WDR Dialogue Theme 3rd cycle

Discussion Paper WDR0612

# Asian Backbone Study:

# A general model applied to India

Version 1.7, March 2006

Harsha Vardhana Singh, with assistance from Rohan Samarajiva & Ayesha Zainudeen
samarajiva@lirne.net

## The World Dialogue on Regulation for Network Economies (WDR)

The WDR project was initiated by *info*Dev, which provides foundation funding. Additional foundation support is provided by the International Development Research Centre (IDRC – Canada), and the LIRNE.NET universities: the Center for Information and Communication Technologies (CICT), Technical University of Denmark; the Economics of Infrastructures Section (EI), Delft University of Technology, The Netherlands; the LINK Centre at the University of Witwatersrand, South Africa; and the Media@LSE Programme at the London School of Economics, United Kingdom.

The WDR Project is managed by the Learning Initiatives on Reforms for Network Economies (LIRNE.NET), an international consortium of research and training centres, administered at the Center for Information and Communication Technologies (CICT), Technical University of Denmark. Members include the Technical University of Denmark; the Delft University of Technology, the Netherlands; the London School of Economics, UK; the University of Witwatersrand, South Africa; LIRNE*asia*, Sri Lanka; and Comunica, Uruguay.

The World Dialogue on Regulation for Network Economies (WDR) facilitates an international dialogue to generate and disseminate new knowledge on frontier issues in regulation and governance to support the development of network economies.

## Contact:

WDR Project, LIRNE.NET
Center for Information and Communication Technologies
Technical University of Denmark, Building 371
DK 2800 Lyngby, DENMARK

Phone: +45 4525 5178
Fax: +45 4596 3171
Email: info@regulateonline.org

WDR Project Coordinator Merete Aagaard Henriksen: henriksen@lirne.net.
WDR <www.regulateonline.org>
LIRNE.NET <www.lirne.net>

## LIRNE*asia*

LIRNEasia is the Asian affiliate of LIRNE.NET. It is a regional ICT [information and communication technologies] policy and regulation capacity building organization, incorporated as a non-profit organization under section 21 of the Companies Act, No. 17 of 1982 of Sri Lanka in 2004 and funded at present by the IDRC and infoDev, a unit of the World Bank. Its primary functions are research, training and informed intervention in policy and regulatory processes. Its current projects include research in South as well as South East Asia.

LIRNEasia aims to improve the lives the people of Asia – by making it easier to make use of the information and communication technologies by facilitating the changing of laws, policies and regulations to enable those uses; by building Asia-based human capacity through research, training, consulting and advocacy.

## Contact:

LIRNEasia
12 Balcombe Place
Colombo 08
SRI LANKA

Phone : +94 11 493 9992
Fax: +94 11 494–0290
Email : asia@lirne.net

<www.lirneasia.net >

# Asian Backbone Study:
# A general model applied to India

**Harsha Vardhana Singh**[1] **with assistance from Rohan Samarajiva and Ayesha Zainudeen**[2]

www.lirneasia.net

Version 1.7, March 2006

[1] Former Senior Economist LIRNE*asia.* At the time of writing he was on leave as Secretary of the Telecommunications Regulatory Authority of India.

[2] Executive Director and Researcher, respectively at LIRNE*asia*

# Table of Contents

# Executive Summary

The lack of adequate backbone or adequate access to backbone curtails potential benefits of telecom services to the end user. With technological developments, especially with the growth of the Internet and broadband, absence of adequate backbone implies that even greater opportunities for economic and social enhancement are foregone. The reasons for lack of adequate backbone are not just economic. Policy that is not conducive to optimal utilization and/or build out and ineffective implementation through regulation contribute to the problem. To the extent that policy and regulation are major reasons for non-availability of backbone or access to it, it is important that the situation in various countries be studied and remedial actions identified.

In addition to the availability of backbone across the country, it is also necessary to ensure that appropriate conditions of access to the backbone exist, if the potential benefits of market competition are to be realized.

Since a country's telecom sector normally has an incumbent with an established backbone and an entrenched market position, and because backbone involves large, upfront investment, the terms and conditions for access to the prevailing backbone becomes crucial for sustaining competition, which will in turn generate telecom sector growth.

Backbone is part of the network used to provide communications services; distinctions can be made between national and international backbones, or cable or fiber and radio based backbones, or terrestrial and satellite links, as well as the level of coverage (entire country or partial). Various types of backbones exist; technologies are constantly being upgraded and the per-unit cost constantly is coming down.

The original decisions regarding open access to backbone were based on recognition of the significance of backbone, that backbone networks are essential facilities. Such essential facilities were commonly assumed to be controlled by one/more operators, but it was necessary to ensure that competitors be given non-discriminatory and cost-oriented access to them because it was not economically/technically feasible to build a substitute. However, a backbone network does not necessarily have to be owned by one entity in most cases. Open access to backbone is most important in the early stages of market opening when entrants are much smaller than incumbent.

Backbone can be established and provided by two different types of operators: one is the "pure infrastructure provider" who establishes and leases out the backbone, and does not provide any other telecom service, especially at the retail level; the other is a "infrastructure and service provider", who establishes and leases out the backbone and also uses it to provide retail telecom services in the market (hereafter referred to as "infrastructure provider" and "service provider," respectively).

Backbone can be established as a commercial investment, through government assistance, through roll-out conditions or by complete or partial government financing.

Infrastructure providers and service providers have different incentive structures with respect to installing backbone and providing access to others. Pure infrastructure providers are likely to favor greater access, compared to those who also provide services, in competition with the bulk customers.

Establishment of a backbone, or access to the backbone, depends on the returns from such activities. The highly capital intensive telecom industry requires relatively large investments in backbone, and since the gestation period for obtaining adequate returns is long, there are substantial uncovered costs, especially in the initial years. For the investment to be viable, the net present value must be greater than or equal to zero. In addition, the investor may also consider whether the pay-back period or the break-even period is adequate in view of the conditions in the financial market, i.e. availability of funds over different periods of time.

The lump sum level of investment implies that there is a threshold level of demand below which the investment is not commercially viable. In the case of India, in some areas and for some operators (primarily for the incumbent) demand appears to exist in range of the threshold; in many areas, especially rural and underserved areas, demand and supply are not in line with threshold demand, requiring different forms of policy and regulatory intervention

The more time it takes to reach this threshold level of demand, greater will be the additional costs (due to losses in the initial years) to cover, and the payback period will become extended, particularly due to the discounting applicable net revenues of different years.

There has been considerable emphasis on open access models for promoting the establishment of the telecom backbone. Important reasons for this include the lower costs these operators have and the incentives they have to provide others with access to their backbone. However, to expect the infrastructure provider to have greater incentive to establish the backbone, on the grounds that its costs are lower, would not be correct in general. There will be situations when the incentive for a service provider to invest in the backbone is going to be greater than that for the infrastructure provider, and still both the types of operators would invest in the backbone. In other situations, depending on the relative revenues and costs, we can have either only the service provider investing in the backbone, or only the infrastructure provider investing in the backbone.

There will likely be many situations when investment in the backbone will not be commercially made by both the service provider and the infrastructure provider, and the government will have to take specific measures to assist the process, including providing incentives. To consider the various possible situations, we denote prevailing demand with "D", the threshold level of demand with "$D_T$", and prevailing supply of backbone with "S". The following table summarizes the situations for which investment in backbone would be commercially unviable.

**Likely growth in backbone, and requisite policy response in situations for which the investment in backbone is commercially UNVIABLE**

| Demand/Supply Situation | Salient Feature | Likelihood of Increase in backbone | Requisite policy response for increasing backbone |
|---|---|---|---|
| (1) $D_T > D > S$ | - Inadequate demand,<br>- but excess demand in comparison to supply (i.e. waiting list in market),<br>- not certain whether certain factors constrain supply | Unlikely | - Increase prevailing demand<br>- Decrease $D_T$ through policies to reduce costs, increase operational flexibility, and reduce delays<br>- See if any factors are constraining supply, and address them |
| (2) $D_T > S > D$ | - Severely inadequate demand (i.e. major demand constraint), | Unlikely | - Strong focus on increasing prevailing demand |

| | | | |
|---|---|---|---|
| | - no excess demand in comparison to supply (i.e. no waiting list in market),<br><br>- not certain whether certain factors constrain supply | | - Decrease $D_T$ through policies to reduce costs, increase operational flexibility, and reduce delays<br><br>- See if any factors are constraining supply, and address them |
| (3) $S > D_T > D$ | - Severely inadequate demand (i.e. major demand constraint),<br><br>- no excess demand in comparison to supply (i.e. no waiting list in market) | Unlikely | - Strong focus on increasing prevailing demand<br><br>- Decrease $D_T$ through policies to reduce costs, increase operational flexibility, and reduce delays |

The next table summarizes the situations for which investment in backbone would be commercially viable.

**Likely growth in backbone, and requisite policy response in situations for which the investment in backbone is commercially VIABLE**

| Demand/Supply Situation | Salient Feature | Likelihood of Increase in backbone | Requisite policy response for increasing backbone |
|---|---|---|---|
| (1) $D > S > D_T$ | - Definite situation of supply constraint<br><br>- excess demand in comparison to supply (i.e. waiting list in market) | Likely, if supply constraint is addressed | - Address factors constraining supply<br><br>- Increasing demand will not help increase backbone |
| (2) $D > D_T > S$ | - Severe supply constraint<br><br>- excess demand in comparison to supply (i.e. waiting list in market) | Likely, if supply constraint is addressed | - Address factors constraining supply<br><br>- Increasing demand will not help increase backbone |
| (3) $S > D > D_T$ | - Definite situation of demand constraint<br><br>- no excess demand in comparison to supply (i.e. no waiting list in market) | Unlikely, unless demand constraint is addressed | - Increase prevailing demand |

Thus we see that in certain situations, we need to focus only on addressing the supply constraint and that increasing the prevailing demand in the market will not help increase the backbone. On the other hand, we see that in a number of situations, the supply of backbone will not increase unless the prevailing demand in the market rises.

If there is excess demand in the market and/or likely growth in demand, it is possible that the capacity demanded will exceed the threshold level for attracting investment in the backbone. Infrastructure sharing can increase incentives for investment, as the costs can be allocated amongst the various entities sharing the infrastructure. The effective cost of the backbone to the user is reduced and is more likely to happen when the backbone is installed by an infrastructure provider than when it is installed by a service provider. USO funds and government programs to expand and promote broadband can change the viability frontier; improved interconnection and access revenues can also increase viability, making backbone viable in areas that were previously commercially unviable.

There also exists a 'price threshold level,' that is the price level below which the extent of increase in demand would be so large that the stimulus from this large market demand would make investment in backbone self-sustaining and viable, even for several erstwhile cases of non-viable investments. It may therefore be desirable to take steps to create the situation for prices to decline below the price threshold level.

Once the market reaches the relevant price threshold, the future growth in demand and revenue sources (through value added services, Internet, and broadband) would ensure that the attractiveness of the investment increases. Further, it is possible that with competition and introduction of new technologies, the price would decline due to market pressure itself.

With respect to the adequacy of telecom backbone in the country, the nature of analysis will depend on the particular situation prevailing in the country. For this purpose, we could have three possible situations:

(a) The backbone in the country is adequate. In this situation, within our framework, the policy focus needs to be on access only, including through policies related to infrastructure sharing.

(b) Backbone in the country is generally adequate, but there are some areas with inadequate backbone supply. Where supply of the backbone is adequate, the focus would be on access to the backbone; where supply of backbone is inadequate, policy analysis would focus on both the establishment of the backbone as well as access to the backbone.

(c) Supply of backbone in the country is inadequate. Both the establishment of the backbone as well as access to the backbone have to be examined.

**The model applied to India**

India's liberalization of its telecom market began in the early 1990s, beginning with the equipment sector. The National Telecom Policy of 1994 ("NTP 1994") recognized a need to open up the telecom sector to private entry to increase teledensity, and to provide modern and affordable services to the people. Since then, the Indian telecom story is one of progressive liberalization, dealing with emerging problems, and devising policy regimes which focus on affordability, utilization of the telecom network, and growth.

India has experienced massive growth in telecom over the recent years, not only across the country, but also within the circles. Only four out of 23 circles have less than a million fixed plus mobile customers. However, unless infrastructure sharing is practiced (either through commercial arrangements or regulatory mandates), the total number of subscribers is not relevant; threshold levels of demand (for each provider's potential investment in backbone) will not be reached. The incumbents, BSNL and MTNL, with their high levels of subscribership (for example, more than a million per circle in 18 of their circles on fixed) on fixed as well as mobile have the incentives to build backbone. In contrast, fixed entrants have more than half a million subscribers only in 8 out of 23 circles; mobile entrants have more than half a million only in 9 circles out of 23.

With regard to supply of backbone in India, not all of the fiber may be lit. It is important to note that dark fiber can be lit easily if the fiber has already been laid, and capacity can be upgraded easily.

The total domestic backbone in India as at 2005, was almost 900,000 Route km, of which the bulk was accounted for by the incumbent, BSNL. As at March 2005, total backbone supply by operators (Fiber plus microwave, including leased capacity) was 662,920 route km; the majority of this was with the incumbent, BSNL. The total backbone supply by infrastructure operators (as at Q1, 2005) was over 50,472 route km.

It is estimated that 1 route km will cost USD 4500-5500 (INR 200,000-250,000) to lay. Long-distance ARPUs [average revenue per user] in India are USD 14/yr

(INR 600). Thus, revenues from 140 subscribers are needed to make fiber viable in India.

According to this analysis, at present, for Reliance Infocomm India as a whole is unviable to build backbone; however, with 10 per cent growth per year, a very realistic target) supplying backbone for India as a whole will become a viable option for Reliance Infocomm.

# 1 Introduction

The telecom sector has exhibited massive growth in most countries, with the advent of competition in the sector, the increasing role played by mobile services, innovative tariff schemes, cost reductions, and technological improvements. Increasing competition has contributed greatly to reduce the tariffs of telecom services, which in turn has encouraged an increase in the market base. These are outcomes of major significance since the availability of affordable communications vastly improves socio-economic opportunities. With increasing use, telecom services give rise to multiplier income effects and to new forms of income earning activities which were hitherto unavailable.

Since telecom services for end-users require the existence of backbone and access to it at cost-oriented and non-discriminatory rates, it is evident that lack of adequate backbone or adequate access curtails potential opportunities. Moreover, with technological developments, especially with the growth of the Internet and broadband, absence of adequate backbone implies that even greater opportunities for economic and social enhancement are foregone. The cost of not remedying this shortcoming is huge in terms of unachieved potential for income, education, and health. This is especially because such lost opportunities might not be just due to low income levels of the country concerned, but due to not following appropriate policies or not taking quick decisions to achieve requisite changes in a timely manner.[3] To the extent that policy is a major reason for non-availability of backbone or access to it, it is important that the situation in various countries be studied and remedial actions identified.

The pace of establishing backbone may not necessarily be linked with the income levels. To the extent that concerted action can improve performance in this regard, it is also possible that the benefits of the availability of the backbone may not be realized even in countries with adequate backbone, due to policies which limit the extent of its use. As noted above, an important factor contributing to growth of affordable telecom services, has been the increase in competition. To generate and nurture competition, it is important to have a regulatory regime which focuses on a level playing field. Since a country's telecom sector normally has an incumbent with an established backbone and market, and because backbone involves large, upfront investment, the terms and conditions for access to the prevailing backbone becomes crucial for sustaining competition. Therefore, in addition to the availability of the backbone across the country, it is also necessary to ensure that appropriate conditions of access to the backbone exist, if the potential benefits of market competition are to be realized.

This paper focuses on the factors which affect the establishment of the backbone, and the access provided by the owners of that backbone to

[3] Similar to Amartya Sen's thesis of the "missing women" caused by gender inequality, this could be termed as the thesis of "missing income, education and health levels" caused by constraints which prevent the realization of the potential of available technologies.

others, taking India as a case study. Based on this, an attempt is made to identify the key policies that might promote establishment of, and access to, the backbone.

In Chapter 2, we develop a theoretical framework to examine the conditions under which investment will take place in the backbone, or access to it will be provided. We consider two different types of backbone providers, one which only establishes the backbone and leases it out ("pure infrastructure provider"), and the other which also uses its own backbone for providing telecom services ("infrastructure and service provider"). We see that the incentive structures for these two types of operators are different and that they will respond differently to market and policy incentives. We identify some broad conditions under which both, or only one of them, would invest in the backbone. The analysis also shows that competition leading to a decline in the tariff for using backbone will be stimulated by the entry of a pure infrastructure provider. Reduction in the price of a major input for telecom services leads to a reduction in the retail tariffs for these services under competitive conditions.

Chapter 2, further examines the question of encouraging pure infrastructure providers. The presence of a pure infrastructure provider reduces the incentives of service providers to install backbone. Therefore, the question arises whether policy should support pure infrastructure providers. The Chapter also considers the minimum demand levels that would be required to make investment viable for these two types of operators, and examines the conditions for such demand to exist. Factors which will adversely affect the provision of access by the service provider are also examined. It is clear that especially in the initial phase of competition, the service provider will be averse to providing access. This justifies the taking of a strong policy position to open up access.

The overall analysis shows the importance of faster growth in demand for both investment and provision of access to the backbone in several contexts. Thus, a case exists for addressing constraints on demand and supply, or both, under different scenarios. Chapter 2 examines the different scenarios under which addressing either demand or supply constraints, or both, would result in augmenting backbone supply.

In the context of facilitating demand growth, we introduce the concept of a price threshold. This is the price level below which the increase in demand in the market will be huge. There will therefore be a strong possibility that this demand would generate a self-sustaining revenue stream which will make investment viable even in hitherto unviable regions. It is clarified that the market will tend to under-estimate the increase in demand for prices below the price threshold, and therefore the investment in the market will be inefficient, i.e. it will be based on a smaller estimate of the market size than is likely to arise for prices below the price threshold.

Based on the above analysis, Chapter 2 identifies the various policy options available to Government to support the growth of backbone and greater access to it, as well as the steps to be taken to generate greater demand. It identifies the conditions for prices below the price threshold which enables the market to sustain investment in the backbone on a commercial basis. The framework of analysis is then summarized, together with a specification of with various information and data that would be required to conduct the analysis.

This theoretical framework is then used to analyze the situation in India. India has been selected because it is a country that has adequate backbone, so that greater focus may be on issues relating to access. A detailed analysis is conducted for India in Chapter 3.

# 2 Theoretical Framework

The objective of this paper is to understand why adequate network backbone may not be available, or adequate access to it may not be provided. Based on this assessment, we identify policy actions that can be taken to create the conditions for adequate supply of, and reasonable access to, backbone in a country. For both availability and access, we need to identify the commercial incentives that affect the decisions of telecom operators. Based on this, we can consider the situations which merit additional policy intervention versus the play of market forces. This Chapter develops a theoretical framework for such an analysis.

The Chapter begins with section 2.1, which describes the types of telecom backbone. Section 2.2 summarizes the private/public initiatives that result in the establishment of the telecom backbone. Since policy initiatives to liberalize the telecom sector aim to attract private investment by allowing a greater role for competition in developing telecom markets, the key starting point in the analysis has to be the factors affecting the commercial viability of investing in the backbone. Section 2.3 begins this analysis with some stylized equations focusing on revenues and costs relating to investment in the backbone. It also notes that there are three types of issues relating to the backbone, namely establishment of the backbone, access by others to the established backbone, and interconnection amongst the networks. The incentive structure affecting the provision of access to the backbone is similar to that applicable to provision of interconnection. Thus, the main focus in this Chapter is on factors affecting the establishment of backbone and provision of access on cost-oriented and non-discriminatory terms to that backbone, because this latter discussion will also broadly cover the incentives relevant to interconnection.

An important point is that the backbone can be established and provided by two different types of operators: one, is the "pure infrastructure provider" (hereafter referred to as an 'infrastructure provider)who establishes and leases out the backbone, and does not provide any other telecom service; the other is a "infrastructure and service provider" (hereafter referred to as a 'service provider'), who establishes and leases out the backbone and also uses it to provide retail telecom services in the market. The incumbent falls into the latter category. Based on this distinction, the stylized equation is presented in more detail in Section 2.4 of this Chapter, so as to better identify the different incentive structure applicable to the infrastructure provider and to the service provider.

The terms and conditions offered by the infrastructure provider are in the nature of "open access." Open access networks have been increasingly a focus of attention because alternative network providers such as power, railways, gas, or cable companies are entering the market for telecom backbone provision, and these operators tend to have relatively lower costs due to the ability to share their common and joint costs with other operations. Thus, these open access networks are expected to contribute in a major way to the extension of the backbone. However, a related concern is that with the establishment of open access networks by infrastructure providers, the service providers will have a lower incentive to establish their own backbones, which will likely have an adverse effect on the availability of backbone in the country. These issues are analyzed in Sections 2.5 to 2.9 below.

Section 2.5 considers some general features regarding the factors which affect investment in the backbone. Section 2.6 considers the market situation where an service provider as well as a infrastructure provider, investing alone in the market, will individually find it commercially viable to establish the backbone. Section 2.6 also identifies situations where only one of them will find it profitable to invest, i.e. either only the service provider or only the infrastructure provider will invest in the backbone. The analysis is extended in Section 2.7 by considering the effect of policy restraints on the price at which the backbone may be leased out to others. This examination is further extended in Section 2.8 to consider the situation when both the service provider and the infrastructure provider operate in the market. The likely policy implications of encouraging or curbing the operations of the infrastructure provider in establishing the backbone are also discussed in this context. In each stage of the analysis we see that the existence of a threshold level of demand, both present and in the near future, is a major factor affecting the incentive for establishing, as well as for providing access to, the backbone.

The incentives for investment in, and growth of, the backbone depend on whether the demand in the market exceeds the threshold level of demand, and also whether the prevailing supply of backbone is less or more than the demand in the market. Section 2.9 identifies six situations of which only three have investment in backbone being commercially viable. However, the likely policy responses to address the constraints on backbone supply do not depend only on commercial viability, but also on whether demand exceeds supply, and the relation to the threshold level of demand. This Section also provides a basis to identify situations when policy has to focus more on releasing supply side constraints, and when the backbone would not increase without a substantial growth in demand.

In light of the key importance of demand for investment in the backbone, Section 2.10 considers the likely assessment of demand growth by the market participants, and argues that the market will always under-estimate the growth in demand arising due to the price decline, especially for prices below a price threshold level. For this reason, the market will always under-invest in the backbone when prices are above the price threshold. Thus, there is a market failure in terms of the likely investment that will take place in the backbone, based on commercial considerations by the operators.

Market failure with respect to investment in the backbone arises not only due to the above reason but also on account of the several positive externalities of providing telecom services that are not adequately captured by private investors. Therefore, a good rationale for government intervention in backbone exists.

Taking account of the analysis of the demand threshold and price threshold, Section 2.11 considers the factors which should be considered when designing government policies to encourage self-sustaining, viable investment in the market. A key point in this context is that if the price in the market is brought below the price threshold, a self-sustaining momentum develops in the market to attract investment even in locations that were earlier considered commercially unviable. Creation of such conditions should be an important focus of the government, and Section 2.11 notes some of the factors which should be examined to help take decisions which will move the market towards such "virtuous circles."

The above policies would need to be supplemented with government intervention to release supply constraints, and to support investment through financial assistance, etc. especially in the period before conditions for self sustaining investment are created. There will still remain unviable areas, and the government may have to expedite the provision of backbone in such places. It may also have to accentuate the effects of its efforts to move prices below threshold levels in order to create adequate demand to attract investment. The various types of government initiatives in this regard are described in Section 2(l). It is pointed out that a policy framework with specific targets must guide policy makers on the objectives to be achieved. A priority list of the main policies to achieve these objectives should be formulated.

The discussion in Sections 2.5 to 2.12 covers a number of points relating to the overall framework of analysis relating to the establishment of, and access to, the telecom backbone. These are summarized in Section 2.13. This framework will provide a reference to the empirical study on India in Chapter 3.

## 2.1 Different types of backbone

Backbone is part of the network used to provide communications services. At the broadest level, distinction can be made in terms of national and international backbone, or cable or fiber and radio based backbone, or terrestrial and satellite links.[4] Further, the backbone can be planned and installed within a part of the country, the country as a whole, or across a number of countries. The greater the coverage of the backbone, greater is the need for coordination.

[4] For a discussion of the various types of backbone, and the prevailing situation in a number of countries, see NEPAD e-Africa Commission (2004).

The various types of backbone include, copper, fiber-optic cable, co-axial cable, digital microwave, VSAT, and satellite transmission.[5] The backbone includes not just the conduit for carrying traffic, but also the microwave towers and masts.

Over time, the backbone technologies have been upgraded and become cheaper in per unit terms. The extent of up-gradation and the extent of cost decline have been large with indications that such changes will continue further. The increase in capacity has been very significant with fiber based systems, but progress is being made with wireless systems too with substantially higher data transfer rates likely to be achieved in the near future. An illustration is given in **Annex 2.1** of this paper. [6]

## 2.2 Different ways of establishing telecom backbone

Backbone networks can be established through a variety of means.[7] These include, for example:

(i) Establishing the backbone as a **commercial investment**. This is the most common scenario that is examined to assess the factors which facilitate or inhibit the establishment of the backbone. A close look at these factors is important because market liberalization seeks growth in the market through private investment. Such investment depends on commercial considerations. To the extent that private enterprise is to contribute to building up the network and the market, factors affecting commercial investment in the backbone are crucial to enhancing the availability of the backbone. This assessment also provides a basis to identify and remedy the prevailing shortcomings in the policy regime as well as in the market conditions.

The commercial viability of investment depends on, for example, the overall investment environment in the country, the policy environment (including regulation) and market situation in the product market, the availability of finance, access to rights of way at low costs, etc. and the likely changes in the above factors.

(ii) Backbone being established through **government assistance**. Such assistance can take various forms, some of which are mentioned in Section 2.11 below. Support from the government may be categorized as demand-side and supply-side policies. An important point to consider is whether the support or assistance policies should be general in coverage, or should be focused on limited regions or service segments.

---

[5] It is noteworthy that the backbone installed by cellular operators in several countries exceeds that installed by fixed-line operators. See, for instance, **ibid.**, section 1.4.

[6] I am grateful to Mr. S.N. Gupta for providing the material in Annex 2.1.

[7] The purpose of these categories is to distinguish between the different commercial and non-commercial initiatives that result in the establishment of backbone. Within each of these categories, the relevant factors can be considered using a framework such as that of the stylized equation given below.

(iii) Establishment of the backbone **through roll-out conditions** included in the license or concession granted for operating services in specified areas. To the extent that roll out of the backbone would have been commercially attractive, and such investment would have been undertaken in any case, the roll-out conditions would not achieve anything new. It could, however, incorporate conditions which may require expediting the establishment of backbone. While roll-out conditions may result in additional or earlier provision of backbone, the license or concession conditions requiring roll-out involve internal cross-subsidies whereby the non-commercial investment has to be funded from surplus from commercially viable regions.

(iv) **Establishment of the backbone by the government through financing it, or by establishing it itself through a government entity**, which may even be the incumbent public sector telecom operator. Once again, an important consideration would be the coverage of such initiatives, and which regions or limited service segments they should address. Moreover, the intervention by the government should be such that it supports and promotes private initiatives over time so that greater commercial investment is generated and segments which were considered commercially non-viable become viable without sustained and/or continued help needed from the government. Thus, conceptually, the government intervention could be seen as being similar to pump priming, which generates substantial private investment as a result of the initial boost provided by the government.

The host of different types of initiatives and planning for phase-in and phase-out of government support, implies that there is a need to clearly identify a broad policy framework, which would contain certain specific objectives and targets which can be considered in terms of their tangible achievement. This should be done with a clear perspective that the role of the policy initiative is to develop the market, so that private investment keeps assuming greater and more important role over time in addition to the substantial public support that may be in place.

In this framework, the most important starting point for assessing the factors which affect the establishment of the backbone is to examine the commercial attractiveness of such investment. This helps to bring out the likely conditions under which the backbone will be established, and access to such backbone will be provided to others. It will also help identify the likely policies which will enhance the possibility of private investment in establishing the backbone. As mentioned above, this is crucial for rapid progress in telecom, because the purpose of introducing competition and inviting private investment is to provide increasingly important role for such investment. The next sections discuss these factors.

## 2.3 A stylized equation of revenues and costs

We begin with an illustrative stylized equation for revenues and costs relevant for the telecom backbone. In simple terms, establishment of a backbone, or access to the backbone, depend on the returns from such activities.[8] The highly capital intensive telecom industry requires relatively large investments in backbone, and since the gestation period for obtaining adequate returns is long, there are substantial uncovered costs, especially in the initial years. The present value for the surplus on the investment can be shown simply as:

(i) … **Present value of the investment** = R – C, or Revenues – Costs.

Or as:

(ii) **Present Value** = $R_1 - C_1 + (R_2 - C_2)/(1+\beta) + (R_3 - C_3)/(1+\beta)^2 + \ldots + (R_n - C_n)/(1+\beta)^{n-1}$

where,

- 1, 2, …, n are the different years for which the investment is in operation;
- $R_1$ , $R_2$ , etc. are the revenues in different years from the investment in the network;
- $C_1$ , $C_2$ , etc. are the costs in different years from the investment in the network; and,
- $\beta$ is the rate of discount.

For the investment to be viable, the present value must be greater than or equal to zero. In addition, the investor may also consider whether the pay-back period or the break-even period is short enough in view of the conditions in the financial market, i.e. availability of funds over different periods of time. In effect, this implies an increase in the discount rate, $\beta$.

The presence of $\beta$ in equation (ii) also shows that if there are some constraints or policy situations which delay the investment from becoming fruitful in terms of final capacity available and used, the present value of the projects returns will become less. Thus, **high priority should be given to implement policies which bring revenues earlier, or increase the revenue base in the critical initial years themselves** (when use and consequently revenues are also likely to be low.).

[8] Regarding the various factors that are considered by investors, Bruce and Macmillan (2002), page 5, mention the following. **Operating statistics and ratios**: subscribers (or lines), employees per subscriber (or line), minutes of use per subscriber, churn rate, country penetration. **Financial/Operating ratios**: Average revenue per user (ARPU), Revenue per minute, subscriber acquisition cost, enterprise value per subscriber, capital expenditure per subscriber, capital expenditure per minutes of use. **Financial Statistics/Ratios**: Operating revenues, EBITDA, EBITDA margin (EBITDA over revenues), free cash flow, Debt/EBITDA, Debt/Market capitalization, Enterprise vale/EBITDA, Capital expenditure/revenues, FCF yield, P/E ratio, Earnings per share, return on equity.

## 2.4 Two types of backbone providers, and issues relating to the backbone (establishment, access, and interconnection)

For understanding the factors which affect the establishment and provision of the backbone, it is useful to separately consider two types of operators. One is the operator who establishes the backbone only to sell the infrastructure service.[9] We will term this operator as the **"infrastructure provider"**. The other operator is one who establishes the network and sells telecom services using that backbone, and also provides others with access to its backbone. This operator will be termed as **"service provider"**.

Bearing this distinction in mind, we slightly expand the components of equation (ii) above to further illustrate the points made in our analysis below. Thus we obtain a stylized equation (iii), to give the following representation for the present value of the investment made in the backbone:

(iii) ….**Present Value** = $(R_v + R_{va} + R_i)_1 - [(r + d + i)(I_k + I_v) + W_k + W_v + T]_1 + \{(R_v + R_{va} + R_i)_2 - [(r + d + i)(I_k + I_v) + W_k + W_v + T]_2\} / (1 + \beta) + \ldots + \{(R_v + R_{va} + R_i)_n - [(r + d + i)(I_k + I_v) + W_k + W_v + T]_n\} / (1 + \beta)^{n - 1}$

where,

- $R_v$ , $R_{va}$ , and $R_i$ are respectively, the revenues from voice, value-added, and revenues from selling infrastructure (or access charges). All services which are non-voice services, are categorized above as value added services;
- $I_k$ and $I_v$ are respectively the Investment required to begin providing services, and additional investment required when volume of services provided is increased;
- $W_k$ and $W_v$ are, respectively the working expenditure counterparts of $I_k$ and $I_v$;
- r is the required rate of return on equity;
- d is the depreciation rate on investment;
- I is the interest rate on debt;
- T is the charges paid to the government, such as License fee, spectrum charge, etc.

---

[9] A number of countries have recognized the importance of such specialized service, especially by other utilities, of providing only infrastructure. They have thus created a special category of License for allowing exclusively the service of infrastructure provision. Likewise, the licensing regimes in a number of countries have evolved to distinguish between those who have infrastructure (which they may or may not use to provide telecom services also), and others who do not have their own infrastructure but themselves provide telecom services using the infrastructure resources taken from others. See for example, Hatfield, Dale and Lie, Eric (2004).

A consideration of the revenue and cost components in equation (iii) above will help us get better insight into the difference in the response of service provider and an infrastructure provider to various situations, as well as the different types of financial and public support policies that can be used to encourage the availability of the telecom backbone. The detailed equation will be relevant more in the section dealing with government policies in Section 2.11. For most of the other analysis, we will rely on simpler forms of the equation, such as in equation (i), to examine the different factors which affect the establishment of, and provision to others of access to, the backbone. The simpler equations are easier to handle and are adequate to broadly indicate the importance of various relevant factors for our purpose.

**A key difference among the service provider and the infrastructure provider**

A fundamental difference between an infrastructure provider and a service provider installing and providing infrastructure is that they have different incentive structures with respect to installation of backbone and providing the backbone to others.

An important feature regarding "infrastructure provider" is that he establishes the infrastructure only to provide others access to it. By definition, therefore, for such an operator, the main issue is whether or not to establish the backbone, because once established, he will not deny others access to it.[10] In other words, **for an infrastructure provider, the establishment of infrastructure and access to infrastructure go hand in hand**.

**For operators having an interest in both the service market and the infrastructure market, an incentive favoring the installation of backbone does not automatically imply that others will be provided access to that backbone**. Let us consider this in terms of equation (iii) above.

A service provider with infrastructure has all the three possibilities of revenues mentioned in equation (iii) above, i.e. $R_v$ , $R_{va}$ , and $R_i$. However, there is commonly a perceived conflict with respect to the revenue source $R_i$ (earned by providing access to backbone), and the revenue sources $R_v$ and $R_{va}$ earned from sale of the services using the backbone. Normally, for any given capacity of the backbone to be utilized in two different ways, namely through provision of a service and through providing access to the backbone, the revenues earned through $R_v$ plus $R_{va}$ (i.e. voice and value added services) exceed the alternative source of revenues from $R_i$ (i.e. by providing access to the backbone). In fact, by definition, for any specified capacity the corresponding amounts of revenue $(R_v + R_{va}) > R_i$, because if it is not so, then the operator will normally not be able to lease capacity and then use it profitably because

[10] However, there is a possibility that the provider may adopt a pricing model that discourages high volumes – the usual monopoly pricing problem.

the revenues earned through services sold will not cover the costs of providing services using that capacity.

The above situation implies that if a service provider is of the view that he will lose his market revenues from services if he allows others to use his backbone and compete with him in the services market, such an operator will prefer to not give others access to its own backbone. Thus, in this situation of a trade off perceived among these two revenue sources, the activity which provides larger revenues will be favoured and the other one not. Therefore, the **in-built incentive structure for the service provider with infrastructure is to use the network itself and not provide its competitors with access to that network**. This incentive structure is likely to prevail in general, as discussed below.

When the market is initially opened up, the newcomer competing in the market attempts to compete for the most valuable customers in the established market, away from the incumbent.[11] The incumbent will be averse to make available any facility such as the backbone, which allows intensifying such competition. **There is a clear trade off for the incumbent between earning $R_v + R_{va}$ and the alternative of earning $R_i$. Since the former is likely to be greater than the latter, access to its backbone will be provided by the incumbent only if it is mandated by policy to do so. This is a major difference between the behavior pattern of an infrastructure provider and a service provider with infrastructure.**

**The above analysis also shows that if competition in the backbone leasing market is to be encouraged, the infrastructure provider is more likely to contribute to the competitive pricing than the service provider.**

**Importance of rapid growth in demand**

It is noteworthy that the service provider will be more willing to provide access to its backbone, if the trade off that we mention above, is reduced. This is likely to happen only when the market is growing rapidly enough so that the service provider with backbone is in a position to continue to increase its market size at a rapid pace even with competition in the market. We see later that **fast growth in the market becomes a key factor, not only for establishment of the backbone but also for the possibility of access being provided to the backbone.**

**Suggestions to separate the functions within a firm**

Noting the different behaviour of the infrastructure provider and the service provider in terms of giving access to others to the backbone, and the disinclination of the service provider to give such access, one view is that there should be a separation of activities to address this situation. As per this view, the operations of the service provider could be segregated into two distinct and separate branches, one dealing with establishment

[11] For some evidence of the new entrants, including the mobile subscribers, focusing on high revenue business subscribers in the initial phase of competition, see ITU (2000), Bruce and Macmillan (2002), **xxxx**

and provision of network elements such as the backbone and the other providing services after leasing the backbone etc. from the section owning and leasing out the backbone. One example of this is the structural separation of BT along such lines.[12]

**The importance of the interconnection regime**

In addition to the above, the nature of the interconnection regime becomes important, and we need to see the types of incentives that the regime provides to those demanding and supplying backbone, as well as seeking interconnection with another network. For example, if the price for access to the backbone is relatively low in comparison to the cost, the supplier will not have an incentive to provide it and those seeking it will have an incentive to demand more than its requirement. This is the well known balance to be maintained in policy regarding the "build" or "buy" decisions**. If $R_i$ is relatively low, others will prefer to "buy" rather than build, and those with the backbone will prefer to "not sell" at all. In fact, if $R_i$ is low, even the infrastructure provider will not have much incentive to build the network.**

Regarding interconnection, an important point is that the interconnection is sought by the new comers with the network of the incumbent, who is a service provider. Therefore, the factors which affect the incentives/disincentives regarding provision of access to the service provider's backbone, also incorporate the effect on the incentive structure for providing interconnection. Thus, in this Chapter, we are not considering in detail interconnection related matters, because the issue of access is considered in some detail and this analysis will also cover the main factors which are responsible for operators not providing interconnection. However, the interconnection regime will be examined in the context of the empirical analysis, because that will be required to have a comprehensive picture of the prevailing situation in India, the country under study.

## 2.5 Some general features of the components of equation (iii) above

This section summarizes some general points relating to equation (iii) above, including a few that have already been mentioned above. These include:

- An increase in revenues implies improved present value, as does a decrease in costs. The revenue increase can take place, for example, due to larger number of services being provided or due to an increase in usage. The unit costs may decrease as technology changes, or with an increase in the utilization of the network.

[12] For more detail, see www.btplc.com.

- In equation (iii) above, the revenues from services are normally much higher than the revenues from selling only the infrastructure.[13] Thus, normally, $R_v$ plus $R_{va}$ is higher than $R_i$.[14]

- Likewise, the incremental cost of increasing the capacity is less than the initial cost. This happens both because the costs of the system decrease over time, and because the capacity of the system can be increased with proportionately less investment than the extent of capacity augmented. This implies that $I_k$ is more than $I_v$, and $W_k$ is more than $W_v$. As a result, average costs per unit capacity will decrease with an increase in the installed capacity.

- Since the establishment of the backbone requires a minimum, lump sum, investment, the average cost per unit of traffic will decrease as usage increases.

- The lump sum level of investment also implies that there is a threshold level of demand below which the investment is not commercially viable.

- The more time it takes to reach this threshold level of demand, greater will be the additional costs (due to losses in the initial years) to cover, and the payback period will become extended, particularly due to the discounting factor applicable to the net revenues of different years.

- With technological change, there is a decrease in costs,[15] and an increase in the types of products under the value added category that may be provided. The latter would imply an increase in $R_{va}$. The decrease in costs can result in price decline and greater usage, which may change $R_v$: the change in $R_v$ will depend on the extent of the increase in usage in comparison to the decline in price.

- If the change in technology allows other service providers to cut into the market of the established operators providing access

---

[13] Although, the cost of bad debts, collection costs, billing problems etc can increase the cost of provision of services.

[14] While this is likely to be true in general, the easiest way of conceptualizing this is to consider the same level of capacity to be used for two alternative sources of revenues, i.e. one, leasing the capacity to others, and the other being the use of the capacity to sell telecoms services. A number of simplifying assumptions underlie this comparison, such as the extent of traffic being the same as that reflected in the implicit capacity utilization considered for determining the access charge for leasing the backbone. Thus, the statements based on this analysis should be seen more as indication of the broad likely features rather than being valid under all possible circumstances. These broad features enable us to get a general perspective on the factors that will affect the establishment and access of the backbone. More detail in terms of the level of capacity utilization is considered in the later sections.

[15] See, for instance, the report by Primetrica, and the Explanatory Memorandum in TRAI (2005a) and (2005b) for evidence on such cost declines.

services, there will be a downward pressure on $R_V$ and $R_{Va}$ for the established access providers.

- The various components of revenues and costs, the interlinkages between the performance in different years, and the likelihood of backbone not being established in several areas which are commercially unviable, implies that the government may need to develop an overall vision and policy framework, and identify the types of initiatives that must be encouraged by the private sector, and the supporting initiatives that must be taken through government policy.

We now approach some specific features relating to investment by service provider and infrastructure provider in the backbone. We begin by considering the market situation facing a service provider, and whether he would find it commercially viable to invest in the backbone under different situations. We then consider the infrastructure provider facing the same market situation, operating alone in the market for backbone, and examine whether the investment response of the infrastructure provider would be the same as for the service provider. Section 2.6 shows that there will be conditions when the investment response of the two, i.e. service provider and the infrastructure provider, will not be the same. We then consider the effect of policy restraints imposed on the price at which backbone may be leased out. This is followed by an examination of the incentives for investment in backbone when both the service provider and the infrastructure provider are together functioning in the market. This examination shows inter alia the crucial role played by excess demand and the growth of demand over time, in this regard.

## 2.6 Investment response of the infrastructure provider in comparison to the service provider for establishing the backbone

We begin our assessment by considering different types of situations within which a infrastructure provider and an service provider examine the viability of investing in the backbone, as if they alone are functioning in the market. This will help identify some of the key differences and similarities in the investment response by these two types of operators. We will follow this analysis in a later Section, with an examination of the situation where both these operators function together in the market. In that Section the focus will be more on whether there are any adverse effects on establishment of the backbone in the country if open access backbone provision is allowed.

Since the focus of an infrastructure provider is only on providing infrastructure, the relevant revenue in the above equation (iii) for the operator is only $R_i$. If we consider the initial situation of establishing the backbone, the relevant equation for a infrastructure provider becomes:

(iii.a)… **Present Value** = $(R_i)_1 - [(r + d + i)(I_k) + W_k + T]_1$ + $\{(R_i)_2 - [(r + d + i)(I_k) + W_k + T]_2\} / (1 + \beta)$ + … + $\{(R_i)_n - [(r + d + i)(I_k) + W_k + T]_n\} / (1 + \beta)^{n-1}$

We have seen above that it is likely that $R_i$ will be less than $R_v$ plus $R_{va}$. Thus, for the same cost levels, the infrastructure provider will have a lower incentive to establish the new backbone in comparison to service provider. For this incentive structure to change, the costs applicable to the infrastructure provider must also be lower, in fact they must be proportionately much lower than the reduction in their revenues in comparison to the service provider. Let us take a simple heuristic example can illustrate this point.

For simplifying the analysis, we could collapse equation (iii) above, into $R_S - C_S$ for the service provider, and equation (iii.a) as $R_i - C_i$ for the infrastructure provider. Since $R_S$ is greater than $R_i$, we can write $R_i = a. R_S$, where "a" is less than one. Likewise, we can write $C_i = b. C_S$ , where "b" may have different values, among which we consider values of less than or equal to 1.[16] While the present value of the investment for the service provider is shown by "$R_S - C_S$", the present value for investment by the infrastructure provider would be indicated by "$a(R_S - C_S) + (a-b)C_S$". We can now consider the various situations for different values of "b" in comparison to "a".

If b > 1, i.e. costs for the infrastructure provider are greater than those for the service provider, then the incentive for the infrastructure provider to invest in the backbone will be less than that for the service provider. However, such a situation is unlikely to prevail because in practice, the costs of the infrastructure provider are likely lower than the costs of establishing the backbone by the service provider, i.e. we will have the value of "b" less than 1. This is expected because the cost of laying the backbone for the infrastructure provider is likely to involve joint costs with another activity, e.g. power or gas lines, roads, pipeline, or railroad operations. Likewise, it is possible that the costs of the backbone established by the infrastructure provider may be shared among certain partners and the effective costs for the capacity available for those partners may be lower than if they establish the whole capacity on their own.

Even with "b" < 1, the situation is not straightforward with respect to incentive for infrastructure provider to establish the backbone in comparison to a service provider. For the incentive for an infrastructure provider to establish the backbone being greater than those for a service provider, we need a stronger condition, namely that the decline in costs for the infrastructure provider must be relatively larger than the decline in its revenues in comparison to the service provider. This means that for

---

16 Conceptually, it is easier to conduct the analysis if the same level of capacity of the backbone is considered for both the service provider and the infrastructure provider.

the incentive structure to change, "b" has to be less than "a". This is explained below for different types of situations.

To understand the basic thrust of the argument below, we need to focus on the estimates of present value for the service provider (i.e. $R_S - C_S$) and for the infrastructure provider (i.e. $a(R_S - C_S) + (a-b)C_S$).

**For backbone investment projects which are commercially viable for the service provider, and "b" is less than 1 but more than "a"**

With b > a, the present value for the infrastructure provider will be substantially less than the present value for the service provider, i.e. it will be less than $a(R_S - C_S)$. In such a situation, the incentive for an infrastructure provider to invest in the backbone will be less than that for a service provider. In fact, if we have $(b - a) C_S > a(R_S - C_S)$, which implies that if we have $(b/a) > (R_S / C_S)$, then while the service provider will invest in the backbone, the infrastructure provider will not do so.

**For backbone investment projects which are commercially viable for the service provider, and "b" is less than 1 and equal to "a"**

With a = b, the present value for the service provider is $R_S - C_S$, and that for the infrastructure provider is equal to $a(R_S - C_S)$, or a fraction of the present value for the service provider. Thus, the incentive for the service provider is more than that for an infrastructure provider to establish the backbone. However, since $R_S - C_S$ is positive, the infrastructure provider would still be willing to invest in establishing the backbone.

**For backbone investment projects which are commercially viable for the service provider, "b" is less than 1 and less than "a"**

For the present value of investment for infrastructure provider shown by $a(R_S - C_S) + (a-b)C_S$, this will exceed the present value for service provider (shown by $R_S - C_S$), for some value of "b" less than "a". Thus, for values of b < a, and investment in backbone being profitable for the service provider, the infrastructure provider will also continue to invest, and in certain cases is likely to be more prone to invest than the service provider.

**For backbone investment projects whose commercial viability for the service provider is just at margin (i.e. $R_S = C_S$), and "b" is less than 1 and less than "a"**

With $R_S = C_S$, the present value of the investment for a service provider is equal to zero. In this situation, he may not invest in the backbone. However, for the infrastructure provider's costs being proportionately lower than its revenues in comparison to a service provider (i.e. b < a), the present value will be more than zero, and the operator will find the investment to be a relatively attractive one. This is one situation where the infrastructure provider is likely to invest in the backbone even when the service provider may not do so.

**<u>For backbone investment projects which are not commercially viable for the service provider is just at margin</u> (i.e. $R_S < C_S$), <u>and "b" is less than 1 and less than "a"</u>**

For situations where the investment is commercially not viable for the service provider, the situation for the infrastructure provider will depend on the values for "$a(R_S - C_S) + (a-b)C_S$". With $R_S < C_S$, the first term $a(R_S - C_S)$ will be negative, showing the unviability of the investment. With $b < a$, the second term $(a-b)C_S$ will be positive. Till the first term dominates over the second one, the investment will remain unviable even for the infrastructure provider. However, if the second term become larger than the first one, for certain values of the variables a, b, $R_S$ and $C_S$, an investment which is unviable for the service provider would become viable for the infrastructure provider.

**<u>Conclusions</u>**

There has been considerable emphasis on open access models for promoting the establishment of the telecom backbone. Important reasons for this include that these operators have lower costs, and their focus is on providing others access to their backbone. However, to expect the infrastructure provider to have greater incentive to establish the backbone, on the grounds that its costs are lower, would not be correct in general. There will be situations when the incentive for a service provider to invest in the backbone is going to be greater than that for the infrastructure provider, and still both the types of operators would invest in the backbone. In other situations, depending on the relative revenues and costs, we can have either only the service provider investing in the backbone, or only the infrastructure provider investing in the backbone. The simplified analysis above suggests that:

- When profitability of investing in the backbone is high for a service provider, then both the service provider and the infrastructure provider would likely invest in establishing the backbone.
- When investment in the backbone is profitable but only to a small extent for the service provider, then the service provider will make such an investment. The infrastructure provider will establish the backbone in such a market situation only if its costs are substantially lower compared to the corresponding costs incurred by the service provider. For such situations, if the costs of the infrastructure provider are not low enough, the service provider and not the infrastructure provider is likely to invest in establishing the backbone.
- For situations where establishing the backbone is not commercially viable for the service provider (e.g. rural areas), the service provider will not make an investment. In such a market situation, however, it is possible that the infrastructure provider may be willing to make a commercial investment in these areas which are commercially non-viable for the service provider, but for this to happen its costs relative to a service provider must be even lower than in the case mentioned immediately above. This is unlikely to happen in several situations when investment by the service provider in the backbone is commercially non-viable.
- Thus, there will likely be many situations when investment in the backbone will not be commercially made by both the service provider

and the infrastructure provider, and the government will have to take specific measures to assist the process.

- As costs decline with technical progress etc., a number of non-viable cases will become commercially viable and investment in backbone will take place in larger parts of the country. However, for the parts which remain commercially unviable, the decline in costs will imply that the extent of advantage that utility companies enjoy because of common and joint costs, would become smaller. With this development, there will be a decline in possibility of infrastructure providers to establish the backbone in places where the service provider finds it commercially non-viable to do so.
- While both the service provider and the infrastructure provider will not invest in areas which are not commercially viable for them, even for their commercially viable areas they will have a preference ordering in terms of the time sequence in which they will cover different areas. Thus, they will tend to cover the more profitable areas first, and the less profitable ones later. To the extent that the government desires to cover these latter areas also early, it will either have to give incentives or to specify mandatory coverage of those areas.
- Another method used by the government to cover the less profitable or commercially unviable areas is to provide specific focus on these areas by allowing easier operating conditions in such areas, or establish organizations which function mostly or exclusively in these areas. However, an important point to bear in mind is that the investment response of such exclusively focused organization is unlikely to be different from others covering a larger area, unless their cost and revenue components are different and more favourable. Thus, if specific organizations are established for operating in areas which are unviable, the government will need to provide assistance and easier operational conditions for such organizations/operators. Least cost subsidy auctions are one option.

## 2.7 Incentives for establishing backbone affected by mandating cost based lease price for backbone, and the threshold level of demand for commercially viable investment

Equation (iii) above shows that the price for leasing the backbone plays a key role in determining the commercial viability of investing in the backbone. This price is often subject to regulatory control, and thus regulatory policy has a major role in determining the incentives for investing in the backbone.

Those supplying the backbone service would like the price, or $R_i$ in equation (iii) above, to be as high as possible. This would encourage them to establish the backbone also. However, since the backbone is a key input used for providing the telecom service, its high price will translate into a high price of the telecom service for the consumer. This has implications for demand and market growth, which are discussed in other sections below. Moreover, the backbone is used by new entrant service providers to compete with the incumbent in the market. If these new entrants have to pay a relatively high price for their key input, they stand at a disadvantage in the market. If the incumbent is charging them a high price for the backbone, it could even be a case of vertical price squeeze. Thus, the regulatory concern would imply pricing the provision of backbone in a manner which maintains fair competition and gives the incentives for the backbone provider to supply the backbone to others.

Normally, this implies cost based pricing, with the costs including a reasonable return on investment. Different cost based pricing methodologies are used for this purpose, including Distributed or Allocated Costs or Forward Looking Incremental Cost Based pricing.[17] The important point is that the prices determined in this context should not be such that they give major incentives to one category, either those demanding backbone or those supplying the backbone. A balance between these two is essential. Further, in making this decision, the important role of the price of telecom service for generating demand should be given high priority, for reasons discussed later in this Chapter.

An important point to note is that regulating the price for leased circuit has different implications for the infrastructure provider and the service provider. For the infrastructure provider, since he established the backbone only to lease it out, this price has an implication for the incentive to establish the backbone. For the service provider, since the main purpose of establishing the backbone is to use it to provide telecom services, regulation of the leased circuit price would not have much impact on his decision to establish the backbone.[18] However, regulating the price for backbone may have an adverse effect on his incentive to provide others access to his backbone. We can see this from the illustrative example below.

In equation (iii) above, we saw that there are three broad sources of revenue, $R_v$ , $R_{va}$ , and $R_i$. For a service provider, all these three sources of revenue are available, and for an infrastructure provider, only $R_i$ is available. We know from above that for any specified level of capacity used for the two alternative purpose, i.e. leasing to others or providing telecom services in the market, $R_v + R_{va} > R_i$ . This can be represented as $R_v + R_{va} = y.R_i$ , where $y > 1$.[19]

---

17 For more detail, see Chapter 4 of ITU (2001b).

18 There may be an indirect effect, through the availability of cheaper leased circuit being available to the competitors, whose operations then affect the market available to the service provider.

19 Of course, the analysis becomes simpler if we consider the same capacity installed (utilized) by both types of operators. The analysis can be extended to include different assumptions on the capacity leased and the revenues that would have been earned if that capacity were used to produce and sell telecom services. The value of "$R_s$" or of "y" can reflect any relevant changes in such a relationship due to difference in the capacity leased out, compared to what would have been the revenue stream from that capacity if it were not leased out.

For the service provider, when he provides access to others he considers the possibility that this backbone will be used by the operators who gets the access to take away a part of the service provider's revenues.[20] Suppose, for any specified capacity level that is leased out to others, the extent of telecom service revenues taken away (or reduced due to competitive price decline) by those leasing the backbone, is equal to: $z (R_v + R_{va}) = z.y. R_i$ , where $0 \leq z < 1$. Thus, if the service provider gives its competitors access to its backbone, the net effect on revenue of providing access to the backbone will be equal to $R_i - z.y. R_i = R_i (1 - z.y)$ .[21] Thus, the service provider will tend provide others access to its backbone if the net loss in revenue is not positive, i.e.

$$1 - z.y > 0, \text{ or alternatively } (1/y) > z.$$

If z = 0, then the new entrant would have tapped into new demand, and the incumbent would not have lost any of the existing demand. If the growth in demand is large, the growth of revenues for the incumbent can also continue without any adverse effect, i.e. the static and dynamic values of "z" would both be zero.

It is noteworthy that the value of "z" is likely to be relatively high in the initial phase of competition, because at that time, the competitor focuses on the most lucrative part of the consumer base, and the competition to retain them by the incumbent is very intense. Moreover, in the initial phase of competition, the incumbent is less well versed in preventing a shift in such consumers, and may find these subscribers choosing the alternative (i.e. new entrant) service provider. Since these customers contribute a large share in overall revenues, a loss of even a small consumer base can have a substantial adverse effect on revenues for the incumbent.[22]

Thus, lower is the expected loss of the market from giving access to others to the backbone, greater the likelihood of the service provider giving such access. The service provider is more likely to give access to its backbone to those whose products do not compete with its main sources of revenue, e.g. internet. However, as the operators selling such products cut into the markets of the service provider through use of

---

[20] The market share competed away is not only by those providing the same service, but eve by those providing substitutable competing services. See for example, Bruce and Macmillan (2002), pages 13-14, for negative impact of mobile growth on fixed line revenues. Likewise, ITU (2000), page 5, states that while mobile companies in Thailand complemented fixed line services in the local call market, the two competed directly in the distance call market.

[21] The term "access" here is not being used to denote interconnection per se, but use of the backbone through leasing the backbone. In the case of interconnection not involving leased circuits, the service provider will not get $R_i$ as revenue, but will only have a loss of revenue shown by the corresponding $z.y. R_i$.

[22] In this context, certain illustrative numbers will put the issue in perspective. At the end of 1990s, 5% of the Indian subscribers contributed about 55% of the call charge revenues. Normally, a thumb rule is used under which 20% subscribers are supposed to contribute 80% of the revenues. Taking these two sets of data, we can see that on average, a shift of only 2 percentage points of subscribers to the new entrant can imply a shift of 8% to 22% of the incumbent's revenues to that operator.

improved technology, e.g. VOIP, the tendency for giving easy access to the backbone for such other operators will also decline. **Hence, if competition is to be encouraged as a matter of policy, the policy maker will have to insist on certain strict conditions for ensuring that access to the backbone is provided by the service provider**.[23]

Likewise, if the price of leasing the backbone is relatively high (i.e. more than the cost based price), greater is the likelihood of the service provider allowing others access to its backbone. However, **a high price has implications for the competitive situation for new entrants, and thus regulatory policy tends to specify cost based prices for such resources.**

Specification of cost based price for the backbone affects the commercial situation and response for the two types of operators. Let us see what a cost based price for backbone would imply for the infrastructure provider and the service provider. For this, we take the above factors into account and collapse the revenues and costs in a single time period. The relevant costs for the service provider and the infrastructure provider can, respectively, be summarized as $C_S$ and $C_i$, where $C_S > C_i$, with the costs including within them a reasonable return on investment.[24] Further, when cost based pricing is specified for leased circuits, the price is normally based on the costs relevant for the service provider. For our purposes, we can take the cost based price for leasing the backbone as $P_i$. This price is determined using a level of capacity used ( = $D_{CS}$ ) from the installed backbone capacity for the service provider, in such a way that the cost based price multiplied by the assumed capacity utilization covers the costs, i.e. $C_S = P_i \cdot D_{CS}$ .

If the cost based price for the backbone is implemented, then the revenues from leasing out the backbone (i.e. $R_i$), will be equal to $P_i \cdot D_i$ , where $D_i$ is the capacity leased out from the backbone. While we use $R_i$ to denote the revenues from leasing out the backbone for both the service provider and the infrastructure provider, the relevant amounts of $R_i$ for each will depend on the capacity leased out by them. With this background, we can now analyse the profitability for the service provider and infrastructure provider for investing in the backbone.

**<u>Service Provider: Without Providing Others With Access To Its Backbone</u>**

Collapsing the revenues and costs for different periods into single values, we get the revenues and costs for the service provider as:

[23] Likewise, a similar approach will have to adopted for the interconnection regime.

[24] This presumes that the capacity installed by both operators is the same. The analysis with this assumption can give us the broad features of the qualitative results. Deviations from this can be taken into account to get a more detailed assessment, but the broad thrust of the qualitative results will remain relevant.

$R_v + R_{va} - C_s$ , if the service provider does not provide others with access to its backbone. This can be represented as $P_s . D_s - P_i . D_{cs}$ , where $D_s$ is the capacity used to provide the telecom services and $P_s$ is the average revenue per unit capacity that he earns from selling the telecom service.

The service provider will find the investment commercially viable if $P_s . D_s \geq P_i . D_{cs}$ , or if $D_s / D_{cs} \geq P_i / P_s$ . Thus, the service provider will find the investment commercially viable if the ratio of the capacity utilized to fulfil the demand for telecom services in the market to the capacity utilization considered for specifying the cost based price for the backbone, is not less than the ratio of the cost based price and the average revenue from using per unit capacity if telecom services are provided with that capacity. Some illustrative estimates suggest that the service provider will find it commercially viable to invest in the backbone in a larger number of situations. [25]

**Service Provider: With Access Provided To Others To Its Backbone**

Providing access to the backbone for others will alter the revenue and cost equations as follows:

$$y.R_i + R_i - z.y.R_i - C_s = [1 + y(1 - z)] R_i - C_s = [1 + y(1 - z)] P_i . D_i - P_i . D_{cs}$$

For the investment to be commercially viable for the service provider, we need:

$$[1 + y(1 - z)] P_i . D_i \geq P_i . D_{cs} \text{ , or}$$

$$y (1 - z) \geq [D_{cs} - D_i] / D_i$$

We know from above that $y > 1$, and $1 > z \geq 0$, which implies that $y (1 - z) > 0$.

The value of $[D_{cs} - D_i] / D_i$ depends on the comparison of $D_{cs}$ and $D_i$. For $D_i \geq D_{cs}$ , the investment will be commercially viable for the service provider.

---

[25] For instance, TRAI (2005a) states in paragraph 5.2 of its Explanatory Memorandum that "the average return from a 64 kbps circuit is around Rs. 3.5 lakhs per annum if the circuit is used for STD". The cost based leased circuit tariff for 64 kbps for 500 kms or more is Rs. 44,000 pr annum. This suggests a ball-park figure of about 1/7 to 1/8 for the ratio of $P_i$ to $P_s$ . With value added revenues being included, the ratio would be lower. The capacity utilization for various speeds has been taken by TRAI (2005b) as ranging between 35% to 50%. Taking these two estimates suggests that the investment will likely be commercially viable for the service provider if a capacity utilization of about 4.5% to 7% of the installed capacity takes place for selling telecom services. Of course, this estimate of the required capacity utilization will increase for speeds of the system which are lower than those considered by TRAI (2005b), or if the revenues from telecom services decline due to price decreases over time

It should be noted that the effect of a change in the extent of revenues from providing telecom services is captured in the values of "y" and "z". To the extent that the revenues from telecom services are low due to low demand and/or price, the value of "y" will be low. In such a situation, it is very likely that the demand for backbone by others will also be low, i.e. we will have $D_{cs} > D_i$ . With a low demand, the competitors are likely to obtain their demand more from attracting away the subscribers of the incumbent, i.e. the value of z will be relatively higher in such situations.

From the above we can see that, for service providers, investment in the backbone **will not be commercially viable if**:

(a) $D_s < D_{cs} . (P_i / P_s)$ for the situation when backbone is not given to others, or,
(b) $1 + y (1 - z) < D_{cs} / D_i$ for situations when access to others is provided to the backbone.

As mentioned above, in areas with low revenues or low demand for telecom services, we will have low values for $D_s$ , $D_i$ , $P_s$ , and y, and a relatively higher value of z. Since $D_{cs}$ and $P_i$ are given when there is cost based pricing of the backbone, we have a basis to consider the situations when the service provider is unlikely to invest in the backbone, i.e. with the values of $D_{cs}$ and $P_i$ being given, we can ascertain the minimum capacity that will be required to provide telecom services which will make investment in backbone attractive for specific values of $P_s$. This would be the minimum threshold level of demand for making establishment of the backbone commercially viable.

**Infrastructure Provider**

Taking the above discussion into account, we know that for an infrastructure provider, it would be commercially viable to install the backbone if :

$$P_i . D_i - C_i \geq 0.$$

Since $P_i . D_{cs} = C_s$ , we have the commercial viability conditions as:

$$(C_s / D_{cs}) . D_i \geq C_i \text{, or}$$

$$D_i / D_{cs} \geq C_i / C_s \text{, or} \quad D_i \geq [C_i / C_s] . D_{cs}.$$

The ratio $[C_i / C_s]$ is a familiar one from our previous analysis. $D_{cs}$ can be expressed in terms of a ratio of the total installed capacity. For example, with reference to the domestic leased circuit, TRAI (2005b) has used ratios for $D_{cs}$ ranging from 35% to 50% of total capacity installed. The minimum threshold level of demand required for the infrastructure provider is going to be a fraction of such capacity utilization levels, because for any given capacity installed, $C_i < C_s$ . Information on $[C_i /$

$C_s$] and $D_{CS}$ can give us an indication of whether there is adequate demand present to provide the threshold demand that will make investment in backbone attractive for the infrastructure provider. In the above example from TRAI (2005b), if [$C_i$ / $C_s$] = 0.5, and $D_{CS}$ in terms of the installed capacity ranges between 35% to 50%, then $D_i$ in terms of utilization of the installed capacity greater than 18% to 25% would be adequate to make investment in backbone attractive for the infrastructure provider.[26]

**Threshold levels of demand for viable investment**

The above discussion provides us with some insight into the minimum threshold level of demand for capacity which will make the investment viable.

For the service provider, the threshold level of capacity utilized to provide the telecom services should be:

$$D_S = [P_i / P_S].D_{CS}$$

This threshold level of demand will increase as the service provider gives others access to its backbone, and this can be examined taking account of the discussion above. For our purpose, we compare the estimate of $D_S = [P_i / P_S].D_{CS}$ with the minimum level of demand for the infrastructure provider, namely:

$$D_i = [C_i / C_S] . D_{CS}$$

The threshold level of demand for the service provider will be more than, equal to, or less than the threshold level of demand for the infrastructure provider depending on whether, [$P_i$ / $P_S$] is, respectively, more than, equal to, or less than [$C_i$ / $C_S$].[27] In general, unless the demand available for telecom services is low, $P_i / P_S$ is likely to be lower than $C_i / C_S$ . This implies that the threshold level of demand for capacity would be lower for the service provider, and it would have an incentive to invest in the backbone at a lower level of demand for capacity itself. Thus, one could assess whether the available demand for the telecom services is adequate to utilize capacity above the threshold level or not, for the service provider, in order to assess whether investment in the backbone would be commercially likely.[28]

---

[26] Rough estimates suggest that the ratio of $C_i$ / $C_S$ could be ranging about 0.2 to 0.5 for different capacities and over long distances.

[27] This threshold level of demand is not the demand for telecom services per se, but is the demand in terms of the capacity required to provide telecom services. Thus, the threshold demand that we are discussing here is a derived demand in terms of the demand for telecom services

[28] Of course, as mentioned earlier, the fact that the investment is commercially viable does not necessarily imply that it will take place within the time horizon that may be desired by the policy maker, because of the sequencing of investment by focusing on relatively more profitable investments earlier.

The above analysis can be extended try estimate the corresponding $D_S$ and $D_i$ for those who will lease capacity from the infrastructure provider. To begin with, we ascertain the market demand for telecom services that may be catered to by those leasing capacity. Based on this the corresponding capacity used to meet that demand also be estimated. Thus, we would have an estimate corresponding to $D_S$ for the service provider using his own backbone (we denote this as $D_S'$).

This gives us a basis to assess the overall capacity that would be leased by the new entrant by taking into account the extent of excess capacity that is normally left from the leased capacity when it is being used to meet the market demand for telecom services. For obtaining a rough estimate of this capacity level, we could for instance divide $D_S'$ by the capacity utilization that is denoted by the ratio of $D_{CS}$ to the established capacity. For example, we saw that in TRAI (2005b), this was taken to range from 0.35 to 0.5. If by dividing $D_S'$ by 0.35 to 0.5, we obtain a level of capacity used that will be at least as much as the threshold level for the infrastructure provider, we can be reasonable certain that the infrastructure provider will be in a position to invest in the backbone. Alternatively, if the capacity so derived is below the threshold level, then there will not be any investment in the backbone on commercial grounds by the infrastructure provider.

**Possibility of capacity demanded exceeding the threshold levels**

The possibility of demand exceeding the threshold level **would depend on the extent of the prevailing excess demand in the market as well as on the extent of likely growth in demand**. Higher the excess demand and the growth in demand, more likely for the threshold demand to be met for attracting investment in the backbone. An initial estimate of the availability of adequate demand could be based on the prevailing teledensity, indications of excess demand, the likely teledensity that should be expected to prevail in relation to the per capita income, and the likely impact on growth of demand due to the trend of price decrease.

Another factor which could increase the incentive to invest is the possibility of infrastructure sharing because that allows the costs to be allocated among various entities sharing the infrastructure.[29] **Infrastructure sharing** thus reduces the effective cost of the backbone to the user, and is more likely to happen when the backbone is installed by an infrastructure provider than when it is installed by a service provider. An alternative form of infrastructure sharing, and thus achieving

[29] Infrastructure sharing is a specific policy initiative in some countries, such as France, in order to encourage the establishment of backbone in areas which are otherwise not covered under a normal market situation. Attempts to share infrastructure have begun among private operators in the Indian telecom sector, and the government is also considering such initiatives in the context of its USO policy.

reduction in effective costs in this situation, is to obtain the financing from potential users through indefeasible right of use for the service provider.[30]

It is also worth noting that if establishment of the backbone is a socially desirable outcome, and the lack of threshold demand levels is applicable only for a few initial years, there may be a valid basis for providing support for the initial years through for example, some bridging finance, or even financial subsidy.

## 2.8 Incentives for establishing backbone for infrastructure provider in comparison to a service provider: the importance of demand available at present and in the future

Till now, we have considered the response of the service provider and the infrastructure provider, with each operator acting in isolation. We now turn to another important aspect, namely the effect on demand for capacity when both the service provider and the infrastructure provider are operating together in the market.

We have seen above the importance of a threshold level of demand for making investment in the backbone. In this regard, one policy concern could be that the entry of the infrastructure provider would depress the incentive for the service provider to establish its own backbone.

This point, i.e. the adverse effect on the service provider's incentive to establish the backbone can be seen in terms of a revenue decline similar to that shown by "$-z.y.R_i$" in the previous section. Thus, those investment projects which are at the margin for the service provider will not get implemented, and those which are economically unviable for the service provider will get even more unviable. To increase the viability of investment, the operator would require a higher level of demand, an increase in alternative revenue sources (i.e. an increase in $R_{va}$ ), and a decrease in costs.

The decrease in costs could come about through improved financial and technical efficiencies, and government support. In this regard, it is noteworthy that technological change leading to technical efficiency has three different possible effects, two of which will enhance the incentive to invest in the backbone, and one will reduce such incentive. The former category of effects of technological change are a decrease in costs, and an increase in sources of revenue by enabling the service provider to give a wider set of services (e.g. use of radio for last mile enhancing the feasible connections and thus the demand available, and broadband allowing an expansion of the scope of services provided and thus enhancing demand).

[30] In a situation where backbone is installed by an infrastructure provider, since there will be lower effective costs, it may be possible for the service provider using the backbone to charge the customer of the service a lower price, which would tend to augment demand.

The adverse effect of technological change on the prevailing revenues takes place when it enables other service providers who were earlier not competing in the market, to start taking away market share by providing competing products using new technologies (e.g. effect of VOIP on the long distance voice market for access providers).

**Should entry/operation of infrastructure provider be allowed**

In the above context, if the entry of the infrastructure provider discourages investment in the backbone by the service provider, then we need to consider whether entry of the infrastructure provider should at all be allowed or encouraged.

The question of whether an infrastructure provider should be allowed to establish backbone becomes relevant only if the policy allowing such entry is not yet in place. In cases where infrastructure provider is already permitted, the issue would be whether to support or promote its activities. In addition, we need to also bear in mind two different situations: one, where the service provider already has established its backbone, and the other where no backbone has been established by the service provider in the region concerned.

Table 2.1 below shows that when we consider all these possible situations, the relevant issues can still be summarized in terms of two different policy questions.

**Table 2.1 Issues that arise due to infrastructure provider reducing incentive of service provider to install the backbone**

| Situation | Relevant Issue |
|---|---|
| 1. Service provider has backbone and infrastructure provider is allowed to establish its backbone | Whether support should be provided for establishment of the backbone |
| 2. Service provider has backbone and infrastructure provider is not yet allowed | Whether infrastructure provider should be allowed, and whether support should be provided for establishment of the backbone |
| 3. Service provider does not have backbone and infrastructure provider is allowed to establish its backbone | Whether support should be provided for establishment of the backbone |
| 4. Service provider does not have backbone and infrastructure provider is not allowed to establish its backbone | Whether infrastructure provider should be allowed, and whether support should be provided for establishment of the backbone |

Let is first consider whether the infrastructure provider should be allowed to establish the backbone.

We have seen in the earlier sections that if the service provider has its own backbone, it does not prefer to provide others with access to that backbone. If new entrants into the market have to compete, they will find it easier to do so if they establish their own backbone or are in a position to obtain backbone from others. It is much easier for them to obtain it from infrastructure providers in the initial period, because they can begin providing their services at a relatively lower cost. The presence of an infrastructure provider helps them to compete more effectively and do so earlier in comparison to establishing their own backbone; in fact, in certain places, the incumbent service provider has itself used the backbone installed by the infrastructure provider. [31]

The relatively lower price at which the backbone is likely to be available from infrastructure provider will also help the new entrants to better compete in the market and to contribute to a price decline for the consumer. We have seen above, that the spur for competition in the backbone market is more likely to come from the infrastructure provider rather than from the service provider. Moreover, we have seen in several contexts above, the importance of an increase in demand for both investment in the backbone and the incentive for providing access to the backbone. As we see in the next section, once the price falls below certain levels, the increase in demand is large and beyond expectation. Since the price of backbone is likely to be lower with the infrastructure provider, its presence will also help the prices of telecom services to decline towards the price threshold (discussed below). These points suggest that it would be useful to allow infrastructure providers to establish their backbone.

**Should operation of infrastructure provider be encouraged/discouraged**

If the infrastructure provider is allowed to operate, then we need to consider whether the operations should be supported or encouraged.

In the context of whether support should be provided for establishing the backbone, an initial crucial issue is whether the social benefit of establishing the backbone exceeds the apparent commercial benefit which guides the investment decisions. There is considerable evidence to show that there is a case for supporting the establishment of a backbone, both because of the social benefits (or externalities) being substantial and the fact that not only is the market not likely to account for such benefits, it s also likely to underestimate the commercial developments in the market as a result of greater competition due to the provision of the backbone (see below). An important point to bear in mind is that if the establishment of the backbone is to be supported, it should be supported irrespective of who establishes it. The exception to this would be if certain reasons can be found to distinguish between different entities establishing the network, in such a manner that the social benefit due to one entity exceeds that due to another.

[31] See for example, NEPAD e-Africa Commission (2004)

## 2.9 An assessment of the policy responses in different situations with respect to excess demand/supply in relation to threshold level of demand

The discussion above shows that if the demand in the market is below the threshold level of demand, investors will not increase the supply of backbone. Further, in such a situation, the service provider will have a strong disincentive to provide others with access to its backbone. However, we will see in this Section that the likelihood of an increase in the supply of the backbone, and the relevant policy response does not depend only on viability or unviability of the investment, but also on whether there is excess demand or supply, and whether demand/supply exceed or are less than the threshold level of demand. To consider the various possible situations, we denote prevailing demand with "D", the threshold level of demand with "$D_T$", and prevailing supply of backbone with "S".[32] We first consider the situations for which investment in backbone would be commercially unviable, and then those for which such investment is commercially viable.

**Table 2.2 Likely growth in backbone, and requisite policy response in situations for which the investment in backbone is commercially UNVIABLE**

| Demand/Supply Situation | Salient Feature | Likelihood of Increase in backbone | Requisite policy response for increasing backbone |
|---|---|---|---|
| (1) $D_T > D > S$ | - Inadequate demand,<br><br>- but excess demand in comparison to supply (i.e. waiting list in market),<br><br>- not certain whether certain factors constrain supply | Unlikely | - Increase prevailing demand<br><br>- Decrease $D_T$ through policies to reduce costs, increase operational flexibility, and reduce delays<br><br>- See if any factors are constraining supply, and address them |
| (2) $D_T > S > D$ | - Severely inadequate | Unlikely | - Strong focus on increasing |

[32] While the discussion on threshold level of demand in the previous section was in terms of the demand for capacity, normally the assessment of demand/supply and excess demand or supply situations is conducted in terms of demand and supply of the product, i.e. for telecoms services. For the purpose of this section, we could consider the demand and supply to be in terms of telecoms services, and this could be subsequently linked with the demand/supply of backbone.

| | | | |
|---|---|---|---|
| | demand (i.e. major demand constraint),<br><br>- no excess demand in comparison to supply (i.e. no waiting list in market),<br><br>- not certain whether certain factors constrain supply | | prevailing demand<br><br>- Decrease $D_T$ through policies to reduce costs, increase operational flexibility, and reduce delays<br><br>- See if any factors are constraining supply, and address them |
| (3) S > $D_T$ > D | - Severely inadequate demand (i.e. major demand constraint),<br><br>- no excess demand in comparison to supply (i.e. no waiting list in market) | Unlikely | - Strong focus on increasing prevailing demand<br><br>- Decrease $D_T$ through policies to reduce costs, increase operational flexibility, and reduce delays |

**Table 2.3 Likely growth in backbone, and requisite policy response in situations for which the investment in backbone is commercially VIABLE**

| Demand/Supply Situation | Salient Feature | Likelihood of Increase in backbone | Requisite policy response for increasing backbone |
|---|---|---|---|
| (1) D > S > $D_T$ | - Definite situation of supply constraint<br><br>- excess demand in comparison to supply (i.e. waiting list in market) | Likely, if supply constraint is addressed | - Address factors constraining supply<br><br>- Increasing demand will not help increase backbone |
| (2) D > $D_T$ > S | - Severe supply constraint | Likely, if supply | - Address factors constraining |

| | | | |
|---|---|---|---|
| | - excess demand in comparison to supply (i.e. waiting list in market) | constraint is addressed | supply<br><br>- Increasing demand will not help increase backbone |
| (3) $S > D > D_T$ | - Definite situation of demand constraint<br><br>- no excess demand in comparison to supply (i.e. no waiting list in market) | Unlikely, unless demand constraint is addressed | - Increase prevailing demand |

Thus we see that in certain situations, we need to focus only on addressing the supply constraint and that increasing the prevailing demand in the market will not help increase the backbone. On the other hand, we see that in a number of situations, the supply of backbone will not increase unless the prevailing demand in the market rises. It is also evident that the presence or absence of a waiting list does not indicate whether investment in the backbone is viable, and whether the supply of backbone will increase only by addressing the constraints to that supply. However, for situations with low teledensity, it is always useful to ascertain whether or not, in addition to excess demand, there are factors which constrain supply. This can be seen, for example, from Table 2.4 given later in the Chapter, that for lower levels of teledensity, the gap between actual teledensity and potential teledensity is much larger, which is likely to be on account of more severe supply constraints for backbone in these countries.

## 2.10 The market is likely to underestimate the increase in demand due to price decline

Effective market demand increases due to several factors such as an increase in income, price decline, emergence of substitutes, change in mind-set about the product, etc. In this section, we make two main points.

- One, that there is a price threshold level below which the decline in price has a major effect on both the overall subscriber base and the overall usage of the network. This is much more likely to happen if a large part of the population is yet to avail of telecom services. Such an increase in overall subscriber base helps to mitigate any adverse effects on present value (such as through $z.y.R_i$ or due to the presence of competitors either in the form of service providers or infrastructure providers). It may therefore be desirable to take steps to create the situation for prices to decline below the price threshold level.

- The increase in demand with the price decline, especially for prices below the price threshold level, will exceed the normal expectations of the market about the demand increase.[33] Thus, especially for prices above the price threshold, the market response in terms of investment, etc. would be based on an under-estimation of the market demand, and therefore would be inefficient. This points towards a need to implement policies which will reduce prices and will manifest the normally unexpected demand levels.

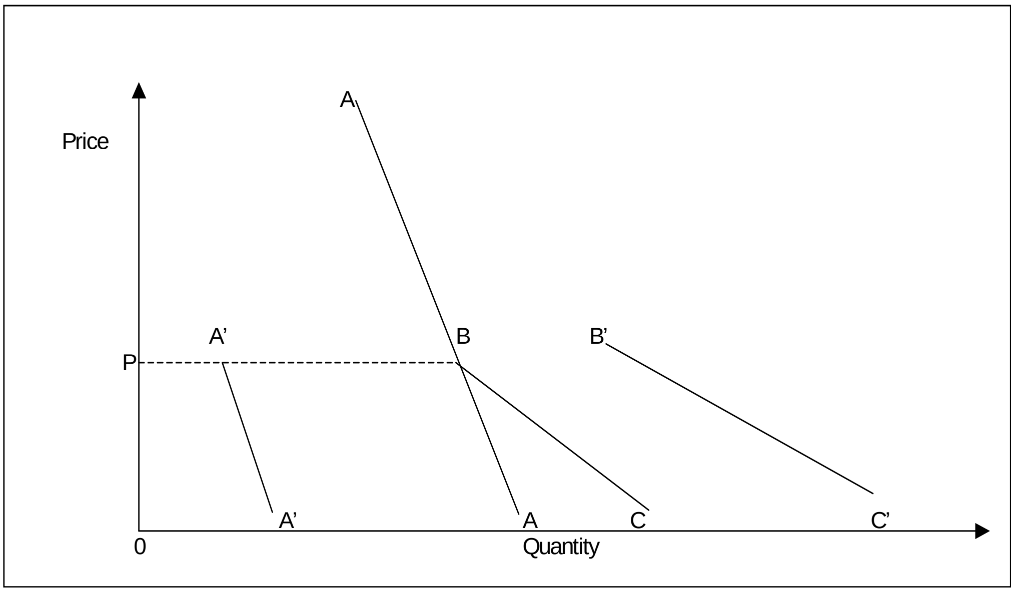
We illustrate below the main reasons for the above two statements. For this, we first describe the components of the analysis.

**Market demand is the aggregation of individual demands**

The prevailing demand in the market can be shown simply in terms of a downward sloping line linking the price levels with the volume of the demand made at that price (see Figure 2.1). Each individual has his demand pattern that can be represented in such a manner, and the overall demand in the market is an aggregation of the individual demand curves. In Figure 2.1 below, we can see this as the demand curves for two consumers, AA and A’A’, with the former being the expression of demand of a large spender and the latter of a low spender. ABC is the aggregation of the two demands, and shows the market demand available if there were only these two consumers in the market. In ABC the demand of the second consumer (as A’A’) becomes manifest in the market only for prices below P’. An important point in this regard is that the number of consumers with demand in the range shown by A’A’ are very large, and as a result, the market demand will see a shift not in terms of BC, but B’C’. In other words, there will be price threshold level below which the sheer number of subscribers that are added will imply a large shift in demand.

**Figure 2.1**

[33] In this regard, it is interesting to note the comment in Tinker (2003), page 9, that “Analysts regularly underestimate new demand due to capex/unit declines. This is why we have been consistently upgrading cellular subscriber estimates in Asia.”




**Income profile of consumers, and their expenditure on telecom in terms of the percentage of household income spent**

In Figure 2.2 below, we show the distribution of the population according to their income levels (shown by AA). The illustration is based on the general profile which has a small proportion of the population with high levels of income, and has larger and increasing proportions as income levels decline, with a peak being reached beyond which the distribution of the proportion of households starts declining (for example, see **Annex 2.2**). In Figure 2.2, the horizontal axis shows the income levels, the left vertical axis shows the proportional distribution of households along the income levels, and the right vertical axis shows the expenditure on telecom as a proportion of total income for the households.[34] The telecom expenditure as a proportion of income is shown by EE′, ranging from 5% at lower income levels and declining to about 1% at higher income levels.[35]

**Figure 2.2**

[34] The diagram combines the concepts of individual and households, but the illustrative lessons derived there-from are valid irrespective.

[35] In this regard, see ITU (1998), pages 35 and 36 which show that this ratio (expenditure on telecom as proportion of household income) generally ranges between 1% to 5%. Another indication of such expenditure can be obtained from a combination of teledensity, and the telecommunication revenue as a percentage of GDP. For example, OECD (2003), page 71, shows that in 2001, the ratio of telecommunication revenue as a percentage of GDP fr OECD countries ranged between 1.96% (Luxembourg) to 5.13% (Slovak Republic, with the average for OECD being 3.35%. Taking account of the teledensity and household size, this implies that telecom expenditure as a proportion of household income would be less than 1%. However, this would still imply a substantial ARPU. Rough calculations based on the Table in OECD (2003) suggest an ARPU of about Indian Rs. 1,700 per month, at the prevailing exchenge rate.

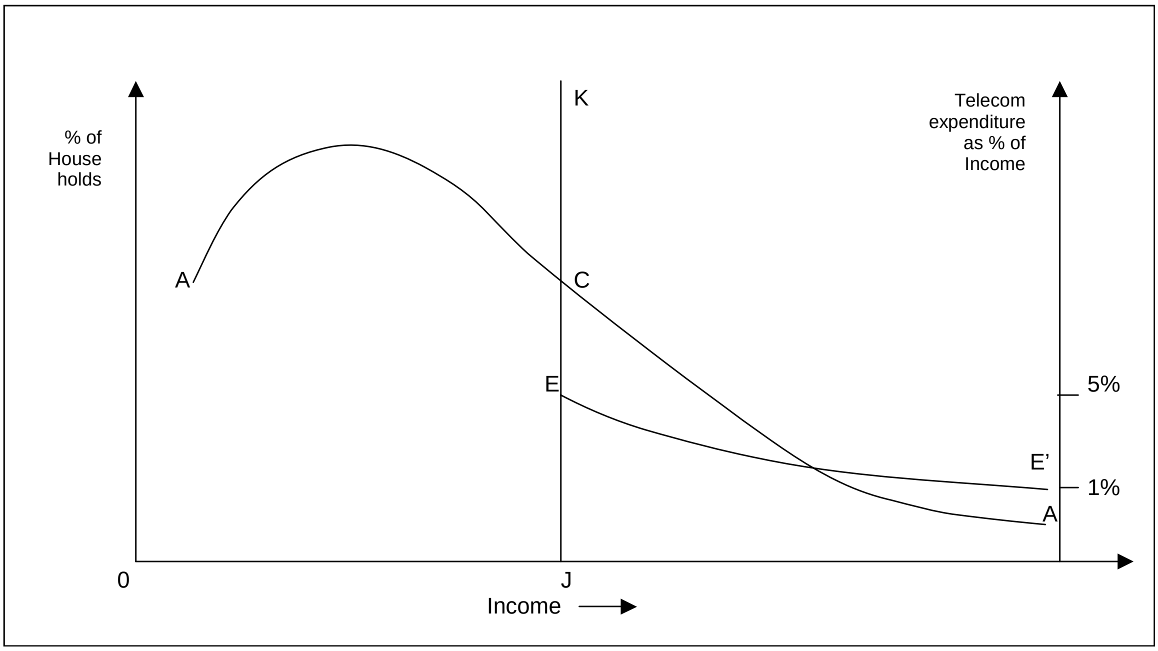



Figure 2.2 also includes one other concept. This combines the minimum expenditure in a tariff package available for telecom (e.g. Rs. 300 per month pre-paid card in India for mobile service), and the corresponding income level for which this minimum expenditure package is 5% (in our example with Rs. 300 per month, this income level is Rs. 6,000 per month).[36] The illustrative figure of 5% is taken because it is the upper limit of our estimate of the share of income spent on telecom. This income level is shown by the vertical line JK in Figure 2.2. This line intersects the curve AA at point C, and this shows that JC per cent of the population (or households) are with the income level which corresponds to the marginal consumers in the telecom market. Their effective participation in the telecom market also depends on whether their habitation area is covered by the network so that services may be provided to them.

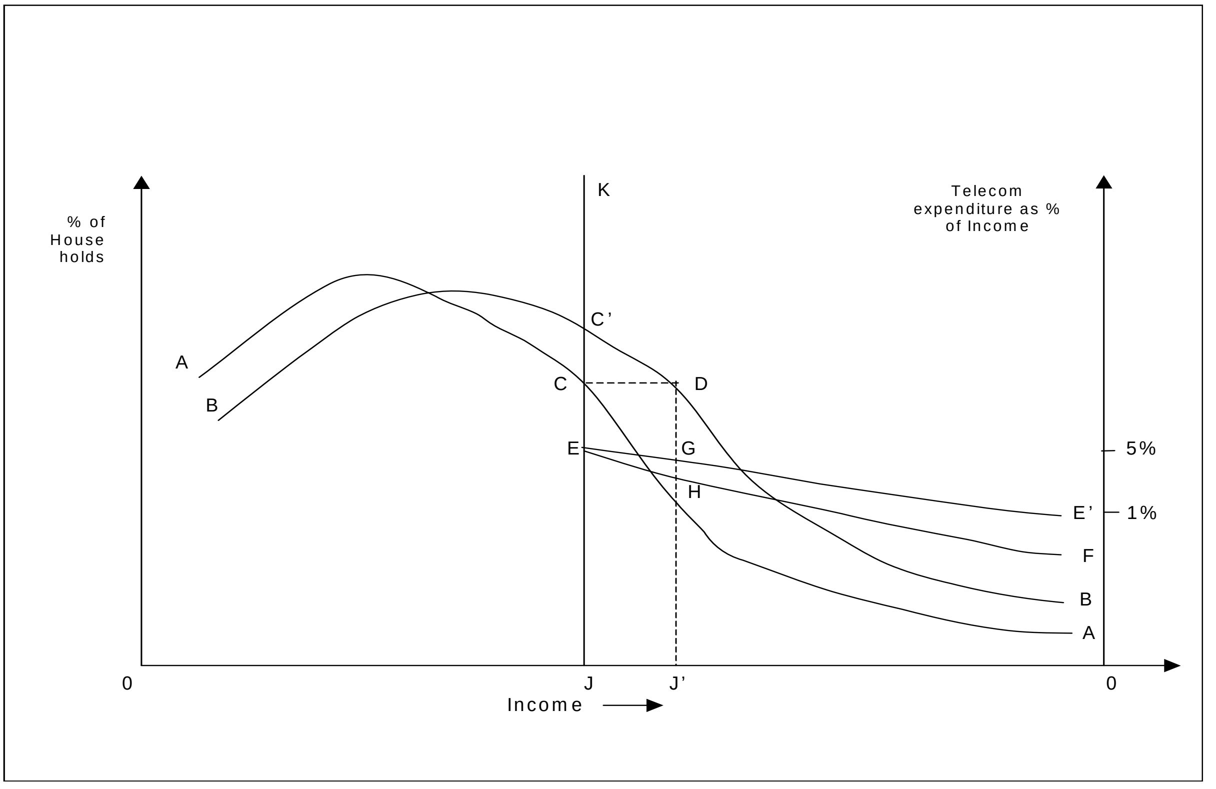
Based on the above, we can now see the reasons for the market being unable to anticipate the extent of increase in market demand when the price falls below the price threshold level.

**Examination of the reasons for large increase in demand and the likely underestimation of this increase by the market**

Certain changes in Figure 2.2 take place with a decrease in price and growth of income over time. These are shown in Figure 2.3 below.

**Figure 2.3**

[36] It is interesting to note that ITU (1998), page 37, had considered for 1995 a threshold of household income of US$ 2,060 per year to consider the households that could afford telephone services. At present exchange rates for Indian Rupees to US dollars, this amount is about Rs. 7,500 per month. The exchange rate for Rupees to dollar was much lower in 1995. Taking the exchange rate for 1995, US$ 2,060 is equivalent to slightly below Indian Rs. 6,000. Further, telecom tariffs have fallen since 1995, the affordability threshold for India at present would be below Rs. 6,000.




With growth in income, the distribution of persons at different levels of income shifts to the right to BB. Point C shifts to D, and in place of C, and JK intersects with BB at C′, which is above C. [37] We now have an increase in the population above the threshold income level equal to the area JCDJ′, which is a substantial portion of the population, all of which now would be added to the group of potential users of telecom services. This increase is likely to exceed the expected increase in demand due to income growth, because of the increasing number of people who become additional potential users of telecom services (shown by the slope of C′D).

In terms of Figure 2.1, the above-mentioned effects would imply a shift down each demand curve with a price decline, a shift of each demand curve to the right because of an increase in income, and an introduction of additional individual demand so that the shift in the overall market demand curve to the right at lower price is more than likely to be anticipated (i.e. the gap between B and B′ in Figure 2.1 is more than anticipated by the market). These shifts take place for a number of other reasons also, such as:

- If the reduction in expenditure on account of price decline and income growth, (shown by AA shifting to BB, and EE′ shifting to EF) is such that there are adequate savings to be able to have an additional phone connection with minimum or little usage, the subscriber would consider having an additional connection for some family member and/or those working for him. This is equivalent to the line JK in Figure 2.3 shifting to the left.
- Over time, the price of handset and entry tariff also decreases, which substantially reduces the barrier to entry and encourages

[37] This shape of the curve is based on the type of distribution that is shown in Annex 2.2.

additional number of subscribers. This again is akin to the line JK in Figure 2.3 shifting to the left.[38]

- As the price decreases and the phone becomes more affordable, the lower income self-employed persons would treat the expenditure on the phone as an investment expense rather than a pure consumption expense. This would increase their willingness to spend on the phone because it helps to contribute to their earnings potential. In terms of Figure 2.3, this would be similar to a rightward shift of the curve BB, a leftward shift of JK, and an upward shift of the point E.
- With price reduction, the value of the services made available by a phone subscription increases, and people are more willing to incur a specific amount of expenditure because it gives them more value. This results not only in greater usage by existing users, but also encourages others to become new subscribers.
- As the price for usage of a substitute product, e.g. mobile telephony, approaches the tariffs or expenditure levels associated with established telephony service, e.g. fixed line, the increase in demand is even more because the new cheap service is considered as a service similar to the established phone service.[39] One example of this can be seen in the Chart in Annex 2.3 of this Chapter, which indicates a massive increase in subscriber base when the effective tariffs for mobile service approached those for fixed line services.
- Change in technology (e.g. use of radio) enables the service to reach a larger part of the population, and adds to the base of available demand for telecom.
- Change in technology results in better or more products to be available, and enhances the demand base.

For the above reasons, the market demand will increase due to a variety of effects, and the normal assessment of the market situation is unlikely to capture all these effects.[40] Therefore, normally the extent of the effect of a price decline on increase in demand will be under-estimated. Moreover, larger the extent of price decline, greater the likely under-estimation of the available demand by the market. With time, the rightward shift in the curve AA or BB will continue, contributing to the market further under-estimating the increase in demand overtime.

---

[38] Tinker (2003) states in this regard that: "Usually 60% of the one-year total cost for customers is the handset. Thus, demand is usually more elastic towards handset prices than tariffs."

[39] This is a very important point in analyzing the substitutability of services like fixed telephony and mobile telephony. Results of empirical studies which indicate low substitutability between these two services could change with their prices coming close to each other.

[40] The kind of demand increase that we mention (i.e. demand following an S-Shape function), can arise also due to an epidemic model whereby the flow of adopters is exogenously related to the stock of existing adopters - see, for example, page 158 of Gruber and Valletti (2003). The point made here is that for reasons other than those mentioned under the epidemic model, the increase in demand will be large beyond certain price levels, and this increase will normally exceed the expectations of the market.

## 2.11 Implications of the analysis of demand threshold and price threshold, for the framework for government Initiatives to promote self-sustaining viable investment

The price threshold that we discussed above involves a decline in prices, and it is possible that till the time that the decrease in price goes beyond the price threshold, total revenues may even fall for some time and investment may become less viable unless costs also decline concomitantly. The point emphasized above is that for prices below the price threshold, the increase in demand is likely to more than compensate for the price decline, and the market response will itself make investment viable, even in several places which earlier might have seemed unviable. Thus, even for unviable areas, the government should consider both policies to support investment/operations (e.g., financially) together with policies that will lead to the prices declining beyond the price threshold. This combination has certain implications in terms of the factors to consider with the aim of maximizing the positive effects of policy initiatives. It implies that:

- **Over time, government support**, such as subsidy and USO type policies, is **not the only way to achieve the objective of wider establishment of the backbone** in situations which presently appear to be commercially unviable for investment in the backbone/services.
- **Market conditions could be created so that** the situation changes due to creation of large additional demand, present and future, and **erstwhile non-viable investment becomes viable**. This is when the prices fall below the price threshold discussed above.
- **The necessary condition for this is the development of a competitive market, but this is not a sufficient condition**. Deliberate policy steps would be needed to create more suitable conditions, even under competition, to take the market beyond the threshold point.
- Since these developments may take time[41], **additional support policies may be required in the interim,** to hasten the process of achieving self-sustaining growth in the market.

We consider in this section the factors relating to the first three of the above points, i.e. factors which affect the efficient operation of competition in the market, to give rise to a situation where demand growth makes investment more viable and self-sustaining.

(a) Specific policies would need to be taken to support or to create the market conditions leading to a major increase in demand, including interconnection policies.

[41] See ITU (1998), page 17, for the time taken for countries to cross various threshold levels of teledensity. That information is also summarized in a Table in Section 2.11, sub-section (5) of this Chapter.

(b) If the price of the backbone is kept high, it will limit the extent to which the price of telecom service can decline. This will make it more difficult for prices to fall below the price threshold.

(c) Price decline takes place under competition, but even under competition it is not necessary for prices to decline to the levels required. For example, if there is excess demand in the market, the pressure to decrease price will be lower even under competition.

(d) It would be necessary to examine why growth in the network is not taking place in the presence of excess demand.

(e) It is necessary to identify whether there are any policies which inherently discourage an increase in subscriber base, e.g. license fee payment linked to number of subscribers.

(f) In addition, it would be necessary to consider whether there are any policies in place which act as constraints to reduction of cost or price. These policies need to be changed in addition to encouraging competition in the market.

(g) To obtain an adequate perspective on the extent of change required to move the market towards a self-sustaining commercially viable mode, it would be useful to consider:
- the prevailing extent of competition in the market,
- impact of competition on prices over time,
- the change in these prices as competition increases,
- extent of likely prevailing excess demand, taking account of teledensity, income levels, etc.[42] In this regards, a relatively low teledensity level would indicate a large potential for market growth.
- if relevant, the reasons for the competition not having "adequate" effects in terms of price decline
- areas which are not covered with backbone, and reasons for lack of coverage
- comparison of the tariffs for fixed line services and mobile services,
- leased circuit tariffs, in comparison to the cost based tariffs,
- what is the likely price threshold below which demand is likely to increase rapidly,
- the extent of change required to achieve prices below the price threshold,
- features of the USO regime that contribute to building up the market and reducing prices.

**To the extent that a more supportive market environment can be created to achieve self-sustaining commercially viable system, the ongoing growth in demand will address several points which adversely affect investment in backbone, e.g. market share being competed away from the incumbent. In addition to the price decline immensely benefiting consumers, a "self-sustaining" system implies that there would not be any need for financial**

[42] For a discussion of the link between per capita GDP and teledensity (which is also referred to as the Jipp curve), see ITU (2002d), pages 64 to 66. Some discussion of this is also given in Section 2.12 of this Chapter.

**support from the government. This would imply a fundamental change in the policy stance towards areas which are presently considered as unviable unless USO type support is provided: the market, rather than government support would propel investment in backbone in these markets. Of course, to the extent that government support can expedite the development, and encourage investment even earlier than the market does so, we should consider also various support policies of the government.** These are addressed in the next section.

## 2.12 Government Intervention/Support

Before deciding on the type of government support, it is necessary too first examine whether there is a case for justifying the provision of such support

**Need for government intervention**

Regarding investment in the backbone, it is important to realize that its establishment has features of a public good.[43] Several studies have documented or stated that establishment of the backbone and provision of telecom service has major economic social benefits, which go much beyond the investment considerations of any individual investor or service provider.[44] The scope of these externalities has increased further with the possibility of establishing the backbone for internet and broadband services.

In addition, there are market failures which result in the market making inefficient decisions, arising from situations such as the above-mentioned situation of the increase in demand being under-estimated by the market.

For these reasons, there is a case for government intervention and support. Of course, the **government has to distinguish between areas where such support (or specific types of support) may not be required, and where focused, targeted support may be clearly desirable**. The initiatives must arise based on objective analysis conducted within an overall policy framework which provides guidance on the policy objectives and directions.

**Need to have an overall policy framework with specified targets**

The discussion above has indicated that there are several inter-related factors that need to be considered in order to promote establishment of the backbone and provision of services at affordable

[43] In fact, the initial initiatives of establishing open access models, were explicitly based on the recognition that backbone was a public good. See for example Tu (2004).

[44] See, for example, Analysys and Technonet, ATKearney, Crandall and Jackson (2001), ITU (2003a), ITU (2003c), The World Bank (2004), **xxxx.** An indication of this effect can be obtained by the several examples in ITU (2003f) and (2003g) of ICT usage for socio-economic programmes, the statement in World Bank (2004), page 129, that telecom growth has a significant multiplier effect on income, with examples from Bangladesh, China, Ethiopia, India, and Latin America; and in ITU (2003a), page 3, about South Korea that “ICT is also adding value to the economy at a rate higher than others sectors. ICT contributed 50 per cent of the growth in overall GDP in 2000.”

prices in the country. Usually, governments come out with their telecom or ICT policy statements, which are useful to guide various policy initiatives and examine the success or failure of the system with respect to specified targets and aspirations. Such a policy framework normally has three different types of targets, for which we will use three different nomenclatures:

- **Visionary Aspirations and Targets (VATs)**: these include the vision of creating modern and world class industry in the country, with frontier technologies and cheap prices, supported by investment from the private and the public sector. These targets are normally not specified in measurable terms, and it is normally difficult to ascertain to what extent such targets have been met.
- **Measurable Aspirations and Targets (MATs)**: these are general targets which are specified in measurable terms, e.g. targets for teledensity in the country. However, the achievement of these targets depends on various activities, for which too certain targets would need to be defined. Thus, the MATs are derived or implied targets, i.e. they are secondary level targets whose achievement depends on the extent to which other specific, primary level targets have been met. These primary level targets are mentioned below.
- **Measurable Primary Level Targets (MPLTs)**: These are targets for activities which are more directly achieved by focusing on the activity itself, e.g. extent to which fibre will be installed in the country, or the number of villages to be covered by public telephones. These are targets on which much greater focus can be given with concentrated efforts made to achieve these targets as well as to address the main constraints which may be limiting the achievement of these targets.

If the government's policy statement does not have MPLTs, then the targets and vision are of a general nature, and it becomes more difficult to analyse and improve upon the prevailing situation. With respect to specific activities such as the growth of backbone in the country, it could even be contended that lack of MPLTs would make it difficult for a coherent approach towards this issue, both in terms of the types of support policies as well as charting out a plan against which performance can be gauged and hopefully improved. Important points in this regard are that:

- some of the policy initiatives involve a **trade-off among two or more objectives**, and a balance has to be maintained among these objectives keeping in mind the specific situation concerned.
- in some other cases, there is a clear **positive externality** i.e. the policy instrument used achieves more than one objective in the context of promoting backbone and telecom services.
- since there are a number of policy initiatives to be considered, it would be important to determine a **priority ordering** of the various policy matters, taking account of their effects on the desired objectives, the time period within which they are likely to have their effect, and the possibility (or need) of having a phased implementation of the policies.

- In addition to priority, it is also necessary to **determine the set of policies that are consistent with each other**, or alternatively those which cannot (or should not) be used as part of a policy package to be implemented.

The various types of government policies can be considered under the following categories[45] :

(a) **Policies that impose a cost burden in terms of charges levied or specified by the government**, i.e. the cost component "T" in equation (iii) above. These policies would include,
   - License fee (one-time, annual)
   - pricing of scarce resources
   - contribution from operators towards the cost of operation of certain operators, or of operations within a specified region
   - charges and terms and conditions for rights of way
   - term and conditions at which leasing or concession rights are given by the government

(b) **Requirements specified by the government, that impose a cost burden**, i.e., they increase the cost component (r +d + i)I in equation (iii) above. These policies would include,
   - Roll-out requirements
   - Obligations to provide services in specified areas

(c) **Timely decision making**, which in terms of equation (iii) above would imply an earlier revenue stream and therefore a higher present value arising due to the revenue stream. These would include, for example,
   - Timely decision for rights of way
   - Timely decisions regarding approval and permission to operate
   - Timely dispute resolution
   - Flexibility included within the Licensing regime for various operations, which then affects time taken for providing specific services or installing the backbone, as well as the facility for different types of operators to start providing services in particular areas that may otherwise be unattractive.

(d) **Government establishing the facilities**, which in terms of equation (iii) would imply taking over or reducing the cost item (r +d + i)I, as well as increasing the potential revenues in equation (iii) above. These initiatives could include,
   - The backbone being established, and being given to any specific agency for offering the facility as open access (i.e.

[45] This is based on a number of studies, which document in particular the steps taken by the governments to promote the provision of backbone etc. in the context of encouraging broadband. These references include, for example, Analysys, ATKearney, Bruce and Macmillan (2002), Crandall (2001), Domus (2005), ITU (2000), ITU (2002a, b), ITU (2003a, b, c, d, g), NEPAD (2004), Roseman, et. al. (2002), and Tu (2004).

funding of backbone fully or partially, and provision of the backbone at relatively lower, cost based prices)

- Backbone being established and services being provided using that backbone, as well as other operators being provided access to the backbone
- Backbone being established and services being provided by the public sector entity using that backbone, but limited access being provided to others to that backbone. In this case, the government intervention would increase the extent of backbone available, but would not increase the extent of competition arising with the use of that backbone
- Establishing portions of the backbone or end links, or providing consumer end equipment, such as establishing public telephones, or internet kiosks, or giving computers to local/village Authorities together with internet connections
- Establishing government Integrated Networks connecting agencies, educational institutions, health agencies, small business, etc. These networks could be used as a platform for commercial activities also.
- Together with operators, taking part of the responsibility for jointly establishing the network in particular areas, which can then be used by the service providers

(e) **Creating conditions under which costs could be shared and thus reduced** for operators, both in terms of capital and operational costs

- promote/allow infrastructure sharing by operators
- co-ordinate deployment efforts and timing of construction of the backbone, and the co-location of fibres

(f) **Reduce costs by giving political guarantees**

(g) **government funding/financial support for establishing the network** thus reducing the cost to the operators in terms of the cost item (r +d + i)I in equation (iii) above. These could include,

- Grant or direct subsidy
- Loans including soft loans and financing through government debt (public bonds)
- Equity funding
- Tax incentives

(h) **government funding/financial support consumers of telecom services,** thus increasing revenue sources in equation (iii) above. These could include subsidies, tax incentives, discount coupons etc. to the consumers.

(i) **government stimulating demand by aggregating demand of various Departments etc.** This would help increase the revenue base, and reduce unit costs.

(j) **government promoting increasing usage of the services by offering their services through the internet, and providing on-line content for public** services

(k) **government developing and promoting various socio-economic programmes through the communications network**, which would have several positive externalities in addition to increasing revenue sources for the operators. These could include e-health, e-education, e-governance, e-education, e-business.

We briefly discuss below, some of the policies which involve a trade off- among different objectives, and a decision on these policies would depend on the weights given to the different objectives. Over tie, these weights could change, especially if it appears that market initiatives rather than government support /requirements may be more efficient for achieving the objectives.

**Reducing the burden imposed by government policies**

Equation (iii) above clearly showed one policy matter which adds a "burden" for the investor is the extent of the charges paid to the government, i.e. "T" in equation (iii). If "T" is reduced, then prices can be lowered and the incentive to install the backbone increases.[46] The trade-off in this context is between obtaining larger funds at present through higher government charges, and the possibility of earning larger amounts later resulting from the growth of the sector. In this context, we need to bear in mind not only the above-mentioned concept of the price threshold, but also that provision of telecom services has immense positive externalities.

A key issue which arises in this regard is whether these charges should be different for infrastructure providers in comparison to service providers, because the infrastructure providers are essentially providing an input for provision of the final service. The government charge could be levied on the telecom services that are provided using the infrastructure. It may even be argued that since the backbone should be subject to zero license fee charge, on the grounds that it is a key input and there is a need to encourage the installation of the backbone because of its multiple positive economic and social effects.

However, if differential treatment is to be provided to the input and the final product, the key distinction is not between infrastructure provider and service provider, but between the provision of inputs and the final product. Thus, even for service providers, if they provide their backbone to others, that activity should be treated as being the same as that of the infrastructure provider. This would address possible inconsistencies in the policy regime, and would also encourage the provision of access to others by the service provider to its backbone.

[46] For a discussion of the License fee charges under different types of regimes, see Dorward, Lynne and Rogers, Clayton (2004)

In such a situation, a valid question would be whether such charges should be made zero or very low for the use of spectrum. In this regard, it would be useful to consider again whether the activity using the spectrum needs to be promoted and whether there is a scarcity of the spectrum. If there is no scarcity of spectrum, then its shadow price is obviously zero. Charge for spectrum would be relevant where there is spectrum scarcity. There is also a concern that treating spectrum charge in the same manner as the above-mentioned zero license fee etc. charge for fibre could create problems because service providers could establish infrastructure provider companies and take away a portion of the scarce spectrum to prevent their competitors from using it (i.e. the spectrum would be hoarded). Any policy with respect to spectrum must bear this possibility in mind, because unlike fibre in which there is upfront investment, if spectrum is provided free of charge where it is limited in relation to demand, there would be an incentive for such anti-competitive behaviour.

**Support to Provision of Backbone**

An extension of the concept of applying zero charges on inputs such as backbone, is to actually apply negative charges (i.e. provide a subsidy) for installing the backbone. To make the investment more attractive, the various types of subsidy or support could be devised so as to increase R in equation (iii) above, or to reduce any or all of the cost components mentioned in equation (iii). The policy may also include providing more certainty about the available finance to the operators, so that in effect the discount rate $\beta$ can become lower. Such support or subsidy could be provided selectively, i.e. in areas where the present value of such investment needs to be increased. This is the underlying basis for USO support, and could be considered especially for certain areas where the investment in backbone is otherwise unlikely to occur.

The important point to bear in mind should be that such support should not distort the competitive level playing field, and that it can be implemented transparently and quickly.

**Roll-out Obligations**

A number of governments have insisted that in order to obtain the right for providing services in profitable areas, the operator must install backbone in certain unprofitable areas, i.e. they impose an obligation for roll-out of the network. This is an attempt to devise a scheme whereby the operator itself provides an internal cross-subsidy to less profitable areas by utilizing the surplus from the profitable areas. If we combine the respective present values of investment and operations in the two areas, i.e. the profitable and unprofitable areas, equation (iii) above would show us that the present value available for the investments would decrease under such a situation compared to a situation where the investor were not subject to the roll-out requirement. This would reduvce the overall attractiveness of the investment.

Thus, there are two conflicting effects of an obligation.

- One, through the obligation the government attempts to ensure coverage of certain areas by the backbone.
- Two, it reduces the incentive to invest in the backbone as such. To the extent that the investment in the backbone in the profitable area is still attractive, such investment will take place, but its extent is likely to be lower than a situation without the obligation.

For the second reason above, the operator will try and minimize its exposure in the unprofitable area, and will either attempt to get out of the obligation or perform it in the minimal possible manner.

**Thus, a key feature in implementing roll-out conditions must be the ability of the policy-maker to ensure that the obligation is effectively met. Moreover, any step taken to ensure implementation of the roll-out condition must bear in mind both the short-term and the long term effect of the policy decisions for the development of the industry**.

Further, if the system of obligations is not similarly applied to all operators, it tends to skew the level playing field. On the other hand, if the same obligation regarding backbone is imposed on all operators, there may be an over-investment in backbone in comparison to the alternative situation of under-investment.

Bearing the above factors in mind, the roll out conditions in several countries have been substantially diluted and replaced by a regime in which financial incentives are given for providing services in specified areas.

## 2.13 A summary of the main features of the framework of analysis

In this section, we bring together the discussion in the paper, and specify the framework and information base that should be considered to get an overall perspective on the factors which affect the establishment of the backbone in a country, access to the backbone, and efficiency of the interconnection regime. This can provide a basis to analyse the developments in various countries, and to identify key policy areas for promoting extension of, and access to, the backbone. The proposed information base is in the form of Information Panels, which may be presented in the form of the Tables, or as a description of the relevant features of the industry covered by the Information Panel. The information items mentioned in different panels will help conduct the analysis, and also enable us to verify related information items so as to assess the robustness of the data components. Thus, over time, it may be possible to use this framework to also improve the quality of the data. Further, an important point with respect to the framework and the information requirement mentioned below is that the level of information sought might be too detailed at present to be fully available. However, while the attempt should be to obtain as much of the information sought as possible for a complete analysis, the analysis at present will have to be conducted with the limited information available. Experience with the analysis will help get more data and to refine and identify the data elements that might be of relatively greater importance in the analysis.

With respect to the adequacy of telecom backbone in the country, the nature of analysis will depend on the particular situation prevailing in the country. For this purpose, we could have **three possible situations**:

(d) The backbone in the country is **adequate**.[47] In this situation, within our framework, the policy focus needs to be on access only, including through policies related to infrastructure sharing.[48]

(e) Backbone in the country is **generally adequate, but** there are some limited areas in the country which have inadequate backbone supply. Then, for the places where supply of the backbone is adequate, the focus would be on access to the backbone. For those parts of the country where supply of backbone is inadequate, policy analysis would focus on both the establishment of the backbone as well as access to the backbone.

(f) Supply of backbone in the country is **inadequate**. In such a situation, both the establishment of the backbone as well as access to the backbone have to be examined.

For examining all these three situations, we need to first understand the policy background of the sector, including how the policy regime has evolved, and the relevant targets of the government. We begin our framework of analysis with this aspect. This is followed by an examination of the extent of backbone in the country, at present and likely in the near future. This information will give us a basis to assess whether or not the backbone in the country is adequate.

Adequacy of the backbone could be considered in terms of two concepts. One, would be **notional adequacy**, i.e. physical capacity available would be adequate for meting the traffic requirements. Another, would be **effective adequacy**, i.e. the physical capacity is adequately available to other operators also for use, and is adequate for the requirements. In this context, the availability of capacity from infrastructure provider in comparison to service provider, and the government policies on infrastructure sharing, assume a key role.

If the backbone is adequate, we need to focus on the issues relating to access. For cases where backbone is inadequate, we need to focus on both access and encouraging the establishment of the backbone.

[47] For example, see ITU (2003b) which mentions that there is more than adequate supply of backbone in Malaysia. Similarly, ITU (2003a), page 11, states that "Korea's local, national and International Internet connectivity is both quantitatively and quantitatively substantial"; and ITU (2003c), page 12, states that Hong Kong has more kms. of optic cable than roads. Hong Kong ranks first in terms of international bandwidth per capita in the Asia-Pacific region.

[48] Of course other issues such as improving the efficient use of backbone, would also be relevant, but in this paper that is not the focus of our analysis.

Following this assessment, we begin by analyzing the factors which affect access to the backbone, including the interconnection regime. Any constraints or problems arising in the context of access are identified in this process, which also suggest the steps that should be taken to address these constraints/problems.

We then examine the factors affecting the incentives to invest in the backbone. Based on the framework given in Tables 2.2 and 2.3. above, we also need to examine the situation regarding the prevailing demand in comparison to the supply, and a comparison of these with the threshold level of demand. This will help us to identify the nature of policy response to emphasize, i.e. whether the focus should be on releasing the demand constraint, supply constraint, or both.

To begin with, we focus on an analysis of the factors which can be used to address the supply side constraints, and to make investment in the backbone more viable. First we will examine the policies meant for specific areas which are considered unviable, such as USO policies. Other support policies of the government, either specific to certain regions or applicable to the country as a whole, are then considered, to get an insight into the measures being adopted by the government to assist the establishment of the backbone and/or promote the telecom sector. The attempt is also to identify specific constraints in the policy mechanism that would need to be addressed in order to promote the supply of backbone and growth of the telecom sector.

This is followed by an examination of the available demand, the demand threshold which would make investment in backbone viable, and the likely demand that could be generated if demand constraints were addressed. Finally, we consider the possibility of reaching the price threshold, below which prices would give rise to self-sustaining growth in the telecom sector making several erstwhile non-viable investment appear as commercially viable to investors.

The analysis conducted within this framework would help us to identify the key problems, whether linked to the supply side or demand side, which are curbing faster growth and availability of the backbone. It will also indicate the priority areas which should be the focus of the policy maker.

**(1) General Background**

For the general background, we need to obtain two types of perspectives. One is based on the policy announcements and major policy initiatives over time, to understand how the policy regime has evolved in the country. Another is information on the prevailing policy regime, and the structure of the telecom industry within that regime.[49]

[49] Manner (2002), pages 156 to 160, has provided a long list of the factors which should be considered as part of the due diligence review by firms investing in telecom sector. These include: competitive overview; foreign investment limits; local presence requirements; ability to obtain capacity (both local and international), cost of entry – both regulator fees and other government fees and taxes, licensing authority; resolution of disputes between authorized service providers and the regulatory authority; terms of forfeiture; sanctions and penalties; authorization modification, assignment, and termination; tariffs and rates; competitive and

**1.(a) Policy developments and targets**

Information on these aspects gives an insight into the main milestones in the evolution of telecom policy in the country, and the aspirations and basic thrust of the country's policies in this sector. In the latter context, it would be useful to also identify the different kinds of targets in the policy framework, which were discussed in Section 2.12 above. The information required for this purpose would include:

**Informn. Panel - 1. Background on Policy Developments**

This would give a chronology of the main policy announcements (or policies implemented in the telecom sector, including broadband), especially since the liberalization of the telecom sector in the country.

**Informn. Panel - 2. Main Features of the Major Policies Announced**

| Major Policies Announced | Targets in the policies* | State of achievement of the targets |
|---|---|---|
| (1) National Telecom Policies | • Visionary Aspirations and Targets (VATs)<br>• Measurable Aspirations and Targets (MATs)<br>• Measurable Primary Level Targets (MPLTs) | |
| (2) National Policies / Initiatives on Broadband | • Visionary Aspirations and Targets (VATs)<br>• Measurable Aspirations and Targets (MATs)<br>• Measurable Primary Level Targets (MPLTs) | |
| (3) Any State / Provincial Level Policy Initiatives (some examples, if any) | • Visionary Aspirations and Targets (VATs)<br>• Measurable Aspirations and Targets (MATs)<br>• Measurable Primary Level Targets (MPLTs) | |

* Including the specific agencies, if mentioned in the policies, that will implement the target.

monopoly services, periods, and territory; rights of way and eminent domains; interconnection rights and responsibilities; billing and collection procedures; service interruptions; reporting information, inspection, and audit requirements; regulator's relationships with other government agencies; enforcement and approval authorities; hearing and appeals process; competitive protections and anti-trust enforcement; consumer protection provisions, accountability, and penalties; universal service and rural coverage arrangement; political stability; economic outlook.

Special attention in this respect needs to be paid to those **targets which directly involve the establishment of the backbone**, either in country as a whole or in selected parts of the country. In this regard, it would also be useful to have information on the **manner in which these directly backbone-related targets are to be implemented, or have been implemented,** e.g. whether the government has established the backbone, or has provided much of the funding for the backbone, such as in the case of broadband expansion in South Korea.

**1.(b) General Information on the industry and its broad policy regime**

This focuses on the overall operational conditions in the country, the nature of services provided, and developments in the telecom market in terms of the number of operators and subscriber base, which in turn can help us to **assess the extent and nature of the competition** in the market.

With respect to the policy framework for competition in the market, we should also consider information on the regime applicable to tariffs and interconnection, and the tariffs and interconnection charges. This will help us to **assess the extent of impact of the prevailing competition on market prices**, as well as the **structure of the interconnection regime in terms of promoting a competitive market**. Some of the information on these items would be useful also to address the issues which are discussed later within this framework of analysis. The information that we focus on under this sub-section is given below.

**Informn. Panel – 3. Types of Licenses, operators with the licenses, and their subscriber base**

| Type of License (name, service covered, areas covered) | Operators | Subscriber base |
|---|---|---|
| License Type - I | Names of operators | Subscriber base for each operator for the last three years |
| License Type - II | Names of operators | Subscriber base for each operator for the last three years |
| License Type – III | Names of operators | Subscriber base for each operator for the last three years |

Notes:

(1) Particular information should be provided in terms of new services or those services which have become possible due to technological changes, e.g. VOIP. The description should focus on both the types of constraints and limitations imposed under the license, and how competition from different licenses might

be evolving to those who establish and provide access to the backbone.

(2) The licenses would include the license of infrastructure provider as a separate license if there is such a category in place. For these Licensees the subscriber base would include the number of operators taking backbone from them.

**Informn. Panel - 4 (a to xx). Name of the type of License, operators with the license, and their subscriber base**

| Regions covered by License Type | Total number of operators per region for each License | Operators with the license | Subscriber base |
|---|---|---|---|
| Region – 1 | Xx | Names of operators (year when received license) | Subscriber base for last three years (if possible for each operator) |
| Region – 2 | Yy | Names of operators (year when received license) | Subscriber base for last three years (if possible for each operator) |
| Region - 3 | Zz | Names of operators (year when received license) | Subscriber base for last three years (if possible for each operator) |

Note 1: There will be one Table or information panel, for each type of License category, i.e. License categories "a" to "xx"

Note 2: The licenses would include the license of infrastructure provider as a separate license if there is such a category in place. For these Licensees the subscriber base would include the number of operators taking backbone from them.

**Informn. Panel – 5. Waiting List of subscribers**

| Region | Urban | Rural | Total |
|---|---|---|---|
| Country | Number or percentage | Number or percentage | Number or percentage |
| Largest operator (fixed line) | Number or percentage | Number or percentage | Number or percentage |
| Largest operator (mobile) | Number or percentage | Number or percentage | Number or percentage |

**Informn. Panel – 6. Main features of the Tariff Regime**

| | |
|---|---|
| What is the regulatory regime for tariffs for<br>- fixed line<br>- mobile | Description (with specific differences if applicable for local, long distance and international tariffs also);<br>If policy maker decides the regime, then what is the principle used. |

| | |
|---|---|
| Two representative or low cost tariff packages for fixed line | Full detail including deposits, call charges for different types of calls (local, long distance, international), monthly rental, any other (postpaid also, if applicable) |
| Two representative or low cost tariff packages for mobile | Full detail including deposits, call charges for different types of calls, monthly rental, any other (postpaid also, if applicable) |
| Conversion of above tariff packages using some standard package of usage pattern (total minutes, incoming and outgoing ratio, etc.) | Amounts per minute based on the standard package of usage pattern (fixed line and mobile, separately) |

The conversion of the tariff packages to comparable per minute charges for fixed and mobile services will provide us with an **indication of the substitutability of the services seen by customers in terms of the applicable tariffs**, i.e. closer these effective tariffs, more substitutable will the two services be considered. This has important implications for the demand for telecom services in the market, as well as the likely growth in this demand.

Likewise, the **interconnection regime can indicate** the extent to which fixed and mobile services can be considered substitutable in the market, the underlying cost structure for calls arising due to the interconnection regime, and the expected pattern of growth in the market (including for the backbone) due to the conditions encompassed in the interconnection regime.

**Informn. Panel – 7. Main features of the Interconnection regime (principles etc.)**

| | |
|---|---|
| Whether any policy document or Order/Regulation on Interconnection in place | Yes/No. If yes, which one |
| What are the main principles of interconnection regime | Description, e.g. non-discrimination, cost oriented, whether mandatory or not, etc. |
| Any restriction on where the interconnection (or point of presence) is allowed<br>- fixed – fixed<br>- fixed – mobile<br>- mobile – mobile<br>- any other relevant interconnection category | Description |
| Any other special feature | Description |

| | |
|---|---|
| of the interconnection regime | |

**<u>Informn. Panel – 8. Main features of the Interconnection regime (charges)</u>**

| | | | |
|---|---|---|---|
| Is there a regime for interconnection usage charges (origination, carriage, termination) | Is this decided by the Policy maker or by the operator. If the policy maker, then what is the principle used to specify the charges | Amount of the interconnection charges for different types of calls | What are the cost based charges, if specified for the country. If not, what are the cost based charges in comparator country |
| Is there a regime for leased circuit charge<br>- national<br>- international | Is this decided by the Policy maker or by the operator. If the policy maker, then what is the principle used to specify the charges | Amount of the charges for different capacities (e.g. 64 kbps, E1) and distances | What are the cost based charges, if specified for the country. If not, what are the cost based charges in comparator country |
| Is there a regime for port charges<br>- national<br>- international | Is this decided by the Policy maker or by the operator. If the policy maker, then what is the principle used to specify the charges | Amount of the charges for different capacities | What are the cost based charges, if specified for the country. If not, what are the cost based charges in comparator country |

**<u>(2). Extent of backbone in the country</u>**

As the focus of this study is on the backbone in the country, after obtaining the general background, we need to focus on this aspect. **Regarding the availability of backbone, we have to cover both the service providers and the infrastructure providers, and among these operators we need to separately consider the fixed line operators and the mobile operators.** Further, it is important to consider both the available backbone capacity, as well as the likely capacity in the near future. Only in this wider context would we be in a position to assess whether the backbone availability in the country is adequate. The information required for this purpose includes:

**Informn. Panel – 9. Backbone installed by various operators (national)**

| Operator* | Type of backbone installed | Area covered by backbone | Reason for the extent of backbone installed** |
|---|---|---|---|
| Operator -1 | Type of Backbone – kms. covered (present; and five years ago) | If possible separately for each type of backbone | Reasons |
| Operator -2 | Type of Backbone – kms. covered (present; and five years ago) | If possible separately for each type of backbone | Reasons |
| Operator -3 | Type of Backbone – kms. covered (present; and five years ago) | If possible separately for each type of backbone | Reasons |

* The list of operators would also include the infrastructure providers

** If available, information on reason for extension of network being planned also to be provided, e.g. due to roll-out requirement, due to commercial viability, assistances from USO programme, government decision to install the backbone

**Informn. Panel – 10. Backbone installed by various operators: international**

| Operator* | Type of backbone installed | Reason for the extent of backbone installed** | Reason why more backbone was not installed** |
|---|---|---|---|
| Operator -1 | Type of Backbone planned and kms. covered (over next two to three years) | Reasons | Reasons |
| Operator -2 | Type of Backbone planned and kms. covered (over next two to three years) | Reasons | Reasons |
| Operator -3 | Type of Backbone planned and kms. covered | Reasons | Reasons |

| | | | |
|---|---|---|---|
| | (over next two to three years) | | |

*  The list of operators should also include the infrastructure providers

**  If available, information on reason for extension of network being planned also to be provided, e.g. due to roll-out requirement, due to commercial viability, assistances from government, government decision to install the backbone

**<u>Informn. Panel – 11. Backbone planned to be installed by various operators: national</u>**

| **Operator*** | **Area yet to be covered by backbone** | **Type of backbone planned to be installed** | **Reason for the extent of backbone installed**** | **Investment planned in the next two to three years** |
|---|---|---|---|---|
| Operator -1 | Indicate area not covered, extent of population in this area, and also if any plan to cover the area in the next two-to three years | Type of Backbone planned and kms. covered (over next two to three years) | Reasons | Amount (of which, if possible, give amount for backbone) |
| Operator -2 | Indicate area not covered, extent of population in this area, and also if any plan to cover the area in the next two-to three years | Type of Backbone planned and kms. covered (over next two to three years) | Reasons | Amount (of which, if possible, give amount for backbone) |
| Operator -3 | Indicate area not covered, extent of population in this area, and also if any plan to cover the area in the next two-to three years | Type of Backbone planned and kms. covered (over next two to three years) | Reasons | Amount (of which, if possible, give amount for backbone) |

*  The list of operators would also include the infrastructure providers

**  If available, information on reason for extension of network being planned also to be provided, e.g. due to roll-out requirement, due to commercial viability, assistances from USO programme, government decision to install the backbone

**<u>Informn. Panel – 12. Backbone planned to be installed by various operators: international</u>**

| **Operator*** | **Type of backbone planned to be installed** | **Reason for the extent of backbone installed**** | **Investment planned in the next two to three years** |
|---|---|---|---|
| Operator -1 | Type of Backbone planned and kms. covered (over next two to three years) | Reasons | Amount (of which, if possible, give amount for backbone) |
| Operator -2 | Type of Backbone planned and kms. covered (over next two to three years) | Reasons | Amount (of which, if possible, give amount for backbone) |
| Operator -3 | Type of Backbone planned and kms. covered (over next two to three years) | Reasons | Amount (of which, if possible, give amount for backbone) |

* The list of operators would also include the infrastructure providers

** If available, information on reason for extension of network being planned also to be provided, e.g. due to roll-out requirement, due to commercial viability, assistances from government, government decision to install the backbone

**<u>Informn. Panel – 13. Information on cost of installing the backbone</u>**

| **Type of backbone** | **Cost per km. (average; range)** |
|---|---|
| Fibre<br>- Service Provider<br>- Infrastructure provider | Amounts |
| Radio<br>- Service Provider<br>- Infrastructure provider | Amounts |
| Any other<br>- Service Provider<br>- Infrastructure provider | Amounts |

**Based on this information, we can assess whether the backbone in the country is adequate, partially adequate, or generally inadequate**.

If the backbone in the country is adequate, it would be useful to identify the factors which have contributed to such a situation. These could include for example, the government itself installing the backbone, providing financial support for installing the backbone, roll-out obligations, etc. This information should be collected as mentioned in the note to Information Panels 11 and 12.

Examining the factors pertaining to establishment of the backbone is relevant for situation when countries have inadequate backbone, either partially or generally. [50] On the other hand, analysis of the factors affecting access to the backbone would be required for each of the three abovementioned situations regarding adequacy of the backbone, i.e. backbone being adequate, partially adequate, or generally not adequate.

We will begin with a consideration of the factors affecting access to the backbone, and will subsequently look at matters relating to the establishment of the backbone. Both these aspects relate importantly to addressing the supply side constraints. It would therefore be useful to prepare the background for this assessment by examining, based on Tables 2.2 and 2.3, the nature of policies that that should be the focus of the policy maker, i.e. should they address much more the demand constraint, supply constraint, or both.

### (3). Assessment of the nature of the operative constraints, i.e. demand, supply, or both

For this analysis, we use the framework provided by Tables 2.2. and 2.3, and the information collected under Information Panels 5, and 9 to 12.

### (4). Factors affecting access to the backbone

To some extent, this information on access to the backbone has already been covered by the Information Panels 7 and 8 mentioned above in the context of the general background information. In addition, the price of the backbone in comparison to the revenues earned from providing telecom services, and the growth in market demand as well as evolving market shares would also give an insight into the likelihood of the service provider giving access to others to its backbone. Information Panels 3, 4, 5, 6 and 13.

Further information for analyzing this matter, can be obtained as per the Information Panel given below.[51]

---

[50] In addition to the factors considered by investors (Bruce and Macmillan (2002), in footnote in Section 2.2 of this Chapter), and factors to be considered in due diligence exercise (mentioned by Manner (2002) in footnote in Section 2.13 (1) of this Chapter), there is another framework mentioned in Roseman et. al. (2002), page 18, which states that the business case analysis for market expansion by the private sector depends on the **size of the market** (potential number of customers and sector revenues), **potential profitability** (return on investment, revenue per subscriber), **regulatory risks** (transparency, liberalization, regulatory trends, particular rules and regulations), **regulatory costs** (license fees, tax provisions, administrative burdens), **issues relating to time to market** (including in-country presence requirements, time taken for licensing and for regulatory decisions), **and overall political and economic stability, including stable currency**. Comparing these three different lists, we can consider the factors with greater relative priority for our own exercise. This is the attempt made in specifying the information to be gathered under the various information panels.

[51] In examining interconnection issues, one could keep in mind the widely accepted interconnection principles, as summarized in Intven, ed. (2000). These include, avoid undue

**Informn. Panel – 14. Perceived problems on access and interconnection matters and steps taken to address them**

| Issue | Perceived Problems | Any steps take to address the problem: by the operators and/or by the policy maker | Any suggestions for dealing with the issue |
|---|---|---|---|
| Access to backbone, and the Interconnection regime | - policies perceived to impose burden<br>- policies which delay implementation<br>- policies which inherently discourage subscriber growth or market growth | Description | Description |

Based on Information Panels 3 to 8, 13 and 14, an analysis can be conducted on the constraints, if any, for access to the backbone and for interconnection.

**(5). Factors affecting establishment of the backbone, with particular reference to the backbone being inadequate in specific areas in the country**

In any situation with inadequate backbone, we conceptually have excess demand, i.e. in terms of Tables 2.2 and 2.3, we have D > S. As shown in these Tables above, such a situation arises when:

- $D_T > D > S$, i.e. there is unviable investment in backbone, supply constraint, there is a need to increase both demand and supply, and need to decrease $D_T$ .
- $D > D_T > S$, i.e. viable investment in backbone, major supply constraint which needs to be addressed; increasing demand will not be the solution

discrimination, permit interconnection at any technically feasible point and requesting operator should pay additional costs of non-standard equipment, interconnection charges be cost based, cost inefficiencies of incumbent should not be passed on to others, with balanced reciprocal amounts bill and keep is an efficient arrangement, prescribe regulatory guidelines and principles in advance, standard terms and procedures should be published for interconnection with dominant operators, interconnection procedures and arrangements should be transparent and should encourage efficient and sustainable competition, network elements should be unbundled and made available at separate charges, charges related to USO should be identified separately and not bundled with interconnection charges, and an independent regulator (or other third party) should resolve interconnection disputes quickly and fairly. These points are also summarized on page 70 of ITU (2002e).

- $D > S > D_T$ , i.e. viable investment in backbone, supply constraint which needs to be addressed; increasing demand will not be the solution

With this background, we first consider the situation where backbone is inadequate only in certain parts of the country. In this situation, in addition to examining the state of access to the backbone, we also need to examine the factors which determine the establishment of the backbone in the part of the country which does not have adequate backbone. For this purpose, we need to consider two types of initiatives.

- One, is whether there are any policies/programmes that focus on the specific areas which have inadequate infrastructure.
- Second, is an examination of the factors which have curbed the establishment of the backbone in specific parts of the country, and whether certain steps can be taken to address them.

Regarding policies/programmes focusing on specific parts of the country, we need to first examine the nature of USO, or similar programmes in the country.[52] This will give us some insight on the attempts made to establishing the backbone in these under-supplied regions, and whether any suggestions can be made to enhance the effectiveness of these initiatives. Information on the USO regime may be gathered as follows.

**Informn. Panel – 15. Main features of the USO regime, and the performance in terms of USO objectives**

| Features/Objectives under USO scheme | Extent to which Objective/Target Achieved | Date for Achieving Objective/Target, if not yet achieved |
|---|---|---|
| Main features of USO scheme, and the activities covered (e.g. public phone, phone on demand, internet, broadband) | Not applicable | Not applicable |
| Targets for the objectives covered under USO, including installation of the backbone | Dates as specified | Dates as per public statements |
| Type of financial or other assistance provided under the USO scheme | Target/objective, as applicable | Date as applicable |

[52] According to ITU (2002e), page 77, the major funding alternatives for universality programmes include: **market based reforms** (e.g. privatization, competition, and cost based pricing); **mandatory service obligations** or other regulatory measures; **cross-subsidies** between or within services provided by the incumbent; **access deficit** charges paid by telecommunication operators to subsidize the “access deficits” of incumbents; and **universality funds** that pool revenues from various sources and provide targeted subsidies to implement universality programmes. These items are covered under different Information Panels within our framework, and can be seen in the specific context where they are mentioned, as well as with respect to the USO programme, per se.

In addition to the USO scheme, there might be other programmes which are aimed either at selected regions or at the telecom sector as a whole. The operation and effectiveness of these programmes can also be analysed to assess how the supply side factors for establishing the backbone are being addressed in the country, i.e. how costs of establishing the backbone are being reduced through such policies. For this purpose, the following information would be useful.

**Informn. Panel – 16. Any other assistance or mandatory schemes for establishing/using the backbone in selected parts of the country, or in the telecom sector as a whole**

| Scheme | Description of the scheme |
|---|---|
| Scheme – 1 | Description and time period since in place, and till when will it be in place; whether a general scheme or area/activity specific scheme |
| Scheme – 2 | Description and time period since in place, and till when will it be in place; whether a general scheme or area/activity specific scheme |
| Policy on Infrastructure sharing | Description of the policy/scheme, and clarification of whether this is limited to specific areas or applies in general. |

To understand the nature of these policies/schemes, it will be useful to consider them on the basis of the types of government policies discussed in section 2(I) of this Chapter.

In addition, we need to examine the various types of policy constraints which adversely affect both the supply as well as the demand side factors, thus adversely affecting the commercial viability of investment in the backbone. For this, we need to consider the problems that may be arising within the policy regimes in place. The information mentioned in Information Panel 16 below could be considered for this purpose.[53]

**Informn. Panel - 17 Perceived problems in selected policy regimes and steps taken to address them**

| Issue | Perceived Problems | Any steps take to address the problem: by the operators and/or by the policy maker | Any suggestions for dealing with the issue |
|---|---|---|---|

[53] The analysis of these constraints could focus on issues similar to those suggested by some authors who have examined the problems to address if one has to transition from the existing regulatory regime to a new regulatory regime. De Torre and Maddens (2004), for example, discuss a need to address issues relating to removing artificial licensing barriers; ensuring level playing field for competition; reviewing universal access and universal service rules; reviewing non-licensing regulations; quality of service issues; interconnection regulation in a converged environment; use of spectrum and other scarce resources; dispute resolution, enforcement, and sanctions; and accommodating the technological developments .

| | | | |
|---|---|---|---|
| (a) License regime | - policies perceived to impose burden<br>- policies which delay implementation<br>- policies which inherently discourage subscriber growth or market growth | Description | Description |
| (b) Tariff regime | - policies perceived to impose burden<br>- policies which delay implementation<br>- policies which inherently discourage subscriber growth or market growth | Description | Description |
| (c) Dispute settlement | Description | Description | Description |
| (d) Any other relevant policy matter | - policies perceived to impose burden<br>- policies which delay implementation<br>- policies which inherently discourage subscriber growth or market growth | Description | Description |

In this section, much of the discussion till now has focused on the constraints arising with respect to supply of the backbone (or access to it), and the policies which address constraints on supply or facilitate the operational conditions. Earlier in the Chapter, we had noted also the importance of demand (including a demand threshold), and of changes in the market which could stimulate demand and even give rise to a situation where the increase in demand could generate a self-sustaining incentive structure for increasing the supply of the backbone. We address these aspects in the next sub-section. The analysis in that sub-section could be applied, as appropriate, to the country as a whole as well as to parts of the country, e.g., rural or urban areas.

**(6). Factors affecting demand in the market**

The importance of prevailing demand, and growth in demand, has been mentioned in several contexts. In the framework given in Tables 2.2 and 2.3, focus on demand would be required in a number of situations, namely that demand constraint needs to be addressed when:

- $D_T$ > D > S, so as to make the investment viable and thus attractive.
- $D_T$ > S > D, in order to make the investment viable, and increase capacity utilization also to make investment attractive.
- S > $D_T$ > D, in order to make the investment viable, and increase capacity utilization also to make investment attractive.
- S > D > $D_T$ , in order to increase capacity utilization and make investment attractive.

In the first three of the above four cases, it would also be useful to implement policies to reduce $D_T$ , by reducing the costs incurred in supplying the backbone. Over time, with the trend decline in costs, the threshold level of demand will decrease from its prevailing levels.

These four situations show that a key part of the analysis is to determine the threshold level of demand, which would then be compared with the prevailing demand. Thus, in this section, we first address the matter of the threshold level of demand. Following this, we would need to determine the level of demand which could be manifested in the market if supply constraints are released, and the evolution of this demand in the near future, based on changes in income as well as in the tariffs for telecom services.

**Estimating the threshold level of demand**

The threshold level of demand could be estimated in two alternative ways. One, is on the basis of the discussion in Section 2.7 of this Chapter, and the other on the basis of the revenues required to recover costs including a reasonable return.

**Based on Section 2.7 of this Chapter**, the exercise would require information on:

- costs of laying the backbone for the service provider and the infrastructure provider, i.e. $C_i$ / $C_S$ mentioned in Section 2.7, based on Information Panel 14,
- the price specified for the backbone, i.e. $P_i$ in Section 2.7, based on Information Panel 8, and
- the average revenues per unit capacity used, i.e. $P_S$ in Section 2.7.

An estimate of the last item could be made based on the information mentioned in Information Panel 18 below, first at the average level and subsequently for estimates taking account of a variation in the revenues per unit capacity.

**Informn. Panel – 18. Revenues and capacity utilization of telecom operators**

| Main Operators | Annual Revenues (each of the previous three years) | Capacity utilization of the backbone by the operator |
|---|---|---|
| Two largest fixed line | Amounts | Percentage (if |

| | | |
|---|---|---|
| operators | | possible, an indication of average and range) |
| Two largest mobile operators | Amounts | Percentage (if possible, an indication of average and range) |
| Two largest infrastructure providers | Amounts | Percentage (if possible, an indication of average and range) |

In addition to $P_S$, it is noteworthy that in Section 2.7, the relationship for threshold demand for backbone capacity is derived in terms of two linked variable, namely $P_i$ and $D_{CS}$, with $P_i$ being the cost based price for backbone and $D_{CS}$ being the capacity utilization considered to determine the cost based price. If the market price for backbone is higher than the cost based price, then a corresponding correction will have to be made in the value of $D_{CS}$ (i.e. there will be a decrease in the capacity utilization used for determining the price). These estimates could be used to determine the threshold level of demand.

It is possible that the above-mentioned requisite price and cost estimates for a country are not available to determine the demand threshold. In that case, we could use a surrogate for cost based price and the corresponding capacity utilization etc., based on some comparator country.

An **alternative estimate of the threshold level of demand (in terms of capacity used or subscribers of the network) could be determined based on an assessment of the adequate revenues to recover costs.** This could be done as follows:

- For the service provider calculate the revenues required to recover costs (based on Information Panel 13 above), and using the information on ARPU (from Information Panel 19 given below), derive the number of subscribers that would give rise to these revenues.
- For the infrastructure provider, based on the revenues per unit capacity, we could determine the capacity level of demand that would provide adequate returns to the investment in the backbone (using data in Information Panels 8 and 13).

These estimates provide us with a benchmark for threshold demand, which needs to be compared with the prevailing demand, at present and in the near future.

**Estimating the prevailing demand (present and in the near future)**

An important point to bear in mind is that the threshold demand level is calculated for a given backbone link, while the demand in the market is normally estimated for the country as a whole or a region as a whole. In this sub-section, we begin with the estimation of demand at the aggregate level, and then consider its allocation to a backbone provider under different conditions, i.e. different market shares for the backbone provider. Comparing the aggregate demand with the demand threshold calculated earlier can help us to also determine the minimum market share required for investing in the backbone, or the extent of growth in the market that will make investment in the backbone worthwhile.

**Aggregate demand levels**

We begin with our analysis on the basis of the general features of the economy which have a link with demand for telecom services. More detailed examination of the situation can follow based on this analysis. Thus, we begin with the following general information.

**Informn. Panel – 19. Country : Selected Features**

| | | |
|---|---|---|
| GDP | Amount (for each of the last three years) | Rate of Growth for each of the last three years |
| GDP per capita (total, urban, rural) | Amount (for each of the last three years) | Rate of Growth for each of the last three years |
| GDP per capita in purchasing power terms | Amount (for each of the last three years) | Rate of Growth for each of the last three years |
| Population (total, urban, rural) | Number, and proportion in total (for each of the last three years) | Rate of Growth for each of the last three years |
| Information on Income distribution, if available | Percentage of households or persons in different income categories | Information, if available, on growth of the income categories |
| Teledensity (fixed and mobile taken together) – total, urban, rural | Number (for each of the last three years) | Percentage change in each of last three years |
| ARPU (fixed line) – total, urban, rural | Number (for each of the last three years) | Change in each of last three years |
| ARPU (mobile) – total, urban, rural | Number (for each of the last three years) | Change in each of last three years |
| Minutes of use per subscriber per month<br>- Fixed line<br>- Mobile | Number | |
| Ratio of mobile subscribers to fixed line subscribers | | |

**The Jipp curve**

The above information can be used to assess the average expected teledensity for the country, using an estimated relationship shown between teledensity and GDP per capita. Such a relationship between GDP and teledensity has been derived based on the Jipp curve.[54] ITU (2002d) shows that the strength of this relationship improves with the inclusion of mobile subscriber base together with fixed line subscriber base, but also states that this result may be misleading because the vast majority of people that own a mobile phone also own a fixed line phone, and as such considering mobile and fixed together for teledensity purposes would imply double-counting the phones.[55] For our purpose, this latter point about double counting is not of major concern.

In our framework of analysis, we consider teledensity not as a measure of how many persons have a telephone, but to indicate the overall demand in the market. To the extent that telednsity and ARPU are considered together, we would get an indication of the overall revenues earned from the phones. Likewise, to the extent that teledensity and traffic per phone or minutes of use per subscribers are taken together, we would get an indication of the overall usage of the phone, which is then linked to the usage of the backbone.

Further, in a number of countries where the fixed line has not been extended across major portion of the population, the existing teledensity is low, and mobile phones are the main source of teledensity growth, the extent of double counting would be smaller.[56] Moreover, even if we limit the definition of teledensity to only fixed line phones, it is not as if the same subscriber does not have more than one phone.

Thus, for our purposes, consideration of teledensity derived on the basis of the Jipp curve can be a reasonable starting point of the analysis. Comparing the expected teledensity with the prevailing teledensity, we can consider whether the country is an under-performer, average performer, or over-performer in terms of teledensity achievement.

**An alternative method for estimating overall or aggregate demand**

Another way of estimating the relevant overall demand in the economy could be based on the proportion of population that has income levels above a particular threshold expenditure amount, which is the amount spent on telecom by the marginal consumer (e.g. the concept shown in Figure 2.2 earlier by the vertical line JK). This estimate could be

---

[54] For more detail, see ITU (2002d), page 64.

[55] This latter statement is in footnote 8 on page 76 of ITU (2002d).

[56] ITU (2003f) has also discussed the point about double counting, On page 74, it states that: "The *total number of telephone subscribers per 100 inhabitants (total teledensity)* is the sum of fixed lines in operation and cellular mobile subscribers divided by the population of a country, and multiplied by 100. The possibility of double counting is the major drawback of using total teledensity since the subscriber could have both a fixed and mobile telephone. One way to overcome this is to use *effective teledensity* which may be defined as *either* fixed telephone subscribers *or* cellular mobile subscribers per 100 inhabitants, whichever is highest. Effective teledensity is a better measure of total *coverage*, but not necessarily of *access*. In a home that has both a mobile phone and a fixed line, there is more likely to be improved access between household members of different age or gender. For that reasons, total teledensity is the preferred measure in the context of MDGs [Millennium, Development Goals]." (emphasis in original)

made for both the urban and rural areas separately, if adequate information is available.

## Further analysis based on the above estimates

If the expected teledensity is less than the prevailing teledensity, it would be useful to examine the reasons for this, including a consideration of whether the prevailing prices are relatively lower or higher than other comparator countries, taking account of the difference in per capita income. That would give us a good insight into the factors which could boost demand in other places also.

If the country is an under-performer in terms of teledensity, the difference between the expected and prevailing teledensity could give us an indication of the likely additional demand that would arise if factors mitigating effective demand are addressed. To the extent that this additional expected demand is covered by expressed unmet demand (e.g. the waiting list as shown in Information Panel 5), we would already have a major indication of the factors responsible, namely the factors due to which there is a waiting list of unmet demand.

In this regard, there is another aspect to be taken into account, namely that even normally the actual teledensity in a country may be much lower than the theoretically estimated potential teledensity based on the threshold level of income for the marginal consumer. [57] We consider this aspect further, based on the data in ITU (1998). The data in ITU (1998) is at the level of the households for 1995, and is presented below in Table 2.4 with countries organized in increasing order of household teledensity. We can see from columns (3) and (6) of this Table that for household teledensity above 10%, the ratio of theoretically expected teledensity and the actual teledensity is about 4 or less. This ratio becomes higher for countries with lower household teledensity, showing perhaps a greater presence of supply constraints. As the supply constraints are removed, this ratio will become lower.

[57] In examining the difference between the expected and actual teledensity, we should also keep in mind that, as ITU (1998) states on page 36, “no country has attained or surpassed a level of household telephone penetration that it could theoretically afford.” In this regard, we also need to bear in mind the likely reasons provided by ITU (1998), page 36, that “One explanation is that tariffs are higher than the average cost structure, discouraging demand. Another explanation is that there is an insufficient stock of telephone lines because of inefficiency, financial constraints, or market restrictions. In both cases, new sources of supply could help, by lowering cost structures and increasing the quantity of telephone lines.” Our framework in this chapter includes these aspects, together with some other relevant factors, to address these issues.

**Table 2.4 Gap between potential household teledensity and actual household teledensity for various countries, 1995**
**(countries organized in increasing order of actual household teledensity)**

| Country (1) | Private Consumption income per Household, US$, 1995 (2) | Percentage of Households with telephone service, 1995 (3) | Percentage of Households that could afford telephone service at income level of US$2,060 (4) | Ratio of US$ 2,060 to column (2) (5) | Ratio of column (4) to column (3) (6) |
|---|---|---|---|---|---|
| Uganda | 1102 | 0.4 | 20 | **1.87** | **50.00** |
| Guinea | 1987 | 0.4 | 30 | **1.04** | **75.00** |
| Tanzania | 619 | 0.8 | 10 | **3.33** | **12.50** |
| Ghana | 1418 | 0.9 | 20 | **1.45** | **22.22** |
| Mauritania | 1907 | 0.9 | 30 | **1.08** | **33.33** |
| | | | | | |
| Kenya | 939 | 1.7 | 20 | **2.19** | **11.76** |
| Lesotho | 2271 | 1.8 | 30 | **0.91** | **16.67** |
| Zambia | 2118 | 2.3 | 30 | **0.97** | **13.04** |
| Sri Lanka | 2605 | 2.5 | 50 | **0.79** | **20.00** |
| Vietnam | 1052 | 2.6 | 20 | **1.96** | **7.69** |
| Guinea-Bissau | 1630 | 4.2 | 20 | **1.26** | **4.76** |
| Cote d' Ivoire | 4243 | 4.7 | 70 | **0.49** | **14.89** |
| Indonesia | 2492 | 5.5 | 40 | **0.83** | **7.27** |
| Senegal | 3980 | 5.8 | 50 | **0.52** | **8.62** |
| Philippines | 4100 | 6.7 | 70 | **0.50** | **10.45** |
| China | 901 | 7.9 | 10 | **2.29** | **1.27** |
| Pakistan | 2430 | 8.5 | 40 | **0.85** | **4.71** |
| | | | | | |
| Honduras | 3055 | 12 | 40 | **0.67** | **3.33** |
| Thailand | 6402 | 18.4 | 80 | **0.32** | **4.35** |
| Morocco | 5053 | 19.7 | 80 | **0.41** | **4.06** |
| Ecuador | 4179 | 19.8 | 60 | **0.49** | **3.03** |
| Tunisia | 6502 | 20.5 | 80 | **0.32** | **3.90** |
| Brazil | 10608 | 20.5 | 70 | **0.19** | **3.41** |
| Moldova | 2237 | 35.7 | 40 | **0.92** | **1.12** |
| Kazakhstan | 3078 | 34.9 | 60 | **0.67** | **1.72** |
| | | | | | |
| Poland | 5702 | 36.2 | 100 | **0.36** | **2.76** |

| | | | | | |
|---|---|---|---|---|---|
| Romania | 3236 | 36.8 | 70 | **0.64** | **1.90** |
| Venezuela | 13748 | 41.8 | 90 | **0.15** | **2.15** |
| Costa Rica | 6886 | 42 | 80 | **0.30** | **1.90** |
| Czech Rep. | 6712 | 42.2 | 100 | **0.31** | **2.37** |
| Sl. Rep. | 4487 | 43.9 | 100 | **0.46** | **2.28** |

Source: ITU (1998), page 37, Table 2.3.

However, if we consider the overall level of demand (or teledensity), then using the data on teledensity in terms of household data as a basis for indicating such overall demand would not be appropriate because it would indicate a substantial difference from (and in certain cases under-estimation of) the prevailing aggregate demand or teledensity.

The teledensity in term of per 100 inhabitants would be given by the teledensity per household divided by the size of the household. Taking for illustrative purposes, four persons per household, we can see in Table 2.5 below the indicative teledensity in comparison to the actual teledensity for 2002 (Table 2.5 has the same countries as in Table 2.4, for which the requisite information is available) .

**Table 2.5 Percentage of household with telephones in comparison to telephone subscribers per 100 inhabitants, 2002**

| Country (1) | Percentage of Households with telephone, 2002 (2) | Total telephone subscribers per 100 inhabitants, 2002 (3) | Column (2) divided by four (4) | Column (4) of Table 2.4 divided by four (5) |
|---|---|---|---|---|
| Uganda | 2.7 | 1.81 | 0.7 | 5.0 |
| Guinea | 1.7 | 1.52 | 0.4 | 7.5 |
| Tanzania | 2.0 | 2.41 | 0.5 | 2.5 |
| Mauritania | 2.9 | 10.39 | 0.7 | 7.5 |
| Lesotho | 5.6 | 5.57 | 1.4 | 7.5 |
| Zambia | 3.8 | 2.12 | 1.0 | 7.5 |
| Cote d' Ivoire | 17.4 | 8.27 | 4.4 | 17.5 |
| Senegal | 17.0 | 7.72 | 4.3 | 12.5 |
| Philippines | 14.2 | 23.29 | 3.6 | 17.5 |
| Honduras | 16.0 | 9.69 | 4.0 | 10.0 |
| Thailand | 27.7 | 36.55 | 6.8 | 20.0 |
| Ecuador | 32.2 | 23.08 | 8.1 | 15.0 |
| Tunisia | 38.0 | 16.89 | 9.5 | 20.0 |
| Brazil | 58.9 | 42.38 | 14.7 | 17.5 |
| Kazakhstan | 41.4 | 19.47 | 10.4 | 15.0 |
| Venezuela | 35.6 | 36.92 | 8.9 | 22.5 |
| Costa Rica | 54.3 | 36.15 | 13.6 | 20.0 |
| Czech Rep. | 68.7 | 121.11 | 17.2 | 25.0 |
| Sl. Rep. | 69.5 | 81.18 | 17.4 | 25.0 |

Source: ITU (2003), World Telecommunication Development Report 2003.

Comparing columns (3) and (4) in Table 2.5 above, we can see that the indicative teledensity based on household teledensity is substantially below the actual teledensity. This shows the presence of several non-household phones, the possibility of households having more than one phone, and the data on household teledensity not including both fixed and mobile phones, while the estimate of total teledensity includes both. For our purpose, which focuses on the viability of investment and the demand available in the market, it would be better to work with the actual teledensity data.

In Table 2.5 above, we have another statistic in column (5), which shows the teledensity indicated by the theoretical demand level calculated in Table 2.4 earlier, for each country based on a threshold income level for 1995. The corresponding estimate for 2002 would be higher, but even the 1995 estimate in column (5), when compared to the actual teledensity in column (3), gives some insights into the situation. We can see that for higher levels of teledensity, e.g. 10% or more, the actual teledensity is in general similar to, or more than, the teledensity indicated by the theoretical estimate of household demand. In contrast, there is a considerable difference for countries with relatively lower actual teledensities.

Thus, for low teledensity countries, it is quite likely that the supply constraints are strong and increasing demand alone would not result in addressing the issue of increasing teledensity. It also shows that for these countries, there would be excess demand in the country. For these countries, we could examine whether the excess demand becoming effective would give rise to adequate demand to make investment in the backbone viable. If not, then policies to encourage demand, or to provide financial support to investment/operations, would also be required.

For relatively higher teledensity countries, the estimated theoretical demand levels are in general likely to be reflected as effective demand in the market. For these countries, the analysis can be done with greater focus on the actual demand (or teledensity), rather than the theoretical estimate of demand. In contrast, for low teledensity countries, the starting point would be the actual demand, but the theoretical demand levels would also be relevant because those are the levels towards which the market could move, if the appropriate constraints were dealt with through policy initiatives.

**Comparison of threshold level of demand and prevailing/expected (theoretical) level of demand**

The prevailing demand as well as the likely expected (theoretical) demand, could be compared with the threshold level of estimated demand. In addition, we could examine how the demand might increase overtime, and whether this would change the investment situation with respect to the establishment of the backbone. This assessment could be done as follows:

(1) To begin with, calculate the theoretical level of demand, based on the Jipp curve and on the level of income in the country (and income distribution). These estimates could be made for the present period, and for the near future, e.g. the next five years, based on the likely increase in GDP per capita, population increase over the threshold level of expenditure for the marginal customer, etc.

(2) Compare the threshold level of demand with these theoretical estimates, and see whether the latter exceeds the threshold level of demand. If it does, then the policy issues relate more to the supply side constraints. If it does not, then we need to consider both demand and supply side policies actively, or the government would have to financially support the provision of the backbone.

(3) In conducting this analysis, it would be useful to consider different situations with respect to the market shares likely to be available to the backbone provider, so that the aggregate demand situation could be considered in terms of the individual backbone provider also.

(4) Next, compare the theoretical expected demand with the prevailing, or actual, demand (teledensity). If the prevailing demand is less than the expected demand, the focus on supply constraints becomes more crucial. On the other hand, if the prevailing demand exceeds the theoretical demand, but is less than the threshold level of demand, then demand needs to be increased further to make investment viable.

(5) For low teledensity countries, we would begin the analysis with the actual teledensity, and see how this is likely to increase towards its theoretical demand with an increase in per capita income in the next few years. In this exercise, we could also take account of the likely time normally taken to move from one teledensity range to another. The latter point could be examined, inter alia, based on the information in Table 2.6 below on the average time taken to transition from one teledensity range to another; in considering this information, it must be borne in mind that that the experience shown in Table 2.6 is for the time prior to the proliferation of mobile services.

(6) Based on the above, we could also calculate the likely time that would be taken for the prevailing demand to reach the threshold level of demand.

**Table 2.6 Time taken by countries to cross thresholds of different levels of teledensity**

| Teledensity (%) range covered by the countries over time | Shortest Time Taken to cross the teledensity range (years) | Average Time Taken to cross the teledensity range (years) | Implicit CAGR for shortest, and average, time taken |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1 to 5 | 5 | 14 | 38% ; 12% |
| 5 to 10 | 3 | 7 | 26% ; 11% |
| 10 to 20 | 3 | 9 | 26% ; 8% |
| 20 to 30 | 3 | 6 | 14.5% ; 7% |
| 30 to 40 | 3 | 7 | 10% ; 4.2% |
| 40 to 50 | 4 | 7 | 4.7% ; 2.7% |

From ITU (1998), page 17.

This exercise will only give us a broad picture, but it will provide us with an indication of whether the market on its own is likely to give rise to investment in the backbone, or whether some special and specific policy initiatives would be required without which there may be little likelihood of investment in the backbone, or in growth of competition in the telecom market in the country.

We also see from above that as the supply constraints are removed, the prevailing demand and expected demand will likely come closer together. In such a situation, there will be an incentive within a competitive environment to increase the market size if adequate demand is likely to be available to provide self-sustaining growth and investment. This brings us to the topic of the price threshold for demand.

**Analysis of the price threshold**

We have mentioned the concept of a price threshold in Section 2.10, which is a price level below which the extent of increase in demand would be so large that the stimulus from this large market demand would make investment in backbone self-sustaining and viable, even for several erstwhile cases of non-viable investments. It would be important to examine whether such a price threshold exists for the country concerned, and if so the level of this price threshold.

One way of assessing the price threshold could be to examine the price level at which the demand would become equal to the threshold level of demand. In effect, a price decline is similar to a growth in purchasing power, or in real income. This concept could be used to ascertain the price level which would give rise to the theoretical demand (or would generate revenues) at which investment in the backbone is viable. For individual backbone providers, different scenarios could be ascertained for the country concerned, based on the number of backbone providers and the relevant market shares.

We should assess the extent of competition in the market, and the price decline that has taken place over time. The price threshold should be compared with the prevailing prices in the market, and we may determine whether competition in the market could lead to the price declining beyond the threshold. In addition, it would be useful to also consider the government policies which add a cost burden on the service provider and increase consumer price, to see whether changes in such policies could help take the prices below the threshold. It is noteworthy that once the price becomes lower than the threshold, the volume effect of demand would tend to compensate for the decrease in government revenues arising due to the policies to reduce "cost burden of policies" on the service provider. Of course, the multiple indirect economic effects of the spread of telecom would also have a beneficial effect on government revenues.

Once the market reaches the relevant price threshold, the future growth in demand and revenue sources (through value added services, internet, and broadband) would ensure that the attractiveness of the investment increases. Further, it is possible that with competition and introduction of new technologies, the price would decline due to market pressure itself.

# 3 India

## 3.1 Background and Overview

India's liberalization of its telecom market began in the early 1990s, beginning with the equipment sector. In policy terms, its National Telecom Policy of 1994 ("NTP 1994") recognized a need to open up the telecom sector to private entry to increase teledensity, and to provide modern and affordable services to the people. Since then, Indian telecom experience is a story of progressive liberalization, dealing with emerging problems, and devising a policy regime which focuses on affordability, utilization of the telecom network, and growth. Table 3.1 provides an overview.

**Table 3.1 Chronology of Significant Events In the Process of India's Telecom Deregulation**

| YEAR | EVENT |
|---|---|
| 1992 | Bids invited for radio paging services in 27 cities |
| | Bids invited for cellular mobile services in four metro cities |
| 1994 | National Telecom Policy announced |
| | Radio paging, V-SAT data services, electronic mail services, voice – mail and video – text services opened to private providers |
| | DoT guidelines for private sector entry into basic telecom services in the country |
| | Eight cellular licensees for four metros finalized after over two years of litigation |
| 1995 | DoT calls for proposal to operate basic, cellular telecom services and public mobile radio trunked (PMRT) services |
| | DoT receives bids for basic, cellular and PMRT services |
| | Most cellular operators in circles sign license agreements |
| | DoT announces cap on the number of circles basic operators can roll out services in. Licensees selected for five circles. |
| 1996 | After setting reserve prices for circles, DoT invites fresh bids for basic services in 13 circles |
| | Five successful bidders short-listed for providing basic services |
| | Poor response to third round of basic telecom bidding. Only on company bids - for Madhya Pradesh. |
| | Selected bidder of first round refuses to extend bank guarantees for its four circles. Challenges in court DoT move to encash guarantees. |
| | Three more companies move court against DoT move to encash guarantees. |

| | |
|---|---|
| 1997 | Telecom Regulatory Authority of India (TRAI) formed. |
| | First basic telecom service company signs license and interconnect agreements with DoT for Madhya Pradesh |
| | Second basic service provider signs basic telecom license pact for Gujarat |
| | TRAI quashes DoT move to increase tariffs for calls from fixed-line telephone to cellular phones |
| | VSNL calls for global tenders to find a partner for its South Asian regional hub project |
| | License agreement for basic services in Maharashtra also becomes operational |
| | Basic service licensees for Andhra Pradesh and Punjab sign basic telecom agreements with DoT. |
| 1998 | Internet Service Provider's Policy announced |
| 1999 | TRAI Issued First Tariff Order. |
| | New Telecom Policy announced. |
| | TRAI Issues First Regulation on Interconnection and Usage Charge |
| | Conditions for migration to revenue sharing from fixed license fee regime issued |
| | Cellular operators allowed the use of any digital technology; MTNL given a license to provide cellular mobile service under these flexible technology conditions. |
| 2000 | Ordinance promulgated divesting TRAI of adjudicatory role. TDSAT created to settle disputes between licensor and licensee. Appeals against TRAI decisions to be heard by TDSAT. |
| | TRAI implements second phase of tariff re-balancing |
| | Policies announced for easier entry/operation of new service providers in the various sectors, e.g., VSAT, PMRTS, Radio Paging, Unified Messaging, Voice Mail |
| | Government has allowed the setting up of international gateways to private internet operators |
| | Guidelines for Issue of Licence for National Long Distance Service |
| | Guidelines for Issue of Licence for Cellular Mobile Telephone Service |
| 2001 | Guidelines for Issue of Licence for Basic Telephone |
| | Convergence Commission of India Bill laid in Parliament. |
| | Open competition policy announced for International Telephony Service |
| | Usage of Voice Over Internet Protocol permitted for international telephony service |
| | First License for National Long Distance service signed |
| | Launch of WLL(M) services by Basic service provider in the market |
| 2002 | Guidelines for Issue of International Long Distance Licence |
| | First License for International Long Distance service signed |
| | First private operator begins ILD service |
| | TRAI revises tariffs for WLL(M) |

| | |
|---|---|
| | TRAI leaves Cellular tariffs to market forces, service providers to notify their Reference Tariff plans |
| | TRAI introduces the Reference Interconnect Offer (RIO) regulation |
| | TRAI introduces Regulation on Quality of Service For VOIP Based International Long Distance Service |
| 2003 | TRAI introduces the Telecommunication Interconnection Usage Charges (IUC) Regulation |
| | TRAI leaves NLD sector left under forbearance subject to a ceiling tariff |
| | TRAI leaves ILD sector left under forbearance |
| | TRAI mandates Basic Service Operators (BSO) to be non-discriminatory in provision of Infrastructure facilities to ISPs |
| | TRAI gives its recommendations on unified licensing for basic and cellular mobile services |
| | TRAI gives its recommendations on "WLL(M) Issues Pertaining To TRAI Based On HON'BLE TDSAT'S Order" |
| | TRAI Forbears Basic Service Tariffs Except Rural Fixed-line Tariffs |
| | NTP 99 amended permitting Unified Licence for Telecommunication Services permitting Licensee to provide all telecommunication/ telegraph services covering various geographical areas using any technology and Licence for Unified Access (Basic & Cellular) |
| 2004 | Broadcasting notified as Telecommunication service under Section 2(i)(k) of TRAI Act. |
| 2004 | TRAI issues a directive on carry forward of unused balance during grace period applicable at the time of recharge for cellular prepaid subscribers. |
| | TRAI notifies Tariff Order to Improve Conditions For Pre-paid Subscribers And To Amend Reporting of Tariffs |
| | TRAI amends quality of service regulations for VOIP (Voice Over Internet Protocol) international long distance services in the interest of consumers of remote areas |
| | TRAI provides its recommendations on Intra Circle Mergers & Acquisition Guidelines to the Government |
| | TRAI issues regulation on filing of interconnect agreements by all Service Providers of Broadcasting and Cable Services |
| | TRAI issues interim recommendation on Conditional Access System (CAS) |
| | Guidelines for merger of licences in a service area issued. |
| | TRAI makes reporting on Accounting Separation mandatory |
| | TRAI decides of References for committee going to work on Regulation for Cable Television Service. |
| | TRAI Amends Notification Specifying Ceiling Rates for Cable Services |
| | TRAI Recommends Technology Neutrality in Last Mile for ISPs; allowing ISPs to use any media (including copper) to establish their last mile. |
| | TRAI Facilitates Provision of Additional International Bandwidth on FLAG Cable by VSNL. |

| | |
|---|---|
| | TRAI provides Interim Recommendation on Private FM Radio Broadcasting |
| | TRAI issues recommendations on Accelerating Growth of Internet and Broadband Penetration |
| | TRAI Intervened Roaming Tariffs of Mobile Service Providers |
| | TRAI's Directive on Publication of tariffs for consumer information |
| | TRAI Receives Asia Pacific Regulator of the Year Award 2004 at the Frost & Sullivan Technology Awards Night in Singapore |
| | TRAI issues directive to provide tariff related information on Auto Roaming services to all pre-paid subscribers |
| | TRAI Mandates minimum validity period of Six Month for Tariffs plans offered by Access Providers |
| | TRAI issues draft recommendations on Unified Licensing Regime |
| | TRAI issues recommendation on office of Ombudsman |
| | TRAI issues recommendations on Licensing Issues Relating to 2nd Phase of Private FM Radio Broadcasting to the Government |
| | TRAI issues amendment of The Telecommunication (Broadcasting and Cable) Services Tariff Order 2004 to clarify that ceiling is on the charges payable exclusive of taxes. |
| | TRAI issues recommendation on "Issues relating to Broadcasting and Distribution of TV Channels" |
| | TRAI begins process for Billing and call charging verification of Telecom Operators by an independent agency. |
| | TRAI releases recommendations on "Funding of TRAI" |
| | TRAI issues recommendations on Licensing Issues Relating to Community Radio Stations. |
| | Guidelines issued for permission to offer Virtual Private Network (VPN) services by Internet Service Providers (ISPs) |
| | Broadband policy announced |
| 2005 | TRAI obtains ISO Certificate |
| | TRAI Announces a New Access Deficit Charge (ADC) Regime. |
| | TRAI issues direction on opening of allotted codes to all service providers |
| | TRAI issues recommendations on Unified Licensing Regime. |
| | TRAI released a Paper for Information/Comments on 'Mobile Telephone Tariff Comparison – Preliminary Results of a Research Study' |
| | TRAI fixes ceiling tariff for international bandwidth .<br>Tariff for international bandwidth segment regulated<br>Ceiling tariff for Higher capacities reduced by about 70%and for lower capacity by 35%. |
| | TRAI issues Regulation on Access to Information. |
| | TRAI defines National and International Roaming. |
| | TRAI Revises Ceiling Tariff for Domestic Bandwidth. |

| | |
|---|---|
| | TRAI specifies separate Ceiling Tariff for 64Kbps domestic leased circuits provided through Managed Leased Line Network (MLLN) Technology. |
| | TRAI's Direction on Premium Rate Services and Value Added Services. |
| | TRAI provides its recommendations on issues relating to publication of Telephone Directory & Directory Enquiry Services. |
| | TRAI Releases Recommendations on Spectrum related Issues |
| | Inter service area connectivity permitted within states of Maharashtra, Tamilnadu, U.P. and West-Bengal |

For opening up the telecom sector to private entry, the country was divided into several Licence areas (or circles), broadly similar in coverage to the provinces in India. Fixed line and Cellular Mobile were treated as separate services, and initially for each of these, a duopoly was planned for each circle.

For Cellular Mobile, the process began with allowing entry into each of the four metro cities (Delhi, Mumbai, Kolkata, and Chennai), and other Licenses were for circles which virtually coincided with provinces in most cases.

For fixed line, one separate metro circle License was given, for Delhi, where Mahanagar Telephone Nigam Limited (MTNL) functioned as incumbent. MTNL functioned as an incumbent in Mumbai also, while Department of Telecommunications (or "DOT", now "Bharat Sanchar Nigam Limited" or BSNL) was the incumbent in the rest of Maharashtra. However, for private sector operators, the whole of Maharashtra was given as a single circle. In all other places in India, DOT (now BSNL) was the incumbent operator. Except Delhi, all other fixed line Licenses for private sector were for circles generally similar in coverage to the provinces. Entry was decided on the basis of bidding. Litigation has intermittently marred the stability of operational conditions, beginning with the initial period itself.

The process of telecom reform had only been initiated with these changes, and there was still a substantial way to go before the new regulatory regime, including the Regulatory Body, came into place.

## 3.2 Establishing the Telecom Regulator

In the mid-1990s, the Government had set up expert groups to help establish a telecom Regulator. The Telecom Regulatory Authority of India (TRAI) was set up in 1997. The functions of the Authority included recommending certain policy matters, and specifying certain policies. Important among the recommendation functions were to recommend to the Government the terms and conditions of licenses, and the timing of entry of new service providers. Thus, the power of Licensing was with the Government. More direct functions of the TRAI included, inter alia, specifying tariffs/tariff policy, addressing interconnection and revenue sharing among service providers, and specifying quality of service parameters (see **Annexure 3.1** shows the functions of the TRAI under the TRAI Act (amended 2000).

The TRAI began its work by focusing on creating the conditions for competition in the market. It began a process of consultations on:

- re-balancing the tariffs and specifying the principles for the tariff regime,
- specifying the interconnection principles and charges,
- terms and conditions for introducing competition in domestic long distance sector, and
- specification of quality of service parameters.

There was a large cross-subsidy from domestic and international calls to local calls, and a small portion of total subscriber base contributed an inordinately large part of the call revenues (**Table 3.2**). With competition, the new entrants would try to attract away the high revenue subscribers, and the competitive pressure would lead to a reduction in the tariffs for the long distance calls. Both these developments would imply a sharp reduction in the revenues and surplus of the incumbent, and for sustaining competition, it was necessary that tariff re-balancing be initiated in India.[58] Otherwise, for example, if only 2 percentage points of the highest revenue subscribers accounting for about 56% of call revenue were taken away, on average the incumbents call revenues would decline on average by 20% and surplus by a much larger amount. An important point in this regard is that the competition for this high revenue subscriber base would come not only from other fixed line service providers but also from the cellular mobile operators to some extent. In a few years' time, therefore, competition would make its functioning unsustainable unless there was tariff re-balancing.

**Table 3.2. Proportion of metered calls made by different subscribers, 1996-97**

| **No. of Bi-monthly metered calls →** | **0** | **1 to 150** | **151 to 500** | **501 to 1,000** | **1,001 to 2,000** | **2,001 to 5,000** | **5,001 to 10,000** | **Above 10,000** | **Total** |
|---|---|---|---|---|---|---|---|---|---|
| **Proportion of total subscriber making calls as per above categories (%) →** | 4.2 | 12.6 | 34.9 | 21.3 | 14 | 7.9 | 2.5 | 2.7 | 100 |
| **Proportion of total metered** | 0 | 0.7 | 7.4 | 10 | 11.6 | 13.4 | 9.8 | 46.1 | 100 |

[58] For more detail of the reasons, see the Explanatory Memorandum to the TRAI's Telecommunication Tariff Order of 9th March 1999.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **calls made by the subscriber category above (%) →** | | | | | | | | | |

Source: Department of Telecommunications; reproduced from the TRAI's Telecommunications Tariff Order of 9th March, 1999.

As the Telecom Licenses had been granted earlier at a time when no agency other than the Ministry was in place to address matters of interconnection, the License terms and conditions contained a number of clauses relating to interconnection. The License mentioned an Interconnect Agreement, and in the case of fixed operators, an Interconnect Agreement had been signed among the incumbent and the new entrants. The operations of the mobile operators were continuing with informal interconnection arrangements, as no Interconnect Agreement had been signed among these operators and the incumbent. The TRAI addressed these matters and began by specifying certain interconnection charges and the guiding principles for interconnection. Over time, more detailed policy steps have been taken by the Regulator with respect to interconnection which have resulted over time in a fundamental change of the interconnection regime (see the section on "interconnection issues" given later in this chapter). This has been a bumpy ride, especially since the most contentious legal issues have related to interconnection matters, and the legal judgments have from time to time curbed the flexibility of Regulatory action regarding interconnection. In legal terms, the basis for could be seen as lying in two points: one, that interconnection terms and conditions are part of the License; two, the strict interpretation that the TRAI Act does not give the Regulator the powers to over-ride Licence terms and conditions. The legal framework has curbed the powers of the Regulator in another important way, as we discuss in the section later on "dispute settlement".

The TRAI came out with its tariff and interconnection policy in the first half of 1999, and gave its Recommendations on opening up the domestic long distance sector, as well as the terms and conditions of other Licenses later. The Quality of Service parameters also took additional time to be specified. The framework for the TRAI's Recommendations on License terms and conditions was provided by the New Telecom Policy 1999 (or "NTP 1999"), which was announced at the end of the first quarter of 1999.

## 3.3 NTP 1999

NTP 1999 was announced on 26th March. 1999 and came into effect from 1st April, 1999. It replaced the national telecom Policy of 1994 and provided for greater detail in terms of, inter alia, a move to a different License fee (from one based on bidding to annual revenue share), introduction of competition for different service, clearer specification of USO objectives and the mechanism to achieve the USO, and provided a basis to move towards greater convergence in the market. The Visionary Aspirations and Targets (VATs), Measurable Aspirations and Targets (MATs), and Measurable Primary Level Targets (MPLTs) mentioned in the theoretical framework in Chapter 2 can be seen from NTP 1999's objectives and targets, and its Section on USO. They are organized below under these three respective categories (the highlighted text shows the targets with relate directly to backbone):

**(a) <u>Visionary Aspirations and Targets</u>**

- Access to telecommunications is of utmost importance for achievement of the country's social and economic goals. Availability of affordable and effective communications for the citizens is at the core of the vision and goal of the telecom policy.
- Strive to provide a balance between the provision of universal service to all uncovered areas, including the rural areas, and the provision of high-level services capable of meeting the needs of the country's economy;.
- Encourage development of telecommunication facilities in remote, hilly and tribal areas of the country;
- Create a modern and efficient telecommunications infrastructure taking into account the convergence of IT, media, telecom and consumer electronics and thereby propel India into becoming an IT superpower.
- Transform in a time bound manner, the telecommunications sector to a greater competitive environment in both urban and rural areas providing equal opportunities and level playing field for all players.
- Strengthen research and development efforts in the country and provide an impetus to build world-class manufacturing capabilities.
- Protect defence and security interests of the country.
- Enable Indian Telecom Companies to become truly global players.

**(b) <u>Measurable Aspirations and Targets</u>**

- Make available telephone on demand by the year 2002 and sustain it thereafter so as to achieve a teledensity of 7 by the year 2005 and 15 by the year 2010
- Encourage development of telecom in rural areas making it more affordable by suitable tariff structure and making rural communication mandatory for all fixed service providers.
- Increase rural teledensity from the current level of 0.4 to 4 by the year 2010.[59]
- Achieve efficiency and transparency in spectrum management.
- Achieve telephone on demand in urban and rural areas by 2002.

**(c) <u>Measurable Primary Level Targets (MPLTs)</u>**

- **Provide reliable transmission media in all rural areas**
- **Achieve telecom coverage of all villages in the country**
- **Provide reliable media to all exchanges by the year 2002**.

[59] The rest of this sentence is shown as the first indent under MPLTs, because that is a more specific target.

- **Provide Internet access to all district head quarters by the year 2000**.
- **Provide high speed data and multimedia capability using technologies including ISDN to all towns with a population greater than 2 lakh by the year 2002**.
- **Convert PCOs, wherever justified, into Public Teleinfo centres having multimedia capabilities such as ISDN services, remote database access, government and community information systems etc.**
- **Provide voice and low speed data service to the balance 2.9 lakh uncovered villages in the country by the year 2002**.

As shown by the highlighted statements above, a number of specific targets required provision of backbone, or reliable media. Thus, extension of backbone was part of the specific targets of NTP 1999, and this has played a major role in the backbone being extended across the country through the efforts of the Government owned service provider, erstwhile DOT and now BSNL.

NTP 1999 specified a number of different services, starting with three types of telecom access providers (cellular mobile service providers, fixed service providers, and cable service providers), and Internet Telephony, Radio Paging Service Providers, Public Mobile Radio Trunking Service Providers, National Long Distance Operator, International Long Distance Services, VSAT Service Providers, Global Mobile Personal Communications Services, and Other Service Providers.

The terms and conditions were changed by the Government for these services, based on the recommendations of TRAI, and much greater competition was introduced. The next section traces the evolution of the change in the Indian telecom market, showing the effect of the policy developments on the main access providers, namely fixed service providers and the mobile service providers. Together with the Infrastructure Providers, these are the main telecom players as far as backbone in the country is concerned.

## 3.4 Evolution of the Indian Telecom Sector

### (a) The initial situation

As shown in **Table 3.1**, Licenses for a number of telecom services were given for private entry into the mare. The two main services were fixed service and cellular mobile service. Entry into the market was decided on the basis of bidding for each License area which was referred to as a circle. These were divided into metros and Circle "A" as the most lucrative ones, Circle "B" which had medium level of attractiveness in terms of market revenues, and Circle "C". Cellular mobile had two circles more than for fixed service, because they had four metro circles: Cellular mobile service was started initially in four metros – Chennai, Delhi, Kolkata and Mumbai) – and thus had these four as distinct circles; In the case of fixed line, only Delhi and Mumbai were separately treated because MTNL operated in each of these two metros. For this service, the two other metros – Chennai and Kolkata – were treated, respectively, as part of the circles of West Bengal and Tamil Nadu, the provinces which contain these metros.

For each of these two services, a duopoly was allowed and bids were invited. With respect to Cellular Mobile, a number of bidders showed interest and entered a large number of circles (**Table 3.3**). In the case of fixed service, however, the operators entered only six circles. Table 3.3. shows the number of Licensees for various types of services till mid-2001, i.e. the period for which the Licensing regime broadly did not change in comparison to the initial regime.

**Table 3.3 Number of Licenses Issued and Number of Licenses For Which Service Started by June, 2001**

| Service | Licenses Issued | Number of Licenses Which Started Service |
|---|---|---|
| Basic | 6 | 6 |
| Cellular Mobile | 42 | 37 |
| Radio Paging | 137 | 92 |
| Public Mobile Radio Trunking | 279 | 54 |
| Data Network | 14 | 9 |
| Voice Mail/ Audio Text | 41 | 2 |
| E-Mail | 16 | 2 |
| Internet | 465 | 130 |
| GMPCS | 1 | - |

Source: TRAI Annual Reports
Note: Duopoly meant that for fixed service, only one additional operator could enter each circle because of the presence of the incumbent. In the case of cellular mobile, in contrast, two operators could enter each License area.

In terms of the number of operators, the experience with regard to the entry of cellular mobile operators was much more of a success than fixed service. In fact, in Delhi and Mumbai, an additional service provider, the public sector operator (and fixed line incumbent in these places), MTNL entered the mobile market in 1999.[60] Thus, for these two metros, the number of cellular mobile operators were more than a duopoly (**Table 3.4**). Another noteworthy feature is that while a duopoly was allowed in each circle, two operators did not enter all the circles for which bids were invited. All the Category "A" circles (including metros) had two private sector cellular mobile operators, but Circle "B" and Circle "C" License areas had some areas with only one operator, and in the case of certain Circle "C" areas, no operators had shown interest to provide cellular mobile services (**Table 3.4**).[61]

[60] At that time, the Government allowed the use of any digital technology for providing mobile service, i.e. it relaxed the earlier condition that mobile service should be provided using only GSM technology.
[61] Later, to increase the attractiveness of Andamans & Nicobar Island, this circle was merged with that of West Bengal.

**Table 3.4 Number of Cellular Mobile Service Providers in Various License Areas, March 2001**

| Category of Circle | Circle | Number of Service Providers per Circle |
|---|---|---|
| **Category "A" (including Metros)** | (a) Delhi, Mumbai | 3 |
| | (b) Kolkata, Chennai, Andhra Pradesh, Gujarat, Karnataka, Maharashtra, Tamil Nadu | 2 |
| | | |
| **Category "B"** | (a) Kerala, Haryana, UP (East), Rajasthan, Madhya Pradesh | 2 |
| | (b) Punjab, UP (West), West Bengal | 1 |
| | | |
| **Category "C"** | (a) Himachal Pradesh | 2 |
| | (b) Bihar, Orissa, Assam & North East | 1 |
| | (c) Andaman & Nicobar, Jammu & Kashmir | Nil |

In contrast to the widespread private entry of cellular mobile, fixed line service in India saw a meager participation from the private sector both in terms of the number of circles and growth in subscriber base (**Table 3.5**). Even till March 2001, the incumbents' market share was over 99%.

**Table 3.5 Subscriber base for Basic Services, 1996-97 to 2000-01 (numbers in '000)**

| Service Provider | Service Area | 1996-97 | 1997-98 | 1998-99 | 1999-2000 | 2000-01 |
|---|---|---|---|---|---|---|
| BSNL | All India except Delhi and Mumbai | 11,530.3 | 14,395 | 17,927.5 | 22,479.7 | 28,109 (86%) |
| MTNL | Delhi and Mumbai | 3,012.3 | 3,406.7 | 3,653.9 | 4,031.6 | 4,327.1 (13.2%) |
| Bharati Telenet Ltd. | Madhya Pradesh | - | - | 14 | 92 | 115.2 (0.35%) |
| Hughes Ispat Ltd. | Maharashtra | - | - | 6.1 | 22.1 | 69.6 (0.21%) |
| Tata Teleservices | Andhra Pradesh | - | - | - | 26.7 | 58.7 (0.18%) |
| HFCL | Punjab | - | - | - | - | 13.4 (0.04%) |
| STL | Rajasthan | - | - | - | - | 9 (0.03%) |
| Reliance | Gujarat | - | - | - | - | 0.1 |

Source: TRAI Annual Reports.

Note: The figures in parentheses for 2000-01 show the share of the service provider in total subscriber base for 2000-01.

The overall subscriber base of cellular mobile was increasing faster than that of the private basic or fixed service providers (compare **Tables 3.5 and 3.6**), but the increase in the initial years for cellular mobile subscriber base was small in comparison to the rise in the fixed line subscribers base during those years (**Table 3.6**), and most of this increase was due to the two incumbents. With the entry of private cellular mobile, however, the increase in teledensity had picked up somewhat in comparison to the abject performance during the first four and a half decades after independence of India in 1947. In fact it took from 1947 to 1995 to reach a teledensity of 1%.

Nonetheless, even with the improvement in teledensity increase after opening up of the telecom sector to private entry, the rise was relatively small and the task of providing adequate telephony service to the nation seemed a very daunting one. The operators were petitioning the Government to reduce their cost burden especially that arising due to the high amounts that had been bid by the new entrants. Both fixed and mobile operators were complaining to the Government of the major cost burden and sought relief, and the teledensity continued to remain at low levels. In the case of fixed service providers it was a combination of the high costs and time taken for roll-out as well as the high bid amounts, the cellular mobile operators were focusing in a major way on the large bid amounts imposing a heavy burden. The extra-ordinarily high bids were based perhaps on an over-estimated consumer base which did not materialize. While Desai (2005) argues that this was importantly due to the deliberate fast increase in network by the incumbents to reduce the waiting list (and thus the market available to the private operators), it was also due to the high initial roll-out costs for the fixed service providers and the relatively high prices which were charged for mobile services, i.e. the service which saw maximum private sector participation. The operators were arguing for the Government to take the License fee on a back-loaded formula instead of a front loaded one, linked to the revenues generated by the service provider. The argument was that a lower License fee burden would help decrease prices and increase demand, which in turn would imply larger revenues over time, with the Government getting a portion of the increased revenue base through a revenue share License fee, as the market increases.

**Table 3.6.** **Number of Telephones (Fixed & Mobile) and Telephone Density**

| **Year ended 31st March** | **Fixed Lines (Dels)** | **Mobile Telephones** | **Number of Telephones (Fixed + Mobile) per 100 population** |
|---|---|---|---|
| | **--- Million ---** | | |
| 1948 | 0.08 | -- | 0.02 |
| 1951 | 0.10 | -- | 0.03 |
| 1961 | 0.33 | -- | 0.08 |
| 1971 | 0.98 | -- | 0.18 |
| 1981 | 2.15 | -- | 0.31 |
| 1991 | 5.07 | -- | 0.60 |
| 1992 | 5.81 | -- | 0.67 |

| | | | |
|---|---|---|---|
| 1993 | 6.80 | -- | 0.77 |
| 1994 | 8.03 | -- | 0.89 |
| 1995 | 9.80 | -- | 1.07 |
| 1996 | 11.98 | -- | 1.28 |
| 1997 | 14.54 | 0.34 | 1.56 |
| 1998 | 17.80 | 0.88 | 1.94 |
| 1999 | 21.59 | 1.20 | 2.33 |
| 2000 | 26.51 | 1.88 | 2.86 |
| 2001 | 32.44 | 3.58 | 3.53 |
| 2002 | 37.94 | 6.43 | 4.29 |
| 2003 | 40.62 | 12.69 | 5.11 |
| 2004 | 42.84 | 33.69 | 7.17 |
| 2005 | 45.9 | 52.21 | 9.08 |

It was in this background that NTP 1999 was introduced, and inter alia, the License fee regime changed. In addition, the focus changed in terms of easing the restriction imposed by having a policy of duopoly. Based on the recommendations of the TRAI, the Government decided to have open entry (subject to specified entry conditions and revenue share License fee) for all services, except for cellular mobile. In the latter case, i.e. cellular mobile, it was decided to have four operators, with the Government operators being the third one. Thus, MTNL entered as a mobile operator in 1999 itself.

**(b). Situation with revised License regime from 2001: Difficult Years Though With Increasing Competition**

The details of the new Licensing policy for both basic (fixed) service and cellular mobile service were announced in 2001. For basic service, open entry was allowed subject to specified terms and conditions. The entry fee was given at varying amounts for different circles, much lower than the bid amounts, so as to facilitate entry. The fixed service providers were allowed to give a limited mobility service (i.e. mobility within the local call area), so as to make investment in that service more attractive and viable. A fourth cellular mobile operator was allowed, but because a selection had to be made among competing claimants for the fourth slot, bidding process was adopted. However, the system used for bidding was changed so that the possibility of over-bidding is reduced. Till that time, the revenue share percentage for mobile service was higher than that for fixed service. However, with the fixed service providers being allowed limited mobility, the Government reduced the revenue share percentage for mobile operators to the same levels as for the fixed service providers. The Government also noted certain other benefits that had been provided to the mobile operators.[62] The change in policy led to an increase in the number of service providers, as shown in **Tables 3.7 and 3.8** below. For

[62] According to Kathuria (2004), these other concessions included amendment dated 25th September, 2001 to the old CMTS license agreement, permitting the Cellular Mobile Service Providers (CMSPs) to provide "Fixed Phones" based on existing GSM cellular network infrastructure in their Licensed Service area; CMSPs being permitted to give mobile PCO or community phone service; and CMSPs being allowed to retain 5% of the long distance call charge pass through charge.

some circles, however, there were small number of operators interested in operating there and the Government was concerned about increasing the participation of operators in these circles also. For these circles,[63] the Government eased the terms and conditions for entry and operations, and sought further interest from private sector operators for these circles.

**Table 3.7 Number of Cellular Mobile Service Providers in Various License Areas, end-2001**

| Category of Circle | Circle | Number of Service Providers per Circle |
|---|---|---|
| **Category "A" (including Metros)** | Chennai, Delhi, Kolkata, Mumbai, Andhra Pradesh, Gujarat, Karnataka, Maharashtra, Tamil Nadu | 4 |
| | | |
| **Category "B"** | (a) Kerala, Haryana, UP (East), Rajasthan, Madhya Pradesh, Punjab, | 4 |
| | (b) UP (West) | 3 |
| | (c) West Bengal | 2 |
| | | |
| **Category "C"** | (a) Himachal Pradesh | 4 |
| | (b) North East | 3 |
| | (c) Bihar, Orissa, Assam | 2 |
| | (d) Jammu & Kashmir | 1 |

Source: TRAI Annual Reports
Note: Except for Delhi and Mumbai (where MTNL gave service), one service provider included in the Table is BSNL, which started its mobile services later, in October 2002 but the policy had made clear that BSNL would be providing mobile services in the country.

**Table 3.8 Number of Basic Service Providers in Various License Areas, End-2001**

| Category of Circle | Circle | Number of Service Providers per Circle |
|---|---|---|
| **Category "A" (including Metros)** | (a) Delhi, Karnataka, Tamil Nadu | 4 |
| | (b) Mumbai#, Maharashtra, Gujarat, Andhra Pradesh | 3 |
| | | |
| **Category "B"** | (a) Punjab, Haryana, Rajasthan, Madhya Pradesh | 3 |
| | (b) Kerala, UP (West), UP (East), West Bengal | 2 |

[63] These circles were Andamans & Nicobar, Assam, Bihar and Orissa. In addition to easier entry and operational terms, Andamans & Nicobar circle was combined with West Bengal circle to increase its viability.

| | | |
|---|---|---|
| | | |
| **Category "C"** | (a) Himachal Pradesh, Bihar, Orissa, Andamans & Nicobar | 2 |
| | (b) Assam, North East, Jammu & Kashmir | 1 |

Source: TRAI Annual Reports
# Mumbai is shown separately from Maharashtra becaue MTNL functioned in Mumbai and BSNL in rest of Maharashtra. For the private operator, Maharashtra as a whole was the License area. Two private operators were the Licensees for Maharashtra.

The permission for basic service operators to give limited mobility was strongly protested by cellular mobile operators on four main grounds. One, they argued that this was not a legal step because only the mobile License allowed to service provider to give mobility. Second, they said that even if for the sake of the argument such mobility were to be allowed, entry should not be allowed without any additional entry fee for spectrum (the Government had decided not to charge any additional entry fee for spectrum because the Basic Service License in any case provided for spectrum for wireless in local loop connectivity). Likewise, if for the sake of the argument such mobility were to be granted, the cellular mobile operators argued that they needed greater compensation than had been provided to them. Fourth, they further argued that the interconnection regime in place for the limited mobility service (see section on interconnection for more detail), was lopsided as it created a non-level playing field in favour of limited mobility and against cellular mobile. In addition, differences of opinion on how to implement the limited mobility emerged between important policy making Bodies.

There was therefore an intense legal battle, with the repercussions felt in all fora related to telecom operations and policy making. That was a time when the overall operational environment was highly vitiated, the various statements by competing groups of operators made the market outlook appear extremely gloomy in terms of predictability and stability of the operational regime, and the situation became even more complex when an important operator providing local mobility started giving call forwarding service which made such limited mobility very close to effective full mobility.

In addition to these factors, the cellular mobile industry also pointed out its otherwise dire straits in terms of a high debt overhang, and mentioned several other costs (including those imposed through policy induced levies and License fees) to illustrate its operational difficulties. The basic service operators also submitted their own problems to the Government, including the high costs imposed through the levies and License fee.

The prospects of rapid growth of the industry did not look bright as a result of these developments, and reminded one of the initial phase of intense litigation in the mid-1990s which had led to major lethargy in the sector.

For the policy-maker, this situation was further complicated because of the technological developments which were making it difficult to maintain the limits on operations and service imposed by different service-specific Licenses. It was becoming clear that the limits imposed by such Licenses could not be sustained in such a situation.

In this situation, BSNL, the incumbent operator started providing its mobile services in October 2002 at highly attractive prices, with price advantages for intra-network calls, i.e. calls to BSNL phones. At that time, the Regulatory Body did not allow differences in intra-and inter-network call tariffs but also had a policy of allowing deviation from the regulatory principles of non-discrimination and non-predation for introductory tariffs. BSNL requested its tariff approval as introductory tariffs (for 90 days) and its entry into the market brought major competitive pressure on the existing service providers.[64] This pressure was further intensified by the entry of Reliance Infocomm as a basic service provider with limited mobility, in end December 2002.[65] In the case of Reliance Infocomm too, there was a difference between intra- and inter-network tariffs due to the mutually negotiated Interconnection Agreement with BSNL, because the latter charged a higher termination charge for calls to its own network. This was also a period of evolution in Interconnection Charge policy because the TRAI was going to announce its Interconnection Usage Charge regime in January 2003 which would address the matters relating to origination, carriage and termination charges for calls.

The mobile market had started witnessing relatively strong market competition since 2002. The entry of the above two large service providers at the end of 2002 added to this competitive pressure since the beginning of 2003, with the GSM based cellular mobile private operators responding to the price competition in an aggressive way. The TRAI had adopted a regulatory framework, and continued to evolve it in such a manner that facilitated the implementation of any competitive decline in tariffs.[66] This competition also saw a major increase in the accessibility of subscribers to handsets, because they were either provided at low prices or under EMI schemes where they paid certain monthly amounts for the

---

[64] After the 90 day period, there was a stay on the tariffs put by the Telecom Dispute Settlement and appellate Tribunal (TDSAT), and the tariffs were maintained by BSNL.

[65] As mentioned earlier, it later started providing call forwarding which made the limited mobility very close to effective mobility.

[66] The process had started with the Telecommunications Tariff Order 1999 itself, which specified a standard tariff package and allowed any alternative tariff package to be given subject to specified regulatory criteria. Later, the monthly rentals for WLL (with limited mobility) were revised downwards based on costs, and in view of the low costs for the service, it was allowed to give greater flexibility in its tariffs. In 2002, tariff regulation was removed for the cellular mobile sector, and in 2003 such flexibility was provided to basic service operators also. Prior to this, in mid-2003, the TRAI had also allowed all operators to self-assess their tariff packages in terms of regulatory criteria, and introduce them in the market without reporting the controlled tariffs to the Authority prior to implementation. Later, the TRAI saw that there was intense competition in the market and amended its non-discrimination criteria to allow different inter- and intra-network tariffs. In addition, the TRAI also announced that it would not regulate the tariff for handsets provided each tariff package was available to a subscriber irrespective of where the handset had been procured.

handset. This reduced the upfront charge paid for the subscriber to get linked to the service.

A lot of other changes took place in 2003, starting with the notification of an Interconnection Usage Charge (IUC) regime in January 2003. Further major policy steps began around mid-July, including the TRAI's initiation of the process to change the Licensing regime to introduce Unified Licenses, with Unified Access License as the first phase of that initiative.[67] The Unified Access Service Licensing regime was announced by the Government in the second week of November 2003. The change in the License regime was seen as ending the period of discord and ushering in a period of relative calm and optimism regarding the regulatory regime.

We will begin with a discussion of the changes in tariffs of mobile services and long distance services, in the next sub-section, which will give an indication of the increasing effects of competition in the market. The year 2003 saw the mobile tariffs decline to a level which is referred to as the price threshold in Chapter 2 which gives the theoretical framework for this paper. The developments on mobile tariffs are shown till recent times and thus the period overlaps with that during which the License regime was changed. However, to provide clarity with respect to developments regarding tariffs and the License regime and market structure, the change in the License regime and the consequent prevailing market situation is discussed in the next sub-section.

### (c). The Effect of Competition on Tariffs

#### (i) Rapid decline in Mobile Tariffs

While the basic service tariffs were low to begin with, the mobile tariffs initially were much higher, but these developments brought the mobile tariffs very close to the fixed line tariffs (see **Table 3.9** below and the Chart in **Annexure 3.2**). From **Table 3.10** (which is derived from Table 3.9), we can see that the year 2001 did not see much tariff competition, but the competition intensified in 2002, even before the entry of the two large players (BSNL and Reliance Infocomm) in later 2002. The entry of these large players, however, added to the competitive pressure and prices saw a large decrease in the year 2003, bringing the effective charge for mobile much closer to that for the fixed line service (Tables 3.9 and 3.10). The stage was set for the price threshold to take effect and the demand to increase in a major way.

**Table 3.9 Trend in Revenue realized per minute by GSM service providers in India**

| Period/Quarter | Rs./minute |
|---|---|
| May-99 to Mar-00** | 6.68 |
| Apr-00 to Dec-00 | 4.16 |

[67] TRAI's consultation Paper on Unified Access Licensing was released on 16th July 2003. The Government announced Guidelines for Unified Access Service License in the second week of November 2003.

| | |
|---|---|
| Qtr ending Mar-01 | 4.35 |
| Qtr ending Jun-01 | 4.37 |
| Qtr ending Sep-01 | 4.19 |
| Qtr ending Dec-01 | 4.10 |
| Qtr ending Mar-02 | 3.78 |
| Qtr ending Jun-02 | 3.53 |
| Qtr ending Sep-02 | 3.13 |
| Qtr ending Dec-02 | 2.75 |
| Qtr ending Mar-03 | 2.32 |
| Qtr ending Jun-03 | 1.86 |
| Qtr ending Sep-03 | 1.73 |
| Qtr ending Dec-03 | 1.52 |
| Qtr ending Mar-04 | 1.38 |
| Qtr ending Jun-04 | 1.33 |
| Qtr ending Sep-04 | 1.34 |
| Qtr ending Dec-04 | 1.22 |

** Prior to May 1999, the cellular mobile's regular call charges were Rs. 8.40 per minute with peak time charges of Rs. 16.80 per minute and off-peak charges of Rs. 4.20 per minute. The charges were mostly regular and peak time charges because off-peak period was only on Sundays and on three national holidays (26th January, 15th August, and 2nd October). These charges were applicable to both outgoing and incoming calls to mobile, and for outgoing calls, additional amount was charged as pass through to the PSTN network.
Note: Data of BSNL/MTNL included from quarter ending Dec-03 onwards. The estimated charge per minute is calculated by total revenues divided by total number of minutes.

**Table 3.10. Percentage decline in mobile average revenues realized per minute**

| **Period during which average change considered from Table 3.9** | **Percentage decline during the period given in first column** |
|---|---|
| March 2000 to March 2001# | 35% |
| March 2001 to March 2002 | 13% |
| March 2002 to March 2003 | 38.6% |
| March 2003 to March 2004 | 40.5% |
| March 2004 to December 2004 | 11.6% |

# The tariff decline during this period was due to a Court case on calling party pays (CPP), where the Court had noted that the tariffs needed to decline in view of the reduction in License fee, and cellular operators had agreed to reduce the tariffs to the levels mentioned in the TRAI's notification on calling party pays. Otherwise, this notification was set aside by the Court on the grounds that as notified, the CPP scheme was inconsistent with the License terms and conditions and therefore could not be implemented unless it was changed to become consistent with the License.

The above average data conceals the fact that in some parts of the country, the tariffs were even lower, as is shown by **Table 3.11** below.

These changes in tariffs brought about a major change in the market for mobile telecom service.

**Table 3.11 Revenue realization per minute for GSM service (quarter ending September 2004)**

| | **Post-Paid** | **Pre-Paid** | **Blended (Post-Paid and Pre-Paid)** |
|---|---|---|---|
| Metros | 1.06 | 1.30 | 1.18 |
| Circle "A" | 1.23 | 1.58 | 1.43 |
| Circle "B" | 1.44 | 1.20 | 1.30 |
| Circle "C" | 1.43 | 1.51 | 1.47 |
| All India | **1.24** | **1.43** | **1.34** |

Source: TRAI, "The Indian Telecom Services Performance Indicators Oct-Dec '04", March 2005

Initially, cellular mobile was seen as a premium service in India. The handset charges and initial charges for subscription were high, call charges were Rs. 8.40 per minute most of the time, with Rs. 16.80 per minute as peak tariffs, and off-peak tariffs not being applicable most of the time (please see note to Table 3.9), and these tariffs being applicable to both outgoing and incoming calls, with the outgoing calls being subject to additional charges for pass through to the PSTN network. Thus, since monthly rental was low at Rs. 156/- per month, people could become subscribers but not use the service much except in general as a paging device. The high overall costs meant that the so-called common man was not seen as a potential subscriber for this service. As the tariffs for mobile came closer to those of the fixed service,

The declining tariff was not limited only to call charges. Over time the market experienced changes due to competition and specific policy initiatives which led to lower tariffs. These included, for instance:

- handset prices dropping or handsets being available at EMIs which made handsets much more affordable,
- initial subscription costs falling,
- introduction of pre-paid cards, so that the subscribers were able to ensure that their expenditure on the phone did not exceed a specified amount,
- TRAI specified that for pre-paid cards, there should be a minimum value card of only Rs. 300 with one month's validity and per minute charges which were reasonable[68],
- TRAI reduced the roaming charges by a large proportion, and capped them at the revised level,
- calling party pays regime was introduced for mobile in mid-2003 which en effect meant a major increase in affordability for the

[68] After the introduction of the Rs. 300 monthly validity pre-paid card, the TRAI refused to approve tariffs which gave in effect minimal number of minutes of usage for such cards to the consumers. The TRAI thus forced the industry to give a low priced pr-paid package which allowed reasonable talk time, and its value to the consumer increased even further when the calling party pays regime was introduced.

customers as they were earlier in a mobile part pays regime where they paid for incoming calls also,

- the Interconnection Usage Charge regime notified in October 2003 focused on convergence and greater facilitation of tariff decreases (see for example, the Chart in **Annexure 3.3** which shows the relationship between termination charge for mobile and tariffs for mobile service), and
- as usage increased, more people realized the flexibility provided by mobile through the facility of carrying a mobile with oneself and being able to be in communication even while not being near a landline phone.

As mentioned above, together with these developments, the call charge per minute for mobile services dropped closer to the levels for fixed service. The comparative tariffs for calls can be seen in **Table 3.12** below, which shows very similar tariffs for the two services. In this comparison, for the fixed to fixed local calls, call holding time rather than the 3 minute pulse is more relevant. The comparison in Table 3.11 is at peak tariffs. It is noteworthy that basic service providers also give free calls and lower tariffs for certain number of metered calls. Further, in the comparison for relative expenditure on the service, it is also necessary to consider tariffs such as monthly rentals. For fixed line, while the rural monthly rentals are low, they are Rs. 180 or Rs. 250 per month in most towns and cities. For low users, if the comparison is with pre-paid cards, mobile phones can be considered similar to the charges for a low user in these places. This can be seen, for example, by **Table 3.13** which gives the amounts of monthly average revenue per user (ARPU) for mobile services.

**Table 3.12 Comparison of BSNL's Present Tariffs of Basic Service and Cellular Mobile Service**

| Basic Service | Cellular Mobile Service |
|---|---|
| • Local (Fixed to Fixed) – Rs.1.20 for 3 minutes.<br>• Local (Fixed to Mobile)- Rs.1.20/minute<br>• Long Distance-Rs.1.20 (intra-circle) and Rs.2.40 (inter-circle)/minute<br>• ILD - Rs.7.20-Rs.12.00/minute | • Local (Mobile to Mobile) – Rs.0.80/minute<br>• Local (Mobile to Fixed) – Rs.1.20/minute<br>• National Long Distance-Rs.1.80 to Rs.2.40/ minute<br>• ILD - Rs.7.20-Rs.12.00 /minute |

Note: The comparison is for peak tariffs. Intra-circle mobile to mobile call is charged at the local rate given for mobile calls.

**Table 3.13 Monthly Average Revenue Per User (ARPU) For Cellular Mobile Service**
**(Rs. per month for September 2004)**

| | Post-Paid | Pre-Paid | Blended (Post-Paid and Pre-Paid) ARPU |
|---|---|---|---|
| Metros | 939 | 320 | 476 |

| | | | |
|---|---|---|---|
| Circle "A" | 602 | 296 | 384 |
| Circle "B" | 620 | 281 | 355 |
| Circle "C" | 674 | 309 | 413 |
| All private operators | 729 | 297 | 403 |
| BSNL/MTNL | 642 | 306 | 405 |
| **All India** | **707** | **299** | **404** |

Source: TRAI, "The Indian Telecom Services Performance Indicators Oct-Dec '04, March 2005

While these above-mentioned monthly ARPU, especially for pre-paid service, may strike one as being exceptionally low they actually embody considerable usage by the subscribers in terms of both the overall minutes of usage as well as outgoing minutes of usage for mobile. This can be seen, for example, from **Tables 3.14 and 3.15** below. Even the relatively lower number of pre-paid subscribers average minutes compare favourably with the minutes of usage in large number of countries, as can be seen for example by the average overall minutes of use in various countries shown in the Table in **Annexure 3.4**. That information shows that the average usage for pre-paid subscribers in India is more than most of the countries included in that Table, which also shows that the average tariffs in India are the lowest among all the countries mentioned there.[69]

**Table 3.14 Minutes of Use (MOU) per Subscriber per month for GSM Mobile Service**

| | **Post-Paid** | **Pre-Paid** | **Blended (Post-Paid and Pre-Paid) MOU** |
|---|---|---|---|
| Metros | 656 | 212 | 324 |
| Circle "A" | 568 | 228 | 326 |
| Circle "B" | 504 | 177 | 249 |
| Circle "C" | 468 | 257 | 317 |
| | | | |
| **All India** | **572** | **209** | **302** |

Source: TRAI, "The Indian Telecom Services Performance Indicators Oct-Dec '04", March 2005

The main picture which emerges is that India has experienced a major fall in mobile tariffs to exceptionally low levels, and this has helped trigger increases in demand and subscriber base which were hitherto completely unanticipated.[70] The volume effect means that the average

[69] That Table shows the tariffs in China to be equal to that for India, but the information there is somewhat dated. The tariffs in India have decline relatively further and are lower than those in China.

[70] The unexpected increase can be seen for example when the growth is compared with the expectation as given in the **special Report prepared in April 2000 on "Infrastructural Development" by the Prime Minister's Council on Trade And Industry**. In its Executive Summary's section on Communications, the Report states inter alia that: "Provided supply can keep pace, this demand could explode to 31 million lines by 2001 and 64 million by 2006 for basic services. Similarly, in the cellular sector, demand could touch 2 million lines by

costs are much lower and the viability of the system can be maintained at much lower ARPUs than even the relatively low ARPUs that prevail in the market.[71]

It is noteworthy that, as shown in **Table 3.6**, in each of the past two years the increase in teledensity every year is substantially more than the total teledensity achieved during the first 50 years of India's independence. **Table 3.15** below (derived from Table 3.6 given earlier) shows the increase in different years of the subscriber base for basic service and cellular mobile service.

**Table 3.15. Annual increase in subscriber base of basic service and mobile service, 1997-98 to 2004-2005**

| **Year (April to March)** | **Annual Increase in subscriber base for basic service in comparison to subscriber level at the end of the previous year (million subscribers)** | **Annual Increase in subscriber base for mobile service in comparison to subscriber level at the end of the previous year (million subscribers)** |
|---|---|---|
| 1997-1998 | 3.26 | 0.54 |
| 1998-1999 | 3.79 | 0.32 |
| 1999-2000 | 4.92 | 0.68 |
| 2000-2001 | 5.93 | 1.7 |
| 2001-2002 | 5.5 | 2.85 |
| 2002-2003 | 2.68 | 6.26 |
| 2003-2004 | 2.22 | 21 |
| 2004-2005 | 3.06 | 18.52 |

Table 3.16 shows that till 2001-2002, the increase in subscriber base of basic service was substantially larger than that for mobile service. This changed in the period April 2002 to March 2003, when the increase in subscriber base during the year was 2.3 times that for basic service. It can be noted from Table 3.10 that the average revenues per minute for mobile decreased by about 38% during that period, thus showing a major tariff decline for mobile service. The tariff declined even more next year (as per Table 3.10, average revenue per minute for mobile declined by about 40% during March 2003 to March 2003), and there was a paradigm change with respect to the increase in mobile subscriber base during the year. During 2003-2004, the increase in mobile subscriber base was about 9.5 times the increase for fixed line, and about 3.4 times that of the previous highest increase previously achieved for mobile subscriber base. The rise in mobile subscriber base since 2003-2004 is of an order which is exceptional from historical experience. This is the concept of Price Threshold that was mentioned in the theoretical framework in Chapter 2.

---

2001, growing to 5 million lines by 2006." The expectation was generally far off the mark in terms of both the growth figures and the relative importance of mobile services in this growth.

[71] According to a study by Morgan Stanley, the cellular mobile system in India is viable at about US$ 5 per month.

The market demand has moved to a different phase on account of the tariff developments.

Based on the rapid growth in demand, the mobile operators are presently considering rapid expansion into rural areas also (see **Table 3.16** below), which will hopefully transform the situation with respect to access to telephony for the masses, changing the focus of USO schemes by making hitherto unviable access in several areas commercially viable, and with developments in technology Indian rural masses will see a major decline in the digital divide. These expansion plans also have major implications for the installation and use of the backbone in the country.

Table 3.16. Present and Proposed coverage of Mobile Networks

**(a) Present Coverage of Mobile Networks (Population Coverage 20%)**

| | **By Area** | **Population Coverage** |
|---|---|---|
| Towns | 1,700 out of 5,200 | About 200 Million |
| Rural Areas | Negligible | Negligible |

**(b) Proposed Network Coverage of Mobile Networks by 2006 (Population Coverage 75%)**

| | **By Area** | **Population Coverage** |
|---|---|---|
| Towns | 4,900 out of 5,200 | About 300 Million |
| Rural Areas | About 350,000 out of 607,000 Villages | About 450 Million |

Source: page 8 of Explanatory Memorandum of TRAI's "The Telecommunication Interconnection Usage Charges (Fourth Amendment) Regulation (1 of 2005), dated 6th January, 2005.

**(ii) Major decline in Long Distance Tariffs**

The mobile tariffs that we discussed above only partly cover another important tariff for telecom users, namely domestic and international long distance tariffs. In the initial phase, the long distance calls from mobile were charged the airtime charge plus a pass through charge equal to the long distance tariff calculated at the highest tariff rate.[72] These long distance tariffs were high, and a fall in long distance tariffs therefore meant a major increase in affordability for the consumer. Over time, these tariffs have become encompassed in the mobile tariffs themselves. **Tables 3.17 to 3.19** below show the change in long distance tariffs during the period since the first Tariff Order in 1999 by TRAI. An important reason for the tariff decrease is the competition in thee markets, as shown by the number of Licensees for domestic and international long distance service in India (**Table 3.20**).

[72] Before May 1999, this was Rs. 1.40 per pulse, and after May 1999 it became Rs. 1.20 per pulse. The pulse duration has increased over time as the long distance tariffs have fallen, i.e. each minute now has fewer pulses to be charged at the specified tariff rate.

**Table 3.17 Trend in National Long Distance Tariffs for INTRA-Circle Calls**
**(Rs. per minute)**

| Distance (Kms.) | Prior to 1st May 1999 | Initial Tariff as per TTO 1999 from 1st May 1999 | Present rates | Per cent decline in comparison to pre TTO 1999 tariffs |
|---|---|---|---|---|
| Up to 50 | 2.08 | 1.20 | 1.20 | 42.3% |
| 51-200 | 9.58 | 6.00 | 1.20 | 87.5% |
| 201-500 | 18.75 | 15.60 | 1.20 | 93.6% |
| 501-1000 | 25.00 | 21.60 | 1.20 | 95.2% |
| Above 1000 | 37.50 | 30.00 | 1.20 | 96.8% |

Note: Intra-circle calls would normally not be more than about 200kms, with some calls being within the 200 to 500 kms. category. These tariffs show a comparison for the peak rates for such calls.

**Table 3.18 Trend in National Long Distance Tariffs for INTER-Circle Calls**
**(Rs. Per minute)**

| Distance (Kms.) | Prior to 1st May 1999 | Initial Tariff as per TTO 1999 from 1st May 1999 | Present rates | Per cent decline in comparison to pre TTO 1999 tariffs |
|---|---|---|---|---|
| Up to 50 | 2.08 | 1.20 | 1.20 | 42.3% |
| 51-200 | 9.58 | 6.00 | 2.40 | 74.9% |
| 201-500 | 18.75 | 15.60 | 2.40 | 87.2% |
| 501-1000 | 25.00 | 21.60 | 2.40 | 90.4% |
| Above 1000 | 37.50 | 30.00 | 2.40 | 93.6% |

Note: These tariffs show a comparison for the peak rates for such calls.

**Table 3.19 Trend in International Long Distance Tariffs (Rs. Per minute)**

| Countries | Prior to 1st May 1999 | Initial Tariff as per TTO 1999 from 1st May 1999 | Present rates | Per cent decline in comparison to pre TTO 1999 tariffs |
|---|---|---|---|---|
| SAARC countries | 37.5 | 30 | 12 | 68% |
| Europe, Africa, Asia, Gulf | 62.5 | 49.2 | 9.6 (Europe except UK) | 84.6% |
| American continent | 75 | 61.2 | 7.2 (US, UK, Canada) | 90.4% |

**Table 3.20 Licensees for National and International Long Distance Market in India**

| National Long Distance Service | Inter-national Long Distance Service |
|---|---|

| | |
|---|---|
| Bharati, Reliance, VSNL, and BSNL | Bharati, Reliance, VSNL, BSNL, and Data Access |

This tariff decline, together with the convergence of long distance tariffs on fixed and mobile (Table 3.12 above), has also contributed in a significant way to achieve the price threshold effect for achieving a large increase in demand for telecom service in India. It has also encouraged the major operators to have a large footprint within the country, thus having a pan-India presence which provides a basis for extending the backbone across the nation as a whole.

## 3.5 Change in the License Regime and the Prevailing Market Structure

In November 2003, the Government announced Guidelines for a new License category, Unified Access Service License (UASL), which allowed the operator to give fixed or mobile service under the same License. With the implementation of the UASL, the License areas were changed to correspond with those for mobile Licenses. Thus, for UASL, there are four metro Licenses and the License for the provinces respectively containing Chennai, Kolkata and Mumbai, exclude these metro cities.

The key features of the Indian market today can be summarized as follows.

**(i). Intensely competitive**

A number of operators changed their License categories to UASL to take advantage of the flexibility. Today, the Indian telecom market for fixed and mobile service is a highly competitive one, especially because both these services actively compete with each other also (**Table 3.21;** all Tables in this Section are given below at the end of summary of main features).

**(ii). Large and growing subscriber base**

Most of these Circles have a large subscriber base, with the subscribers for mobile and fixed service being less than one million per Circle only for four out of 23 Circles, and in several Circles the subscriber base being much more than a million (**Table 3.22**). The extent of the subscriber base is an important data item to consider the possible viability of installing a backbone in different circles.[73]

[73] As discussed in the section on backbone, if we consider that for the Indian tariffs, 140 subscribers would justify one Route Km. of fibre, this overall subscriber base would justify 664,000 Route Kms. of fibre. If there is a 20% increase in the subscriber base annually, the subscriber base would justify about 800,000 Route kms. of fibre at the end of 2005 and about 950,000 Route Kms. at the end of 2006, under these assumptions. Of course, since the investment decision for backbone would be taken for incremental stretches of the area to be connected, this does not mean that this fibre would be similarly distributed. In fact, areas of low revenue likelihood would not be commercially covered by the backbone.

**(iii). Three main types of Licensees with growing emphasis on mobile/wireless in local loop**

With the change in the License regime, for access service, there are three main types of Licenses, i.e., UASL, basic service and mobile service. The incumbents (BSNL and MTNL) are the only main basic service providers in the country. The extent of their presence in the different Circles is shown in **Table 3.23**. Their subscriber base exceeds about a million in most circles, showing a basis for their interest in extensively establishing a backbone.

The subscriber base of the Unified Access Service Licensees and the Mobile Service Licensees are shown, respectively, in **Tables 3.24 and 3.25**. These Tables show that some of the operators have a presence in a large number of Circles, and their subscriber base is substantial for them to be interested in establishing backbone in most of the regions where they operate.[74] Moreover, all these operators emphasize use of radio based technology, either mobile or wireless in local loop, and thus the analysis of viability would require taking account of the costs for these technologies and the types of services which they can make available.

**(iv). Some private operators have in effect pan-India License, and others present in several Circles**

**Table 3.26** shows that two private operators have License for each Circle, one other has Licenses for virtually all the Circles, and yet another has Licenses for more than half the Circles. Thus, there are at least three operators who can actively operate with a pan-nation strategy. In effect therefore, India will have four large operators (including the incumbent) and a number of others who will give intense competition in the portions where they operate.

**(v). At present, the rural sector is served virtually exclusively by BSNL**

Although the subscriber growth in India has seen a substantial growth and the industry is growing rapidly, there is a lopsided nature to this growth. As shown by **Table 3.27**, most of the subscriber base in rural India is served by BSNL, and the private sector has virtually no coverage in that regard. This is a major lacuna which needs to be addressed. To some extent the coverage of rural India will increase if the network growth takes place as mentioned in Table 3.17 above, but there is a large way to go to make up this gap.

**(vi). Consequently while urban teledensity is growing fast, rural teledensity is stagnating**

As a result of the operators (except BSNL) not focusing on rural subscriber base, the rural telephony coverage is very low, and the gap between urban and rural teledensity is growing fast (**Table 3.28**). Another

---

[74] Individually, the incumbents still have a relatively large subscriber base compared to individual private sector operators. But the subscriber base of the private sector operators is increasing rapidly and they will become much closer to the incumbent’s size in some years time.

important feature about lack of full rural telecom coverage is that there are yet a number of villages which need to be covered (Table 3.28), and there is still a substantial waiting list for phones in the rural area (**Table 3.29**).

The Government and the Regulator are addressing these matters, and trying to devise various policy initiatives, including amendments to the USO regime to enable mobile services to cover these areas hitherto not having access to telecom services.

**(vii). Efforts beginning to initiate the spread of broadband in the country**

The Government has announced a Broadband policy, with specific targets for broadband coverage, and greater use of e-governance etc. activities. This service will assume a much larger role in the future in the telecom market.

**Table 3.21 Number of Operators in Different License Areas**

| Service Area | Mobile** | Fixed |
|---|---|---|
| Delhi | 6 | 4 |
| Mumbai | 6 | 3 |
| Chennai | 6 | 4 |
| Kolkata | 6 + 1* | 2 |
| Maharashtra | 6 | 3 |
| Gujarat | 6 | 3 |
| Andhra Pradesh | 6 | 3 |
| Karnataka | 6 | 4 |
| Tamil Nadu | 6 | 4 |
| Kerala | 6 + 1* | 2 |
| Punjab | 7 | 3 |
| Haryana | 6 | 3 |
| U. P. (W) | 6 | 2 |
| U.P. (E) | 6 | 2 |
| Rajasthan | 7 | 4 |
| Madhya Pradesh and Chattisgarh | 6 + 1# | 3 |
| West Bengal and A&N | 6 + 1* | 2 |
| Himachal Pradesh | 6 + 1* | 2 |
| Bihar & Jharkhand | 5 + 1* | 3 |
| Orissa | 5 + 1* | 3 |
| Assam | 3 + 1* | 1 |
| North East | 3 + 1* | 1 |
| Jammu & Kashmir | 2 + 2* | 1 |

* Additional Licensee(s), who had not started service till 30th April 2005.
** In each Circle, there is one service provider who provides mobile service with two technologies, namely GSM and CDMA.

# One License has been surrendered, but permission granted to operate till October 2005.

**Table 3.22 Subscriber Base in Various Circles for Mobile, and Fixed services, as on 31st December 2004 (subscriber numbers in '000s)**

| | Mobile | Fixed and WLL(F) | Total [Mobile + Fixed and WLL(F)] |
|---|---|---|---|
| Delhi | 5,272 | 2,332 | 7,604 |
| Mumbai | 4,733 | 2,885 | 7,618 |
| Chennai | 1,994 | 1,309 | 3,303 |
| Kolkata | 1,830 | 1,447 | 3,277 |
| Maharashtra | 3,842 | 4,243 | 8,085 |
| Gujarat | 3,406 | 3,069 | 6,475 |
| Andhra Pradesh | 3,589 | 3,632 | 7,220 |
| Karnataka | 3,335 | 3,142 | 6,478 |
| Tamil Nadu | 3,155 | 3,086 | 6,241 |
| Kerala | 2,375 | 3,506 | 5,881 |
| Punjab | 3,449 | 2,308 | 5,757 |
| Haryana | 1,023 | 1,246 | 2,269 |
| U. P. (W) | 1,852 | 1,942 | 3,794 |
| U.P. (E) | 2,074 | 1,515 | 3,590 |
| Rajasthan | 1,497 | 1,982 | 3,479 |
| Madhya Pradesh and Chattisgarh | 1,541 | 1,937 | 3,478 |
| West Bengal and A&N | 697 | 1,302 | 1,998 |
| Himachal Pradesh | 304 | 484 | 789 |
| Bihar & Jharkhand | 935 | 1,483 | 2,418 |
| Orissa | 566 | 826 | 1,392 |
| Assam | 238 | 522 | 760 |
| North East | 92 | 370 | 462 |
| Jammu & Kashmir | 213 | 304 | 517 |
| Total | **48,014** | **44,872** | **92,886** |

Note: The numbers are in thousands, and have been rounded up to the nearest thousand.

**Table 3.23 Main Basic Service Operators and their subscriber base in various Circles (as on 31st December 2004, subscriber numbers in '000s)**

| | BSNL | MTNL |
|---|---|---|
| Delhi | | 1,733 |

| | | |
|---|---|---|
| Mumbai | | 2,342 |
| Chennai | 1,001 | |
| Kolkata | 1,360 | |
| Maharashtra | 3,940 | |
| Gujarat | 2,719 | |
| Andhra Pradesh | 3,198 | |
| Karnataka | 2,752 | |
| Tamil Nadu | 2,898 | |
| Kerala | 3,402 | |
| Punjab | 2,035 | |
| Haryana | 1,115 | |
| U. P. (W) | 1,896 | |
| U.P. (E) | 1,468 | |
| Rajasthan | 1,809 | |
| Madhya Pradesh and Chattisgarh | 1,659 | |
| West Bengal and A&N | 1,250 | |
| Himachal Pradesh | 483 | |
| Bihar & Jharkhand | 1,457 | |
| Orissa | 812 | |
| Assam | 522 | |
| North East | 370 | |
| Jammu & Kashmir | 304 | |

Note: No entry means that operator does not have License for the circle.

**Table 3.24 Main Unified Access Licensees with subscriber base in various Circles (as on 31st December 2004, subscriber numbers in '000s)**

| | **Reliance Infocomm** | **Bharati** | **Tata Teleservices Limited** |
|---|---|---|---|
| Delhi | 1,119 | 1,554 | 195 |
| Mumbai | 926 | 647 | 147 |
| Chennai | 449 | 446 | 64 |
| Kolkata | 449 | 501 | (B) |
| Maharashtra | 729 | 597 | 55 |
| Gujarat | 665 | 410 | 61 |
| Andhra Pradesh | 800 | 871 | 165 |
| Karnataka | 614 | 1,137 | 85 |
| Tamil Nadu | 485 | 325 | 27 |
| Kerala | 428 | 332 | (A) |
| Punjab | 491 | 1,251 | (B) |
| Haryana | 200 | 226 | (B) |

| | | | |
|---|---|---|---|
| U. P. (W) | 302 | 345 | (B) |
| U.P. (E) | 423 | 171 | (B) |
| Rajasthan | 320 | (C) | 2 |
| Madhya Pradesh and Chattisgarh | 317 | 216 | (B) |
| West Bengal and A&N | 102 | 96 | (B) |
| Himachal Pradesh | 3 | 177 | (B) |
| Bihar & Jharkhand | 184 | (B) | (B) |
| Orissa | 109 | 41 | 0.06 |
| Assam | (C) | (B) | |
| North East | (C) | (A) and (C) | |
| Jammu & Kashmir | (A) | 71 | |

(A) = Service yet to start ; (B) = Service started after December 2004 ; (C) = Has Mobile License ; No entry shows that operators does not have License for the circle.

Note: Other Unified Access Service Licensees (and within square parentheses, their subscriber base, in thousands, as on 31st December 2004) were as follows:

**Hutch**: UP (W) [80]; West Bengal and A&N [58]; has mobile License for several other areas. **HFCL**: Punjab [49]. **Spice**: Punjab [1,159]. **Shyam Telelink**: Rajasthan [26]. **Dishnet Wireless Limited**: Licenses obtained, but services yet to start in West Bengal and A&N, Himachal Pradesh, Bihar, Orissa, Assam, North East and Jammu & Kashmir.

**Table 3.25 Main Mobile Licensees with subscriber base in various Circles (as on 31st December 2004, subscriber numbers in '000s)**

| | BSNL | MTNL | Hutch | Idea | Reliance Telecom |
|---|---|---|---|---|---|
| Delhi | | 273 | 1,407 | 603 | |
| Mumbai | | 321 | 1,440 | | |
| Chennai | 310 | | 220 | | |
| Kolkata | 239 | | 617 | | |
| Maharashtra | 690 | | | 1,213 | |
| Gujarat | 521 | | 1,152 | 583 | |
| Andhra Pradesh | 776 | | 361 | 562 | |
| Karnataka | 640 | | 501 | | |
| Tamil Nadu | 765 | | | | |
| Kerala | 670 | | | 545 | |
| Punjab | 329 | | 161 | | |
| Haryana | 284 | | 143 | 158 | |
| U. P. (W) | 548 | | | 561 | |
| U.P. (E) | 716 | | 744 | | |
| Rajasthan | 377 | | 296 | | |
| Madhya Pradesh and | 159 | | | 469 | 288 |

| | | | | | |
|---|---|---|---|---|---|
| Chattisgarh | | | | | |
| West Bengal and A&N | 290 | | | | 148 |
| Himachal Pradesh | 102 | | | | 23 |
| Bihar & Jharkhand | 399 | | | | 340 |
| Orissa | 291 | | | | 124 |
| Assam | 145 | | | | 88 |
| North East | 72 | | | | 20 |
| Jammu & Kashmir | 140 | | | | |

(A) = Service yet to start ; (B) = Service started after December 2004 ; No entry shows that operator does not have License for the circle.

Note: Other Mobile Licensees (and within square parentheses, their subscriber base, in thousands, as on 31st December 2004) were as follows: **BPL**: Mumbai [1,190]; Maharashtra [518]; Tamil Nadu [390]; Kerala [371]. **Bharati**: Rajasthan [414]. **Spice**: Karnataka [339]. **Reliable Internet**: Kolkata (B). **Aircel**: Chennai [493]; Tamil Nadu [1,155]. **Escorts Communications**: Licenses obtained, but services yet to start in UP (E), Rajasthan, Himachal Pradesh.

**Table 3.26 Service Areas for which Operators Have Licenses**

| | **Number of Circles for which License** | **Number of Circles For Which Not Licensed** |
|---|---|---|
| BSNL | 21 | 2 {Mumbai, Delhi} |
| MTNL | 2 {Mumbai, Delhi} | 21 |
| Bharati | 23 | None |
| Reliance | 23 | None |
| Tata | 20 | 3 {Assam, North East, Jammu & Kashmir} |
| Hutch | 13 | 10* |
| Idea | 8** | 15 |
| Dishnet | 7# | 16 |
| BPL | 4 {Mumbai, Maharashtra, Tamil Nadu, Kerala} | 19 |
| Escorts Communications | 3 {UP (E), Rajasthan, Himachal Pradesh} | 20 |
| Aircel | 2 {Chennai, Tamil Nadu} | 21 |
| Spice | 2 {Punjab, Karnataka} | 21 |
| HFCL | 1 | 22 |

| | | |
|---|---|---|
| | {Punjab} | |
| Shyam Telelink | 1 {Rajasthan} | 22 |
| Reliable Internet | 1 (Kolkata) | 22 |

* Maharashtra , Tamil Nadu, Kerala, Madhya Pradesh & Chattisgarh, Himachal Pradesh, Bihar & Jharkhand, Orissa, Assam, North East, Jammu & Kashmir
** Delhi, Maharashtra, Gujarat, Andhra Pradesh, Kerala, Haryana, U. P. (W), Madhya Pradesh & Chattisgarh,
# West Bengal and A&N, Himachal Pradesh, Bihar & Jharkhand, Orissa, Assam, North East, Jammu & Kashmir

**Table 3.27 Rural and Urban Subscriber base of service providers, as on 31st December 2004 (subscriber figures in thousands)**

| Operators | Area of Operation | Urban Subscribers | Rural Subscribers | Total Subscribers |
|---|---|---|---|---|
| BSNL | All India except Mumbai and Delhi | 23,573.3 (64.6%) | 12,921.1 (35.4%) | 36,494.4 (100%) |
| MTNL | Mumbai and Delhi | 4,074.9 (100%) | 0.19 (0%) | 4,075.1 (100%) |
| Tata Teleservices Ltd | Maharashtra, Andhra Pradesh, Tamil Nadu, Chennai, Karnataka, Gujarat, Delhi, Bihar, Orissa, Rajasthan | 2,000.4 (99.8%) | 4.0 (0.2%) | 2,004.4 (100%) |
| Reliance Infocomm Ltd. | Andhra Pradesh, Bihar, Delhi, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Mumbai, Orissa, Punjab, Rajasthan, Tamil Nadu, Chennai, UP (E), UP (W), West Bengal, Kolkata | 1,174.9 (99.4%) | 7.4 (0.6%) | 1,182.3 (100%) |
| Bharati Telenet Ltd. | Madhya Pradesh, Delhi, Haryana, Tamil Nadu, Chennai, Karnataka | 803.1 (99.9%) | 0.61 (0.1%) | 803.7 (100%) |
| HFCL Infotel Ltd. | Punjab | 181.0 (99.6%) | 0.73 (0.4%) | 181.7 (100%) |
| Shyam Telelink Ltd. | Rajasthan | 125.3 (96.1%) | 5.1 (3.9%) | 130.4 (100%) |
| **Total** | | **31,933.0 (71.2%)** | **12,939.1 (28.8%)** | **44,872.1 (100%)** |

Source: TRAI, "The Indian Telecom Services Performance Indicators Oct-Dec '04, March 2005

Notes: (1) The share of urban and rural subscriber base in total is shown in parentheses for each service provider.

(2) The subscriber base has been rounded up for the last digit shown.

**Table 3.28 Village Public Telephones (VPTs), Public Call Office (PCO), and Teledensity, 1999-2000 to 2004-05**

| Financial Year (April to March) | VPTs ('000) | PCOs ('000) | Urban Teledensity (Per 100 persons) | Rural Teledensity (Per 100 persons) | National Teledensity (Per 100 persons) |
|---|---|---|---|---|---|
| 1999-2000 | 375 | 658 | 8.23 | 0.68 | 2.86 |
| 2000-2001 | 410 | 885 | 10.37 | 0.93 | 3.53 |
| 2001-2002 | 469 | 1078 | 12.20 | 1.21 | 4.29 |
| 2002-2003 | 513 | 1493 | 14.32 | 1.49 | 5.11 |
| 2003-2004 | 522 | 1924 | 20.79 | 1.55 | 7.17 |
| 2004-2005 | 537# | 2531# | 26.2 | 1.74 | 9.08 |

# As on 31st December 2004.

Note: The total number of villages are 607,491.

**Table 3.29 Waiting List for Rural Direct Exchange Lines (DELs), Million DELs**

| 1999-2000 | 2000-01 | 2001-02 | 2002-03 | 2003-04 | 2004-05 |
|---|---|---|---|---|---|
| 1.65 | 2.48 | 1.28 | 1.31 | 1.37 | 1.25 # |

# BSNL data

**(e) Backbone in the Country**

Backbone in the country is installed by the telecom operators, those operators with a License category called Infrastructure Provider (IP), the Government through its e-Governance programmes, and individual State Governments who wish to implement their own e-governance etc. programmes. The main entities installing backbone on an all-India basis for telecom operations are the telecom service providers and the IP licensees.

The previous section has indicated the main telecom operators in the country, including two operators with an effective pan-India License and one with virtually a pan-India License (i.e. the operators has Licenses for all Circles except three). Together with the incumbent operator these are the main entities installing backbone in the country.

The IP Licenses are of two types: IP-I, which allows provision of dark fibre to users of backbone, and IP-II which allows provision of infrastructural facilities such as lit backbone, but not the end link. **Table 3.30** shows that there are a large number of IP-I operators, and seven IP-II providers. While the IP-I operators are large in numbers, they are not the primary source of alternative supply of backbone (i.e. supply other than from the telecom operators). The main alternative suppliers of backbone are the IP-II service providers. As shown in Table 3.30, there are six IP-II service providers with an all-India coverage.

**Table 3.30 Licencees for Infrastructure Provider Service**

| Service | Number of Licensees | Service Providers (Coverage of Area) |
|---|---|---|
| Infrastructure Provider – I | 86 | * |
| Infrastructure Provider – II | 7 | - RailTel Corporation of India (All India)<br>- Power Grid Corporation of India Ltd. (All India)<br>- Gas Authority of India (All India)<br>- Hughes Escorts Communications Ltd. (All India)<br>- The Tata Power Company Ltd. (All (India)<br>- Tata Power Broadband Company Ltd. (All India)<br>- Delhi Metro Rail Corporation (Delhi) |

* List too long to provide here. The parentheses show the operational area f the IP-II service providers

In addition to the domestic bandwidth, three suppliers of international bandwidth for India have installed (or are in the process of installing) 16 terabits of international connectivity, of which only 0.35 terabit have been lit and less than 0.02 terabit are being used.[75] In the international sector, there is adequate bandwidth available. The issues that are raised in this regard are the tariff of this bandwidth and the terms and conditions of access (including for those with cables which need landing facilities in India).

For the domestic backbone too, we will see below that there is widespread and mostly adequate availability in terms of backbone installed. There is, however, some concern about converting this widespread reach into universal reach, in such a way that both telephony and broadband services could be made available in all parts of India. In addition, operators have often raised the matter of access to the backbone of the incumbent and the issue of infrastructure sharing. We will address these matters in later sections after taking a look at the availability of the backbone in India.

**(a) Availability of backbone in the country: Total Route Kms.**

The total domestic backbone in India is at present almost 900,000 Route kms., of which the bulk is accounted for by the incumbent, BSNL. At the end of the financial year 2003-2004 (i.e. in March 2004), BSNL had 549,087 Route Kms. of fibre and 155,216 Route Kms. of MW connectivity (**Table 3.31**). As mentioned above, the private operators are extending

[75] Baijal (2005), "Rural Connectivity – not an Obligation but an Opportunity", page 3.

their backbone capacity rapidly to cover larger parts of the country, and over time will have a larger portion of the overall backbone.[76]

**Table 3.31 Backbone installed by main telecom service operators (except MTNL) - Route Kms.**

| | **OFC (Around March 2005 - present; and end-2005 or March 2006 - Planned)** | **MW + Spectrum** | **Total** |
|---|---|---|---|
| BSNL | 462,527 (March 2005)<br>513,827 (March 2006) | 66,932## | |
| Reliance | 58,607 (March 2005)<br>80,962 (December 2005) | 644 | |
| Bharati | 26,203 [2,007] (March 2005);<br>N.A. | N.A. | |
| Tatas | 9,410.28 [18,367] (March 2005);<br>15,841.53 [24,754.11] (March 2006) | | |
| Other Private Operators | 18,200 + (March 2005) | 23 + | 3,523 + |
| **Total of above** | **574,947 +**<br>**655,033 +** | **67,599 +** | **642,546 +**<br>**722,632 +** |

## 341 Route Kms. is on satellite media.
Note: The square parentheses show the leased RKms. by the operators. These are not shown in the Total. The Tables focuses on those operators which carry long distance calls (even if these calls are within the circle), and thus does not include MTNL although it is one of the main operators in India.

The backbone availability in the country is also being augmented through IP-II service providers (**Table 3.32** below), and their present capacity is likely to be augmented further in the future (see **Annexure 3.5** for more detail on the three main IP-II service providers). An important feature of the plans of these operators is that they are covering the main towns, and over time plan to provide other services also. Thus, in time, these operators will not remain only infrastructure providers but will become service providers also, by acquiring telecom service Licenses for national

[76] The Economic Times of 23rd May, 2005 in its story "Top 4 mobile cos seize 72% market share", has talked about the extensive coverage of BSNL in the country and for private operators has mentioned that: "Reliance Infocomm has embarked on an expansion that will ensure coverage of about 4 lakh villages during 2005. Bharati is planning to increase its coverage from the current 2,700 towns to 5,200 by the year end. … Bharati plans to set up 10,000 more base transmission systems (BTS) during the current financial year for better network facility, in addition to the current 10,000 BTS on March 31, 2005. … Reliance is currently on a network expansion drive aimed at ensuring coverage of 5,700 cities and towns and nearly two thirds of India's villages. The expansion involves setting up 8,500 BTS (base transceiver stations) towers that will cover 91% of the country's national highways and 85% of rail routes."

and even international long distance service. They are already Licensees for Internet Service.

**Table 3.32 Transmission Network Infrastructure (OFC & MW in Route Kms)**
**of the Main Infrastructure Providers – II (first quarter 2005)**

| | **Optical Fibre Cable in Route Kms.** |
|---|---|
| RailTel | 26,668 |
| Power Grid | 15,204 |
| Gail India | 8,000 |
| Others | 600 + |
| **Total of Above** | **50,472 +** |

Note: Over time, even the others plan to cover all the Circles in the country.

**(b) Availability of backbone in the country: MPLTs of New Telecom Policy of 1999**

We can see from Tables 3.16, 3.31 and 3.32 above that the service providers other than BSNL do not as yet have much backbone presence in the country. Thus, for the purpose of assessing the coverage of the backbone in terms of MPLTs of NTP 1999, we would need to focus on the backbone of BSNL only. We recall below the NTP 1999's Measurable Primary Level Targets (MPLTs) that had a direct bearing on the installation of backbone in the country. We reproduce those targets again for facilitating the discussion.

The MPLTs directly linked with the backbone are:

- Provide reliable transmission media in all rural areas
- Achieve telecom coverage of all villages in the country
- Provide reliable media to all exchanges by the year 2002.
- Provide Internet access to all district head quarters by the year 2000.
- Provide high speed data and multimedia capability using technologies including ISDN to all towns with a population greater than 2 lakh by the year 2002.
- Convert PCO's, wherever justified, into Public Teleinfo centres having multimedia capability like ISDN services, remote database access, government and community information systems etc.
- Provide voice and low speed data service to the balance 2.9 lakh uncovered villages in the country by the year 2002.

BSNL is owned by the Government. Since the other operators were not growing fast enough to help substantively in achieving the NTP 1999 targets for backbone and connectivity, the task of fulfilling these targets fell primarily on BSNL. Thus, the owner of the company, i.e. the Government, asked BSNL to provide the links as specified in NTP 1999, and BSNL made the required investment.

The extent of the spread of BSNL's backbone can be seen from the statement in TRAI (2004) that about 90% of the rural exchanges of BSNL are connected by fibre. To understand the scope of this coverage we can see from **Table 3.33** that BSNL has a total of about 37,000 exchanges in various circles, or which over 29,000 are rural exchanges.

**Table 3.33 Circle-wise Number of Exchanges for BSNL, as on 31st March 2005**

| **Circle** | **Urban** | **Rural** | **Total** |
|---|---|---|---|
| Chennai | 210 | 0 | 210 |
| Kolkata | 518 | 0 | 518 |
| Maharashtra | 626 | 4,315 | 4,941 |
| Gujarat | 540 | 2,749 | 3,289 |
| Andhra Pradesh | 472 | 2,869 | 3,341 |
| Karnataka | 486 | 2,222 | 2,708 |
| Tamil Nadu | 853 | 1,294 | 2,147 |
| Kerala | 250 | 968 | 1,218 |
| Punjab | 317 | 1,219 | 1,536 |
| Haryana | 297 | 818 | 1,115 |
| U. P. (W) | 379 | 576 | 955 |
| U.P. (E)# | 664 | 2,096 | 2,760 |
| Rajasthan | 379 | 1,962 | 2,341 |
| Madhya Pradesh and Chattisgarh | 728 | 2,709 | 3,437 |
| West Bengal and A&N | 204 | 1,212 | 1,416 |
| Himachal Pradesh | 83 | 851 | 934 |
| Bihar & Jharkhand | 353 | 1,238 | 1,591 |
| Orissa | 205 | 931 | 1,136 |
| Assam | 154 | 440 | 594 |
| North East | 134 | 351 | 485 |
| Jammu & Kashmir | 110 | 253 | 363 |
| **Total** | **7,962** | **29,073** | **37,035** |

# In the data above, the exchanges of Uttaranchal have been combined with UP (E).

The MPLTs of NTP 1999 mention the targets in terms of districts, towns and villages. We will focus on the first two to begin with and address the targets relating to villages subsequently.

The total number of exchanges shown in the Table above far exceed the various administrative units, including those smaller than town or a district. We saw earlier that there are 5,200 towns in India. The number of districts are about 600, and lower level administrative categories or Tehsils and Sub-Divisions are together more than 4,200, and the short distance charging areas (or local call areas) are more than 2,600 (**Table 3.34**). The exchanges far outnumber all of these. In fact to have an idea about the extensive coverage of exchanges we can consider their spread in terms of "Stations", which are also mentioned in Table 3.34 below. A station is defined in terms of each city/town or village which has an exchange. Thus each town may have several exchanges but it would be classified as one Station. From Table 3.34 we can see that the number of exchanges are positioned at a much more smaller level of geographical coverage than the local call area of the lower level administrative categories. For instance, after accounting for the 5,200 towns in India, the exchanges are in addition in 26,552 other places as is shown by the number of Stations.

**Table 3.34. Number of BSNL Exchanges, SDCCs, Stations, and Certain Administrative Area Categories in India**

| | Exchanges | District HQs | Short Distance Charging Centres | Sub-Divisn. HQs | Tehsil HQs | Stations |
|---|---|---|---|---|---|---|
| Chennai | 210 | 1 | 1 | 1 | 8 | 1 |
| Kolkata | 518 | 5 | 1 | 10 | -- | 1 |
| Maharashtra | 4941 | 35 | 304 | 112 | 361 | 4730 |
| Gujarat | 3289 | 28 | 161 | 46 | 226 | 2198 |
| Andhra Pradesh | 3341 | 23 | 243 | 73 | 316 | 2953 |
| Karnataka | 2708 | 27 | 180 | 52 | 175 | 2455 |
| Tamil Nadu | 2147 | 30 | 129 | 73 | 200 | 1837 |
| Kerala | 1218 | 14 | 58 | 21 | 63 | 1078 |
| Punjab | 1536 | 18 | 55 | -- | 70 | 1362 |
| Haryana | 1115 | 19 | 54 | 47 | 67 | 867 |
| U. P. (W) | 955 | 20 | 64 | -- | 87 | 733 |
| U.P. (E)# | 2760 | 63 | 202 | -- | 255 | 2213 |
| Rajasthan | 2341 | 32 | 245 | 105 | 241 | 2163 |
| Madhya Pradesh and Chattisgarh | 3437 | 64 | 353 | 202 | 356 | 3188 |
| West Bengal and A&N | 1416 | 20 | 73 | 68 | 7 | 1334 |
| Himachal Pradesh | 934 | 12 | 33 | 51 | 75 | 896 |
| Bihar & Jharkhand | 1591 | 60 | 179 | 136 | -- | 1459 |
| Orissa | 1136 | 30 | 120 | 58 | 171 | 1053 |
| Assam | 594 | 26 | 46 | 48 | 134 | 526 |

| | | | | | | |
|---|---|---|---|---|---|---|
| North East | 485 | 55 | 174 | 144 | 171 | 433 |
| Jammu & Kashmir | 363 | 14 | 34 | 12 | 59 | 278 |
| **Total** | **37,035** | **596** | **2,619** | **1,259** | **2,901** | **31,758** |

# Uttaranchal data have been combined with UP (E).
Note: The categories "Sub-Division HQs and Tehsil HQs are used interchangeably for similar types of administrative categories. Short Distance Charging Centres (SDCCs) are the points in the SDCA or local call area for charging purposes. Each SDCA would have an SDCC. Above, 23 SDCCs are not mentioned (8 in Chattisgarh, 2 in North East-II, and 13 in Rajasthan) as they do not have an established exchange due to lack of demand.

In the context of backbone, the BSNL network has a number of noteworthy features.

(1) All BSNL exchanges are connected to reliable media.[77] Thus, the spread of backbone can be effectively utilized by the subscribers linked to all the exchanges of BSNL.
(2) Most of the exchanges are connected by fibre. **Table 3.35** below shows that more than 93% of the exchanges were connected by fibre, end-March 2005.
(3) Taking all the urban exchanges as being linked to fibre, based on Table 3.35 there were 26,568 rural exchanges linked to fibre. These are more than 91% of the rural exchanges.
(4) The Circles for which all the exchanges were linked to fibre at end-March 2005 were Chennai, Kolkata, and Gujarat.
(5) Circles which had some, but less than 5%, exchanges not connected by fibre as on end-March 2005, were Karnataka (2.3%), Tamil Nadu (4.8%), Kerala (1.2%), Punjab (0.2%), Haryana (0.5%), Rajasthan (3.7%),West Bengal and Andamans & Nicobar Islands (3.5%), Bihar & Jharkhand (3.6%), and Orissa (0.6%).
(6) This shows that Circles from all three, i.e. "A", "B" and "C" categories have virtually all their exchanges connected by fibre.
(7) Circles with more than 10% of their exchanges not connected by fibre as on end-March 2005 were Andhra Pradesh (11.3%), UP (East) (13.6%), Madhya Pradesh & Chattisgarh (10.2%), Himachal Pradesh (23.6%), Assam (20%), North East (51.8%), and Jammu & Kashmir (29.2%). For these exchanges, radio based reliable links have been installed.
(8) Those circles which have a relatively large portion of their exchanges linked to radio based links, are not surprisingly, largely hilly regions.
(9) Over time, BSNL is increasing its fibre links and reducing its reliance on radio based links. Thus, for example, in comparison to 31st March 2005 there were more exchanges

[77] In addition, all exchanges of BSNL have STD facilities.

with fibre link as on 30th April 2005. End-March there were 34,530 exchanges with fiber links and end-April there were 34,551 exchanges with fiber link.

**Table 3.35. Type of Reliable Media Provided For the BSNL Exchanges, end-March 2005**

| | Exchanges | Provided on All Types of OFC Systems | Provided on All Types of Digital M/W Systems | Provided on All Types of Satellite Systems | Provided on Other Reliable Media ## |
|---|---|---|---|---|---|
| Chennai | 210 | 210 | 0 | 0 | 0 |
| Kolkata | 518 | 518 | 0 | 0 | 0 |
| Maharashtra | 4941 | 4687 | 226 | 10 | 18 |
| Gujarat | 3289 | 3289 | 0 | 0 | 0 |
| Andhra Pradesh | 3341 | 2965 | 238 | 5 | 133 |
| Karnataka | 2708 | 2647 | 61 | 0 | 0 |
| Tamil Nadu | 2147 | 2043 | 62 | 4 | 38 |
| Kerala | 1218 | 1204 | 0 | 6 | 0 |
| Punjab | 1536 | 1533 | 0 | 0 | 3 |
| Haryana | 1115 | 1109 | 4 | 0 | 2 |
| U. P. (W) | 955 | 891 | 0 | 0 | 64 |
| U.P. (E)# | 2760 | 2385 | 292 | 0 | 83 |
| Rajasthan | 2341 | 2254 | 31 | 15 | 41 |
| Madhya Pradesh and Chattisgarh | 3437 | 3085 | 19 | 15 | 318 |
| West Bengal and A&N | 1416 | 1367 | 35 | 14 | 0 |
| Himachal Pradesh | 934 | 714 | 132 | 50 | 38 |
| Bihar & Jharkhand | 1591 | 1534 | 3 | 0 | 54 |
| Orissa | 1136 | 1129 | 4 | 0 | 3 |
| Assam | 594 | 475 | 115 | 4 | 0 |
| North East | 485 | 234 | 79 | 65 | 107 |
| Jammu & Kashmir | 363 | 257 | 55 | 47 | 4 |
| **Total** | **37,035** | **34,530** | **1,356** | **235** | **914** |

# Uttaranchal data have been combined with UP (E).
## These other reliable media are underground cable (4 exchanges), Analog/Digital UHF (458 exchanges), PCM (2 exchanges), other media (450 exchanges)

**8 exchanges are unaccounted for Kerala???xxx**

Thus, the following backbone-related MPLT of NTP 1999 have been accomplished:

- Provide reliable media to all exchanges by the year 2002

- Provide reliable transmission media in all rural areas
- Provide Internet access to all district head quarters by the year 2000

The PCOs are in urban areas and the objective relating to PCOs is not a major one in terms of the distribution of the backbone across the country.

The main objectives which have yet to be fulfilled are those relating to providing telecom coverage in all villages, and to provide voice and low speed data to the villages that were yet to be covered when NTP 1999 was announced. **Table 3.28** above showed that about 50,000 villages are still to be covered by telephony.[78] Thus, while most of the country has been covered by reliable media, including fibre going to most of the exchanges even in rural areas, there are still a few parts which are yet to be covered. It is expected that all these villages, some of which are in very remote parts of the country, would be provided telephony latest by the year 2007.[79]

The data above gives us a picture of a widely spread backbone in India. Three important points that need to be emphasised in this context.

One, that India is today prepared with its fibre connections to give broadband service in very large parts of the country. With technological progress as the capacity of radio based technologies increases, this coverage could be extended across virtually the entire country.

Second, that the growth of the backbone in India has taken place in a manner analogous to that for Korea's broadband, in the sense that in both places the Government bore the burden of installing the backbone. The difference of course is that BSNL had to make these investments from its funds despite being in a competitive market where other operators were not subject to the same burden. The important policy point however is that in both places, i.e. India and Korea, the Government intervened in a major way to extend the backbone so as to have its virtually ubiquitous presence, and provide a basis for further growth of the telecom services in the country.

Third, the extensive coverage of the backbone is achieved by a single operator, the incumbent. This implies that either the other operators be provided access to this backbone, or they should build a backbone of their own (i.e. the concepts of <u>notional adequacy</u> in contrast to <u>effective adequacy</u> which were mentioned in Chapter 2). If the service provider

---

[78] On 10th November 2004, Agreements were signed with BSNL for providing village public telephones (VPTs) in 66,822 remaining villages. It was decided that 21,000 villages which were insurgency prone and those with population less than 100, would not be covered under the present policy.

[79] In this regard, see the Minister's statement reported in The Hindu Business Line, 14th April 2005, "India targets 250 million phone connections by 2007". For another news item with the same announcement as well as the introduction of a US$ 35 mobile phone in the market, see http://technology.news.designerz.com/all-indian-villages-to-have-tlephones-by-2007-minister.html

does not have effective adequacy and has to build its own backbone, then further issues need to be examined:

- We first need to consider how the backbone is being extended in terms of the distribution across the country, and the factors which will affect the viability of the backbone's extension, e.g. revenues earned and the demand for the services.
- Since the extension of the backbone will take some time, we also need to consider the issue of access to the backbone and other access matters, including the policy regarding infrastructure sharing become relevant in that context. This relates to the concepts of

These issues are addressed in the sections below, which will mention some of the problems that may arise for the private operators in laying their backbone.[80]

## 3.6 Extension of the backbone by service providers (other than the incumbent)

If commercial considerations are the basis of installing telecom backbone in the country, the backbone would be used to link up those routes which give adequate returns for the investor. Linking up non-lucrative places with backbone requires specific mandated obligations or effective USO policy. Thus, one could have a large backbone but it may serve mainly cities and towns. Hence, in addition to the total availability of the backbone we need to consider its distribution also.

The main private operators are extending their backbone across the country, and they hope to cover much of the country in a few years' time. **Table 3.36** shows the information on the extension of backbone in specified parts of the country by an operator who has Licenses for all Circles in the country. The Infrastructure Providers are also increasing their fibre capacity and coverage. For example, RailTel is planning to have about 42,000 Route Kms. of fibre by March 2008 (**Table 3.37** below). PowerTel is planning by next year to have a broadband network of about 19,400 kms. As on March 2005, the network commissioned by PowerTel was 15,534 kms. In the financial year 2005-2006, another 3,818 kms. will be commissioned. These service providers will keep increasing the coverage of fibre and capacity over time, also because they plan to enter into the telecom market as national long distance service providers.

**Table 3.36. Reliance Infocomm: OFC and MW Scope (in Route Kms.), as on 26th March 2005**

| License Area | OFC RKms. (Phase I - completed) | OFC RKms. (Phase II - ongoing) | OFC RKms. (Phase I plus Phase | MW scope |
|---|---|---|---|---|

[80] In this regard, BSNL does not face the same type of situation as private operators because under the Indian Telegraph Act, erstwhile DOT and now BSNL, have greater powers and flexibility for laying their backbone.

| (1) | (2) | (3) | II)<br>(4) | (5) |
|---|---|---|---|---|
| Delhi | 1626 | 9 | 1635 | 21 |
| Mumbai | 1477 | 398 | 1876 | |
| Chennai | 1080 | 221 | 1301 | |
| Kolkata | 497 | 232 | 729 | |
| Maharashtra | 7054 | 1898 | 8952 | 72 |
| Gujarat | 5127 | 1209 | 6336 | 15 |
| Andhra Pradesh | 6652 | 2887 | 9539 | 10 |
| Karnataka | 4838 | 1057 | 5895 | 22 |
| Tamil Nadu | 5303 | 1086 | 6389 | 58 |
| Kerala | 2876 | 1022 | 3898 | 15 |
| Punjab | 2263 | 1295 | 3558 | 11 |
| Haryana | 1823 | 755 | 2578 | |
| U. P. (W) | 2224 | 1830 | 4.54 | 91 |
| U.P. (E) | 2009 | 1654 | 3664 | |
| Rajasthan | 3020 | 1157 | 4177 | 28 |
| Madhya Pradesh and Chattisgarh | 4873 | 1771 | 6644 | 15 |
| West Bengal and A&N | 1964 | 949 | 2913 | 163 |
| Himachal Pradesh | | 103 | 103 | 98 |
| Bihar & Jharkhand | 2445 | 2393 | 4838 | 5 |
| Orissa | 1456 | 427 | 1883 | 20 |
| **Total** | **58607** | **22355** | **80962** | **644** |

Note: Phase II has been completed in some Circles, and will be fully completed by end-2005.

**Table 3.37 Optic Fibre Cable of RailTel Corporation of India**

| | **Report on Route Kms. As on 31st January 2004** | **Report on Route Kms. As on 30th April 2005** |
|---|---|---|
| **Total Fibre Programmed →**<br><br>**of which:** | **28,317** | **32,378** |
| (a) Optic Fibre Cable Commissioned | 16,807 | 22,877 |
| (b) Optic Fibre Cable Unlit | 2,278 | 2,097 |
| (c) Optic Fibre Cable Work in Progress | 3,746 | 1,694 |
| (d) Optic Fibre Cable Proposed | 5,486 | 5,710 |
| | | |
| **(2) Optic Fibre Cable Future Works** | **11,652** | **10,240**<br>**(by March 2008)** |
| | | |

| | | |
|---|---|---|
| **Grand Total** | **39,969** | **42,618** |

As shown by the Tables above and the network extension plans summarized in Table 3.16, the backbone is likely to be extended by the major operators to cover a large part of the country. However, the private operators cannot be obligated to cover all the parts of the country because after fulfilling their roll out obligations, which are specified mainly in terms of Points of Presence, they will cover only those parts which are commercially viable for them. The analysis of commercial viability could be conducted in terms of direct revenues or direct and indirect revenues. These concepts could be explained by considering investment in an incremental portion of the backbone.

By direct revenues, we mean that the additional revenue generated by the subscribers in the incremental area covered by the incremental investment. By indirect commercial viability, we mean the overall revenues generated as a result of the additional possibilities opened up through the incremental backbone. These incremental revenues are generated not only due to the subscribers in the area covered by the incremental backbone, but also by those who call these subscribers as well as the general impression about the network giving a more complete coverage and therefore providing better communication facilities for subscribers which are roaming or are mobile in various villages etc.[81]

This will become clearer by considering two different situations, one based on the revenues required to recover the investment in the backbone, and the other based on the data in **Table 3.38** below.

**Revenue required to recover the investment in backbone**

The cost of laying the fibre and installing the relevant equipment can be considered in terms of cost per Km. This cost would range between Rs. 200,000 to Rs. 250,000 per Km. There are other estimates of costs which are of a higher amount, ranging about Rs. 270,000 to above Rs. 400,000 per Km. However, the cost estimates which appear reasonable would put these costs at about Rs. 200,000 to Rs. 250,000 per Km. for India.[82] We will work with the latter estimate, and of this amount we will consider one third as being the relevant amount that should be earned each year to recover costs and give reasonable returns.[83]

[81] At present, such a perception is a strong selling point for the mobile service of BSNL.

[82] See Section 4.7 of the Explanatory Memorandum of TRAI (2005c) for a discussion of how costs have been declining over time. Also, in paragraph 4.75 of the document it is stated that: "To further pursue the above reasoning, a recent submission by a State Government pursuing e-governance project had indicated the costs for their network build-out. While not all categories were compatible, those that were are significantly cheaper than those submitted by operators for this exercise. One such example is the Cost of Laying Cable, which is more than 45% lower than the normal cost considered by the Authority for the current costing exercise. This indicates that newer more efficient operators can indeed achieve these cost levels." It is noteworthy in this context that the Cost of Laying cable is a substantial part of the overall cost of the backbone.

[83] This is in effect a higher return than is normally given in cost based tariffs. This is especially because the depreciation for the most costly items is very low, i.e. the lifetime for those items is relatively long.

Based on the Annex Tables I to X in Annex B of TRAI (2005a), which give the outgoing and incoming minutes for long distance calls, we can estimate the amount of revenues earned per subscriber for such calls. The rough estimate for this amount is about Rs. 50/- per subscriber per month, or Rs. 600/- per subscriber per year. Taking these estimates, we see that revenues from about 140 subscribers would be adequate to recover the costs of fibre per Km..

Commercial viability based on direct revenues would require that for every incremental extension of the backbone to any region, there should be 140 subscribers per Km. to make the investment viable.

**Indirect revenues**

**Table 3.38** shows a comparison of one of the main private sector operator's subscriber base in December 2004 and the notional number of subscribers that would give the direct revenues which would make the backbone installed in each circle to become viable. A striking feature of the data there is that in the metros, the number of prevailing subscribers is far in excess of those required to make the investment in backbone there viable. This does not mean that more backbone should be put in the metros. Rather, the subscribers in the metros need to talk to others in other Circles also. Thus, the revenues generated by these subscribers cover the costs of the backbone in the other Circles also.[84] For assessing the viability of the network, we have to therefore consider the indirect revenues rather than the direct revenues. Hence, the number of subscribers that would be required to make investment in the backbone viable would be fewer than those estimated using the direct revenue method. In our later analysis, however, we will work with the direct revenue method because it uses a specific amount (or subscriber base) which is not easy to estimate for the indirect method. By using the direct revenue method we would be certain that if the investment costs are covered by the revenues, they would definitely be covered using the indirect revenue method.

**Table 3.38. Reliance Infocomm: Subscriber Base in Different License Areas and Notional Subscriber Base for Indicative Viability of Installed Backbone in Route Kms.**

| License Area (1) | Subscribers (31st Dec. 2004) (2) | Notional Subscribers if 140 subscribers per RKm. (Phase I RKm) (3) | Notional Subscribers if 140 subscribers per RKm. (Phase I and II RKm) | Ratio of column (3) to column (2) | Ratio of column (4) to column (2) |
|---|---|---|---|---|---|

[84] As an illustration, the actual calculations based on traffic and subscriber base can be seen in TRAI (1999a), which has shown that in India there is relatively heavy traffic among 40 to 42 cities, and has compared the viability of providing long distance service only in metros, only regionally, and in the country as a whole. Limitations on the service areas lead to non-viability or lower viability of the service, which shows that without the possibility of indirect revenues, laying the backbone only in limited places (even with high subscriber base) would not attract investment.

| | | | (4) | (5) | (6) |
|---|---|---|---|---|---|
| Delhi | 1,285,388 | 227640 | 228900 | 0.18 | **0.18** |
| Mumbai | 1,068,606 | 206780 | 262640 | 0.19 | **0.25** |
| Chennai | 479,020 | 151200 | 182140 | 0.32 | **0.38** |
| Kolkata | 535,193 | 69580 | 102060 | 0.13 | **0.19** |
| Maharashtra | 818,944 | 987560 | 1253280 | 1.21 | **1.53** |
| Gujarat | 771,463 | 717780 | 887040 | 0.93 | **1.15** |
| Andhra Pradesh | 857,238 | 931280 | 1335460 | 1.09 | **1.56** |
| Karnataka | 663,433 | 677320 | 825300 | 1.02 | **1.24** |
| Tamil Nadu | 515,095 | 742420 | 894460 | 1.44 | **1.74** |
| Kerala | 532,565 | 402640 | 545720 | 0.76 | **1.02** |
| Punjab | 582,277 | 316820 | 498120 | 0.54 | **0.86** |
| Haryana | 225,063 | 255220 | 360920 | 1.13 | **1.60** |
| U. P. (W) | 347,786 | 311360 | 567560 | 0.90 | **1.63** |
| U.P. (E) | 469,139 | 281260 | 512960 | 0.60 | **1.09** |
| Rajasthan | 361,730 | 422800 | 584780 | 1.17 | **1.62** |
| Madhya Pradesh and Chattisgarh | 342,986 | 682220 | 930160 | 1.99 | **2.71** |
| West Bengal and A&N | 114,634 | 274960 | 407820 | 2.40 | **3.56** |
| Himachal Pradesh | 3,721 | 0 | 14420 | 0 | **3.88** |
| Bihar & Jharkhand | 202,132 | 342300 | 677320 | 1.69 | **3.35** |
| Orissa | 122,795 | 203840 | 263620 | 1.66 | **2.15** |
| **Total** | **10299208** | **8204980** | **11334680** | **0.80** | **1.10** |

If we take an aggregate perspective to indicate the possibility of indirect revenues to cover costs, Table 3.38 shows that with more than 10% growth of the subscriber base during 2005 (which is more than likely), the investment in the backbone will be viable. However, indirect revenues have to be seen not in the aggregate or average terms, but in terms of the incremental investment at each stage. It is likely that the incremental investment would not be covered by indirect revenues especially where there is a large gap in the direct revenues covering these costs (e.g. in the last few Circles in Table 3.38). With the gap in the notional subscriber base to recover costs being relatively high for a Circle, it is likely that there are more places where incremental extension of the backbone may not be commercially viable even taking account of the indirect revenues. These are the places which need to be a major focus of public policy to promote installation of the backbone.

In India's case, this problem is less onerous because the incumbent has installed its backbone in most places. However, the incumbent has to compete in the market, and additional burden should not be imposed on it which hampers its ability to compete. The USO policy in India has therefore identified those SDCAs or local call areas which do not provide adequate revenues to recover costs (termed as "net cost positive SDCAs).

The USO Fund Administrator has identified 1,685 such SDCAs, and USO assistance is to be given to the operators to provide rural Household DELs in these areas. Agreements have been signed in March 2005 with operators to provide rural DELs in these ADCAs, with BSNL covering 1,267 SDCAs, Tata Teleservices covering 215 SDCAs (of which Tata Teleservices in Maharashtra is covering 43 SDCAs), and Reliance Infocomm covering 203 SDCAs (see **Table 3.39**). **Table 3.40** shows the proportion in total SDCAs that is accounted in different circles by the net cost positive SDCAs in those circles. This Table shows a surprising result, namely that SDCAs which otherwise appear to relatively profitable have a substantial portion which gives low revenues in terms of the costs involved. Also, several Circles with a large proportion of SDCAs which are net cost positive are also among those which have more than 90% of their BSNL exchanges linked with fibre.

**Table 3.39. Number of Net Cost Positive SDCAs for USO in Different Circles, and the Number of These SDCAs Primarily Addressed By Various Service Providers**

| License Area (1) | Number of Net Cost Positive SDCAs (2) | Primary USO Bid Won By BSNL (3) | Primary USO Bid Won By Tata Teleservices (4) | Primary USO Bid Won By Reliance Infocomm (3) | Primary USO Bid Won By Tata Teleservices (Maharashtra) (4) |
|---|---|---|---|---|---|
| Maharashtra | 228 | 172 | 0 | 13 | 43 |
| Gujarat | 120 | 99 | 0 | 21 | 0 |
| Andhra Pradesh | 117 | 81 | 0 | 36 | 0 |
| Karnataka | 117 | 66 | 8 | 43 | 0 |
| Tamil Nadu | 24 | 6 | 0 | 18 | 0 |
| Kerala | 15 | 10 | 0 | 5 | 0 |
| Punjab | 18 | 5 | 12 | 1 | 0 |
| Haryana | 16 | 0 | 13 | 3 | 0 |
| U. P. (W) | 50 | 29 | 9 | 12 | 0 |
| U.P. (E)# | 84 | 39 | 30 | 15 | 0 |
| Rajasthan | 203 | 118 | 80 | 5 | 0 |
| Madhya Pradesh and Chattisgarh | 318 | 297 | 11 | 10 | 0 |
| West Bengal and A&N | 13 | 6 | 0 | 7 | 0 |
| Himachal Pradesh | 22 | 11 | 0 | 11 | 0 |
| Bihar & Jharkhand | 122 | 110 | 9 | 3 | 0 |
| Orissa | 96 | 96 | 0 | 0 | 0 |
| Assam | 26 | 26 | 0 | 0 | 0 |
| North East | 77 | 77 | 0 | 0 | 0 |
| Jammu & Kashmir | 19 | 19 | 0 | 0 | 0 |

| Total | 1,685 | 1,267 | 172 | 203 | 43 |
|---|---|---|---|---|---|

**Table 3.40. Proportion of total SDCAs in Different Circles That Is Accounted By The Number of Net Cost Positive SDCAs for USO in These Circles (%)**

| License Area (1) | Proportion Of SDCAs Accounted For By Net Cost Positive SDCAs (2) | Proportion of Exchanges Which Were Linked With Fibre as on 31st March 2005 (3) |
|---|---|---|
| Maharashtra | **75%** | **95%** |
| Gujarat | **75%** | **100%** |
| Andhra Pradesh | 48% | 89% |
| Karnataka | **65**% | **98%** |
| Tamil Nadu | 19% | **95%** |
| Kerala | 26% | **99%** |
| Punjab | 33% | **100%** |
| Haryana | 30% | **99%** |
| U. P. (W) | **78**% | **93%** |
| U.P. (E)# | 42% | 86% |
| Rajasthan | **83%** | **96%** |
| Madhya Pradesh and Chattisgarh | **90%** | **90%** |
| West Bengal and A&N | 18% | **97%** |
| Himachal Pradesh | **67%** | 76% |
| Bihar & Jharkhand | **68%** | **96%** |
| Orissa | **80%** | **99%** |
| Assam | **57%** | 80% |
| North East | 44% | 48% |
| Jammu & Kashmir | **56%** | 71% |
| **Total** | **64%** | **93%** |

Note: Shares of more than half for the net cost positive SDCAs have been highlighted. Shares of more than 90% for Exchanges linked with fibre are highlighted.

Another noteworthy feature is that as shown by Table 3.16, the main operators in India were planning to extend their network across the country to cover it extensively even without taking the USO assistance into account. Thus, these operators were planning to extend the network on a commercial basis. This depends crucially on the revenues generated through the subscriber base and the tariffs or ARPU available, e.g. the illustrative estimate above of 140 subscribers per Km. being required to make that Km of fibre viable. If we conduct an analysis of the demand in terms of aggregate direct revenue effect, it gives us a good perspective on the minimum revenues required to lay the requisite fibre, i.e. it provides us with a necessary condition but not a sufficient condition to judge whether the backbone will be extended to all the places. Much more detailed, and location specific information would be required to assess the sufficient condition for the backbone being provided in all places. However, with greater competition which will also include the selling point of comprehensive coverage of the network, with greater market revenues coming from broadband, and with progress in mobile technologies which can be effectively used to cover larger spread with lower investments, the results based on necessary conditions for investment will more and more reflect those based on the sufficient condition for the investment in backbone being generated.[85] We therefore examine the extent of growth in subscriber demand in the country.

**Backbone for international communication**

India's backbone availability for international capacity far exceeds its requirements. There are three main operators with backbone in the international sector, and the expected capacity utilization of the established capacity in about a couple of years is likely to be less than 5%. There are however two concerns which are being addressed by the Regulator. One is the tariff at which this capacity is available, and second is the access conditions for capacity landing in India. The TRAI had notified the ceiling tariffs for IPLCs, but these charges were taken to the TDSAT by the incumbent. The TDSAT has ruled inter alia that the charges should be decided after showing all relevant data to the incumbent. The TRAI has appealed this decision in the High Court. Nonetheless, with respect to the availability of backbone, there is adequate capacity in India, and this is likely to increase even further in the near future.

## 3.7 Use of the backbone by service providers: issues relating to access to existing backbone

Chapter 2 had discussed the estimation of demand based on the Jipp curve, percentage of households above the threshold level of income which would allow entry as marginal telecom subscribers, and the historical experience of countries in crossing over different threshold levels of teledensity. We will consider all these three methods to have a rough estimate of the likely subscriber base in India. The discussion in Chapter 2 also pointed out that the teledensity implied by these methods may actually be an under-estimate because of the emergence of mobile services, which face fewer infrastructural/capital cost constraints. WE will bear this aspect in mind in our assessment below.

In determining the demand for telecom subscribers in India, we should also keep in mind the targets which have been announced by the Government, namely 250 million subscribers by 2007. This would imply almost 200 million subscribers of mobile service.

**(a) The Jipp Curve**

[85] This is also indicated by the result in different tables which show that a number of circles which are considered to be relatively high potential revenue earners are also those which have relatively larger number of SDCAs which are net cost positive.

As mentioned in Chapter 2, for India we are using the Jipp curve based on the data for 2002 for low income and lower middle income countries. The Jipp curve was derived for two situations, one with a zero intercept and another as a regular regression determining the Jipp curve. The teledensity derived from both these curves are shown below in **Table 3.41**. A range of per capita GDP is taken into account starting from US$650 up to US$ 1,000, so as to get an indication of the progressive increase in teledensity indicated as the GDP per capita increases.

**Table 3.41 Teledensity indicated by the Jipp Curve for Different Levels of GDP Per Capita**

| GDP per capita (US$) | Jipp curve with zero intercept: teledensity (%) | Regular Jipp curve: teledensity (%) |
|---|---|---|
| 650 | 8.2 | 11.2 |
| 700 | 8.9 | 11.7 |
| 750 | 9.5 | 12.2 |
| 800 | 10.1 | 12.7 |
| 850 | 10.7 | 13.2 |
| 900 | 11.4 | 13.8 |
| 950 | 12.0 | 14.3 |
| 1,000 | 12.6 | 14.8 |

Based on the regular Jipp curve, by 2007, the teldensity is indicated to be above 13%, say about 14%. This suggests a subscriber base of about 140 million, way below the target that has been announced. To the extent that the greater flexibility of the mobile service is embodied in the Jipp curve, the expected teledensity would be higher. To reach a level of about 250 million subscribers, it would have to increase by about 80% or almost double.

**Extent of ADDITIONAL Backbone that could be Established by the Operator Based On The Additional Subscriber Base by 2007**

Even in the above situation, we can examine the extent of backbone that could be installed based on the assumption that 140 subscribers would justify one Route Km. of the backbone. Based on the above estimates, we could consider that the subscriber base would increase by at least 40 million by 2007. Of this 40 million, only a part would be the share of the main telecom operators. We have **Table 3.42** below, which indicates in aggregate the number of Route Kms. that would be viable with share of the total subscriber base ranging from 5% to 25%. This Table shows that even if the subscriber base increases as per the Jipp curve, there will be a major incentive for a substantial increase in the backbone extension. There is thus a good likelihood that the picture given in Table 3.16 about the planned extension of the backbone, would likely become a reality.

**Table 3.42 Extent of Backbone (in RKms.) Viable with different shares in Aggregate Increase of 40 Million for the Subscriber Base**

| Share of total Subscriber Base for the operator concerned | Extent of Backbone in RKms. Which Would Be Viable With the Market Share |
|---|---|
| 5% | 14,285 |
| 10% | 28,570 |
| 15% | 42,855 |
| 20% | 57,140 |
| 25% | 71,425 |

**Extent of Additional Backbone that could be Established by the Infrastructure Provider**

The tariffs for leased circuits in India have declined sharply over time (**Annexure 3.6**). Taking the present tariff ceilings for E1, for different distances, it is possible to estimate the number of E1s that should be leased from the infrastructure providers in order to recover their costs. In this regard, one aspect that is not clear for the infrastructure provider is the extent to which its costs are lower than those for the service provider. This arises mainly account of the difficulty of allocating the extent of the joint and common costs to its different activities which use the backbone. Companies use different costing formulae which could give rise to different extent of a cost decline. One could allocate the entire capital cost or alternatively the entire digging cost to the primary activity of infrastructure providers such as Railways, Power Grid or GAIL India Lmt., because they would have needed to put in the fibre in any case. However, to the extent that they have entered the business of Infrastructure Provider, they would have laid additional fibre and in locations that they may otherwise not have gone to. Another presumption could be that the costs be shared equally or to a larger extent by the Infrastructure activity. Thus, a range of the E1s leased could be determined for recovering the costs. Taking 100% of the costs being recovered from the amount of revenue generated per RKm. By 140 subscribers per se, and applying a reduction in the costs, we obtain in **Table 3.43** the number of E1s that would provide adequate recovery of costs.

**Table 3.43 Number of Leased E1s for Different Distances That would Recover Costs for Infrastructure Provider, For Various Extent to Which Costs For Them Are Lower Than The Total Cost Of Backbone**

| Distance Leased → <br><br> Extent of cost for Infrastructure Provider in comparison to the total costs | 50 Kms. | 100 Kms. | 200 Kms. | 500 Kms. |
|---|---|---|---|---|
| **20%** | 10 | 10 | 10 | 10 |
| **30%** | 14 | 15 | 15 | 15 |
| **40%** | 19 | 20 | 20 | 20 |
| **50%** | 23 | 24 | 25 | 25 |

| | | | | |
|---|---|---|---|---|
| **60%** | 28 | 29 | 30 | 30 |
| **70%** | 32 | 34 | 35 | 35 |
| **80%** | 37 | 39 | 40 | 40 |

If we work with the costs being lower by about 50% to 60%, and consider the 500 kms distance as being leased, then 25 to 30 E1s leased would recover the costs for the Infrastructure Provider. This is a feasible number in the market especially with several internet service providers, and even operators who may wish to use the backbone from them.

**(b) Expected Demand Based on Household Incomes**

Chapter 2 has shown that the estimates of teledensity based on household income tend to be under-estimates because a number of phones are official or commercial lines, several subscribers or households may have more than one phone, and those with higher income levels may provide a number of their family members and workers with phone subscriptions. Bearing this in mind, an attempt has been made in **Annexure 3.7** to ascertain the factor by which the teledensity indicated by household income distribution should be multiplied in order to obtain a more accurate estimate of the likely teledensity. Thus, based on the ITU data for 2002 for percentage of households with telephones, the implied teledensity is calculated by dividing the household telednsity by the household size. The household size is taken as 4.5, which is close to the household size relevant for India, as shown by some of the Tables given later below. These estimates of teledensity implied by the household teledensity are then compared with the actual estimates for teledensity. It is seen that the latter is generally higher than the former, and a multiplier factor is estimated by dividing actual teledensity by the implied teledensity figure based on household teledensity data. For India, the multiplier is 2.57.

Let us now consider the distribution of Households in India by the income levels. We consider this information from two different sources, the National Sample Survey of India and the UNDP's Human Development Report 2004. **Tables 3.44 to 3.46** shows the distribution of households by their consumption levels. Tables 3.44 and 3.45 show the increasing share in households for the upper consumption level categories. Table 3.47 shows the latest survey with the share of households in different consumption categories and the household size for the corresponding consumption categories. The per capita consumption level for the household can be converted into the household income level by multiplying the household size to the per capita level.

We have two other adjustments before reaching the estimate of the proportion of households that have income levels above or equal to that for the marginal consumer. One is to determine the expenditure by the marginal consumer, and second is the corresponding income level.

The expenditure can be derived from the ARPU levels for the pre-paid subscribers, because they are the subscribers which tend to dominate the new entrants. This ARPU, as shown in Table 3.13 is about Rs. 300 per month. We need to add to this the stream of expenditure derived from the fixed cost of a cellular mobile phone. Based on the handset cot being about Rs. 2,000 we can add another about Rs. 50 per month to the recurring expenditure. Taking the upper end of the range of 7% as the share of income spent on telecom, this gives us a total of about Rs. 5,000.

**Table 3.44 Proportion of Households in RURAL India in different classes for Monthly Per Capita Expenditure (MPCE) – All India Average (%)**

| MPCE (Rs.) | Survey for 2001-2002 | Survey for 2002 | Survey for 2003 |
|---|---|---|---|
| **950 and more** | 8.1 | 9.8 | 10.9 |
| **775 to 950** | 8.1 | 7.4 | 7.8 |
| **615 to 775** | 11.8 | 13.3 | 13.7 |
| **525 to 615** | 10.6 | 12.5 | 12.8 |
| | | | |
| **Household size All India Rural** | 5.02 | 5.0 | 5.0 |

Source: NSS Household Consumer Expenditure and Employment-Unemployment Situation in India, July 2001 to June 2002; July to December 2002; January to December 2003.
Note: Percentage of population is in terms of number of households per 1,000 households.

**Table 3.45 Proportion of Households in URBAN India in different classes for Monthly Per Capita Expenditure (MPCE) – All India Average (%)**

| MPCE (Rs.) | Survey for July 2001 to June 2002 | Survey for July to December 2002 | Survey for January to December 2003 |
|---|---|---|---|
| **1925 and more** | 10.7 | 13.2 | 13.0 |
| **1500 to 1925** | 7.5 | 9.1 | 9.3 |
| **1120 to 1500** | 14.8 | 14.3 | 14.9 |
| **915 to 1120** | 11.7 | 12.7 | 12.4 |
| **775 to 915** | 9.9 | 9.2 | 10.5 |
| **665 to 715** | 9.8 | 8.8 | 9.8 |
| | | | |
| **Household size all India** | 4.48 | 4.4 | 4.5 |

Source: NSS Household Consumer Expenditure and Employment-Unemployment Situation in India, July 2001 to June 2002; July to December 2002; January to December 2003.
Note: Percentage of population is derived from number of households per 1,000 households.

**Table 3.46 Distribution of persons by MPCE and average Household size in different MPCE classes for All India, 2003**

| Rural MPCE class (Rs.) | Percentage of population – Rural | Rural Average Household size | | Urban MPCE class (Rs.) | Percentage of population – Urban | Urban Average Household size |
|---|---|---|---|---|---|---|

| | **(%)** | | | | **(%)** | |
|---|---|---|---|---|---|---|
| 0 to 225 | 3.0 | 6.2 | | 0 to 300 | 2.6 | 6.6 |
| 225 to 255 | 3.4 | 6.3 | | 300 to 350 | 2.9 | 6.4 |
| 255 to 300 | 6.9 | 6.1 | | 350 to 425 | 6.6 | 6.1 |
| 300 to 340 | 8.9 | 6.0 | | 425 to 500 | 8.1 | 5.9 |
| 340 to 380 | 9.0 | 5.7 | | 500 to 575 | 9.0 | 5.5 |
| 380 to 420 | 8.5 | 5.5 | | 575 to 665 | 9.0 | 5.2 |
| 420 to 470 | 10.5 | 5.2 | | 665 to 775 | 10.3 | 4.8 |
| 470 to 525 | 10.7 | 5.2 | | 775 to 915 | 10.8 | 4.7 |
| 525 to 615 | 12.0 | 4.7 | | 915 to 1120 | 11.9 | 4.3 |
| 615 to 775 | 12.4 | 4.6 | | 1120 to 1500 | 13.0 | 3.9 |
| 775 to 950 | 6.4 | 4.2 | | 1500 to 1925 | 7.3 | 3.5 |
| 950 + | 8.2 | 3.8 | | 1925 + | 8.5 | 2.9 |
| | | | | | | |
| **All classes** | **100** | **5.0** | | **All classes** | **100** | **4.5** |

Source: NSS Report Number 490: Household Consumer Expenditure and Employment-Unemployment Situation in India, 2003
Note: Percentage of population is in terms of number of households per 1,000 households.

We now consider the data in Table 3.46 above, and convert the consumption estimates into income estimates. Based on an average saving rate of 25% for the higher income households, we can deduce the levels of income corresponding to the consumption expenditure levels. These per capita levels are then converted into household income levels by multiplying them by the household size estimated at the national level (the estimates of household size for different States are shown in **Annexure 3.8**). Further, since the estimates are for 2003, they need to be increased to become relevant for the period 2005 to 2007, i.e. the period during which we have to consider the target subscriber base. This increase would be about 40% by the end of 2007 (or by 2008).[86] Based on this, we could consider the per capita consumption level of Rs. 615 as that corresponding to the marginal consumer in rural areas and Rs. 665 per month for urban.

[86] This reflects an annual average growth rate of 90% in the nominal income levels. The actual growth is likely to me more.

The next step would be to take the proportion of households with per capita consumption levels equal to and above Rs. 615 in Table 3.46 and add up their shares in households. We then get a weighted average share of the total rural and urban households by using a weightage of 70% for rural and 30% for urban. Adding this would give us the share of households with income levels equal to or more than that of the marginal consumer. To this we would multiply a factor of 2.57, to obtain the teledensity that would account for the various factors which lead to the household teledensity under-estimating the national teledensity. Based on **Table 3.46** the overall likely teledensity if all demand is satisfied by 2007, would be above 23%.

There is a likelihood that the price of handsets may drop in the future, and there may be a fall in the tariff package available, which would allow even lower level of income levels to become part of the market. Thus it is likely that the overall demand in the market would be reflected by teledensity of about 23.5% based on the calculation above, or even higher if the growth rate of income is higher than considered here. Taking this into account and the population of India as the base, the telecom demand in India would be more than 250 million.[87]

If we take more conservative assumptions and consider only those Households which have per capita monthly consumption levels of Rs. 775 and above, the overall demand in the Indian market by the end of the year 2007 would be equivalent to a teledensity of about 17% (potential subscriber base of about 190 million).[88] Considering 20%, i.e. a mid-point between the 17% and 23%, for the equivalent demand would give us a level of potential subscribers of about 220 million by 2007.

It should be noted that these potential demand estimates are for the country as a whole, and would be available for the operators provided the network coverage also extends across the country as a whole. This is unlikely except for the incumbent, BSNL. The plans of the other two main operators seem to suggest that by 2007 their network would cover only about 75% of the population. This would imply covering more than 75% of the potential subscriber base because these 75% population which would be under the network coverage would have a relatively larger market potential (due to a relatively income share and subscriber base share).

Thus, by 2007, the increase in potential subscriber base available for operators in their operational areas, in comparison to the end of 2004,

[87] This is also shown by the data given by ITU (2004) which shows on the basis of UNDP data that 50% of the Indian Households could afford telecom service. Taking a weighted average household size of above 4.5 for India, and multiplying by a factor of 2.57, we get a teledensity of more than 25%.

[88] This estimate for teledensity also arises if we take the monthly consumption threshold of Rs. 615 per person, multiply the factor of 2.57 only to the implied teledensity calculated for urban areas and use zero multiplier for the rural area. A 1% annual increase in population is taken over the period 2004 to 2007.

is likely to be at least about 90 million[89], and would be substantially higher if there is a reduction in the tariff package during the next two years. There is a distinct possibility of such a tariff decrease, as well as a reduction in the handset price.[90]

It is therefore possible that if there is an adequate coverage of the network in the country, and tariffs decline further, then the target subscriber base of 250 million could be realized by end of 2007, or with a lag of about one year.

We saw earlier in the discussion on the Jipp curve that there was adequate basis for service providers to widely install backbone in the country with a demand equivalent to teledensity of about 16%. Since the Jipp curve data pertains to a period prior to the spurt in mobile, it is likely to underestimate the likely demand. Hence, there likely to be adequate basis for a demand level equivalent to a teledensity of about 20% or more.

**Need to cover the gap between overall and incremental availability of backbone**

The extent of backbone in the country will be adequate if we consider the situation in overall or aggregate terms. However, there are parts of the country which will not commercially justify the installation of the backbone, even if the indirect revenues are taken into account. These are likely to be villages with little likelihood of a large enough subscriber base to recover the costs. In such situations, we need to consider three complementary options:

- Possibility of providing the service through radio linkage,
- Assisting the operators through USO expenditure, and
- Increasing the possibility of revenue sources for the operator, including for public access to the service

ITU (2004) shows for India, that the available radio based technologies can on average provide telecom linkage to the villages at about US$ 300 per subscriber, with the upper limit of the cost per subscriber being about $ 700 for remote villages. For the average cost per subscriber of $300, using the required rate of return mentioned in ITU (2004), an ARPU of about Rs. 440 per month would be sufficient to provide adequate return on the investment.

It is likely, however, that the ARPU in the village from telephony may be less than the requisite amount. Thus, additional revenue sources, including for example from broadband connections (both public access and if desired by any person, private connections also) would help increase the revenue base. The broadband connections could become possible with the improvement in mobile technology within the next few years.

---

89 This corresponds to a subscriber base equivalent to 90% of the overall potential subscriber base at 20% teledensity, taking an annual rate of growth of population to be 1% each year between 2004 and 2007.

90 An interesting feature in this regard is that the operators have started giving recharge coupons for pre-paid cards which have a value less than Rs. 300 per month.

Moreover, there are a number of uses with broadband that are being developed in various parts of the world, including India. In fact, in India, these diverse uses are being implemented or planned even with speeds substantially lower than that specified for broadband (see **Annexure 3.10**)

In addition, assistance from the USO Fund could help encourage the incremental extension of backbone, on radio, to the villages which otherwise would not be covered. The recent bids for phone lines in net cost positive SDCAs has amounted to up-front payment ranging from Rs. 3,500 to 17,200 per line, with an average up-front amount of Rs. 10,000 per line.[91] Thus, on average, more than $200 is to be funded for each line in the net cost positive SDCAs from the USO Fund. This would imply that revenues that would recover an up-front investment of about Rs. 4,000 would be sufficient to commercially attract the operator to provide the line.

From the above, it appears that the USO programme would in general, or on average, be sufficient for making backbone links to the villages commercially attractive in the SDCAs which are net cost positive. The issue arises with respect to the incremental investment in other SDCAs, and in SDCAs which would involve a higher investment, e.g. the upper limit of $ 700 per line that is mentioned in ITU (2004). In these SDCAs, the incumbent would be well placed to provide the service especially if there is a move to link all the villages with Broadband. Another possibility could be the States or Provinces themselves having a scheme to link up the villages through their network, such as is being planned in certain States of India. Another possibility is to consider schemes for network sharing, such as the schemes that are used in the "white zones" in France.

Regarding access to the backbone, we will first consider the situation in India with respect to infrastructure sharing. Subsequently, we will discuss the situation regarding the terms and conditions of interconnection. With respect to these aspects, a major point that emerges is that the policy-makers have been evolving the policy structure in India to deal with various concerns, and that the likely policy and market framework that will evolve over the next few years will create better conditions to address even those concerns that remain at present.

## Infrastructure sharing

The policy stance regarding infrastructure sharing in India has been based on a concern that the private operators have largely confined themselves to the urban areas, and that the sharing of infrastructure

[91] These amounts are based on the bids made by the service providers themselves, and thus would cover the requisite amount required to make the investment commercially viable for the bidder. Once the amount is decided on any bid, the same amount is available to all the operators providing connections in that SDCA.

should not allow the operators to bypass their license terms and conditions by showing inter-Circle calls as intra-circle calls. The concern regarding bypass of calls may become non-substantive over time due to implementation of a Unified License regime, phase-out of the ADC regime and prior to that the conversion of the regime to a revenue share, and the proposal of the Minister to have the same call charge for calls throughout the country. The concern of the Government regarding private operators limiting themselves mostly to the urban areas would be addressed if the above-mentioned plans of the operators to extend their networks are implemented soon. For the present, however, infrastructure sharing in India is allowed only to a limited extent, as mentioned below.

The private operators have been raising the issue of infrastructure for quite some time. This matter was addressed initially in 1998 by the Regulator. On 19 August 1998, the TRAI gave a directive addressing certain issues relating to interconnection between DOT and CMTS, namely points of interconnection, set up costs of interconnection, access charges, charges for leased lines, linking with other networks, and sharing of facilities with other networks (see **Annexure 3.10**). For sharing of facilities with operators of other networks, the Directive stated that passive network (e.g. towers) which was not involved in call carriage, could be shared, but permission to share the active network was not given at that time. This matter was to be addressed later, but the situation has still not changed.

Sharing of the network of BSNL by other operators came up again in the context of BSNL allowing the subscribers of other mobile operators to use its network for roaming purposes, but this was not allowed by BSNL on the grounds that it has laid its network with considerable expenses and it forms a commercial niche for its sales on the basis that BSNL can carry calls to all places. Forcing BSNL to allow other operators' subscribers to roam on its network where the other operator did not have its own network, would amount to penalizing BSNL by taking away its market growth strategy and helping the other operators even though they had not invested in the area. The policy maker accepted BSNL's position on this matter.

More recently, the same view has been expressed by the Minister in the context of a request for allowing others to share BSNL's network. In this regard the Minister's statement was reported as follows: "[The Minister] rejected the operators' plea of sharing the Bharat Sanchar Nigam Limited's infrastructure and asked them to build their base in small towns and villages to help boost mobile penetration. … Rejecting the cellular operators' demand for sharing of the BSNL network and infrastructure, particularly in rural areas, the Minister said the government operator took initiative in areas where its private counterparts failed to venture. Now when the BSNL has turned into a good business opportunity, it needs to capitalize on it. … The Government has given enough concessions to the private players and they should now leave Delhi and work in other places to consolidate their position and build infrastructure. Their all other concerns would be taken care of. … The BSNL and private operators should form a forum to discuss various issues such as that of interconnectivity, high licence fee and taxes, and the Government would take pro-active action on them."[92]

This does not mean that BSNL does not give its backbone on lease to other operators. However, the focus of these policies and announcements are that the operators should install their own end links, or active portion of the network. This is also reflected in the current policy of the Government of India on broadband. The recent statement quoted above goes further, shows an emphasis on other operators also installing their network in rural areas, instead of BSNL being the only one or mainly the one to do so.

The TRAI has recently given its Recommendations to the Government, on Unified Licensing. One part of those Recommendations is to allow a "niche operator" in each SDCA with teledensity less than 1%. These niche operators would be able to function efficiently if they have access to the existing network. In this context, it would be worthwhile considering whether the existing operators could also be allowed to share infrastructure at least in these SDCAs, with appropriate cost based prices being charged for sharing the network. One complication would arise if these SDCAs are also net cost positive SDCAs (which is very likely) and are hence covered under the USO programme. It would be necessary to decide whether any additional policy matter needs to be addressed because of the overlap of USO and potential infrastructure sharing, particularly for broadband purposes. In fact, such a policy could be determined after a year or two for the entire rural area, with the main operators having spread their infrastructure in the meantime.

**Interconnection: Timely provision and financial terms and conditions**

As in other countries, the process of liberalization has experienced a number of interconnection problems, relating to both the timely provision of interconnection (or even threat of disconnection), and the amount of money paid for carriage and termination of a call. The discussion below notes a number of points which have led to a view that the Indian telecom industry has faced large number of problems with respect to interconnection. In fact, the interconnection issues began with the initial conditions themselves. The initial policy regime (starting with the License terms and conditions) as well as the incumbent's legacy network and its procedures for procurement of equipment, were responsible for a number of interconnection related problems. The policy maker (both the Government and the Regulator) has taken several steps to address these problems. Today, several interconnection related matters have been settled or are in the process of being settled, but some additional issues still need to be addressed. However, an important point with respect to the future efforts by the Regulator is that with some recent judgements of the TDSAT, there has been a major reduction in the scope of the

---

[92] "Remove Connectivity Hurdles", *The Hindu*, 27th April 2005.

Regulator's powers as defined under the Legal framework compared to that commonly perceived after the amendment in the TRAI Act in 2000.

The interconnection experience in India needs to be considered not only in terms of timely provision of interconnection, but also other key areas where interconnection policy needed to be addressed with experience and review, because in an environment where operators feel interconnection is not being adequately provided, these situations also add to the perception of problems in the interconnection regime. The interconnection issues in India can be considered within a framework with six key components:

- Initial License terms and conditions,
- Interconnection Agreement(s) among operators,
- Changes in License Terms and Conditions,
- Implementation of the Interconnection Usage Charge (IUC) regime and certain Interconnection-related directives of the TRAI,
- The legal framework for the Regulator to intervene in interconnection related matters, and
- Pending issues.

**Initial License Terms and Conditions**

The initial License terms and conditions specified certain conditions for interconnection among the networks of new entrants and the incumbent, and also provided for the negotiation of an interconnection agreement. Such an interconnection agreement was signed between the six new entrants for fixed service, but not for the mobile operators. This Interconnection Agreement provided, inter alia, a period of twelve months for giving interconnection sought by the new entrant. This period basically reflected the view that in most places the incumbent would have to augment its capacity to provide interconnection[93], and that this would take a considerable time due to its procedures for procuring equipment. Moreover, this was considered a not unreasonable situation because it was considered that the new entrants should be in a position to plan ahead for two to three years and give their request for interconnection based on such an assessment. This implied that a substantial time lag would take place after the request for interconnection was made.

The interconnection charges for leased circuit and port charges were high (see for example, Annexure 3.6). Moreover, the charges for leased circuit that were charged to certain operators (e.g. mobile operators) were double the normal charges.[94]

The Licence for fixed line specified particular amounts to be given to the long distance operators for domestic and international long distance

[93] For fixed line operators, the Point of Interconnection was at the SDCA level, or Level III in the network hierarchy). Please see Table 3.33 for the large number of rural exchanges, and Table 3.34 for the SDCCs (which indicate the number of SDCAs) for BSNL. Moreover, a number of urban exchanges of BSNL also had high capacity utilization.

[94] A reflection of this is in Chapter VIII of TRAI (1998), where the principal of non-discrimination is emphasized across services for leased circuit charges.

calls.[95] These amounts were lower than those to be paid under the mobile licenses (see below).

For cellular mobile operators, there was no Interconnection Agreement, and interconnection was provided to them in an ad hoc manner covering various Levels in the network. However, it was mandatory under the License for them to interconnect with other mobile networks only through the fixed network (i.e. the incumbent). For each call which was made from mobile to mobile, they had to pay a charge to the fixed network, equivalent to the highest tariff slab for fixed line. The same charge had to be paid to the fixed line network when a call was made by the mobile subscriber to the fixed line subscriber. In addition, for domestic and international long distance calls, the entire amount of the tariff (charged at the highest tariff charge) had to be given to the long distance operator by the mobile operator. The mobile sector was subject to a mobile party pays regime, and the License specified that the incumbent would not pay the mobile operator for call termination.

For national long distance operators, the License terms and conditions required the operator to interconnect at the LDCA (i.e. second level in the hierarchy) but deliver the call up to the SDCA (third level of hierarchy).

While the time period for interconnection could not be easily addressed initially due to the legacy issues, the Regulator specified certain interconnection charges and notified the guiding principles for the interconnection regime in its Regulation of May 1999, which included non-discrimination, cost based interconnection charges, provision of (and payment for) only that part of the network which was required, timely interconnection, recourse to TRAI in case of delay beyond specified time periods, etc. Even earlier, on 25th April 1997, the TRAI had decided in the case of a petition that "*interconnection should be given at any point required by the operator who seeks that connection, provided that this is technically feasible. In the event that interconnection at a point selected by the interconnection seeker is not technically feasible, it should be indicated by which date technical feasibility could be achieved*".

In addition, both in its Tariff Order of March 1999 and the Interconnection Regulation of May 1999, the TRAI specified cost based tariffs/charges for leased circuit and port charges, which led to a major reduction in the prevailing charges (see for example, Annexure 3.6). Likewise, end-1999, the Government allowed the mobile networks to interconnect directly on a mutually agreed basis. However, an attempt of the Regulator to introduce calling party pays for cellular mobile was struck down by the Court on the grounds that the cellular mobile License specified that the incumbent should not pay mobile network for call

[95] For local calls, the License specified bill and keep, and for domestic long distance calls the long distance operator had to be paid at Rs. 0.50 per pulse and for international calls the amount was Rs. 0.70 per pulse. There was no termination charge.

termination, and the TRAI did not have the authority to overturn License terms and conditions.

While the above process was going on, there were various occasions when the incumbent used to threaten disconnecting the interconnection on the grounds that the new entrants had not met the requisite conditions. The Regulator used to intervene in such situations and allow further action only on the basis of an examination of the incumbent's justification of its proposed action.[96] The TRAI also started monitoring the time taken by the incumbent to provide interconnection, and it emerged that while the incumbent was taking time to give interconnection (for a variety of procedural reasons which in a number of cases showed expected incumbent behaviour, as well as due to lack of adequate capacity and thus a need to augment capacity). The Regulator instituted a process to address these matters (see below, in the next sub-section). In some cases it was found that there was an inflated demand because the newly announced prices for ports gave operator's an incentive to seek a larger number of ports than was perhaps required.[97] This was addressed by the Regulator by revising the port charges to remove the existing anomaly.

**Interconnection Agreements among operators**

As mentioned above, while there was an Interconnection Agreement between the incumbent and the fixed operators, the interconnection agreement among the incumbent and the cellular mobile operators was not in place. Since reaching agreement in this regard was proving difficult, the Regulator tried to mediate through its good offices to help the parties reach an agreement. For this purpose, the TRAI also gave a determination, which specified the points of interconnection where cellular operators should be given interconnection,[98] and that interconnection could be given at other places with mutual consent. It also clarified that any existing interconnection which was at levels other than those mandatory, should be allowed to continue.[99] The TRAI Determination on interconnection, however, was not made effective because the matter ended up as a dispute in the Telecom Dispute Settlement and Appellate Tribunal (TDSAT).

A number of Interconnection Agreements were finalized among the incumbent and the new entrants, which were examined by the TRAI and intervened wherever certain regulatory principles were violated. Since the Agreements involved mutual agreement, it was considered inappropriate to intervene otherwise. This did, however, lead to agreements which

---

[96] In general, the Regulator's intervention used to act as a mediation and the incumbent would not disconnect the link, providing the other party more time to address the matter. In certain cases where the links had been disconnected, they were normally restored with the Regulator's mediation.

[97] This was happening because after a particular number of ports, the technological base used to calculate the price was different and a larger number of ports were also available for the same amount of money as smaller number of ports with more traditional technology.

[98] This was "Level I", or the highest Level, in the network hierarchy.

[99] For more detail, see the TRAI website (trai.gov.in) for "TRAI Determination on Interconnection, dated 25th November, 2005, under the category "Directives".

involved onerous conditions for the new comers, particularly with respect to the interconnection usage charge regime (i.e. carriage and termination charges levied by the incumbent).

The Regulator was concerned that at least a minimum capacity should be provided through interconnection to the new entrants, and that various technical problems relating to interconnection be monitored and addressed. A Technical Committee was established under the aegis of TRAI, with all operators and certain TRAI officials as members, for this purpose, but the issues were only partly addressed through this mechanism. In this background, the TRAI notified a Regulation on Interconnect Offer (RIO). The RIO was an attempt to address all the diverse interconnection issues, including the number of interconnection links that should be provided within a specified shorter period (e.g. 90 days).[100] The RIO was also taken to the TDSAT under a dispute. A recent TDSAT judgment in this case has been challenged by the TRAI in the Supreme Court.

Recognizing the constraint imposed by the limited capacity in the incumbent's exchange, the Regulator has also begun a process to consider whether an internet exchange could be put in place through which all operators have adequate capacity for interconnection.

**Changes in the License terms and conditions and certain Interconnection related policies**

Three of the most significant changes in the License terms and conditions which have affected interconnection matters are:

- Allowing basic service Licensees to give wireless in local loop with limited mobility service (or WLL-M), in addition to fixed service,
- Introduction of calling party pays regime for mobile, and
- The introduction of the Unified Access Service License regime.

The introduction of WLL-M service led to severe disputes on the legality of the policy as well as the terms and conditions at which the service had been allowed. With respect to interconnection, a major point raised by the cellular mobile operators[101] was that WLL-M was treated identically as fixed service, despite providing mobility within the local call area, and thus the Points of Interconnection being at SDCA were more favourable and the cellular mobile had to pay termination charges to WLL-M in the same manner as for calls to fixed line. This meant that the tariff of WLL-M could be lower[102] and the termination charge paid to WLL-M allowed it to use these funds to compete with cellular mobile because the

[100] The main issues addressed by the RIO included, inter alia, traffic routing and Points of Interconnection, co-location, provisioning of interconnection circuits, carrier selection, charging mechanism and account settlement (inter-operator billing), costs of interconnection/upgradation, and interconnection usage charge. The last item was addressed in greater detail in other Regulations.

[101] This was, of course, in addition to the basic point of the cellular mobile operators that the Government had breached its License conditions by allowing WLL-M service for the fixed operators.

[102] This was because the call handover was in the local call area and thus the carriage component (or the distance component) in the tariff was less.

cellular mobile had a mobile party paid regime (i.e. it did not receive any termination charge). This matter was addressed first when the calling party pays regime was introduced together with the IUC regime, and finally (and fully) when the Unified Licensing regime allowed all such Licensees to provide full mobility service also.

The introduction of a calling party pays regime was allowed as a result of the change in the condition in the mobile License that DOT (the operator) would not have to pay termination charge to mobile network. The introduction of the calling party pays regime changed the payment structure for call termination, and also introduced the same termination charge for cellular mobile and WLL-M, together with an overall IUC regime. Experience and inputs from the industry showed certain difficulties and anomalies with respect to the initial interconnection regime. The Regulator addressed these in an amended regime based on a review, and inter alia specified the same termination charge for the call irrespective of where it terminated. This has paved the way for having a regime for converged services.[103]

The Unified Access Service (UAS) License regime allowed an operator to provide any access service under the same License. This meant that all UAS Licensees could provide full mobile services in addition to fixed and limited mobility services (and vice versa). This implied that a number of WLL-M subscribers could now become fully mobile subscribers without much change in conditions if the market conditions led to such a situation. A large number of subscribers opted for such a conversion. This raised certain interconnection related problems[104] which were addressed within a transition period.

**Implementation of the Interconnection Usage Charge (IUC) regime**

The Regulator notified an Interconnection Usage Charge (IUC) regime in January 2003 (implemented May 20030, under which it specified charges for call origination, carriage and termination, and an Access Deficit Charge (ADC) regime.

The IUC regime was specified in terms of per minute charges, which was difficult to implement mainly because the incumbent did not have the relevant equipment in place. Additionally, certain inconsistencies were seen between the IUC regime, including the fact that the reported tariffs for fixed line service were lower than the IUC incorporated rates, and the operator stated that this was required in order to compete with cellular

[103] It is noteworthy that the regime was worked upon at the same time as the TRAI's work on the Recommendations for Unified Access Service License, which was part of (and the first phase of) the overall Recommendations on Unified License.

[104] These problems arose mainly for two reasons. Since the Points of Interconnection are different for full mobility and others, this meant a major change in the available interconnection links at the POI for full mobility. Furthermore, as these links were at the LDCA from where the call had to be carried further to the called party, which implied a carriage charge for such calls. To identify these calls for this purpose, specific numbers had to be provided for the full mobility service.

mobile service which had relatively lower tariffs for long distance calls.[105] The TRAI reviewed and revised its regime for IUC, including specifying the same termination charge for calls irrespective of which network they terminated.

The IUC regime incorporates an ADC regime to compensate the fixed line operators for providing below cost access, and their inability to increase their local call charges while there was intense competitive pressure on their long distance charges. Since the competitors, namely the mobile operators, were not under a similar constraint, they were able to charge more for shorter distance calls and could therefore compete effectively in the long distance call market. The ADC has been provided to smoothen the process of adjustment during the period of intense competition in the long distance market, and is to be phased out in a few years. However, since the ADC is specified in per minute terms[106], there have been some problems in its implementation because of inadequate equipment with the incumbent to make the requisite measurements. While a method to broadly address this problem was devised earlier, the incumbent has now established the equipment required for this purpose. There are a number of other issues also which arise in the context of this regime. The TRAI is in the process of reviewing this regime.

**Certain Interconnection-related directives of the TRAI**

The Regulator has given a number of directives etc. to address interconnection related matters. Three examples will illustrate the types of issues that arise and the process taken by the system to address the.

One, relates to the TRAI's steps to address BSNL's decision that while it will charge discounted tariffs for long distance calls from its own customers, the carriage on its network of calls from other operators will be charged at the ceiling rate specified for long distance tariffs by the TRAI. Since this would have created a non-level playing field, the TRAI notified that the same charges must be charged by BSNL for both types of calls. This matter was taken as a dispute by BSNL to TDSAT, and took a long time to be fully disposed. Meanwhile, the notification of the IUC regime had over-taken the issue by specifying the carriage charges and also specifying that the tariff regimes should be IUC consistent.

Another relates to the insistence by BSNL that for its mobile service, it did not need to directly interconnect with another mobile operator irrespective of whether the other operator requests for such interconnection. This meant that the mobile operators would interconnect with BSNL mobile through the exchanges of BSNL fixed service, and in that process pay a specified amount to BSNL each time the call was carried forward. In addition, while under the Indian regime, the interconnection seeker has the responsibility to bear the costs of linking up, in this case the previously established mobile operators would do so

[105] Calls from cellular mobile service was not included in the ADC regime notified in January 2003.
[106] This was done because the regime tries to balance a number of objectives, with a primary emphasis on providing a framework for price reduction while maintaining local call charges.

because in relation to the fixed service provider, they were the interconnection seeker. The TRAI directed that direct connectivity be provided if any operators seeks it, but this direction was taken as a dispute to the TDSAT, and a decision in this regard has been given recently. In its decision, the TDSAT has stated that direct connectivity need not be provided but the mobile operators will not pay BSNL for the calls to BSNL mobile. The TRAI has taken the case in appeal to Supreme Court.

A third example is of a direction by TRAI to BSNL that it must restore Points of Interconnection to a certain service provider. This direction was also taken to the TDSAT by BSNL on the grounds that TRAI did not have the jurisdiction to do so. The TDSAT has ruled in favour of BSNL. These judgments have defined the legal framework of operation for TRAI in such a way that in effect, the TRAI will not be able to play the role of mediator or quickly address interconnection related problems, as explained below.

**The legal framework for the Regulator to intervene in interconnection related matters**

A number of cases relating to the TRAI have been filed in the High Court as well as the TDSAT (please see **Annexure 3.11** for a Table on interconnection related cases). It was mentioned earlier in this paper that the High Court had ruled that calling party pays regime for mobile could not be implemented because TRAI did not have the powers to change the License terms and conditions, and because the mobile License specified that DOT (the operator) did not have to pay mobile operators for call termination.

The amendment in the TRAI Act in 2000 established the TDSAT, and provided additional powers to the TRAI with respect to interconnection. However, certain recent judgements of the TDSAT have circumscribed the legal framework in such a manner that TRAI's role in interconnection matters is effectively circumscribed. Two features of these judgements are noteworthy in this regard.

One, is that the TDSAT has decided in its judgements that if there is any dispute relating to any matter under the TRAI Act (which includes Section 11(1)(b) or otherwise), the matter goes beyond the TRAI's jurisdiction. In a judgement dated 21st April, 2004 in a case pertaining to TRAI's Directions on an interconnection matter (disconnection of Points of Interconnection), the TDSAT has stated: "*But when dispute arises and if there has been any breach of the license agreement or in the terms of interconnecting between the service providers, it is Appellate Tribunal (TDSAT) which is the sole judicial authority to decide the dispute on a complaint filed by the service provider or group of consumers or licensor to see that the service providers conforms to the terms & conditions imposed by the Licensor in its license and by TRAI in the interconnection agreement between the service providers. Functions of TRAI are in all together different place.*

*The appeal is, therefore, allowed and the impugned Direction is set aside except the period of notice for disconnection of POI which shall not be less than 10 days*."

Such a decision was re-iterated by TDSAT in other judgments, e.g., dated 10th and 16th August, 2004. In the latter Decision, for example, the TDSAT has stated: "*Based on the detailed reasoning spelt out in the said order TDSAT had set aside the impugned directions of the TRAI and had clearly held that when a dispute arises in regard to breach of license agreement or the terms of inter connectivity between service providers, it is the TDSAT which is the sole judicial authority to decide the dispute*".

Another decision of TDSAT is that the additional powers that TRAI got when the Act was amended, only allows TRAI to change the interconnection conditions for Licenses prior to the amendment of the Act, so as to make them consistent with the later Licenses as far as interconnection was concerned. The TRAI does not have any other additional power with respect to interconnection.

Since any problem related to inter-connection will likely be a dispute or can be made a dispute, the role of TRAI in addressing the problem through mediation is finished. Moreover, since a number of interconnection related issues are mentioned in the License, which the TRAI does not have the power to over-rule, the scope of TRAI's action on interconnection is therefore reduced in a major way. This is an aspect which will need to be given due thought by the Government.

# ANNEXS: Asian Backbone Study: A general model applied to India

**Harsha Vardhana Singh**[107] **with assistance from Rohan Samarajiva and Ayesha Zainudeen**[108]
www.lirneasia.net
Version 1.7, March 2006



LIRNEasia
Learning Initiatives on Reforms for Network Economies

[107] Former Senior Economist LIRNE*asia*. At the time of writing he was on leave as Secretary of the Telecommunications Regulatory Authority of India.
[108] Executive Director and Researcher, respectively at LIRNE*asia*

## *Annex 2.1: Fixed Wireless Access (FWA) Technologies for Broadband*

### *1. Introduction:*

Broadband can be deployed through following access technologies:

- o DSL on the existing copper loops
- o Cable Modem on the Cable TV network
- o Terrestrial Wireless based (radio) technologies
- o Satellite based technologies (VSAT & DTH)

Among the above, terrestrial wireless based technologies have started becoming very popular because of the technological developments, ease of deployments and cost advantages. Most significant among these are Fixed Wireless Access (FWA) technologies, which are described below:

### *2. Fixed Wireless Access (FWA) Technologies*

Fixed wireless systems make use of radio spectrum, which is a finite and scarce resource. Fixed wireless systems generally use frequencies between 700 MHz to 40 GHz, with higher frequencies able to carry far more data but not able to travel as far as lower frequencies and often require line of sight. Higher frequencies also require more complex equipment, which can be more expensive. Some of the important types of FWA technologies are described below:

- **Multipoint microwave distribution system (MMDS)**
  It is a fixed wireless technology, which exists n microwave bands normally beyond 2 GHz. MMDS was traditionally used to provide one-way, analogue wireless cable TV broadcast service and was widely known as "wireless cable". MMDS frequencies (2.5 GHz to 2.9 GHz, 3.3 GHz to 3.5 GHz) are now increasingly being used for providing broadband services. This frequency range does not require line of sight. With MMDS, a transmitting tower must be placed at a high elevation and can provide high-speed data rates of up to 10 Mbps over a 48-56 km radius.
- **Local multipoint distribution system (LMDS)**
  LMDS was originally designed for wireless digital television transmission over short distances. It occupies a large amount of spectrum above 20 GHz (10 GHz to 11 GHZ, 24 GHz to 30 GHz) and requires Line Of Sight (LOS) clearance. It can provide two-way broadband service including video, telephony and high-speed Internet access. These have not become very popular because of their very short ranges (Few Kms).
- **Wireless LAN (Wi-Fi) Technologies**
  A wireless local area network (WLAN) is a local area network using radio waves to transmit and receive data over short distances in place of wired access. Mobile devices access the "wired" network by connecting, to an Access Point (AP) in the network. Wireless LAN’s are most commonly used as last 100 meters diffusers of a broadband connection, although they are being used increasingly as methods of providing broadband access over longer distances in rural areas by increasing power levels of the equipment, using specialized antennae, and ensuring line-of-sight clearance.

Several factors have contributed to the phenomenal growth of WLAN's: a steep drop in prices, the mobility benefits of wireless connectivity, off-the-shelf availability, and easy installation. Different variants of WLAN technologies are following:

**i.** **802.11b (Wi-Fi)**– It uses the 2.4 GHz frequency band to deliver 11 Mbps of data over a range of 100 meters, although obstacles such as trees or walls between the wireless adapter and the access point cause the speeds and range to drop. Directional antennae and amplifiers (provided the total power radiated does not exceed what is allowed by nationally applicable regulations) can be used to extend the range of 802.11b products. 802.11b is a half duplex protocol - whereby transmissions can be sent or received at a time, but not simultaneously. It shares the 2.4 GHz band (ISM band normally unlicensed) with cordless phones, microwave ovens and some wireless local loop (WLL) radio systems. Therefore, it is prone to interference.

**Range of Wi-Fi in Different Environments**

| **Environment** | **Range** | |
|---|---|---|
| | Maximum | at 11Mbps |
| Outdoors / open space with standard antenna | 225 - 300 m | 45 – 100 m |
| Office / light industrial setting | 75 - l00 m | 30 - 45 m |
| Residential setting | 40 - 60 m | 20 - 25 m |

**ii.** **802.11a (Wi-Fi5)** – 802.11a was conceived earlier than 802.11b, but took longer to develop and was later to market than more popular variant, 802.11b. 802.11a uses the less-crowded 5 MHz band and enables speeds of up to 54 Mbps, almost five times faster than Wi-Fi. Wi-Fi products are currently less expensive and much more prevalent that 802.11a ones, and the arrival of newer technologies such as 802.11g are making 802.11a even less likely to gain a large following. 802.11a has the advantage of operating at fast speeds in an open area of spectrum and the recent decision by the ITU World Radio Conference in July 2003 to release additional spectrum for WLAN use in that range may also add to its popularity

**iii.** **HiperLAN2** – HiperLAN2 stands for "High Performance Radio Local Area Network" and is a European WLAN standard developed by the European Telecommunications Standards Institute (ETSI). It operates in the same 5 GHz frequency band as 802.11a, using orthogonal frequency division multiplexing (OFDM) and offering data rates of up to 54 Mbps, but their modulation schemes are different. HiperLAN has some advantages by making more efficient use of the spectrum and can transfer more data at any given time. In addition, HiperLAN offers quality of service support that is not possible with 802.11a, making HiperLAN a better choice for time-sensitive transmissions such and video, audio, and voice.

iv. **802.11g** – This is the latest WLAN standard, and has recently become available off the shelf. 802.11g is backward compatible with Wi-Fi because both run in the same frequency band of 2.4 GHz. But, by using the same Orthogonal Frequency Division Multiplexing (OFDM) modulating technique, it enables speeds of up to 54 Mbps. With equipment being closely priced to 802.11b devices, while providing five times the speed and backwards compatibility, 802.11g is likely to become the dominant WLAN technology for shorter ranges

v. **802.16 (WiMAX)** – It stands for Worldwide Interoperatability of Microwave Access. The IEEE recently standardized 802.16 as a new fixed-wireless standard using point-to-multipoint architecture. The initial version (802.16) was developed to meet the requirements for broadband wireless access systems operating between 10 and 66 GHz, while a recent amendment (802.16a) does the same while using radio spectrum between 2 and 11 GHz. WiMAX equipment is able to cover a range of 32 - 56 km with maximum data rates close to 70 Mbps. Unlike wireless LAN technologies in the 802.11 series, WiMAX is meant to be a high-speed wireless backbone for larger distances.

Recently, another variant of Wi-Max is being talked about in the form of 802.16e. This is being developed to provide mobility to the wireless broadband.

Various radio bands being used for Wi-Max deployment are following:

- Licensed 2.5 GHz MMDS band
- Licensed 3.5 GHz MMDS band
- Unlicensed 3.6 GHz to 3.7 GHz band
- Unlicensed 5.1 GHz to 5.4 GHz and 5.7 GHz to 5.8 GHz band

### *3. Summary*

The summary of various WLAN standards is given below:

**A. Wi-Fi**

| | **802.11** | **802.11b** | **802.11a** | **HiperLAN2** | **802.11g** |
|---|---|---|---|---|---|
| Spectrum Band | 2.4 GHz | 2.4 GHz | 5 GHz | 5 GHz | 2.4 GHz |
| Data rate | 2.4 Mbps | 11 Mbps | 54 Mbps | 54 Mbps | 54 Mbps |
| Standard by | IEEE | IEEE | IEEE | ETSI | IEEE |
| Modulation/ Radio technique | FH/DS (QPSK) | DS (QAM) | OFDM | OFDM | OFDM |
| Channel Bandwidth | 10-20 MHz | 10-20 MHz | 10-20 MHz | 10-20 MHz | 10-20 MHz |
| Typical range* | 100 m | 100 m | 100 m | 100 m | 100 m |

* This range can be improved upon (few Km) in non urban area by using high power equipment and high gain special antennas as well as the height of transmitter’s tower

**B. Wi-Max**

| | **802.16** | **802.16a** | **802.16e** |
|---|---|---|---|
| Spectrum Band | 10-66 GHz | 2-11 GHz | <6 GHz |
| Data rate | 32-134 Mbps | 70-100 Mbps | Upto 15 Mbps |
| Configuration | LOS | NLOS | NLOS |
| Modulation/ Radio technique | QAM | OFDM | OFDM |
| Channel Bandwidth | 20-28 MHz | 1.25 – 20 MHz | 5 MHz |
| Mobility | Fixed | Fixed | Upto 120 Kmph |
| Typical range | 2-5 Km | 5-8 Km | 2-5 Km |

## Annex 2.2: Distribution of Households by Incomes In India, at 1998-99 Prices

(Source: NCAER (2003)

**Table A 2.1. Distribution of Households in India by Annual Income Levels, 1985-86 (at 1998-99 prices)**

| Annual Income (Rs.) at 1998-99 prices | Urban (%) | Rural (%) | Total (%) |
|---|---|---|---|
| **≤ 35,000** | 42.1 | 73.6 | 65.2 |
| **35,001 – 70,000** | 35.8 | 21.4 | 25.2 |
| **70,001 – 105,000** | 15.2 | 4.0 | 6.9 |
| **105,001 – 140,000** | 3.9 | 0.7 | 1.5 |
| **> 140,000** | 3.1 | 0.3 | 1.1 |
| **Total** | 100 | 100 | 100 |

**Table A 2.2. Distribution of Households in India by Annual Income Levels, 1992-93 (at 1998-99 prices)**

| Annual Income (Rs.) at 1998-99 prices | Urban (%) | Rural (%) | Total (%) |
|---|---|---|---|
| **≤ 35,000** | 38.4 | 65.5 | 58.2 |
| **35,001 – 70,000** | 33.0 | 22.6 | 25.4 |
| **70,001 – 105,000** | 16.1 | 8.2 | 10.4 |
| **105,001 – 140,000** | 7.6 | 2.3 | 3.7 |
| **> 140,000** | 4.9 | 1.4 | 2.3 |
| **Total** | 100 | 100 | 100 |

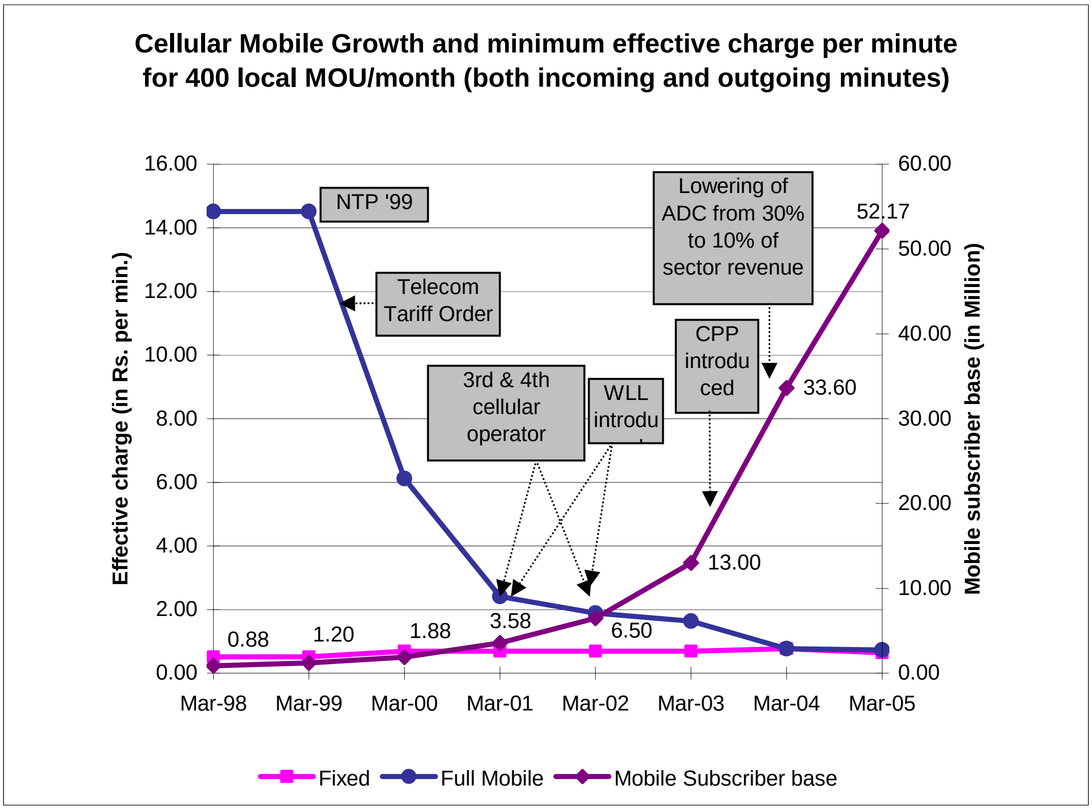
**Table A 2.3. Distribution of Households in India by Annual Income Levels, 1998-99 (at 1998-99 price**

| Annual Income (Rs.) at 1998-99 prices | Urban (%) | Rural (%) | Total (%) |
|---|---|---|---|
| **≤ 35,000** | 19.0 | 47.9 | 39.7 |
| **35,001 –** | 33.8 | 34.8 | 34.5 |

| | | | |
|---|---|---|---|
| **70,000** | | | |
| **70,001 – 105,000** | 22.6 | 10.4 | 13.9 |
| **105,001 – 140,000** | 12.2 | 3.9 | 6.2 |
| **> 140,000** | 12.5 | 3.0 | 5.7 |
| **Total** | 100 | 100 | 100 |

## Annex 2.3: Cellular mobile growth and minimum effective charges

(per minute for 400 local MOU/month, incoming and outgoing)



## *Annex 3.1: Functions of the Telecom Regulatory Authority of India, as specified in Section 11 of the Telecom Regulatory Authority of India (as amended in 2000) Act 1999*

**11. Functions of Authority**

Notwithstanding anything contained in the Indian Telegraph Act, 1885, the functions of the Authority shall be to-

(a) make recommendations, either suo motu or on a request from the licensor, on the following matters, namely:-

- (i) need and timing for introduction of new service provider;
- (ii) terms and conditions of license to a service provider;
- (iii) revocation of license for non-compliance of terms and conditions of license:
- (iv) measures to facilitate competition and promote efficiency in the operation of telecommunication services so as to facilitate growth in such services.
- (v) technological improvements in the services provided by the service providers.
- (vi) type of equipment to be used by the service providers after inspection of equipment used in the network.
- (vii) measures for the development of telecommunication technology and any other matter relatable to telecommunication industry in general;
- (viii) efficient management of available spectrum;

(b) discharge the following functions, namely:-

- (i) ensure compliance of terms and conditions of license;
- (ii) notwithstanding anything contained in the terms and conditions of the license granted before the commencement of the Telecom Regulatory Authority (Amendment) Ordinance,2000, fix the terms and conditions of inter-connectivity between the service providers;
- (iii) ensure technical compatibility and effective inter-connection between different service providers.
- (iv) regulate arrangement amongst service providers of sharing their revenue derived from providing telecommunication services;
- (v) lay down the standards of quality of service to be provided by the service providers and ensure the quality of service and conduct the periodical survey of such service provided by the service providers so as to protect interest of the consumers of telecommunication services;
- (vi) lay down and ensure the time period for providing local and long distance circuits of telecommunication between different service providers;
- (vii) maintain register of interconnect agreements and of all such other matters as may be provided in the regulations;

(viii) keep register maintained under clause (viii) open for inspection to any member of public on payment of such fee and compliance of such other requirement as may be provided in the regulations;

(ix) ensure effective compliance of universal service obligations:

(c) levy fees and other charges at such rates and in respect of such services as may be determined by regulations.

d) perform such other functions including such administrative and financial functions as may be entrusted to it by the Central Government or as may be necessary to carry out the provisions of this Act:

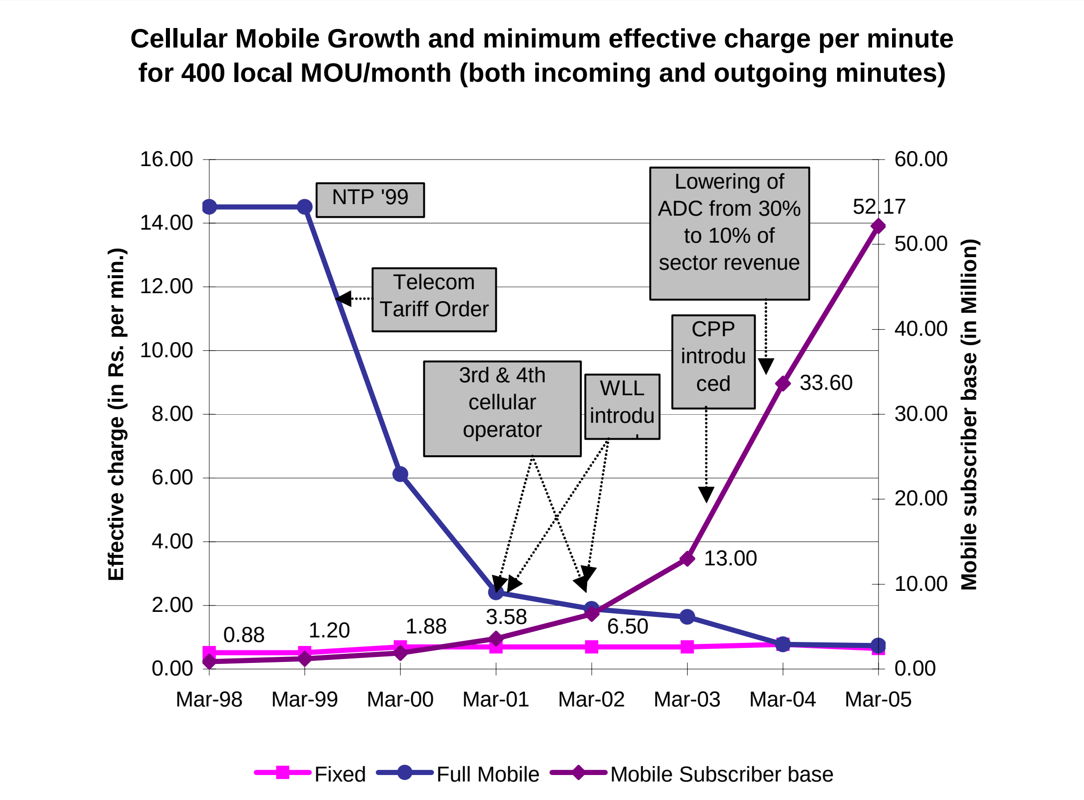
Provided that the recommendations of the Authority specified in the clause (a) of this sub-section shall not be binding upon the Central Government:

Provided further that the Central Government shall seek the recommendations of the Authority in respect of matters specified in sub-clauses (i) and (ii) of clause (a) of this sub-section in respect of new licence to be issued to a service provider and the Authority shall forward its recommendations within a period of sixty days from the date on which that Government sought the recommendations:

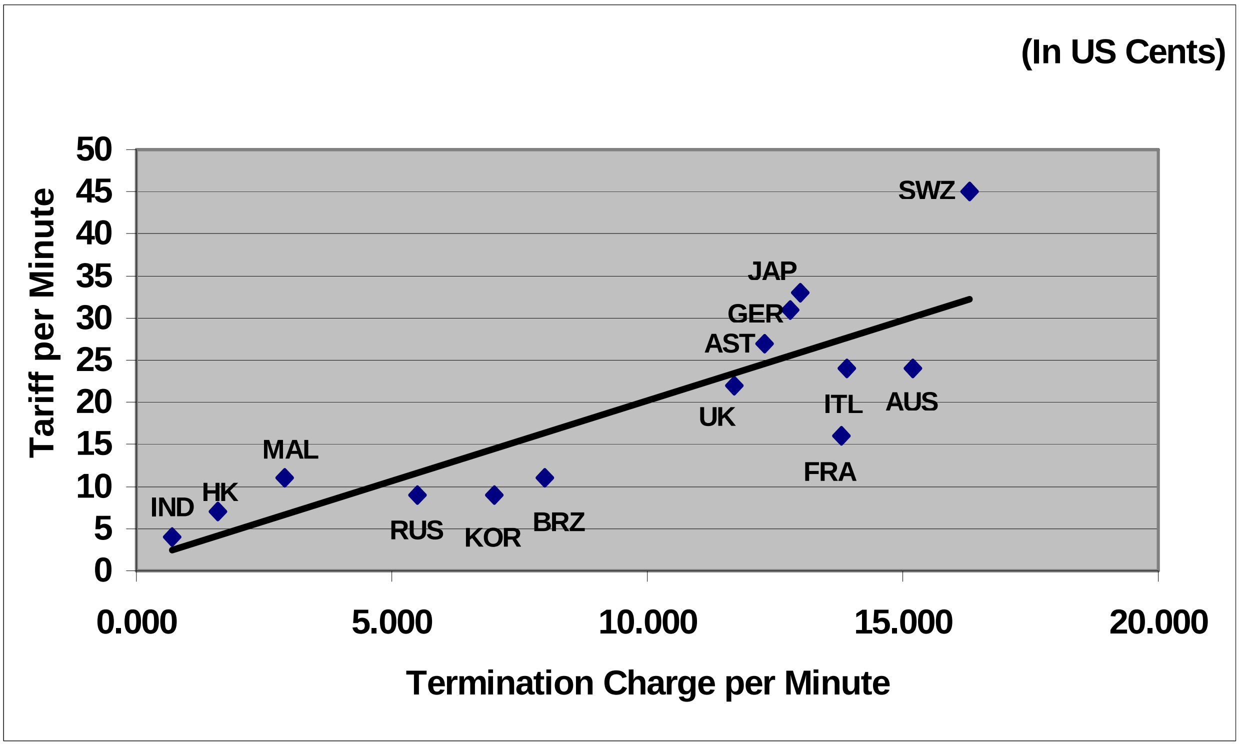
Provided also that the Authority may request the Central Government to furnish such information or documents as may be necessary for the purpose of making recommendations under sub-clauses (i) and (ii) of clause (a) of this sub-section and that Government shall supply such information within a period of seven days from receipt of such request:

Provided also that the Central Government may issue a licence to a service provider if no recommendations are received from the Authority within the period of specified in the second provision or within such period as may be mutually agreed upon between the Central Government and the Authority.

## *Annex 3.2: Cellular mobile growth and minimum effective charges*



## Annex 3.3: Per minute tariff versus termination charge per minute, international comparison




**Per minute tariff versus termination charge per minute, international comparison.**

## *Annex 3.4: Comparison of Monthly ARPU, Minutes of Use Per Subscriber (MOUPS), and Rate Per Minute for Calls*

| | | ARPU (US$) | MOUPS (Minutes) | Rate Per Minute (US$) |
|---|---|---|---|---|
| **4** | **Argentina** | **13** | **121** | **0.11** |
| **5** | **Australia** | **43** | **159** | **0.24** |
| **6** | **Austria** | **40** | **127** | **0.27** |
| **7** | **Belgium** | **42** | **108** | **N.A.** |
| **8** | **Brazil** | **11** | **92** | **0.11** |
| **9** | **Canada** | **39** | **344** | **0.11** |
| **10** | **Chile** | **12** | **105** | **0.12** |
| **11** | **China** | **10** | **261** | **0.04** |
| **12** | **Colombia** | **11** | **106** | **0.10** |
| **13** | **Czech Rep.** | **21** | **80** | **0.22** |
| **14** | **Denmark** | **32** | **155** | **0.17** |
| **15** | **Egypt** | **17** | **167** | **0.10** |
| **16** | **Finland** | **43** | **247** | **0.15** |
| **17** | **France** | **40** | **213** | **0.16** |
| **18** | **Germany** | **28** | **74** | **0.31** |
| **19** | **Greece** | **34** | **117** | **0.25** |

| | | | | |
|---|---|---|---|---|
| **20** | **Hong Kong** | **27** | **380** | **0.07** |
| **21** | **Hungary** | **25** | **118** | **0.22** |
| 22 | India | 11 | 309 | 0.04 |
| **23** | **Indonesia** | **11** | **NA** | **NA** |
| **24** | **Ireland** | **54** | **198** | **0.21** |
| **25** | **Israel** | **36** | **297** | **0.11** |
| **26** | **Italy** | **32** | **118** | **0.24** |
| **27** | **Japan** | **63** | **156** | **0.33** |
| **28** | **Korea** | **35** | **316** | **0.09** |
| **29** | **Malaysia** | **20** | **185** | **0.11** |
| **30** | **Mexico** | **18** | **105** | **0.17** |
| **31** | **Netherlands** | **38** | **137** | **0.24** |
| **32** | **New Zealand** | **33** | **147** | **0.20** |
| **33** | **Nigeria** | **48** | **NA** | **NA** |
| **34** | **Norway** | **49** | **191** | **0.21** |
| **35** | **Philippines** | **8** | **NA** | **NA** |
| **36** | **Poland** | **19** | **71** | **0.24** |
| **37** | **Portugal** | **30** | **120** | **0.23** |

| | | | | |
|---|---|---|---|---|
| **38** | **Russia** | **13** | **130** | **0.09** |
| **39** | **Singapore** | **31** | **277** | **0.09** |
| **40** | **South Africa** | **27** | **140** | **0.18** |
| **41** | **Spain** | **37** | **132** | **0.25** |
| **42** | **Sweden** | **28** | **119** | **0.22** |
| **43** | **Switzerland** | **59** | **119** | **0.45** |
| **44** | **Taiwan** | **19** | **193** | **0.09** |
| **45** | **Thailand** | **9** | **NA** | **NA** |
| **46** | **Turkey** | **14** | **66** | **0.19** |
| **47** | **UK** | **39** | **144** | **0.22** |
| **48** | **US** | **57** | **619** | **0.09** |
| **49** | **Venezuela** | **16** | **77** | **0.21** |
| 50 | Average | **30** | **235** | **0.13** |

## Annex 3.5: Summary of the Main Infrastructure Provider – II Licensees in India

(Relies on Hajela (2002), and on information provided by the service providers)

**RailTel**

Until the early 1960s the telecom requirements of Indian Railways depended on the DOT. Over time, the Railways built their own nationwide network consisting mainly of microwave systems in SHF band with UHF spur links, copper quad cables, overhead alignments, Optical Fibre cables, local telephones and transit exchanges. Recently, internet and mobile services have been introduced.

In the late 1990s, OFC began to be installed on electrified track systems, and was then extended to the non-electrified track sections. The telecom network of the Railways is capable of providing bandwidth far in excess of its own requirements. In this background, the Railway Ministry established a Telecom Corporation, The Railtel Corporation of India to build a nationwide broadband telecom and multimedia network.

Railtel has the following Licenses:

- Infrastructure Provider Category – I (IP – I)
- Infrastructure Provider Catgeory – II (IP – II)
- Internet Service Provider Category A (i.e. all India coverage)

Railtel is building its network to provide high quality bandwidth services in such a way that important cities fall in at least two rings. Presently the network is spread along the railway track. The total network is broadly divided at three levels: STM – 16 based long haul network (this will connect important business centres and LDCAs as defined by DOT; the long haul is being built with the ring length of 1,500 to 2,000 Rkms.); STM – 4 based edge layer network; and STM – 1 based access network. The STM-1/4 is another layer on separate fibre which connects other, relatively less important cities and important SDCA (as defined by DOT). Overlaid on the backbone is the planned MPLS based IP network to provide for IP services.

RailTel has provided PDH electronic on 7,141 kms., STM-1 on 15,544 kms., STM-4 on 1,308 kms., and STM-16 on 4,846 kms. It offers a number of services which include:

- Bandwidth from 64 kbps to 156 kbps and 2.5gbps;
- Tower space for antennae (with 600 towers nationwide);
- As Internet Service Provider.

In future, it is planning to provide services including:

- Co-location facilities;
- Virtual private network;
- National long distance service;
- International long distance service.

Its clients till March 2005 included a wide range covering a number of service providers, Internet Service Providers, educational institutions, and some other companies. On 31st March 2005, it had rented out 1,232 E1s.

By 31st March 2004, RailTel had invested Rs. 7,280 million, of which Rs. 3,780 million were for right of way. According to Hajela (2004), RailTel proposes to invest Rs. 11,450 million in its capacity by the year 2007-2008. By March 2008, Railtel is expected to have 42,618 RKms. of fibre.

Railtel is implementing a comprehensive plan to establish cybercafes at all its railway stations, to be operated on a franchisee basis.

**Power Grid Corporation of India Limited (Powertel)**

Power Grid Corporation of India Ltd. Is the national power transmission grid utility. Relying on the availability of optic fibre ground wire all along the transmission lines, PGCIL diversified into Telecommunications in January 2001. The telecom wing of Power Grid is known as Powertel. It has Licenses for:

- Infrastructure Provider Category – I (IP – I)
- Infrastructure Provider Catgeory – II (IP – II)
- Internet Service Provider Category A (i.e. all India coverage)

In addition, it plans to extend its activities to the national long distance sector, provide international connectivity, especially with neighbouring countries. In collaboration with the State Electricity Boards and Access Provider(s), Powertel is considering to form a Joint Venture Company to provide VOIP and Information services.

Power Grid is planning by next year to have a broadband network of about 19,400 kms. As on March 2005, the network commissioned was 15,534 kms. In the financial year 2005-2006, another 3,818 kms. will be commissioned. This network connects all the metros on a DWDM network (about 6,400 kms.), and the rest of the network is on SDH links. Major nodes lie on at least two rings. Its network spread goes deep into North-East, far North and to coastal areas, and also several rural and remote areas.

Power Grid had invested about Rs. 8,000 million by March 2005, and plans to invest about Rs. 1,500 million during the financial year 2005-06.

Customers of Power Grid include operators, internet service providers, software companies, and other companies. By March 2005, it had leased out capacity of 1,400 E1s.

**GAIL (India) Limited (GailTel)**

The Gas Authority of India Limited (GAIL) was established in 1984, and was converted into a corporate entity in 2002 under the name of GAIL (India) Ltd.. Telecommunication is an operational necessity for efficient management and functioning of the core business in the Gas sector. A separate Division, GAIL TEL was formed on 4th June 2000. It has the Licenses for Infrastructure Provider – II, and for Internet Service Provider Category A (i.e. All India). In addition to bandwidth services, it also offers co-location facilities, tower sharing, and offtake from GAILTEL POP to Access Providers.

In Phases I and II of the telecom project, a national communication backbone employing OFC based telecom systems installed along GAIL's pipeline has been established covering 5,3000 Kms. and providing DWDM communication path between:

- Delhi-Mumbai and additional 35 cities (1,700 Kms.)
- Delhi-Vadodara via the state of Madhya Pradesh with extension of network to states of U.P., Punjab, Haryana, and Maharashtra (1,650), and
- Vadodara-Mumbai by extending the network to states of Andhra Pradesh and completing Delhi-Vijaipur ring (1,900 Kms.)

In phase III of the project, it will cover 3,000 Kms. by expanding its network in South India in the States of Tamil Nadu, Karnataka, and Kerala, as well as covering Bihar, Orissa and West Bengal.

Gail India has invested about Rs. 3,950 million. It employs state of the art transmission equipment:

- SDH scalable to STM 64
- DWDM scalable to Terabit capacity
- Supporting Ethernet over SDH/DWDM on Fast Ethernet and Gigabit Ethernet Levels.

GAILTEL's total installed capacity is 10 Gbps, of which the activated capacity is 2.5 Gbps. Including the captive requirement of Gail India, till March 2005 2,179 Mbps is in use on its fibre network. At present, the major customers of Gail India are the telecom operators, which have leased about 1,300 Mbps from it.

## Annex 3.6: Trend in Domestic Leased line tariffs

(Rs. Lakhs per annum)

**Trend in Domestic Leased line tariffs (for distance of 50 Kms)**

| | Before May 1999 | Ceiling tariff as per TTO 1999, May 1999 | Market price as of Dec 2004 | Revised Tariff (2005) |
|---|---|---|---|---|
| **64 Kbps** | 1.87 | 0.34 | 0.34 | 0.13 |
| **E1** | 15 | 3.49 | 1.39 | 0.93 |
| **DS3** | 315 | 73.21 | 29.28 | 7.09 |
| **STM1** | 945 | 219.64 | 87.86 | 19.01 |

**Trend in Domestic Leased line tariffs (for distance of 100 Kms)**

| | Before May 1999 | Ceiling tariff as per TTO 1999, May 1999 | Market price as of Dec 2004 | Revised Tariff (2005) |
|---|---|---|---|---|
| **64 Kbps** | 2.25 | 0.41 | 0.41 | 0.16 |
| **E1** | 20.00 | 5.38 | 2.15 | 1.76 |
| **DS3** | 420 | 113.07 | 45.23 | 13.15 |
| **STM1** | 1260 | 339.23 | 135.69 | 35.25 |

**Trend in Domestic Leased line tariffs (for distance of 200 Kms)**

| | Before May 1999 | Ceiling tariff as per TTO 1999, May 1999 | Market price as of Dec 2004 | Revised Tariff (2005) |
|---|---|---|---|---|
| **64 Kbps** | 3.44 | 0.54 | 0.54 | 0.23 |
| **E1** | 30.00 | 9.51 | 3.81 | 3.44 |
| **DS3** | 630 | 459.97 | 183.99 | 61.58 |
| **STM1** | 1890 | 599.40 | 239.76 | 67.72 |

**Trend in Domestic Leased line tariffs (for distance of 500 Kms)**

| | Before May 1999 | Ceiling tariff as per TTO 1999, May 1999 | Market price as of Dec 2004 | Revised Tariff (2005) |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| **64 Kbps** | 5.62 | 0.96 | 0.96 | 0.43 |
| **E1** | 37.5 | 21.90 | 8.76 | 8.47 |
| **DS3** | 564.38 | 459.97 | 183.99 | 61.58 |
| **STM1** | 1693.13 | 1379.93 | 551.97 | 165.15 |

**Trend in Domestic Leased line tariffs (for highest distance slab of >500 kms, except that before May 1999 distance slab is > 1,000 kms)**

| | **Before May 1999** | **Ceiling tariff as per TTO 1999, May 1999** | **Market price as of Dec 2004** | **Revised Tariff (2005)** |
|---|---|---|---|---|
| **64 Kbps** | 14.06 | 0.96 | 0.96 | 0.44 |
| **E1** | 67.18 | 22 | 8.8 | 8.50 |
| **DS3** | 1,410.78 | 462 | 185 | 61.59 |
| **STM1** | 4,232.34 | 1386 | 554 | 165.20 |

**Trends in IPLC (Half Circuit) Lease rental (Rs. Lakhs per annum)**

| **Capacity** | **Year wise tariff for IPLC (Per annum)** | | | | | |
|---|---|---|---|---|---|---|
| | **2002*** | **2003 #** | **1.1.04 #** | **1.4.04#** | **2005#** | **Revised Tariff (2005)** |
| E1 (2Mbps) | 26 | 30.8 | 23.7 | 21.3 | 20.2 | 13 |
| DS3 (45Mbps) | 471 | 471 | 445 | 401 | 361 | 104 |
| STM1 (155Mbps) | 1365 | 1365 | 1235 | 1112 | 1000 | 299 |

* Tariff for IPLC services irrespective of the destination
# Tariff applicable for restorable Category and for the farthest destination from India

Annex 3.7: Ratio of actual total teledensity to the teledensity **(Derived from estimates of household teledensity, 2002)**

| Country<br><br>(1) | Tele-density (per 100)<br><br>(2) | House-holds with telephone (%)<br><br>(3) | Teledensity derived from Household teldensity##<br><br>(4) | Column (2) divided by Column (4)<br><br>(5) |
|---|---|---|---|---|
| Cote d'Ivoire | 8.27 | 17.40 | 3.87 | 2.14 |
| Ethiopia | 0.60 | 1.30 | 0.29 | 2.08 |
| Guinea | 1.52 | 1.70 | 0.38 | 4.02 |
| **India** | **5.19** | **9.1** | **2.02** | **2.57** |
| Lesotho | 5.57 | 5.60 | 1.24 | 4.48 |
| Madagascar | 1.40 | 2.00 | 0.44 | 3.15 |
| Mali | 1.03 | 2.40 | 0.53 | 1.93 |
| Mauritania | 10.39 | 2.90 | 0.64 | 16.12 |
| Mongolia | 14.16 | 17.00 | 3.78 | 3.75 |
| Nigeria | 1.92 | 1.80 | 0.40 | 4.80 |
| Senegal | 7.72 | 17.00 | 3.78 | 2.04 |
| Sudan | 2.65 | 10.00 | 2.22 | 1.19 |
| Tanzania | 2.41 | 2.00 | 0.44 | 5.42 |
| Togo | 4.54 | 7.00 | 1.56 | 2.92 |
| Uganda | 1.81 | 2.70 | 0.60 | 3.02 |
| Uzbekistan | 7.39 | 30.70 | 6.82 | 1.08 |
| Zambia | 2.12 | 3.80 | 0.84 | 2.51 |
| Zimbabwe | 5.51 | 7.10 | 1.58 | 3.49 |
| **Low Income** | **4.59** | **8.20** | **1.82** | **2.52** |
| Algeria | 7.38 | 37.60 | 8.36 | 0.88 |
| Armenia | 16.17 | 54.30 | 12.07 | 1.34 |
| Bolivia | 17.22 | 23.70 | 5.27 | 3.27 |
| Brazil | 42.38 | 58.90 | 13.09 | 3.24 |
| Cuba | 5.19 | 12.00 | 2.67 | 1.95 |
| Djibouti | 3.83 | 5.50 | 1.22 | 3.13 |
| Dom. Rep. | 31.71 | 33.40 | 7.42 | 4.27 |
| Ecuador | 23.08 | 32.20 | 7.16 | 3.23 |
| Egypt | 17.72 | 48.00 | 10.67 | 1.66 |
| Honduras | 9.69 | 16.00 | 3.56 | 2.73 |
| Iran (I.R.) | 22.01 | 67.00 | 14.89 | 1.48 |
| Jordan | 35.54 | 57.00 | 12.67 | 2.81 |
| Kazakhstan | 19.47 | 41.40 | 9.20 | 2.12 |
| Maldives | 25.11 | 23.30 | 5.18 | 4.85 |
| Namibia | 14.48 | 17.00 | 3.78 | 3.83 |
| Paraguay | 33.56 | 18.80 | 4.18 | 8.03 |
| Philippines | 23.29 | 14.20 | 3.16 | 7.38 |
| Serbia & | 48.91 | 81.30 | 18.07 | 2.71 |

| | | | | |
|---|---|---|---|---|
| Montenegro | | | | |
| South Africa | 41.05 | 31.00 | 6.89 | 5.96 |
| St. Vincent | 31.88 | 90.00 | 20.00 | 1.59 |
| Syria | 14.67 | 50.00 | 11.11 | 1.32 |
| Thailand | 36.55 | 27.70 | 6.16 | 5.94 |
| Tonga | 14.67 | 67.00 | 14.89 | 0.99 |
| Tunisia | 16.89 | 38.00 | 8.44 | 2.00 |
| Turkmenistan | 7.88 | 41.90 | 9.31 | 0.85 |
| **Lower Middle Income** | **32.36** | **49.4** | **10.98** | **2.95** |
| Belize | 32.82 | 42.00 | 9.33 | **3.52** |
| Chile | 65.86 | 54.00 | 12.00 | 5.49 |
| Costa Rice | 36.15 | 54.30 | 12.07 | 3.00 |
| Czech Republic | 121.11 | 68.70 | 15.27 | 7.93 |
| Gabon | 23.97 | 12.80 | 2.84 | 8.43 |
| Grenada | 38.77 | 90.00 | 20.00 | 1.94 |
| Latvia | 69.49 | 77.00 | 17.11 | 4.06 |
| Lithuania | 74.56 | 74.00 | 16.44 | 4.53 |
| Mauritius | 55.95 | 80.00 | 17.78 | 3.15 |
| Mexico | 40.12 | 45.30 | 10.07 | 3.99 |
| Panama | 31.15 | 40.40 | 8.98 | 3.47 |
| Saudi Arabia | 36.10 | 70.00 | 15.56 | 2.32 |
| Slovak Republic | 81.18 | 69.50 | 15.44 | 5.26 |
| Uruguay | 47.22 | 73.40 | 16.31 | 2.89 |
| Venezuela | 36.92 | 35.60 | 7.91 | 4.67 |
| **Upper Middle Income** | **49.78** | **39.00** | **8.67** | **5.74** |
| Australia | 117.84 | 97.00 | 21.56 | 5.47 |
| Austria | 127.50 | 88.00 | 19.56 | 6.52 |
| Canada | 101.26 | 97.40 | 21.64 | 4.68 |
| Finland | 139.09 | 99.00 | 22.00 | 6.32 |
| France | 121.59 | 97.00 | 21.56 | 5.64 |
| Ireland | 126.56 | 85.00 | 18.89 | 6.70 |
| Israel | 142.17 | 96.00 | 21.33 | 6.66 |
| Korea (Rep.) | 116.80 | 91.80 | 20.40 | 5.73 |
| Netherlands | 136.24 | 90.00 | 20.00 | 6.81 |
| New Zealand | 106.98 | 96.00 | 21.33 | 5.01 |
| Portugal | 124.65 | 78.00 | 17.33 | 7.19 |
| Singapore | 125.84 | 97.90 | 21.76 | 5.78 |
| Slovenia | 134.14 | 93.00 | 20.67 | 6.49 |
| Spain | 133.04 | 90.30 | 20.07 | 6.63 |
| Sweden | 162.45 | 100.00 | 22.22 | 7.31 |
| Taiwan, China | 164.31 | 97.80 | 21.73 | 7.56 |
| U. K. | 143.13 | 95.00 | 21.11 | 6.78 |
| United States | 113.40 | 95.30 | 21.18 | 5.35 |
| **High Income** | **124.93** | **96.1** | **21.36** | **5.85** |

| | | | | |
|---|---|---|---|---|
| **World** | **36.91** | **49.8** | **11.07** | **3.34** |
| **Africa** | **7.36** | **13.00** | **2.89** | **2.55** |
| **Americas** | **64.62** | **70.80** | **15.73** | **4.11** |
| **Asia** | **24.41** | **37.60** | **8.36** | **2.92** |
| **Europe** | **92.10** | **81.30** | **18.07** | **5.10** |
| **Oceania** | **89.27** | **95.10** | **21.13** | **4.22** |

Source: ITU (2003), World Telecom Development Report 2003
# Assumed figure; ## Column (4) divided by 4 (i.e. assumed household size) to give per capita teledensity, and this number divided by column (3)/100 to give a derived overall per capita teledensity based on household teledensity

## Annex 3.8: Rural and Urban MPCE and average Household size in selected states of India, 2003

| State | Average MPCE Rural | Average MPCE Urban | Average MPCE Urban as % of Rural | Average Household Size Rural | Average Household Size Urban |
|---|---|---|---|---|---|
| Andhra Pradesh | 567 | 1,065 | 188 | 4.1 | 4.1 |
| Assam | 520 | 875 | 168 | 5.2 | 4.7 |
| Bihar | 415 | 674 | 162 | 5.8 | 5.6 |
| Gujarat | 626 | 1,046 | 167 | 5.2 | 4.5 |
| Haryana | 781 | 1,141 | 146 | 5.4 | 4.7 |
| Jharkhand | 422 | 888 | 210 | 5.0 | 4.6 |
| Karnataka | 556 | 960 | 173 | 4.9 | 4.3 |
| Kerala | 981 | 1,300 | 133 | 4.4 | 4.1 |
| Madhya Pradesh | 455 | 1,029 | 226 | 5.4 | 4.9 |
| Maharashtra | 584 | 1,166 | 200 | 4.8 | 4.4 |
| Orissa | 398 | 832 | 209 | 4.6 | 4.6 |
| Punjab | 886 | 1,250 | 141 | 5.3 | 4.5 |
| Rajasthan | 570 | 912 | 160 | 5.4 | 5.3 |
| Tamil Nadu | 609 | 1,087 | 178 | 4.0 | 3.8 |
| Uttar Pradesh | 509 | 786 | 154 | 5.8 | 5.5 |
| West Bengal | 538 | 991 | 184 | 5.0 | 4.1 |
| | | | | | |
| **All India** | **554** | **1,022** | **184** | **5.0** | **4.5** |

Source: NSS Report Number 490: Household Consumer Expenditure and Employment-Unemployment Situation in India, 2003

## Annex 3.9: Two Examples Of Technologies Used For Rural Connectivity in India

**(a) <u>CorDect Technology</u>**

The CorDECT technology has been jointly developed by TeNeT (Telecommunications and Computer Networks Group of IIT Madras) and Midas Communication Technologies Pvt Ltd. TeNeT has over the past few years incubated several companies which have developed different technologies suitable for rural areas in developing countries (please see below). The focus has been on building a scalable and successful business in rural areas, using:

- Technology, which is cost effective, affordable, robust, scalable and capable of delivering the relevant applications
- A clear business model, which addresses all market, stakeholder and operational needs
- An organization which is exclusively focused on the rural market

An exchange and a base station are installed at the taluka or county where fibre is located. This exchange functions at a temperature of 55 degree centigrade, and doesn't require air conditioning. The total power requirement is 1 KW. This capability counters the problem of lack of power in small towns of India. Also, in a situation when power in unavailable, a one KM generator can be easily obtained and used as a backup. CorDECT is capable of offering simultaneous voice and Internet access and can deliver a 35/70kps connectivity to villages which are within a radius of 25 kms from the fibre connected taluka.

The next generation corDECT technology, which will be released in the latter part of the year, aims to deliver 80/150kbps-sustained rate on each Internet connection. The TeNeT group is also working on a solution that combines satellite and terrestrial wireless to provide low cost connectivity to rural areas covered by mountainous regions and forests.

Within the above framework, an organization/company called N-logue uses this technology as a rural service provider whose entire focus is rural India. It focuses on providing commercial telephone and Internet connection to every village. The company is prohibited from operating in urban areas by virtue of its charter. N-Logue follows a three tier operational model based on demand aggregation at the village level, with servicing the kiosks in terms of local linkages and technical assistance at the district/taluka (or county) level, and connectivity and content servicing being handled by n-Logue on a national level.

N-Logue aggregates demand in small villages by creating an Internet kiosk with a computer, an Internet connection, a printer and some accessories like web/digital camera in each village. The kiosk is the hub of the rural connectivity providing communication services (e-mail, chat, browsing), as well as other much-needed applications like education and training, healthcare, agriculture consultancy and e-governance. The kiosk operators need regular support in terms of maintenance, connectivity and handling of other local issues. It was therefore decided that a middle tier of Local Service Providers (LSPs) would be created to service the needs of the kiosk operators in every county or taluka. The LSP is located in a town not more than 15 to 20 kms. from each village. This proximity enables the LSP to reach a kiosk in about 60 to 90 minutes in case of an emergency.

N-Logue provides the connectivity backbone in the operations, co-ordinates with multiple technology providers for relevant applications and content, trains LSPs and kiosk operators, sources critical supplies for kiosks including the available hardware and software, co-ordinates with regulators and policymaker to ensure service availability and markets the services to the community with the help of the LSPs and kiosk operators.

It was found that existing language software was quite expensive to be installed at the village kiosk. This led to development of CKShakti, an lOffice suite package in the local language, which is a relatively cheap package offering, most of the features normally used by other software in English. It also has a dual language option, which facilitates switching between the local language and English. CKShakti is available in three dual language packages as well as in English.

A video conferencing software (iSEE) which can function at very low bandwidth, was also created to facilitate communications and applications such as telemedicine, education, agri-consultancy. Likewise, a low-cost remote diagnostic kit has also been launched in its incubation stage. This is placed in kiosks and enables the doctor to measure a person’s temperature, blood pressure, pulse count and ECG remotely. A low cost ($1,000) ATM has also been developed for specifically rural applications, to offer non-cash transactions, micro-deposits, credit and other services catering to the rural area.

**(b) <u>Kerala’s State-wide data network initiative with a Pilot Project at Malappuram for Akshaya, using MMDS technology</u>**

The State of Kerala has decided to roll out a State-wide data connectivity project. In November 2002, a pilot project was launched under “Akshaya”, as part of the Kerala State IT Mission, with the aim that at least one member of every family in every village in a backward district, Mallappuram (3,600 square kms. of highly vegetated mountainous terrain), should be computer literate and should have access to Internet and to the state Intranet. Today Malappuram has over 500 Computer centers, each with five PC’s and interconnected to the state data center and the outside world over wireless. It is the largest wireless IP network of its kind in the world. Akshaya center in one village has even started medical transcription. Another center is planning to start distributed BPO operations.

Akshaya uses MMDS, an IP based, low cost, multi point Wireless technology which is circuit switched and delivers a shared bandwidth of 4MBPS (i.e. extremely high speeds) capable of interactive voice, data, video and entertainment services on one platform. Emphasis was given to develop a system which offered practical, reliable and economic viable options, which could be replicated by scaling up. The programme is run, together with the Kerala State Government, by Tulip IT Services Ltd. The model used by Tulip involves:

- Setting up of the main gateway along with the NOC and data center at Mallapuram.
- Extending the functionalities of this gateway, to about twenty POP's using point to point radio links (the backbone network)
- Thereafter, install WipLL base stations (the access network)
- As the centers sign up for service, install WipLL CPE at the training centers and they are up and running.

The network:

- Has high Bandwidth Scalability – Starting as low as 16 Kb and scale up to 4 Mb
- Is Voice enabled from Day One – Voice services in the CUG can be made available immediately
- Supports Streaming Video – E Learning and tele-medicine programs can be started from Day One
- Provides Bandwidth on Demand from the beginning itself

The model is entrepreneur driven, with adequate room for provision of value added services and services to non government organizations and business in the district to make it economically viable and self sustaining.

At the same time, to leverage the advantages of this infrastructure, government of Kerala has started implementing the next phase of the initiative of connecting the Gram Panchayats, other government organizations and bodies that go into any effective e- governance model. All these would ride on the same network rather than each department trying to create its own infrastructure. The system would set up a "Data Umbrella" over the entire district. An umbrella that provides voice, data, video and entertainment.

## Annex 3.10: Main points from the text of the Directive of the TRAI dated 19th August, 1998 addressing matters relating to interconnection

*(i) Points of interconnect*

The question of Points of Interconnect has been decided by the Authority in its judgment pronounced on 25.4.97 in Petition No. 1 of 1997. The Interconnect Agreement should follow the decision conveyed in this judgment.

*(ii) Set up costs of interconnection*

The set up costs of interconnection should be borne by the interconnecting Service Provider, i.e. the Service Provider seeking interconnection to the interconnected Service Provider i.e., the Service Provider whose network is sought to be interconnected.

*(iii) Access charges*

Access charges shall be as fixed by TRAI from time to time.

*(iv) Charges for leased lines*

Charges for leased lines shall be as fixed by TRAI from time to time.

*(v) Linking with other networks*

The connectivity between two service providers in the same service area for terminating traffic only should be left to the mutual agreement and not forced through the third network in that service area.

The demand for direct connectivity with VSNL for international voice calls would be reviewed along with the case of liberalization of the long distance sector.

*(vi) Sharing of facilities with other networks*

The Passive Network should be allowed to be shared freely based upon mutual agreement. The issue of sharing Active Networks should be discussed separately, as it would involve further study and should be left out of purview of the Interconnect Agreement at this point of time.

## Annex 3.11: Legal cases involving TRAI

**(Appeals in TDSAT, High Court etc.)**

Appeals in TDSAT in 2001 (Total = 10)

| ***S No*** | ***Appeal No/Parties*** | **Brief subject** | **Remarks** |
|---|---|---|---|
| 1. | 1/2001<br>BSNL vs. TRAI | Appeal against the TRAI direction dated 16-02-2001. On OTCEI's representation TRAI directed BSNL not to disconnect any telephone of OTCEI. | Disposed on 24.04.01 |
| 2. | 2/2001<br>COAI vs. TRAI & Ors. | Challenging the determination of TRAI dated 08-01-01 on interconnection issues pending between the parties and also challenging BSNL' s letter dated 12-02-01 | Appeal withdrawn |
| 3. | 3/2001<br>Fascel Ltd. Vs. TRAI & Ors. | Challenging the determination of TRAI dated 08-01-01 (determination on six major issues relating to Interconnection between the networks of CMSPs and DOT) as the same is beyond jurisdiction, in contravention of the provision of TRAI Act and contrary to the interest of the consumers and the appellants. | Appeal withdrawn |
| 4. | 4/2001<br>Escotel Mobile vs. TRAI & ors. | --- do --- | --do-- |
| 5. | 7/2001<br>VSNL Vs. TRAI & Ors. | Appeal against TRAI's decision on payment terms, rolling deposit etc. reported by VSNL. Against TRAI's order dated 9-4-2001 issued in pursuance of Madras High Court order on petition filed by Dishnet DSL Ltd. | Reverted back to TRAI for fresh hearing. Heard and disposed of. |
| 6. | 11/2001<br>ABTO & Ors Vs. TRAI, BSNL & COAI | Challenging the effective date of 15th Amendment notified by TRAI. Prayer is for preponing the date of | Pending |

| | | | |
|---|---|---|---|
| | | implementation of 15th amendment order to 26-01-01 from 20-7-2001. | |

Appeals in TDSAT in 2002 (Total = 12)

| *S. No* | **Appeal No./Parties** | **Brief subject** | **Remarks** |
|---|---|---|---|
| 1. | Appeal No. 3/2002 BSNL Vs. TRAI | Appeal against TRAI's order dated 25-01-2002 regarding carrying of default traffic on alternate days by BSNL and IndiaOne. | Disposed of with direction to TRAI to issue final order. |
| 2. | Appeal No. 4/2002 Telecom Watchdog Vs. TRAI | Appeal against TRAI's order dated 25-01-2002 regarding carrying of default traffic on alternate days by BSNL and IndiaOne. | Dismissed as not pressed |
| 3. | Appeal No. 5/2002 BSNL Vs. TRAI & others | Appeal challenging the correctness and sustainability of the Telecom Interconnection(Charges and Revenue sharing) Regulation, 2001(5/2001) | Pending |
| 4. | Appeal No. 6/2002 Telecom Watchdog Vs. TRAI | Appeal challenging TTO(20th amendment), 2002 dated 14th March, 2002. | Dismissed as withdrawn |
| 5. | Appeal No. 7 BSNL Vs. TRAI and another | Challenging the legality, validity and correctness of the order/direction dated 30-5-2002 of TRAI directing the appellant to provide additional circuits as well as lease lines to M/s Birla Tata & AT&T for interconnecting the network of BSNL and M/s Birla Tata & AT&T | After agreement between parties the case became infructuous. |
| 6. | Appeal No. 11/02 BSNL Vs. TRAI | Challenging TRAI's Telecom Interconnection(Reference Interconnect Offer) Regulation, 2002 | TRAI does not have power to override the licence condition. Tribunal has also given decision on the modifications suggested by TRAI in RIO of the operator |
| 7. | Appeal no. 12/02 MTNL Vs. TRAI | -do- | |

Appeals in TDSAT in 2003 (Total = 11)

| **S. No** | **Appeal No./Parties** | **Brief subject** | **Remarks** |
|---|---|---|---|
| 1. | Appeal No. 1/03 COAI Vs. TRAI | An appeal by COAI challenging the show cause notices issued by the Authority for non-compliance of its order for restoration of interconnection to WLL(M) services | Dismissed as withdrawn |
| 2. | Appeal No. 6/03 Data Access Ltd. | Data Access (India) Ltd., challenging IUC Regulation | Dismissed as withdrawn |
| 3. | Appeal No. 7/03 Bharti Tele Ltd | Bharti Telecom Ltd., Challenging IUC Regulation & TTO (24th ) amendment 2003 | Dismissed as withdrawn |
| 4. | Appeal No. 8/03 filed by COAI | COAI challenging IUC Regulation & TTO (24th) Amendment | Dismissed as withdrawn |
| 5. | Appeal No.16/2003 ABTO Vs. TRAI | Challenging the IUC regime and 24th Amendment to TTO, 1999 as they fail to completely resolve all interconnect issues between service providers | Pending in TDSAT. The next date yet to be fixed. |
| 6. | Appeal No.18/2003 COAI vs TRAI | Challenging the decision of the Authority to launch criminal proceedings against the Cellular Operators under Section 29 and 30 read with Section 34 of the TRAI Act in various courts for alleged violation of its directions for restoration of interconnection. | Dismissed as withdrawn. |
| 7. | Appeal No. 19 to 30/2003 COAI &CMSPs vs. TRAI & Others. | -do- | -do- |
| 8. | Appeal No. 31/2003 BSNL vs. TRAI | BSNL has challenged the Authority's directive dated 22-07-2003 vide which all Service Providers (BSO/CMSPs) were directed to establish direct connectivity between service provider at the earliest and not later than three months from the date of the issue of the direction. | The directive set aside on the ground that TRAI does not have power to override licence conditions for making direct connectivity mandatory |

Appeals in TDSAT in 2004 (Total = 5)

| **S. No** | **Appeal No./Parties** | **Brief subject** | **Remarks** |
|---|---|---|---|
| 1. | Appeal No. 1/ 2004<br>BSNL Vs. TRAI | Challenging the communication/direction dated 4-12-2003 vide which BSNL was directed to restore points of interconnection to HFCL Infotel Ltd. in Punjab Circle | TRAI directive quashed by TDSAT order dated 16.08.2004 saying that HFCL is not entitled to handover its traffic originating from SDCA in Amritsar LDCA at LDCC tax at Sangrur for termination to BSNL subscriber in Barnala SDCA. |
| 2. | Appeal No.2/2004<br>BSNL Vs. TRAI | Challenging the direction/communications dated 31-12-2003 of TRAI vide which all service providers were directed not to terminate the interconnection arrangements or resort to disconnection of POIs | Direction of TRAI set aside expect period of notice for disconnection of POI which shall not be less than 10 days vide TDSAT order dated 21.04.04. Review application filed by TRAI in TDSAT was also dismissed vide order dated 10.08.04. An Appeal in Supreme Court has been filed. |

Appeals in TDSAT in 2005 (Total = 7)

| **S. No** | **Appeal No./Parties** | **Brief subject** | **Remarks** |
|---|---|---|---|
| 1. | A.No.1/05<br>Tata Teleservices Vs. TRAI | Challenging the Directive of TRAI dated 06.01.05 vide which the fixed wireless service was advertised as walky service | The Appeal was dismissed as withdrawn vide TDSAT order dated 13.01.05 after TRAI's assurance |

| | | | |
|---|---|---|---|
| | | | that it will withdraw impugned directive and shall issue a show cause notice in accordance with law. |
| 2. | A.No.3/2005 MTNL Vs. TRAI | MTNL challenged TRAI IUC (4th Amendment) Regulation of 06.1.05. | No stay granted to MTNL vide TDSAT order dated 31.01.05 TRAI has filed Writ Petition in Delhi High Court challenging the Jurisdiction of TDSAT on the issue. The case is pending. |
| 3. | A.No.4/2005 AUSPI Vs. TRAI | Association of UTSPI also challenged TRAI IUC (4th Amendment) Regulation of 06.1.05. | AUSPI's Advocate intervene in Appeal No. 3 of 2005 and requested TDSAT to make him co-appellant. However he was directed to file the Appeal. The appeal being heard along with Appeal No.3 of 2005. |
| 4. | A.No.5/2005 VSNL Vs. TRAI | VSNL challenged the notification 11.3.05 on the issue of IPLC. | TRAI's notification was set aside vide order dated 24.08.05 stating that in the absence of non disclosure of information to the Appellant principle of natural justice has been violated. TRAI has breached the mandated requirement of transparency in its functioning as required U/s 11 (4) of TRAI Act. An Appeal filed before Supreme |

| | | | |
|---|---|---|---|
| | | | Court. |
| 5. | A.No.7/2005 COAI Vs. TRAI | COAI has challenged TRAI Interconnection Usage Charge (5th Amendment Regulation (7 of 2005) of 11.4.05 on the issue of new set of definitions for the term "Roaming" and prescribed additional ADC on such calls. | Counter reply has been filed by TRAI. The case will come up for hearing in July'2005. |

Petition in TDSAT in 2002 (Total = 3)

| S.No | Petition No./Parties | Brief subject | Remarks |
|---|---|---|---|
| 1. | 50.1 2/2002 DSS Mobile Vs. U.O.I. & ors. | Illegal demand notice and threat of disconnection in violation of license agreements by respondents. | Dismissed as withdrawn |
| 2. | 5/2002 COAI Vs. U.O.I. & Others | Petition against failure on the part of TRAI and U.O.I. to ensure that the Fixed Service Providers comply with the terms and conditions of their license in that they use only V 5.2 interface or an approved version thereof based on PSTN architecture for providing WLL (M) | Disposed of. |

**Petition in TDSAT in 2003 (Total = 3)**

| S.No | Petition No./Parties | Brief subject | Remarks |
|---|---|---|---|
| 1. | 07/2003 ABTO Vs. UOI | Petition against the dispute is regarding the revenue sharing on the basis of adjusted gross revenue. The issue is inclusion of some items in the AGR, which is not consistent with the recommendation of the TRAI. | The next date is 28.01.04. |
| 2. | 10/2003 COAI Vs. DOT & Others | Petition against the implementation of TRAI's determination dated 08-01-2001 whereunder TRAI has allowed Cellular Operator to | The next date is 19.01.04. |

| | | | |
|---|---|---|---|
| | | retain 5% of their pass through revenue to cover their cost of bad debts and collection charges. | |
| 3. | Telecom Watchdog Vs. Bharti cellular Ltd. | Seeking direction from the TDSAT to respondent including TRAI to ensure uninterrupted calls of the WLL (M) Subscriber in wake of blocking calls CMSP's | Dismissed. |

**Petition in TDSAT in 2004 (Total = 4)**

| S.No | Petition No./Parties | Brief subject | Remarks |
|---|---|---|---|
| 1. | P.No.20/2004 COAI Vs. BSNL | Seeking the implementation of direct connectivity by BSNL Cell one with the cellular operators as mandated in, inter alia, the Cellular Operators licenses, the TRAI's Interconnection Regulation dtd. 29.10.03, National Telecom Policy, 1999; DOT's letter dated 09.08.2000 etc., and for ensuring level field. | TRAI does not have power to override licence conditions for making direct connectivity mandatory<br><br>BSNL directed not to charge 0.19 paise from cellular operators by way of transit charges for accessing. BSNL cellone subscribers where MSC of both are connected to the same BSNL switch. |

**Petition in TDSAT in 2005 (Total = 1)**

| S.No | Petition No./Parties | Brief subject | Remarks |
|---|---|---|---|
| 1. | P.No.6/2005 Calcutta Comm. Pvt. Ltd. Vs. TRAI & Ors. | Against order of disconnection of channels by Indian Cable Net Co., Star India and Set India Pvt. Ltd. | No reply has been filed by TRAI since no relief has been sort against us. We are not appearing in this case. |

**Writ Petition in High Court in 2005 (Total = 6)**

| S. No | WP No. & Parties | Brief subject | Remarks |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1. | WP No. 1672/05 TRAI Vs. TDSAT (Delhi High Court) | Writ filed by TRAI against TDSAT jurisdiction to hear the appeal No. 3 of 2005 filed by MTNL in TDSAT challenging TRAI Regulation reducing the ADC. | Heard in Delhi High Court on 23.2.05, 14.3.05 & 6.4.05. Order is reserved by Court. |
| 2. | WP No. ____/ 2005 Set Discovery Vs. UOI (Delhi High Court) | The CWP filed against TRAI directive of 12.1.05 directing the petitioner to restore the signals deactivated by him from 14.12.04 of R.No.4, Three Star Communication and challenging the vires of Broadcasting Interconnection Regulation. | Counter reply filed. High Court has permitted TRAI to file criminal complaint in Delhi against the operator. |
| 3. | WP No. ____/2005 Mewar Channel Vs. TRAI | Writ filed by M/s Mewar Channel challenging the vires of clause 3.3 of Telecommunication (B&CS) Interconnection Regulation 2004. | Notice issued on 25.4.05. A reply is being filed by TRAI. |

**Writ Petition in High Court in 2004 (Total = 7)**

| S. No | WP No. & Parties | Brief subject | Remarks |
|---|---|---|---|
| 1. | CWP. No.1431/04 National Consumer Awareness Vs. TRAI (in the Chandigarh High Court.) | Grievance relates to the imposition of Access Deficit Charge on the international calls. ADC to be paid to BSNL. In international calls, BSNL has no role to play and the network of BSNL is not used for ILD calls. | Reply filed by TRAI. Last date of hearing was 10.09.04. Checked from Advocate. Next date not yet fixed. |
| 2. | WP No. 12958/04 Cellular Phone User Ass. Vs. UOI (Delhi High Court) | The Modus operandi of illegal/grey market operator consists in receiving calls from foreign calling party which are then transmitted through the unauthorised international link set up by them. The Breach of National Security. Poor quality of service of illegal telephone calls. | No direction for TRAI was given and hence no reply was filed. Heard on 4.8.04, 8.9.04, 03.11.04 & 15.12.2004. Writ Petition is dismissed on 29.04.05. |
| 3. | CWP No.10978/04 Hutchison Esser South | To Quash the orders of Chandigarh directing the petitioners to remove the cell sites/ towers from | The Technical opinion sought by the High Court from TRAI was |

| | | | |
|---|---|---|---|
| | (Chandigarh High Court) | buildings in the Municipal areas. | filed. As advised by our counsel no action is required on our part. She has been asked to keep a watch. |

**Writ Petition in High Court in 2003 (Total = 7)**

| S. No | WP No. & Parties | Brief subject | Remarks |
|---|---|---|---|
| 1. | CWP No.3545/03 filed by B.K.Sharma against UOI & others | Petition filed in the Delhi High Court regarding the CCB (Coin Collection Box). The CCB PCOs has blocked the calls to WLL and cellular phones. | Dismissed |

**Writ Petition in High Court in 2002 (Total = 2); in 2001 (Total = 3), in 2000 (Total = 2)**

**Writ Petition in High Court in 1999 (Total = 4)**

| S. No | WP No. & Parties | Case of Calling Party in the High Court | Remarks |
|---|---|---|---|
| 1. | MTNL Vs. TRAI P.No.6543/99 & 6483/99 | In these petitions the Telecom Interconnection Charges & Revenue Sharing Fifth Amendment) Regulation 1999 and TTO (fifth amendment) 1999 were challenged does not have power to issue any regulation which effects the rights of individuals under contracts or which seeks to override terms and conditions of license. | Disposed of |