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390**

**THE GROWTH PERFORMANCE OF
INDIA'S TELECOMMUNICATIONS
SERVICES INDUSTRY, 1991-2006
CAN IT LEAD TO THE EMERGENCE OF A
DOMESTIC MANUFACTURING HUB?**

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ABSTRACT

India's economy is much more integrated with rest of the world now than it was in 1991. Several factors have facilitated this, some fiscal and some physical. One of the most important physical factors is the spectacular growth of telecommunications in India. An important facet of this revolution has been the phenomenal increase in the number of telephones in the country although its spatial distribution still is a problem. A distinguishing aspect of this growth performance is that India now has five mobile phones for every one fixed telephone and the monthly additions to mobile subscribers are well over six million. Such a huge growth in telecom services have a number of spillover effects for rest of the economy and one of the more important effects is its potential to create a major manufacturing hub in the country for the manufacture of telecom equipments and indeed for downstream industries such as semiconductor devices that are required for the manufacture of these equipments. The telecom industry in India is thus slowly emerging as a fine example of the service sector acting as a fillip to the growth of the manufacturing sector.

Key words: telecommunications, telecom equipment, telecom services, Internet, Broad band, Telecom Regulatory Authority, Import dependence, Concentration.

JEL Classification: L 63, O31, O32, O38

Introduction

The phenomenal growth of the IT industry in India has brought to the fore the growing importance of India as a knowledge powerhouse. But this competitiveness is restricted to the services sector. In fact, it is the sector that is increasingly contributing to the high growth rate recorded in the country. Despite showing a good growth performance over the last three or four years, the manufacturing sector is still a non-performer although three industries constituting the manufacturing sector, namely auto parts, cotton textiles and pharmaceuticals are showing much dynamism in terms of exports. However, India's exports have now diversified to encompass services. In fact, the service sector in general have come to occupy pre eminent position in India's economy in terms of its contribution to overall GDP, exports and as a destination for Foreign Direct Investments (Table 1). Nevertheless, the manufactured exports is still dominated by low and medium technology products although, as stated earlier some high tech products such as pharmaceuticals and certain types of machine tools have crept into India's export basket. But the growth of IT exports and evidences of moving up the value chain in IT, the emergence of other high technology industries such as biotechnology, aerospace etc., is enabling India to be in the league of high technology producers from the developing world. The recent growth of R&D outsourcing is yet another illustration of the country's prowess in high technology activities. An interesting dimension of high technology production in India is that this

capability is largely in the realm of services rather than in manufacturing. However, there are indications that this capability in high tech services is slowly percolating to high tech manufacturing. And an industry where it is very clearly visible is in the area of telecommunication where a revolution of sorts is taking place (Mani, 2007). In the context, the purpose of the present paper is to understand the technological implications of the phenomenal growth of this industry.

The paper is structured into five sections. The first section traces the contribution of the telecommunication services sector to the overall growth performance of India's economy and in that process to the catching up of her economy. The second section distils out the various dimensions of the telecom services industry. Seven dimensions of the growth performance are identified and discussed here. The third section identifies at least three disquieting features of this growth performance in terms of the growing digital divide, the increasing dependence on imported equipments for providing these services and the low diffusion of Internet. However there is at least one silver lining in this otherwise dark cloud, namely the possibility that India may soon emerge as a major manufacturing hub for not just mobile handsets but also the manufacturing of semiconductor devices that go into the production of these handsets. A detailed discussion of this tendency and its implication for the economy forms the theme of the fourth section. Finally the fifth and concluding section summarises the main findings of the paper and identifies the policy conclusions that arises from this study.

I. The contribution of telecommunications to the growth performance of India's economy: Communications is the fastest growing sector within India's economy. The average compound rate of growth of the economy works out to 24.02 per cent per annum since the turn of this millennium. See Table 2. No other sector of the economy has clocked such a high rate of growth. The sector accounts for about 4 per cent of GDP and therefore with this rather high rate of growth contributes about 11 per

cent of the growth in overall GDP of the country. Of the Information and Communications Technology (ICT) sector of the economy, it is again the communications sector that is more important. This is evident from a dataset on ICT spending developed by World Information Technology and Services Alliance (2006), of the total spending on ICT by India, about 63 per cent was in communications. See Figure 1.

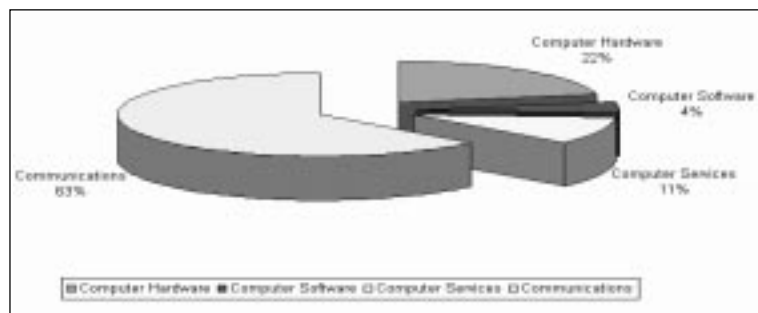


Figure 1: Distribution of total ICT spending in India, 2001-2006

Source: World Information Technology and Services Alliance (2006)

Table 1: Relative share of the service sector in India's economy, 1990-91-2006-07

(per cent)

| | Real GDP | Exports | FDI |
|---------|---------------------|----------------|---------------|
| 1990-91 | 40.6 | 20 | Not Available |
| 2006-07 | 61.8 | 39 | 81 |

Source: Computed from Reserve Bank of India (2007)

The communication sector is composed of both services and equipment manufacturing although in the above characterization the data refers only to the services segment. The domestic production of telecom equipments has shown some impressive increases during the period since 2001, but even now (c2006), it accounts for only about 15 per cent of the total telecoms industry. Even then with some fluctuations the

equipment sector is slowly decreasing its share in the total revenues of the telecommunications industry. See Figure 2.

Table 2: Contribution of the communication sector to India's growth performance 1999-2000 to 2005-06

| | Share | Growth rate of the communications sector | Overall rate of growth of GDP | Contribution (%) |
|-----------|-------|--|-------------------------------|------------------|
| 1999-2000 | 1.6 | | | |
| 2000-2001 | 1.9 | 26.9 | 4.1 | 12.47 |
| 2001-2002 | 2.2 | 19.5 | 5.6 | 7.66 |
| 2002-2003 | 2.6 | 25.6 | 3.4 | 19.58 |
| 2003-2004 | 3.1 | 25.4 | 8.6 | 9.16 |
| 2004-2005 | 3.5 | 22.8 | 7.5 | 10.64 |
| 2005-2006 | 4 | 23.9 | 9.1 | 10.51 |

Source: Central Statistical Organisation (2007)

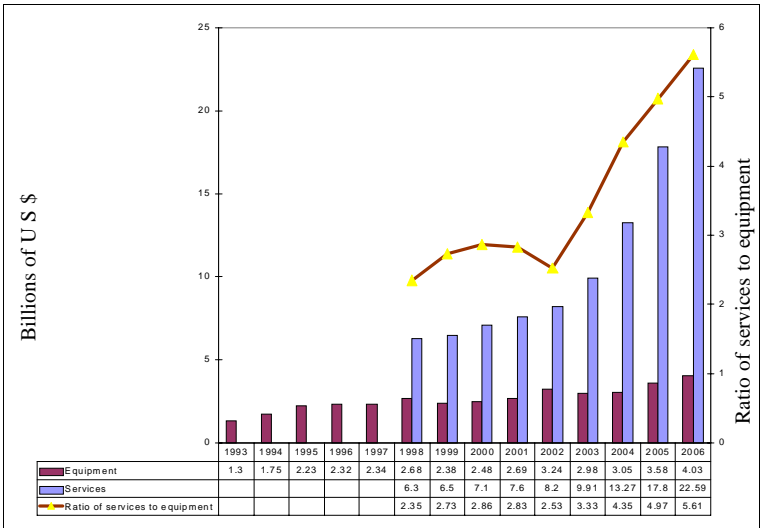


Figure 2: Relative shares of the equipment and service sectors in the total telecom equipment sector, 1992-93 to 2005-2006

Source: Department of Telecommunications (2007) and World Markets Research Centre (2005)

II. Dimensions of the of the growth performance of telecommunications services

In 1991, India had just 5 million telephone subscribers. As at the end of July 2007, there are 233 million subscribers thus showing an average annual growth rate of over 27 per cent per annum. No other country in the world, other than China, has shown such high rates of growth in the number of telephone subscribers. See Table 3. Tele density too which was below 1 telephone per 100 population has now risen sharply to about 20. Among the infrastructure industries, telecommunications is the only industry that has shown significant improvements over the reform period. Consequently it is generally opined that a revolution of sorts is taking place in the Indian telecoms industry. There are at least, seven dimensions of this growth performance that merit our attention.

(i) Dominance of wireless technology than wireline

The Indian telecom sector is now heavily dominated by wireless technologies, which include cellular mobile and fixed wireless technologies. In fact, almost the entire increases in the availability of telephones have been contributed by wireless technologies. India has one of the highest ratios of wireless to wireline technologies, which is now almost 5 (Table 3). In fact what is interesting is that since 2005, the availability of wireline technologies has started decreasing. A number of factors explain this and this decrease in the popularity of fixed telephones has now become a worldwide trend. This rather heavy reliance of wireless technologies, while extremely positive from the availability point of view, has some implications for the diffusion of Internet in the country. This will be analysed in some more detail in one of the subsequent sections.

Table 3: Trends in the number of telecom subscribers and in tele-density, 1991-2007

| | Fixed (in millions) | G.Rate | Mobile (in millions) | G. Rate | Total (in millions) | G. Rate | Tele density (per 100 people) | Ratio of mobile to fixed |
|----------------------------|---------------------------|--------|----------------------------|---------|---------------------------|---------|--|--------------------------------|
| 1991 | 5.07 | | | | 5.07 | | 0.6 | |
| 1992 | 5.81 | 14.60 | | | 5.81 | 14.60 | 0.67 | |
| 1993 | 6.80 | 17.07 | | | 6.8 | 17.04 | 0.77 | |
| 1994 | 8.03 | 18.09 | | | 8.03 | 18.09 | 0.89 | |
| 1995 | 9.80 | 22.04 | | | 9.8 | 22.04 | 1.07 | |
| 1996 | 11.98 | 22.24 | | | 11.98 | 22.24 | 1.26 | |
| 1997 | 14.54 | 21.37 | 0.34 | | 14.88 | 24.21 | 1.56 | 0.02 |
| 1998 | 17.80 | 22.42 | 0.88 | 158.82 | 18.68 | 25.54 | 1.94 | 0.05 |
| 1999 | 21.59 | 21.29 | 1.2 | 36.36 | 22.79 | 22.00 | 2.33 | 0.06 |
| 2000 | 26.51 | 22.79 | 1.88 | 56.67 | 28.39 | 24.57 | 2.86 | 0.07 |
| 2001 | 32.44 | 22.37 | 3.58 | 90.43 | 36.02 | 26.88 | 3.58 | 0.11 |
| 2002 | 41.48 | 27.87 | 13 | 263.13 | 54.48 | 51.25 | 4.3 | 0.31 |
| 2003 | 42.58 | 2.65 | 33.58 | 158.31 | 76.16 | 39.79 | 5.1 | 0.79 |
| 2004 | 45.00 | 5.68 | 50 | 48.90 | 95 | 24.74 | 7.04 | 1.11 |
| 2005 | 49.00 | 8.89 | 76 | 52.00 | 125 | 31.58 | 10.66 | 1.55 |
| 2006 | 40.43 | -17.49 | 149.5 | 96.71 | 189.93 | 51.94 | 17.16 | 3.70 |
| 2007* | 39.73 | | 201.29 | | 241.02 | 22.61 | 21.2 | 5.07 |
| Average rate of growth (%) | | | | | | 27.44 | | |

* as on August 31, 2007

Source: Department of Telecommunications (2005) and Telecommunications Regulatory Authority of India (various issues)

(ii) Monthly addition to mobile subscribers and the growing market for telecom handsets

As a corollary of the above, it is seen that there has been a steady increase in the average number of mobile subscribers per month since 2003 (Table 4). In 2003, on an average 1.5 million new subscribers were added to the existing stock. This has since increased to 6.4 million per month since 2007. The very sharp reduction in the number of subscribers in March 2007 was due to a governmental security regulation¹. These large increases in the number of mobile handsets have strong positive implications for the telecom equipment industry and specifically the mobile handsets industry, which means that close to 6 million handsets are being sold every month. Consequently a huge domestic market for

Table 4: Monthly additions to mobile subscribers, 2003-07(in million numbers)

| | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|----------------|-------------|-------------|-------------|-------------|-------------|-------------|
| January | | 0.64 | 1.58 | 1.76 | 4.69 | 6.81 |
| February | | 0.6 | 1.6 | 1.67 | 4.27 | 6.22 |
| March | | 0.96 | 1.93 | 0.78 | 5.03 | 3.53 |
| April | 0.28 | 0.64 | 1.37 | 1.46 | 3.88 | 6.11 |
| May | 0.29 | 2.26 | 1.33 | 1.72 | 4.25 | 6.57 |
| June | 0.35 | 1.42 | 1.43 | 1.97 | 4.78 | 7.34 |
| July | 0.36 | 2.32 | 1.74 | 2.46 | 5.39 | 8.06 |
| August | 0.49 | 1.79 | 1.67 | 2.74 | 5.9 | 8.31 |
| September | 0.37 | 1.61 | 1.84 | 2.48 | 6.07 | |
| October | 0.53 | 1.67 | 1.51 | 2.9 | 6.71 | |
| November | 0.72 | 1.9 | 1.56 | 3.51 | 6.8 | |
| December | 0.8 | 1.69 | 1.95 | 4.46 | 6.4 | |
| Average | 0.46 | 1.46 | 1.63 | 2.33 | 5.35 | 6.62 |

Source: Telecom Regulatory Authority of India (various issues)

1 Owing to security concerns, the government insisted that the service providers verify the *bonafides* of new subscribers. See Telecom Regulatory Authority of India (2007).

telecom equipments has suddenly emerged in the country spawning the creation of a significant manufacturing base. The South Indian city of Chennai has become a thriving cluster for mobile handsets manufacturing and this has important implications for the downstream industries such as the semiconductor industry. This point will be discussed in some depth in the fourth section.

(iii) Increasing privatisation of the telecom services industry: The distribution of telecom services in the country was entirely in the hands of the public sector for a very long time until the middle of the 1990s. The new telecom policy of 1994 changed all this.

The share of the private sector in the overall telecoms industry has been rising (Figure 3) and the ratio of private to public has actually crossed unity in 2006. This again is due to the fact that the public sector is more dominant in wireline (or fixed) and the private sector is dominant in the wireless (mobile) segment (Table 5).

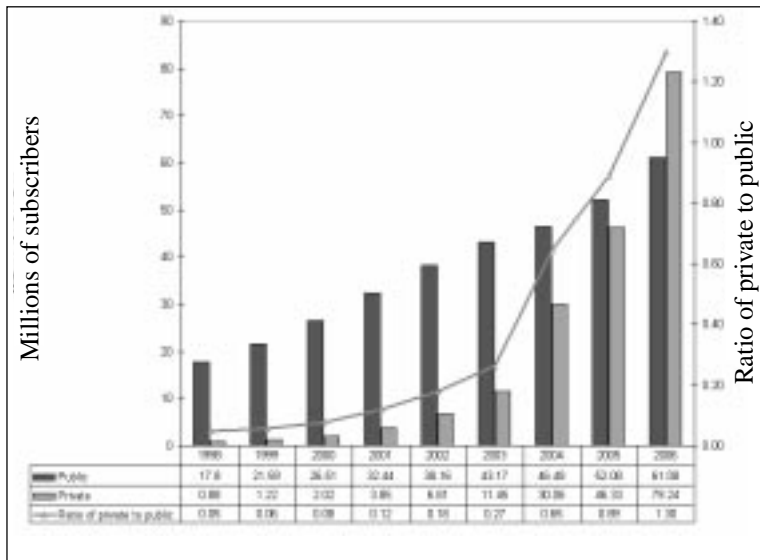


Figure 3: The rising privatisation of the telecommunications services sector, 1995-2006

Source: Department of Telecommunication (2007)

This sort of a structure of the industry is largely the product of historical reasons. The two public sector service providers BSNL and MTNL dominated the wireline sector, while the private sector was able to dominate the new wireless technology. In fact it was only quite recently that the government allowed the public sector entities to provide wireless communication services.

Table 5: Structure of the telecommunications services industry according to ownership

(percentage shares as on May 31 2007)

| | Wireline | Wireless |
|---------|----------|----------|
| Public | 91 | 19.32 |
| Private | 9 | 80.68 |
| Total | 100 | 100 |

Source: Telecom Regulatory Authority of India (2007)

(iv) Competition in the provision of telecom services: Fixed vs. Mobile and within Mobile GSM vs. CDMA

An interesting feature of the industry is that after a very long time, it has suddenly become very competitive. There are three dimensions to this competition. First it is a competition between two standards or technologies, namely Global System for Mobile Communications (GSM) vs. Code Division Multiple Access (CDMA) standards. Second it is a competition between various service providers, although this competition was restricted to public policy designed spaces or markets known as telecom circles. A still another dimension is the type of market. There are essentially three types of markets based on the geographic coverage of the service. They are: i. Local telephone market; ii. Long distance or national telecom services; and iii. Foreign or the overseas market. In the present we focus on all the three dimensions of competition between the service providers.

A. Competition in Fixed and Mobile technologies: The markets for mobile services are much more competitive than the one for fixed line services. In the latter the incumbent service provider, BSNL continues to have a lion's share of the market. However the existence of mobile communication services have made the market for fixed line services contestable and as a result despite high concentration, prices of fixed telecom services kept falling or kept under check over the last five years or so. The trends in prices of telecom services will be analysed in detail below. I now analyse competition in the fixed and mobile technologies separately.

(a) Competition in fixed telephone services: If one goes by overall summary measures of domestic competition, the market for fixed telephone services are much more concentrated than the one for mobile services. For instance (as on May 31 2007), the Herfindhal Index for fixed services for the nation as a whole works out to 0.6899 while the one for mobile services work out to 0.1592. This national level picture hides the level of competition that exists at the sub national level. In order to gauge this, I have computed the structure of the market for fixed telecom services in each of the 28 telecom circles that the country is divided into. See Table 6. As can be seen from this Table, the market for fixed telecom services is highly concentrated in all the telecom circles, although in seven of them, namely Delhi-NCR, Chennai, Madhya Pradesh, Mumbai, Punjab and Karnataka, the H. Index has a value less than 0.8000. Of course this does not mean that the market for fixed telecom services is not competitive. There are two dimensions to this level of competition for fixed services. First, as has been argued earlier, the consumers are increasingly substituting mobile for fixed services, so the fixed service providers face intense competition from mobile services. Second, the existence of telecom regulator too has acted as a check on the dominant service provider, BSNL from charging high prices. Instead what one sees is a significant improvement in the performance of BSNL

during this period². First of all, BSNL is one of the leading profit making central public sector enterprises in the country: in 2005-06 it made a net profit of Rs 89.40 billion- one of the few non oil public sector enterprises (PSE) in the top 10 profit making PSEs in the country. Three areas where the firm has made performance improvements are in: (a) considerable reductions in the number of consumers on the waiting list for a connection; (b) reductions in the number of faults per subscriber; and (c) number of personnel per 1000 subscribers. On all the three indicators BSNL has made substantial progress (Department of Telecommunications, 2007) and I argue that this entirely is due to the force of competition leading to efficiency gains for this rather monopolistic firm which have had a previous history of being completely impervious to the demands of consumers.

(b) Competition in the mobile services industry: The history of the mobile services industry can be traced to 1997 or so, when GSM cellular services were started. Since then the industry has grown and matured with another standard, CDMA, being introduced towards the end of 2002. Compared to the fixed services, the mobile services industry has a number of distinguishing features. First, the industry started as one dominated by private sector enterprises and the government religiously followed a policy of “managed competition” by licensing more than one service provider in a telecom circle. In fact majority of the 28 circles have at least four services providers and in a number of cases there are six service providers as well. In short, right through

2 BSNL's sales revenue emanate from two major segments: basic services and cellular services. Of the two, although the share of basic services has gone down even in 2005-06, its share was over 80 per cent of the total. So the performance of BSNL depends to a large extent the way it manages fixed telephone services although with the growth of mobile services the relative importance of fixed telephone services is likely to come down over time. See the Annual Report 2005-06 of BSNL at http://www.bsnl.co.in/company/results2005-06/resultcomplete_06.pdf (accessed on August 25 2007)

Table 6: Degree of competition in the market for fixed telephone services

(as on May 31 2007)

| Telecom Circle | Number of service providers | Herfindhal Index | Dominant supplier (with market share in per cent) |
|-------------------------|-----------------------------|------------------|---|
| 1. Andaman and Nicobar | 1 | 1 | BSNL (100) |
| 2. Andhra Pradesh | 4 | 0.8659 | BSNL (93) |
| 3. Assam | 1 | 1 | BSNL (100) |
| 4. Bihar | 3 | 0.9977 | BSNL(99..88) |
| 5. Chennai | 4 | 0.6109 | BSNL (76) |
| 6. Chattisgarh | 1 | 1 | BSNL (100) |
| 7. Delhi-NCR | 4 | 0.5464 | MTNL (69) |
| 8. Gujarat | 4 | 0.9131 | BSNL (98) |
| 9. Haryana | 4 | 0.9511 | BSNL (98) |
| 10. Himachal Pradesh | 3 | 0.9963 | BSNL (99) |
| 11. J.K | 2 | 0.9999 | BSNL (99) |
| 12. Jharkand | 1 | 1 | BSNL (100) |
| 13. Karnataka | 4 | 0.7333 | BSNL (86) |
| 14. Kerala | 4 | 0.9719 | BSNL (99) |
| 15. Kolkata | 4 | 0.9001 | BSNL(95) |
| 16. M . P | 4 | 0.6679 | BSNL (79) |
| 17. Maharashtra | 4 | 0.9371 | BSNL (97) |
| 18. Mumbai | 4 | 0.7162 | MTNL (84) |
| 19. North East -I | 1 | 1 | BSNL (100) |
| 20. North East-II | 1 | 1 | BSNL (100) |
| 21. Orissa | 2 | 0.9953 | BSNL (99) |
| 22. Punjab | 5 | 0.7537 | BSNL (86) |
| 23. Rajasthan | 5 | 0.8232 | BSNL (90) |
| 24. Tamil Nadu | 4 | 0.8908 | BSNL (94) |
| 25. UP (East) | 3 | 0.9478 | BSNL (98) |
| 26. UP (West) | 3 | 0.9559 | BSNL (98) |
| 27. Uttaranchal | 1 | 1 | BSNL (100) |
| 28. West Bengal | 2 | 0.9969 | BSNL(100) |
| India as a whole | 7 | 0.6899 | BSNL (82) |

Source: Telecommunications Regulatory Authority of India (various issues)

inception, the government envisaged an oligopolistic form of competition. Second, most of these private sector enterprises had some of foreign equity holding of sorts. Third, all of them are based on new technologies that were state-of-the art. Fourth, the conduct of the industry was, relatively speaking, more regulated by the newly created independent regulatory agency, the Telecom Regulatory Authority of India (TRAI). Fifth, it is one of the fastest growing industries in India and it can be safely assumed that it is the growth of this industry that has catapulted the communications sector as one of the major growth-contributing sectors of India's economy. Sixth, the mobile communications industry, especially the equipment part of the industry is the second largest in the world (next to China) and therefore has attracted considerable FDI in the manufacture of handsets leading to the employment of skilled manpower. Seventh, India is supposed to be having the cheapest mobile telecom tariffs in the world. The early part of the industry was of course riddled with much controversy pertaining to the terms and conditions under which the licenses were issued and the spectrum allocated between various kinds of service providers (Desai, 2006). Since all the services providers were new and had the same vintage of technology, their competition was more in terms of price and conditions of sale and of late these two aspects are much in public scrutiny thanks to the timely intervention, on various occasions, by the regulator.

If one computes the H-Index for the industry, at the national level (which is not exactly as meaningful as some of the providers are only at specific telecom circles), it shows a mild increase: the H-Index for the industry increased from 0.1370 in 2002 to 0.1593 in 2007. However this increase hides considerable variations at the circle level. See Table 7.

Most of the service providers have focused on specific regional markets, with the exception of Bharti (the largest mobile service provider). In fact there are only four service providers who have a presence in at

Table 7: Degree of competition in the market for mobile telephone services

(as on May 31 2007)

| Telecom Circle | Number of service providers | Herfindhal Index | Dominant supplier (with market share in per cent) |
|-------------------------|-----------------------------|------------------|---|
| 1. Andaman and Nicobar | 3 | 0.4908 | Bharti (42) |
| 2. Andhra Pradesh | 4 | 0.2882 | Reliance (59) |
| 3. Assam | 4 | 0.2606 | Aircel (31) |
| 4. Bihar | 5 | 0.2985 | Bharti (38) |
| 5. Chennai | 6 | 0.1910 | Aircel (26) |
| 6. Chattisgarh | 1 | 1 | BSNL (100) |
| 7. Delhi-NCR | 6 | 0.1851 | Hutchison Essar (21) |
| 8. Gujarat | 6 | 0.2246 | Hutchison Essar (38) |
| 9. Haryana | 6 | 0.2335 | Reliance (27) |
| 10. Himachal Pradesh | 6 | 0.2431 | BSNL (30) |
| 11. J.K | 4 | 0.4489 | BSNL (55) |
| 12. Jharkand | 1 | 1 | BSNL (100) |
| 13. Karnataka | 6 | 0.2307 | Bharti 329) |
| 14. Kerala | 6 | 0.1978 | BSNL (29) |
| 15. Kolkata | 5 | 0.2124 | Hutchison Essar (25) |
| 16. M.P | 5 | 0.2432 | Reliance (32) |
| 17. Maharashtra | 6 | 0.1793 | Idea (23) |
| 18. Mumbai | 6 | 0.1810 | Hutchison Essar (25) |
| 19. North East –I | 4 | 0.2777 | BSNL (35) |
| 20. North East-II | 1 | 1 | BSNL (100) |
| 21. Orissa | 5 | 0.2482 | Bharti (31) |
| 22. Punjab | 7 | 0.2001 | Bharti (30) |
| 23. Rajasthan | 7 | 0.1994 | BSNL (27) |
| 24. Tamil Nadu | 6 | 0.2008 | Aircel (28) |
| 25. UP (East) | 6 | 0.2189 | Hutchison Essar (22) |
| 26. UP (West) | 6 | 0.1763 | Hutchison Essar (22) |
| 27. Uttaranchal | 1 | 1 | BSNL (100) |
| 28. West Bengal | 6 | 0.2146 | Hutchison Essar (29) |
| India as a whole | 12 | 0.1593 | Bharti (23) |

Source: Telecom Regulatory Authority of India (various issues)

least 20 of the 29 circles. It is also interesting to see that the circles where BSNL has a monopoly position are also those with very low revenue potential. In other words, the private sector providers have positioned themselves in the most revenue earning circles. Also it is seen that it is the circles with high revenue earning potential that one sees an increase in the intensity of competition- the metros of Delhi, Mumbai and Chennai for instance.

B. Competition between mobile standards: It was seen above that mobile phones were introduced in the country towards the latter half of the 1990s and specifically in 1997. Ever since that year and until the end of 2002, the market was dominated by just one technology, namely the GSM. But in December 2002, a firm called Reliance Infocomm Ltd launched CDMA services across 17 circles. CDMA has since been growing faster than GSM, although there are some year-to-year variations. See Figure 4. Most Indian consumers are unaware of the *nitty gritty* of the two technologies. So the deciding factor between the two technologies is often based on price and other conditions of offer such as the coverage of the service ease of obtaining a new connection and whether a handset is available at a reduced price as part of the deal etc. Given this sort of a possibility of perfect substitution between the two types of technologies, the existence of the two standards have made both the markets for GSM and CDMA services very competitive. This is especially so when the market for CDMA services is highly concentrated with just two service providers accounting for almost the entire output. See Table 8. This is further indicated by the higher Herfindhal Index for CDMA services. What is being argued here is that despite being highly concentrated CDMA service providers have to compete with GSM service providers and this has prevented the CDMA service providers wielding any excessive market power.

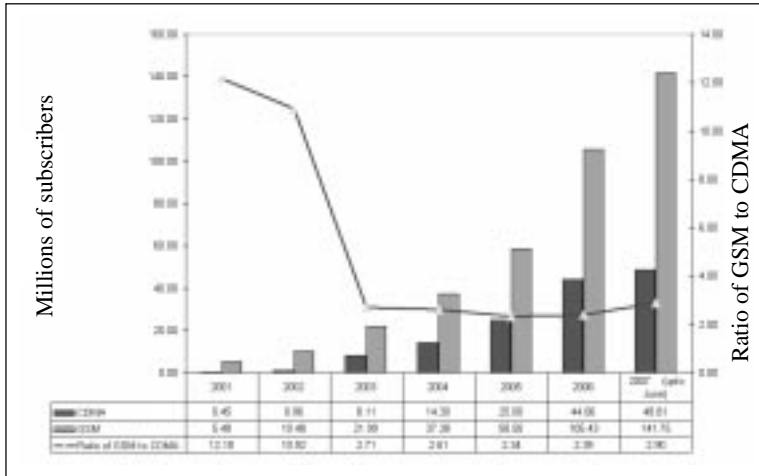


Figure 4: Ratio of GSM to CDMA subscribers, 2001 through 2007

Source: Cellular Operators Association of India (<http://coai.in>); and Association of Unified Telecom Service Providers of India (<http://www.auspi.in/default.asp>)

Table 8: Structure of the GSM and CDMA Services Industry
(as on March 31 2006)

| GSM | Market share | CDMA | Market share |
|------------------|--------------|-------------------|--------------|
| Bharti | 0.2830 | Reliance Infocomm | 0.7356 |
| BSNL | 0.2480 | Tata Teleservices | 0.2315 |
| Hutchison | 0.2220 | BSNL | 0.0234 |
| Idea | 0.1065 | MTNL | 0.0053 |
| Aircel | 0.0377 | HFCL | 0.0029 |
| MTNL | 0.0280 | Shyam Telelink | 0.0014 |
| Spice | 0.0279 | | |
| Reliance | 0.0275 | | |
| BPL group | 0.0194 | | |
| Herfindhal Index | 0.2063 | Herfindhal Index | 0.5952 |

Source: Telecom Regulatory Authority of India (2007)

One of the most important institutional requirements for competition to emerge and sustain, is the introduction of number portability³. Number portability allows a customer to move from one mobile service to another within GSM, and also between GSM and CDMA, while retaining the same telephone number. TRAI had recommended in March 2006 to the Department of Telecommunications (DoT) that mobile number portability be introduced by April 2007. According to this recommendation, a subscriber would be able to avail himself of the service by making a one-time payment of Rs 200 that would enable the operator to recover in three to five years her investment cost involved in introducing portability. It appears that DoT has not accepted this recommendation citing technical reasons such as non availability of dual technology handsets that can handle both GSM and CDMA handsets. It is generally held that major opposition to number portability came from GSM service providers while the CDMA providers were welcoming it with the hope that it would allow them to expand their market share.

(v) Price of telecom services: One of the more direct effects of this competition is lower prices. Before the deregulation of the telecom services industry and indeed the entry of mobile service providers, the telecom consumers were periodically subjected to increases in the tariff. This has now been effectively checked. Although it is not easy to talk about the price of telecom services, basically it follows a two part tariff both in the case of fixed and mobile services, first an activation charge followed by a charge for each type of calls. For mobile communication consumers then, there is the additional cost of calls according to whether it is post or prepaid. Based on estimates made by TRAI (2006), I have obtained the minimum effective charge derived out of an outgoing usage of 250 minutes per month per quarter during 2003 through 2005. This is

3 It refers to the ability of the telecom consumer to transfer either an existing fixed-line or mobile telephone number assigned by a local service provider and reassign it to another service provider.

plotted for both fixed and mobile services as well. Although charges for both the calls have come down, a higher reduction is noticed in the case of mobile services. In fact, India now has one of the cheapest mobile tariffs in the world (Table 9) and this can give an additional fillip to the growth of the Information and Communications Technology (ICT) industry in the country. If one were to plot the price of telecom services and the number of subscribers, one can see an inverse relationship in the case of mobile services although in the case of fixed services such an inverse relationship is not visible. This is because of the relative advantages which mobile technology can bestow on its user.

Table 9: Cost of mobile calls in India compared to other countries (as in June 2004)

| Country | Call charges per minute (US \$) | Minutes of usage per subscriber per month | Average Revenue per User (US \$) | Termination rates per minute Mobile (US \$) |
|-------------|---------------------------------|---|----------------------------------|---|
| Australia | 0.24 | 159 | 43 | 0.152(.016)** |
| Brazil | 0.11 | 92 | 11 | 0.080(0.020) |
| China | 0.04 | 261 | 10 | 0.025(0.010) |
| Switzerland | 0.45 | 119 | 59 | 0.163(0.017) |
| Japan | 0.33 | 156 | 63 | 0.130(0.022) |
| India | 0.03* | 309 | 11 | 0.007(0.007) |

Note: * refers to 2005 rates; **Figures in parentheses indicate the termination rates per minute for fixed telephones.

Source: Telecom Regulatory Authority of India (2006), p. 17

The two state-owned service providers, BSNL and MTNL have launched “One India Plan” with effect from 01.03.2006. Under this a three minute local call and a one minute national long distance call (referred to as STD calls) will cost only Re. 1. The “One India” plan, also, for the first time, takes away the distinction between the fixed line

tariff and the cellular tariff and thus, makes the tariff “technology independent”. A similar plan has also been introduced for the customers of post paid and pre-paid mobile services of BSNL and MTNL.

(vi) Institutional support: An interesting feature of the growth of telecommunications industry in the 1990s and beyond, compared to the earlier period, is the strong public policy support that the industry has received. It manifested in the form of the following policies:

- National Telecom Policy of 1994
- Telecom Regulatory Authority Act of 1997
- New Telecom Policy of 1999
- Broadband Policy of 2004

As a result the structure of India’s telecommunications industry evolved into a fairly sophisticated structure as outlined in Figure 5

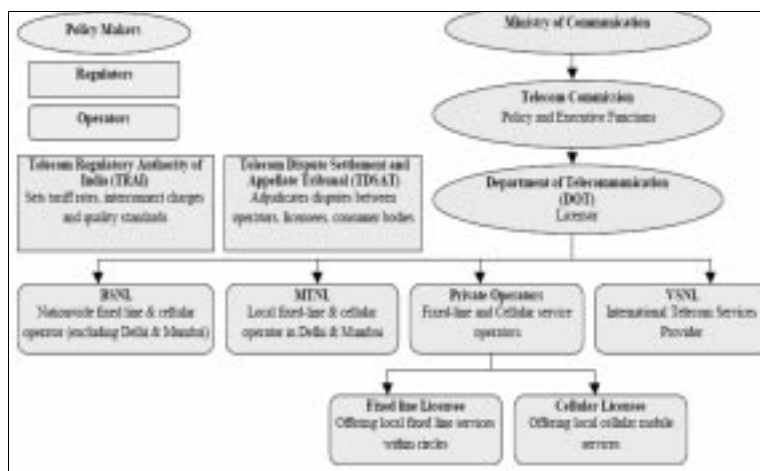


Figure 5: Structure of India’s Telecommunications Services Industry (c2007)

Source: ABN AMRO (2001), p.5

Other policies having an indirect effect: FDI Policy, the Electronic Hardware Policy of 2003, and the Semiconductor Policy of 2007⁴.

(vii) Growing R&D outsourcing: It is generally held that India has emerged as a major R&D hub. The recently concluded Technology Information and Forecasting Assessment Council (TIFAC) (2007) study has confirmed this commonly held proposition and according to this study, R&D investment worth of \$1.13 billion has flowed into India during the five-year period 1998-2003. The total receipts on R&D services have doubled itself from US \$ 221 million in 2004-05 to US \$ 519 million in 2005-06 (Reserve Bank of India, 2006, p. 1355). Telecom along with the pharmaceutical industry is a major recipient of these investments. The innovative performance of this segment can be gauged from the fact the number of US patents issued to inventors from India (including MNCs having operations in India) in the area of telecom technologies have increased from just 1 in 2001 to 13 in 2005 (Table 10).

Table 10: Patents issued to Indian inventors in the US, 2001-2005

(Number of patents)

| | Multi-plexing | Pulse or Digital | Telephonic | Telecommu-nications | Total |
|------|---------------|------------------|------------|---------------------|-------|
| 2001 | 0 | 1 | 0 | 0 | 1 |
| 2002 | 2 | 1 | 0 | 1 | 4 |
| 2003 | 3 | 1 | 0 | 1 | 5 |
| 2004 | 6 | 2 | 1 | 0 | 9 |
| 2005 | 7 | 2 | 1 | 3 | 13 |

Source: Compiled from USPTO

II. Three disquieting features

In the previous section I have outlined several dimensions of the growth of the industry. All these were positive features such as the

4 For the specific details of the policy, see <http://www.isaonline.org/semiconpolicy.html> (accessed on September 6 2007)

phenomenal growth of the industry, significant reductions in the waiting time to get a telephone connection and indeed in the price of telecom services. However, this growth has also been without some features that make us a bit uncomfortable with. Three such disquieting features of the growth of the industry have been identified. They are:

- i. The growing digital divide;
- ii. Increased dependence on imports as far as the equipments are considered; and
- iii. The relatively low penetration of Internet in India.

i. The growing digital divide: Several commentators and notably Desai (2006) had referred to the growing inequalities in the availability of telephones especially between states and indeed between the rural and urban areas within a state. This is so severe that the national picture that I presented above is only representative of the urban areas of some of the states. This growing digital divide, as it is usually referred to, is of course a reflection of the growing divides within the country as far as income and wealth is considered. The ratio of urban to rural tele density, which kept falling until 2002 has started rising again since 2003 and in 2005 is much higher than what was in 1996, when the mobile revolution was just about to begin. To illustrate, the ratio of urban to rural tele density increased from 14 in 1996 to nearly 20 by the end of 2005 (Department of Telecommunications, 2006).

A still another dimension of the digital divide is the variation in tele density across the various telecom circles (Table 11). Tele density (in 2005) ranged from as high as 60 per 100 people in the national capital region to just 2 in the backward state of Chattisgarh. The urban divide within each of the telecom circles is presented in Table 10. It shows that Kerala, Tamil Nadu (excluding Chennai) and Punjab have one of the lowest urban-rural divides, while Uttar Pradesh, Bihar and Assam have the highest digital divides. The Table also shows that rural tele density are significantly below urban ones across all the circles and even for the nation as a whole it has

remained at a very low level. This confirms the oft-expressed view that the telecom revolution spearheaded by the mobile phones has remained largely as an urban phenomenon. The government is very much aware of this situation and has put in place an institutional arrangement for bridging the digital divide. Specifically, the National Telecom Policy of 1999 envisaged implementation of Universal Service Obligation Fund (USO Fund) to provide telecom services in rural, remote areas and non-remunerative areas. This fund is raised through a 'universal access levy', which is 5 per cent of the adjusted gross revenue earned by the service providers under various licenses. The Universal Service Support Policy for Implementation of USO has taken effect from April 1, 2002. It is administered by the DoT and it has three major components: (i) providing public shared access; (ii) providing individual access; (iii) infrastructure support for mobile service providers. The latter policy is on the anvil and is yet to take shape. The overall performance of the USO Fund is far from satisfactory, as cumulatively speaking only about a third of the funds accumulated have actually been disbursed (Table 12).

The service providers, excepting for the state-owned BSNL, are rather reluctant to provide shared access. However, the private providers are keen to participate in the provision of individual access in rural areas as it is more profitable than providing shared access (Department of Telecommunications, 2007).

Hitherto, the USO funds have been utilised only for provision of fixed line connections. Given the fact that the future is in mobile communications, it is prudent to involve mobile service providers too. Some recent amendments made to the utilization of USO Funds have expanded the scope of the funds to include three more items⁵. In very specific terms the following additional four items were included:

5 An Ordinance was promulgated on 30.10.2006 as the Indian Telegraph (Amendment) Ordinance 2006 to amend the Indian Telegraph Act, 1885 in order to enable support for mobile services and broadband connectivity in rural and remote areas of the country. Subsequently, an Act has been passed on 29.12.2006 as the Indian Telegraph (Amendment) Act 2006 to amend the Indian Telegraph Act, 1885.

Table 11: The digital divide within telecom circles in India (as on March 31, 2006)

| | Urban | Rural | Ratio of U to R |
|-------------------------|--------------|-------------|-----------------|
| Andaman & Nicobar | 22049 | 9.15 | 2.46 |
| Kerala | 47.61 | 9.74 | 4.89 |
| Tamil Nadu (-) Chennai | 23.1 | 2.86 | 8.08 |
| Punjab | 51.57 | 5.34 | 9.66 |
| Haryana | 29.21 | 2.9 | 10.07 |
| Uttaranchal | 17.05 | 1.68 | 10.15 |
| Maharashtra (-) Mumbai | 27.71 | 2.59 | 10.70 |
| Gujarat | 30.12 | 2.63 | 11.45 |
| Himachal Pradesh | 78.11 | 6.82 | 11.45 |
| North East-II | 14.21 | 1.21 | 11.74 |
| Karnataka | 31.26 | 2.49 | 12.55 |
| Andhra Pradesh | 30.19 | 2.37 | 12.74 |
| North East-I | 15.93 | 1.24 | 12.85 |
| Chattisgarh | 7018 | 0.46 | 15.61 |
| Rajasthan | 22.94 | 1.45 | 15.82 |
| Kolkata | 25.09 | | |
| Mumbai | 45.81 | | |
| Chennai | 48.03 | | |
| Delhi | 52.09 | | |
| National Average | 28.25 | 1.74 | 16.24 |
| West Bengal (-) Kolkata | 17.14 | 1.05 | 16.32 |
| Jharkhand | 8.56 | 0.51 | 16.78 |
| Orissa | 21.35 | 1.05 | 20.33 |
| Jammu & Kashmir | 19.87 | 0.78 | 25.47 |
| Madhya Pradesh | 17.15 | 0.67 | 25.60 |
| Assam | 18.22 | 0.67 | 27.19 |
| Bihar | 19.71 | 0.57 | 34.58 |
| Uttar Pradesh | 18.89 | 0.52 | 36.33 |

Source: Department of Telecommunications (2006)

Table 12: Functioning of the Universal Service Fund, 2002-03 through 2006-07
(Rs in Crores)

| | Opening Balance | Funds collected as Universal Service Fund Levy | Funds allocated and disbursed | Balance at the end of the Year | Disbursement Rate |
|---------|-----------------|--|--|--------------------------------|-------------------|
| 2002-03 | 0 | 1653.61 | 300.00 | 1353.61 | 18 |
| 2003-04 | 1363.61 | 2143.22 | 200.00 | 3296.83 | 9 |
| 2004-05 | 3296.83 | 3457.73 | 1314.59 | 5439.97 | 38 |
| 2005-06 | 5439.97 | 3533.29 | 1766.85 | 7206.41 | 50 |
| 2006-07 | 7206.41 | 4211.13 | 1500.00 | 9917.54 | 36 |
| 2007-08 | 9917.54 | | 10.08 Crore disbursed against an allotment of 255 Crore out of 1800 Crore announcement in Parliament | | |
| Total | | 14998 | 5081.44 | 27214.36 | 34 |

Note: The 2006-07 disbursements data is up to December 2006

Source: Department of Telecommunications, <http://www.dot.gov.in/uso/implementationstatus.htm> (accessed on August 25 2007)

- Creation of infrastructure for provision of mobile services in rural and remote areas;
- Provision of Broadband connectivity to villages in a phased manner;
- Creation of general infrastructure in rural and remote areas for development of telecommunication facilities; and
- Induction of new technological developments in the telecom sector in rural and remote areas.

Only the first of four are in the form of some implementation⁶.

However it makes a lot of sense to extend the USO funds to provide

6 A scheme is being launched by the Government to provide support for setting up and managing 7871 number of infrastructure sites spread over 500 districts for provision of mobile services including other Wireless Access Services like Wireless on Local Loop (WLL) using Fixed/ Mobile terminals in the specified rural and remote areas of the country, where there is no existing fixed wireless or mobile coverage. The NIT for this scheme has been issued on 18.01.2007 and has been placed on DoT website for inviting bids from the stakeholders. The bids have since been received and are in the process of evaluation.

mobile services in rural areas as increasingly much of the growth in mobile communications have emerged from 'B' and 'C' Circles (Table 13). In fact the four Metros have ceased to be the major force behind the growth of the mobile connections in the country. Encouraging the growth of mobile communications to the other circles and the rural areas within the circles can increase the tele density in the country. Although such increases in tele density through mobile phones have some negative consequences, which is discussed below.

Table 13: Contribution of the various telecom circles to the growth of mobile services in India, 2002-03 through 2005-06 (percentage shares)

| Markets | Cities/States/UT covered | 2002-03 | 2003-04 | 2004-05 | 2005-06 |
|-----------------|---|---------|---------|---------|---------|
| The Four Metros | Delhi, Mumbai, Kolkata and Chennai | 30 | 26 | 21 | 17 |
| "A" Circle | Maharashtra, Gujarat, AP, Karnataka and Tamil Nadu | 36 | 40 | 35 | 34 |
| "B" Circle | Kerala, Punjab, Haryana, UP-W, UP-E, Rajasthan, M.P. West Bengal, Andaman & Nicobar | 30 | 30 | 35 | 36 |
| "C" Circle | HP, Bihar, Orissa, Assam, NE, J&K | 5 | 4 | 9 | 13 |
| Total | | 100 | 100 | 100 | 100 |

Source: Computed from Telecom Regulatory Authority of India (various issues)

There are also various other proposals for bridging the digital divide and this is an immediate task before the policy makers.

ii. Import dependence for telecom equipments is increasing

The country had assiduously built up a domestic telecom equipment manufacturing industry in all the three segments of the industry, namely in switching, transmission and terminal equipments. From the beginning until 1985 or so, the manufacture of telecom equipments were exclusively

reserved for the public sector, when in that year certain customer premises equipments like the Electronic Private Automatic Branch Exchanges (EPABX) were thrown open to the private sector. In fact the very first public sector enterprise established in independent India, ITI was devoted to the manufacture of telephone switching and terminal equipments. In 1985, the government established the stand-alone laboratory, Centre for Development of Telematics (C-DOT) to develop a family of digital switching technologies, which it licensed to both government and private sector enterprises. In fact Mani (2005) had argued that the C-DOT is credited with the establishment of a modern telecom equipment industry in the country. The Government's policy of public technology procurement practiced through its DoT, which was the only telecom service provider for a very long time until the late 1980s also contributed to the emergence and sustenance of a domestic manufacturing industry in telecom equipment which fitted very well with the overall policy of import substitution that was being followed. The deregulation of both the equipment and services industries, the liberalization of the economy, the virtual abandoning of the public technology procurement policy and above all the growth of the mobile communications industry have virtually put a leash on the growth of a domestic manufacturing industry. This is because both the research and production components of the industry focused only on fixed telephone technologies and with the mobile communications becoming very important, the demand for such equipments had to be increasingly met through imports. Box 1 presents a summary view of the present scenario.

I have attempted to estimate the net self-sufficiency rate for India's telecom equipment industry during the period 1992-93 through 2004-5. Self Sufficiency Rates (SSR) is defined as the ratio of domestic production to total availability, where total availability is the sum of domestic production and net imports. Two variants of the rate, SSR1 and SSR2 have been computed (Figure 6): SSR1 is based on net availability data from the World Telecom Indicators 2006 of the International

Box 1: Present (c2007) scenario with respect to the telecommunications equipment industry in India

- ❑ Private sector service providers have no compulsion to use equipment manufactured by indigenous companies. Their procurement of equipment is dependent of choice of technology, funding mechanism with long-term low interest credits by foreign suppliers.
- ❑ C-DoT and other R&D institutions could not develop new technologies, resulting into closure of units set-up for manufacture of their earlier products due to decline in demand.
- ❑ Government has allowed trading of telecom equipment to foreign companies under 'cash and carry wholesale trading'. Institutional sale is considered under wholesale.
- ❑ With the rapid growth of wireless access, GSM and CDMA, the entire demand is being met through import.
- ❑ Even companies like ITI have become 'Traders', which are importing the equipment and supplying to BSNL/MTNL. In order to take advantages of lower customs duty, a separate procedure of 'high-sea sale' is being followed. Even reservation quotas of PSUs are being used for trading of goods manufactured abroad and without any commitment of transfer of technology.
- ❑ Manufacturing is now based on orders from BSNL/MTNL with no commitment to continued supply. These orders are mostly being met by import of finished equipment from abroad.
- ❑ Tie-ups with foreign suppliers are also tender based. It is seen that, in a number of cases, a single foreign supplier will have tie-up with different companies and such suppliers (and their Indian agents) would become L-1, L-2 and even L-3 so that they get bulk of the order. This has also resulted into closure of those companies who were doing genuine manufacturing through transfer of technology, as they failed to secure orders from BSNL/MTNL and other private operators.

Source: Own compilation

Telecommunications Union and SSR2 is based on data on net availability of telecom equipments developed by us on the basis of data on exports and imports of telecom equipments from India contained in the on line database, UN Commodity Trade Statistics (UN Comtrade, <http://comtrade.un.org/db/>). Although the level of SSR as indicated by the two series is slightly at variance with each other, the direction of movement is roughly the same although SSR1 shows a much steeper fall in the self-sufficiency rate. Suffice it to say that the industry, which was more or less sufficient, is now increasingly depended on equipment imports. In other words, the phenomenal increase in the growth of services have not really benefited the local Indian manufacturers as most of them do not have the technological capability to service the new technology based equipments demanded by the 'service industry'. The New Telecom Policy



Figure 6: Self sufficiency rates of Indian telecoms equipment industry, 1992-93 through 2004-5

Source: Computed from International Telecommunications Union (2006) and UN Comtrade

of 1999 had envisaged making the country a leading centre for the manufacture of telecom equipments. But as to be discussed below, this is being achieved by opening up the market to domestic investments by MNCs. Even for IT solutions such as for software requirements, the domestic mobile service providers are depending on foreign vendors. One of the more recent publicised examples of this is the recently concluded US \$ 700 million contract between Idea Cellular and IBM for consolidating and managing IT infrastructure and applications of the mobile company. Although India is a leading exporter of computer software and indeed telecom software, its own service providers are depending on foreign sources. This is the paradox, if one can call it that way, I am referring to.

(iii) Low penetration of the Internet

The Internet services in India were launched on August 16 1995 by Videsh Sanchar Nigam Limited (VSNL). During the first three years of VSNL operation, the Internet subscriber base grew slowly. By the end of March 1998, it had barely reached 140,000 subscribers. In November 1998, the Government recognized need for encouraging spread of Internet in the country and opened the sector for provisioning of Internet Services by private operators. The license conditions for providing Internet services were liberal with no entry and license fee until October 31, 2003 there after a token license fee of Re 1 per annum. ISPs could set their own tariffs and even their own International Gateways. There were also restrictions on the number of service providers. To date, there are 389 ISP licensees, but out of this only 135 are operational. Public sector providers dominate with 56 per cent of the market (2006). 5 ISP's account for 83 per cent of the market with the top 1 alone accounting for 42 per cent. The top 20 ISP's cater to 98 per cent of the subscribers, while the remaining 115 ISPs cater only to the remaining 2 per cent of the subscribers. Approximately 60 per cent of the users still use dialup Internet access. Broad band access was introduced in October

2004, but its diffusion is still very low (Table 14)⁷. Out of 128 ISPs permitted to provide Internet telephony, only 32 have started the service.

Table 14: Diffusion of Internet in India, 1995-2007
(Numbers in millions)

| | Number of Internet subscribers | Number of broadband subscribers |
|-------------|--------------------------------|---------------------------------|
| August 1995 | 0.01 | |
| March 1996 | 0.05 | |
| March 1997 | 0.09 | |
| March 1998 | 0.14 | |
| March 1999 | 0.28 | |
| March 2000 | 0.95 | |
| March 2001 | 3.04 | |
| March 2002 | 3.42 | |
| March 2003 | 3.64 | |
| March 2004 | 4.55 | 0.04 |
| March 2005 | 5.55 | 0.90 |
| March 2006 | 6.95 | 1.35 |
| March 2007 | 9.27 | 2.32 |

Source: Telecom Regulatory Authority of India (2006), Telecom Regulatory of India (various issues), Telecom Regulatory Authority of India (2007a)

⁷ It may be pointed out that there is no consensus on the number of Internet and indeed broadband subscribers in the country. There are a plethora of estimates widely diverging from each other. For a detailed account of these various estimates, see Chandrasekhar (2006).

The Table shows that the rate of growth of the industry has come down over time and especially since 2002. Only about a quarter of the Internet subscribers have changed over to broadband access technologies. Majority of the subscribers use the older dial up technologies for accessing the Internet. According to a recent study on Internet in the country by the Internet and Mobile Association of India (2006), almost 76 per cent of the PC users have taken Internet connections. This means that the two technical reasons militating against the higher Internet diffusion in the country is the lack of ownership of PCs and not having a fixed telephone for accessing the Internet. Although it is possible to access Internet over a mobile phone,⁸ the current generation of mobile technology that is common in the country is 2 G and 2.5 G does not really facilitate the access. Of course it is generally held that whenever the country moves over to 3G phones accessing Internet over mobile phones is easier⁹. But given the much higher prices of 3 G handsets, it is not very likely that its diffusion will be high in the initial years. So the low Internet diffusion in the country is a direct consequence of the country being too reliant on mobile phones.

IV. The silver lining on the cloud

The silver lining is that India is becoming a major manufacturing hub for especially mobile handsets. This has the potential of increased demand for semiconductor devices, like for instance Digital Signal Processors (DSP), and this increased demand can precipitate the domestic manufacturing of semiconductor devices. Although all the players are expected to be MNCs as no local companies are available as of now. The government has responded to this prospect by announcing a semiconductor policy on March 22, 2007.

India emerging as a manufacturing hub: The New Telecom Policy of 1999 had envisaged that the country becomes a major

8 Recent estimates by the TRAI (2007a) show that approximately 31 million subscribers access the Internet through mobile phones.

9 See *Economic and Political Weekly* (2006) 'Telecom, 3G Face-offs'. Editorial, December 9 2006.

manufacturing and export hub for telecom equipments¹⁰. But for a long time this sounded more like an empty statement not backed by the reality where, as noted above, the country is depending heavily on imports. This was reflected in the rates of self sufficiency that I presented earlier showing a declining trend. However this situation is changing very rapidly in the last one year, specifically since 2006. The more proximate cause of this change is the large size of the market for mobile communication that is emerging in the country. With a monthly sale of over 5 million pieces since July of 2006, India has now become the second largest market for mobile handsets in the world, that all the major mobile handsets and other equipment manufacturers have commenced local manufacturing operations since 2006. See Box 2 for the specific details.

Domestic output of telecom equipments, although fluctuating, has shown some significant increases over the last two years (Figure 7). Also, although the numbers of data points are few, one can see an almost perfect positive correlation between the growth of the services sector and the equipment sector (Table 15). My argument is that this correlation is bound to become more significant in the future, given the present trends.

Table 15: Relationship between the growth of the services and equipment segments of the Indian Telecoms Industry, 2002-03 through 2005-06 (Rs. in Millions)

| | Telecom Equipments | Telecom Services |
|-----------|--------------------|------------------|
| 2002-2003 | 144000 | 480000 |
| 2003-2004 | 140000 | 610000 |
| 2004-2005 | 160900 | 800000 |
| 2005-2006 | 178330 | 1000000 |

Sources: Department of Telecommunications (2006 and 2007); and Telecom Regulatory Authority of India (2006), p. 13

10 The policy had stated that, "With a view to promoting indigenous telecom equipment manufacture for both domestic use and export, the Government would provide the necessary support and encouragement to the sector, including suitable incentives to the service providers utilising indigenous equipment". See the New Telecom Policy of 1999 at the DoT Website: <http://www.dot.gov.in/ntp/ntp1999.htm> (accessed on August 27, 2007)

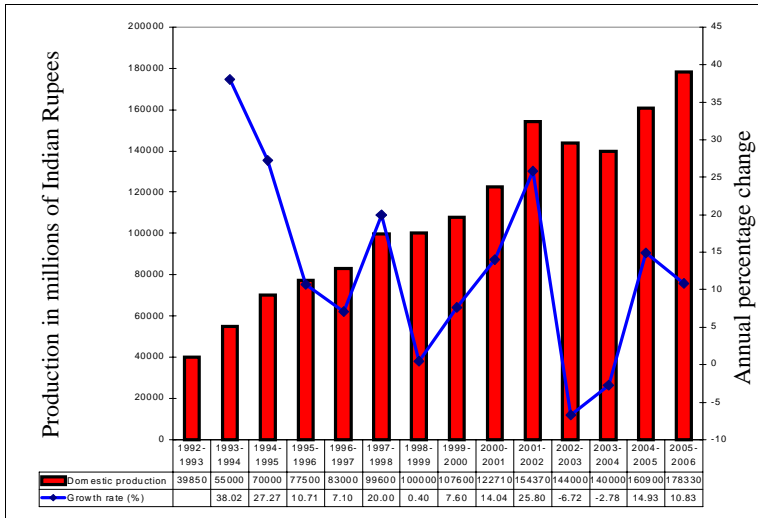


Figure 7: Domestic production of telecom equipments in India, 1992-93 through 2005-06

Source: Department of Telecommunications (2006 and 2007)

However the industry is going to be dominated by affiliates of MNCs. In fact, telecom industry has been one of the major recipients of FDI in the country since 1991 (Table 16). Although much of these investments (over 50 percent) are in the services segment, increasingly (since 2001), the equipment sector has received about a quarter of the total investments. In short the domestic manufacturing industry will be more dominated by foreign enterprises (Table 17).

Further the import dependence of the industry will in all probability continue to be high for a few more years as the local manufacturing of mobile equipments is at present based on Fully Knock Down (FKD) and Semi Knock Down (SKD) kits. But as the domestic manufacturing of electronic components and semiconductor devices increase, the import dependence is sure to come down. In this way the experience on this count will be similar to the Indian automotive industry.

Table 16: FDI Inflows to India's Telecoms Industry, 1991-2006
(Rs in Millions)

| | FDI Inflows |
|------|---------------|
| 1991 | 20.6 |
| 1992 | 160.8 |
| 1993 | 2228.2 |
| 1994 | 9876.5 |
| 1995 | 22328.4 |
| 1996 | 40084.8 |
| 1997 | 42211.5 |
| 1998 | 45097.3 |
| 1999 | 84806.3 |
| 2000 | 95621.3 |
| 2001 | 98635.3 |
| 2002 | 103183.8 |
| 2003 | 104087.8 |
| 2004 | Not Available |
| 2005 | 14125 |
| 2006 | 118087.9 |

Source: Department of Telecommunications (2007), p.12

This growth of the manufacturing sector has several spillover effects besides direct employment. One of the more important of these is the demand for electronic components and specifically semiconductor devices, which are used in the manufacture of these equipments. According to estimates by the newly formed (in 2004) Indian Semiconductor Association, the total available market (after taking into account imports) is bound to increase from \$ 0.91 billion to over \$ 16 billion by 2015. Mobile handsets and equipments will be one of the

Table 17: India emerging as a manufacturing hub for mobile telecom equipment (c2007)

| Name of the manufacturer | Type of facility with the location |
|--------------------------|--|
| 1. Ericsson | GSM Radio base Station facility-Jaipur R&D Centre in Chennai |
| 2. Elcoteq | Contract Manufacturer-Bangalore |
| 3. Nokia | Mobile Handsets-Chennai |
| 4. LG Electronics | Mobile Handsets-Pune |
| 5. Flextronics | Contract Manufacturer-Chennai |
| 6. Foxconn | Contract Manufacturer-Chennai |
| 7. Motorola | <ul style="list-style-type: none"> • Mobile Handsets • R&D centres |
| 8. Sony Ericsson | Mobile Handsets through Flextronics and Foxconn |
| 9. ITI | <ul style="list-style-type: none"> • GSM facility with Alcatel at Nainital and Manakapuri UP • CDMA with ZTE, China at Bangalore |

Source: Own compilation

larger markets for these devices. Consequent to this thinking, a semiconductor manufacturing industry is emerging in the southern part of the country:

- SemIndia promoted by Vinod Agarwal - US\$ 3 Billion (12" Fab) at Hyderabad;
- NANO-TECH Silicon India Pvt Ltd (NSTI) promoted by Dr. Jun Min - US\$ 0.6 Billion (8" Fab) at Hyderabad;
- Hindustan Semiconductor Manufacturing Co. (HSMC) promoted by Deven Mehta- US\$ 4.5 Billion (8" Fab) - Location to be confirmed;

- India Electronics Manufacturing Corp IEMC promoted by Rajendra Agarwal - US\$ 3.0 Billion (12" Fab) -Location to be confirmed;
- A number of chip companies from around the world have established research centers in India. Qualcomm Inc., the largest chip design house by revenue and a major U.S. mobile chip company, has also opened a software and chip development lab in India. The company uses it as a base for research and development as well as a place from which to promote its CDMA according to its Web site,;
- The state owned Semiconductor Complex at Chandigarh, (which has been taken over by the Department of Space), is drawing up a roadmap for its new baby. It expects to rejuvenate SCL and put India on the 0.35-micron map in the foreseeable future; and
- The Indian Semiconductor Association has close to 100 members as of now.

If all the projects materialise, India will soon be safely in the “bus” that it had missed several years ago as far as electronic hardware is concerned. The semiconductor itself has based itself on the chip design capabilities which India’s IT industry already possesses.

The government has responded to these private initiatives by announcing, on March 21 2007, a special financial incentive package to attract investments for setting up semiconductor fabrication and other micro and nanotechnology manufacturing industries in the country. The incentive is in the form of capital subsidies to the tune of 20 per cent of the total investment expenditure incurred by a fab or eco-systems units¹¹ during the first ten years, provided that these units are located within a

11 ‘Fab units’ with threshold Net Present Value (NPV) investment of Rs 25 billion would be covered by the Special Incentive Package Scheme. For other units in the ecosystem, there would be a threshold NPV investment of Rs 10 billion.

Special Economic Zone (SEZ) and 25 per cent if they are located outside a SEZ. In addition, the units are also exempted from countervailing duties. Further the units will have to be established before March 31, 2010.

In response to this incentive package, the government is expecting US \$ 10 billion worth of investment. It remains to be seen whether this will fructify or not. Such an incentive induced investment strategy is sometimes criticised as the government is essentially taxing the citizens of a country and passing on the benefits to a few private sector individuals.

Thus the growth of the telecom services industry is leading to the emergence of not just the telecom equipment industry, but also the electronic components and semiconductor devices that are required for the manufacture of these equipments as well. Thus the Indian telecoms industry is an excellent example where the growth of the services is leading to the emergence of an attendant manufacturing industry as well.

V. Conclusions: The telecom industry is a fine example of what can be achieved by easing governmental regulations with respect to production, imports and exports and focusing more on tariffs and other conditions of sale. The growth of the services segment of the industry is appears to be spawning a manufacturing industry. In order to sustain this high growth, the government ought to be very serious about examining various proposals for bridging the digital divide through the support of private sector service providers as well. But unlike the Chinese case, the colour of one part of this industry is largely foreign. The policy focus of the government would be to maximize the spillovers of this activity to local Indian companies especially downstream industries such as components and semiconductor manufacturing. A beginning towards this has been made. The formation of a Telecom Equipment Export Forum and the announcement of the Indian Semiconductor Policy 2007 are right steps in this direction. Success crucially depends on the response of the private sector to these incentives. Given the importance that a regulatory agency can play in this crafting, no effort should be lost in

strengthening the powers of the TRAI. The benefits to the Indian economy from having both a strong services and manufacturing segments in the telecom sector cannot be undermined.

Box 2. India as a manufacturing hub for mobile communications equipment

- Indian mobile handset market is now worth about US\$ 2 billion, but will surge by over 60 percent in two years.
- The growth has caught the imagination of global handset majors. More than a dozen large electronic manufacturing service companies are sprucing up plans to set up their handset facilities in India. Apart from catering to the burgeoning Indian market, they are also looking at this country as a sourcing base for low-cost phones.
- The world's top five mobile handset makers-Nokia, Motorola, Samsung, Sony Ericsson and LG - have started manufacturing their products in India.
- Korean consumer electronics major LG Electronics is one such company. It has a facility in the outskirts of Delhi and is setting up another near Pune. By 2010, LG aims to produce 20 million mobile phone units of which 50 percent will cater to the export market. The facility will involve an investment of US\$ 60 million by the year 2010.
- Nokia, a leader in India's US\$ 2.5 billion mobile phone market, has set up a unit in Chennai. The manufacturing unit will be Nokia's tenth mobile device production facility globally. Nokia anticipates investing an estimated US\$100-150 million in the India production plant. The plant has started commercial production in March 2006 and has already started exporting handsets manufactured here to Malaysia, Singapore, Indonesia, Thailand and Vietnam. The plant currently employs about 2700 persons, 80 per cent of which is in production itself. The plant manufactures low value but high volume mobile handsets and base station controllers.

- Another Finnish firm, Elcoteq, the world's third-largest supplier of handsets to original equipment manufacturers (OEMs), has already set up a facility in Bangalore. Elcoteq's Indian plant is relatively small compared to its plants elsewhere - it will produce about 4 to 6 million handsets in a year, similar in size to the company's unit in Russia. But it could set a trend for smaller manufacturers to begin looking at India.
- Motorola has set up a manufacturing facility near Chennai with an initial investment of \$30 million (Rs. 135 crore), which will go up to \$100 million (Rs 450 crore) within a year. The company signed an agreement with the Tamil Nadu Government (June 2007) to establish the facility in the 300-acre Sriperumbudur Hi-Tech Special Economic Zone, coming up 40 km west of Chennai. The special economic zone is being jointly developed by the Tamil Nadu Government, Motorola and component suppliers such as Fox Conn. The facility will supplement the presence of its six R & D centres in India, including Motorola Labs, Core Networks Division, Embedded communications Computing and Global Software Group.
- Sony Ericsson has announced it's going local and plans to start making mobile phones in Chennai. Significantly these plans will be realised through agreements with its existing outsourced manufacturing partners - Flextronics and Foxconn.

Source: Own compilation

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