertical price squeezing is a particular type of anticompetitive conduct that may be engaged in by incumbent operators. This form of conduct can occur if the incumbent provides services in two or more "vertical" markets. Vertical markets are sometimes labelled "upstream" and "downstream" markets. For example, the oil production market is upstream of the oil refining market, which in turn is upstream of the gasoline sales

market. Instead of upstream and downstream, the terms "wholesale" and "retail" are often used.

Vertical price squeezing can occur when an operator with market power controls certain services that are key inputs for competitors in downstream markets, and where those same key inputs are used by the operator or its affiliates to compete in the same downstream market.

To take an example, in telecommunications markets, incumbents often control local access and switching services. Consider one such service - the provision of dedicated local circuits from customer premises to local exchanges. Dedicated local circuits can be viewed as "upstream" services. These services are used as an input by the incumbents in providing "downstream" services, such as dedicated Internet access services. Dedicated local circuits are also a key input for competitors who provide dedicated Internet access services. In other words, both the incumbent and other suppliers compete in the downstream market for dedicated Internet access services.

If the incumbent decided to engage in vertical price squeezing, it could increase the price to competitors for the upstream input (i.e. dedicated local circuit rates) - while leaving its downstream prices the same (i.e. prices for its dedicated Internet access services). The effect would be to reduce or eliminate the profits (or "margins") of competitors. Their margins would be "squeezed". To increase the squeezing effect, the incumbent could also reduce its downstream prices for Internet access. This would be a "two-way" or margin squeeze.

6.5.7 Predatory pricing

Predatory pricing is the practice of providing services at prices that are low enough to drive competitors out of a market, so as to monopolize the market. There is considerable debate about what prices and what conduct constitute predatory pricing. While the competition laws of various countries differ, it is generally agreed that a number of elements must exist to constitute predatory pricing. Typical elements for the definition of predatory pricing are set out below:

- The predator must charge prices that fall below a predatory price standard. This standard varies somewhat between countries. Generally, in competition law, prices in this sector must be below Average Total Costs, and near or below Average Variable Costs.
- There must be evidence of a clear policy of selling at predatory prices, not just sporadic or reactive price cutting.
- Normally, there must be a reasonable expectation that the predator will be able to recoup its losses after its predation ends (e.g. after competitors are driven out of the market).

Predatory pricing is often prohibited under national competition laws. It may also be prohibited under the laws or policies applied by a telecommunications regulator. Either way, it will be necessary for the regulator to have the means to investigate and stop instances of predatory pricing and to implement suitable penalties or remedies. Remedies vary. Predators may be penalized, competitors which have been the victims of predatory pricing may be compensated, or both.

CHAPTER 7

CONCLUSION AND RECOMMENDATION

7.1 CONCLUSION

In 2004-05 the fixed line telephone penetration rate was 0.64 telephone per 100 population, which is far below the world average of 10 per 100. The number of mobile phone subscribers rose by 120% in 2005-05, where the fixed line growth rate was 5.83%. But the average call completion rate is about 30% and fixed phone network barely supports modern value added services such as call waiting, call forwarding, voice mail, etc. Moreover, due to inadequate interconnection facilities between mobile and fixed phone operators, only about 10% of mobile subscribers can make calls to fixed phone subscribers.

The exchange capacity and number of connected subscribers are increasing gradually for BTTB for fixed line subscribers. But it is not sufficient compare to pending demand. Constraints in Government Annual Development Project, limitations in administrative & financial authorities are the main obstacles in the development of exchange capacity.

The subscribers' growth in cellular mobile communication is phenomenal for the last few years. The main reasons behind this growth are: long waiting time & high level of initial investment cost. On the other hand mobile phones are easily available and there are prepaid facilities.

In Bangladesh there are six cellular mobile operators in which one is CDMA operator and other fives are GSM operators. In order to maintain equal playing field for all mobile operators, it is necessary to distribute equal frequency distribution. Moreover, about 37 zonal PSTN licenses have been issued for fixed line services under open licensing regime and they are also given access frequency to provide services. If there is lack of proper monitoring facilities, these fixed phone service providers may provide cellular services under PSTN license.

In Bangladesh about 75% households have income level below 6,000.00 taka. It is observed in other countries in the world that initial mobile subscriber growth rate is very high, but after few

years it goes down. So, in our country after getting mobile phones, many people will find that it is beyond their means. And this will limit the exponential growth of mobile phones in near future.

In telecommunication sector about 61% revenue is generated in mobile sector. In mobile sector, foreign investors have 68% share and they are authorized to take their whole profit in the form of US$. As on June 2005, the revenue for the foreign investors was 11% of Bangladesh Bank foreign currency reserve. So it is envisaged that the foreign investors in telecommunication sector will put tremendous pressure in our socio-economic environment in future.

7.2 RECOMMENDATION

- In order to step ahead with the telecommunication networks and services, it is necessary that an appropriate balance be maintained between the private and public sectors and promotes competition among the investors/business entities to ensure speedy and systematic growth. Then the benefits of telecommunication will come into effect on every economic level. So, it is essential to ensure a framework for development in this sector to provide cost effective and efficient services within the reach of common people.

- Rural access to telecommunications has always been a special concern o decrease the digital gap between urban and rural area. In this case, cellular mobile communication would be the missing link to decrease this gap as network deployment of cellular infrastructure is easy and cost effective. Since it is still expensive for individual to purchase a handset, new solutions cab be developed to share mobile phone in communities through mobile payphone management.

- The license should be in detail and clearly mentioned the terms and conditions so that the operator can understand its duties and obligations as well as consumers can understand the operators duties, responsibilities and various types of services it can provide.

- In order to maintain good quality of services, there should be clear rules and regulations with the provision of penalty, if it is not followed properly. It is also necessary to prevent abuses of market power such as excessive pricing and anti-competitive behaviour by dominant operator.

- The telecommunication market will be more competitive if the interconnection arrangement and agreement are transparent and equally applicable to all. In this regard, new licenses can be given to third party to provide only interconnection facilities.

REFERENCES

1. Eppen, J.D., F. J. Gound, C. P. Schmidt, Jefffrey H. Moore and Larry R. Meatherford, 1998, Introductory Management Science, 5th edition, Prentice Hall, New Jersey, USA.
2. Gupta, S.P., and M. P. Gupta, 1995, Business Statistics, 10th revised and enlarged edition, Sultan Chand and Sons, India.
3. Intven, Hank and McCarthy Tetrault, November 2000, Telecommunications Regulation Handbook, 1st print. infoDev, Washington DC, USA.
4. Rappaport, Theodore S., 2004, Wireless Communications Principles and Practice, 2nd edition, Pearson Education, Inc., India.
5. Pahlavan, Kavch and Prashant Krishnamurthy, 2003, Principles of Wireless Networks – A Unified Approach, Prentice-Hall, India.
6. Tanenbaum, Andrew S., 1999, Computer Networks, 3rd edition, Prentice-Hall, India.
7. Ramo, Simon, John R. Whinnery and Theodore Van Duzar, 1994, 3rd edition, John Wiley & Sons, Inc., Singapore.
8. Mehrotra, Asha, 1997, GSM System Engineering, 1st edition, Artech House, Inc., USA.
9. Kahabka, Marc, GSM Pocket Guide, Vol.2, Wandel & Gultermann GmbH & Co., Germany.
10. Yang, Samuel C., 2004, 3G CDMA2000 Wireless System Engineering, Artech House, Inc., United Kingdom.
11. The APT Yearbook 1994 - 2005, R.B. Kumarapathirana, Asia Pacific Telecommunity, Bangkok, Thailand.
12. CDMA/CDMA2000 1X RF Planning Guide, March 2002, Motorola, Inc., USA.
13. CME 20 : System Survey, February 1996, Ericsson Radio Systems AB, Sweden.
14. Asia Pacific Forum on Telecommunications Policy and Regulation (Regulation in the era of convergence), May 2002, Asia Pacific Telecommunity, Malaysia.

15. World Telecommunication Development Report 2002: Reinventing Telecoms, Executive Summary, March 2002, 6th edition, International Telecommunication Union.
http://www.itu.int/itu-d/ict/publications/wtdr_02/material/contents.html

16. World Telecommunication Development Report 2003: Access Indicators for the Information Society, December 2003, 7th edition, International Telecommunication Union.
http://www.itu.int/ITU-D/ict/publications/wtdr_03/material/WTDR2003Sum_e.pdf

17. Shah, Priyam, February 2006, Bangladesh Telecommunications Report 2005, BIS Shrapnel. Australia.
http://www.bis.com.au/verve/_resources/TOC_Bangladesh_Telecom_Report_2005.pdf

18. Mobile Overtakes Fixed: Implications for Policy and Regulation, 2003, International Telecommunication Union.
http://www.itu.int/osg/spu/ni/mobileovertakes/Resources/Mobileovertakes_Paper.pdf

19. Social and Human Considerations for a More Mobile World, February 2004, International Telecommunication Union.
http://www.itu.int/osg/spu/ni/futuremobile/presentations/srivastava-presentation2.pdf

20. Trends in Telecommunication Reform 2004/05: Licensing is an era of convergence, December 2004, International Telecommunication Union.
http://www.itu.int/ITU-D/treg/publications/Trends04_summary.pdf

21. Study paper on "Financial Analysis of Telecom Industry of China and India", 16 June 2005. Study Paper No. 1/2005, Telecom Regulatory Authority of India.
http://www.trai.gov.in/paper16jun05.pdf