Lessons of Reforms of the Telecom Sector

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Abstract

The telecommunications sector has emerged as one of the key sectors that have put the Indian economy on a revival path. Proactive policies such as opening up the sector to private players and competition, unbundling the policy, regulatory and operational roles of the government, removal of restrictions on foreign investments coupled with viewing reforms as a continuous process created an environment conducive to growth. These reforms enabled induction of new technologies.

In this paper, we examine the lessons of reforms of the Indian telecom sector. We first examine where the sector is in terms of its impact on service provision and to the economy in relation to the past. Then we outline the sector structure examining the role and relationships of different players. Next, we provide the roadmap of reforms carried out over two decades. From this, we abstract the enabling principles that drove the reform process and bring out lessons for other infrastructure sectors.

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1 Introduction

The telecommunications sector has emerged as one of the key sectors that have put the Indian economy on a revival path. Proactive policies such as opening up the sector to private players and competition, unbundling the policy, regulatory and operational roles of the government, removal of restrictions on foreign investments coupled with viewing reforms as a continuous process created an environment conducive to growth. These reforms enabled induction of new technologies.

In this paper, we examine the lessons of reforms of the Indian telecom sector. We first examine where the sector is in terms of its impact on service provision and to the economy in relation to the past. Then we outline the sector structure examining the role and relationships of different players. Next, we provide the roadmap of reforms carried out over two decades. From this, we abstract the enabling principles that drove the reform process and bring out lessons for other infrastructure sectors.

2 Sector Impact

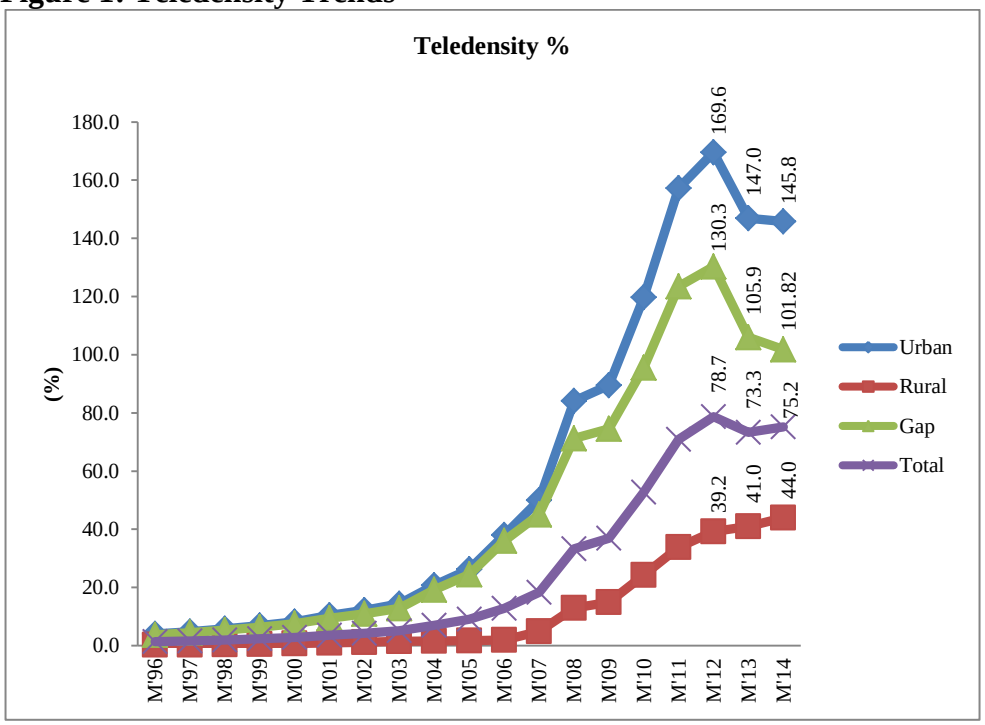
We study the primary impact of the sector in terms of quality of service, including penetration, mobility, reliability, tariff, and value added services. In terms of its impact on the economy, we examine the size of key players, earnings to the government, foreign direct investments (FDI) and employment.

2.1 Penetration/Teledensity

As of March 31, 2014, India was the second largest cellular network and the second largest telecommunications network in the world[2]. The total, urban and rural teledensity[3] as of March 31, 2014 were 75.2%, 145.8%, 44.0% respectively[4], showing a phenomenal growth over the last 15 years. Figure 1 provides a 18 year comparison.

[2]Status of Telecom Sector, http://www.dot.gov.in/sites/default/files/AR%202013-14%20English%20(2)_1.pdf, accessed on December 19, 2014
[3]Teledensity is the number of connections, including for voice and data, per 100 population
[4] http://www.trai.gov.in/WriteReadData/WhatsNew/Documents/Press%20Release-TSD-Mar,14.pdf, accessed on December 19, 2014

Figure 1: Teledensity Trends



Source: TRAI, The Indian Telecom Services Performance Indicators Reports,Various Years, http://www.trai.gov.in/Content/PerformanceIndicatorsReports/1_1_PerformanceIndicatorsReports.aspx, accessed on February 2, 2015

As per the Telecom Regulatory Authority of India (TRAI) records, the teledensity had 'peaked' as of March 2012, since the cellular user data reflected the total subscriber base including inactive numbers. This was corrected by looking at the cellular users as active numbers, which is reflected in the data for the subsequent years where in there is a 'reduction' in total teledensity. This was primarily due to the correction affecting urban teledensity.

The penetration had further increased to 77.1%, 148.1% and 45.4% by October 31, 2014[5]. In comparison, as on March 31, 1996 India's total teledensity was 1.6% and its urban and rural teledensities were 4.8% and 0.3% respectively.

There were 27.3 million (mn) wireline and 935.4 mn cellular subscribers as of October 31, 2014 compared with 11.9 mn wireline subscribers and insignificant cellular

[5]http://www.trai.gov.in/WriteReadData/PressRealease/Document/PR-TSD-80-05122014.pdf, accessed on December 19, 2014

subscribers as of March 31, 1996[6]. Of the cellular subscribers, 548.8 mn were urban and 386.6 mn were rural. While cellular subscribers have been continuously on the rise, wireline subscribers reached a peak of 41.5 mn as on March 31, 2006.

The cellular subscriber base refers to the total sim cards sold (Table 1). Out of the total 905 mn sim cards sold as on March 31, 2014, 791 mn were active. Based on the estimate of 1.15 sim cards per subscriber, 688 mn were actual users (excluding multiple sims).

Table 1: Active and Actual Cellular Users

(March 31, 2014)	**No of Users** *(mn)*
Total Cellular Subscriber Base	905
Active Numbers	791
Actual Users (excluding multiple sim cards)	688*

**estimate is based on a 1.15 sim cards per subscriber*
Source: TRAI, http://www.trai.gov.in/WriteReadData/WhatsNew/Documents/Press%20Release-TSD-Mar,14.pdf, accessed on July 22, 2014

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In the early nineties, the waiting period for a telephone connection was nearly five years. There were provisions to 'jump the queue', based on status and/or significant extra payments. The waiting list for fixed lines as on March 31, 1996 was 2.2 mn[7], which had reached a peak 3.7 mn on March 31, 2000[8]. The latest data available for fixed line showed a waitlist only for Bharat Sanchar Nigam Limited (BSNL) as 2.2 mn on March 31, 2009 and for Mahanagar Telephone Nigam Limited (MTNL) at 655[9]. The data for BSNL waitlist subscribers for subsequent years has not been reported. The MTNL waitlist was cleared during 2009-10. On the other hand, one can procure a cellular telephone connection anytime in just about Rs 50.

As per Census 2011, the total number of households in India was 247 mn, of which 168 mn were rural and 79 mn were urban (Table 2). 54.3% of rural and 82.0% of urban

[6]DoT Annual Report 1995-96
[7]Ibid
[8]TRAI Annual Report 2005-06, http://www.trai.gov.in/WriteReadData/UserFiles/Documents/AnuualReports/ar_05_06.pdf, accessed on February 19, 2015
[9]DoT Annual Report 2008-09, http://www.dot.gov.in/sites/default/files/AR_English_2008-09_0.pdf, accessed on February 19, 2015

households had telephones, resulting in an overall average of 63.2% households. In terms of numbers, this implied 91.2 mn rural and 64.7 mn urban households had telephones. It is notable that the number of rural households having telephones is greater than the number of urban households having telephones.

Table 2: Number of Households Having Telephones

(Census 2011, February-March 2011)	**Total** *(mn)*	**Rural** *(mn)*	**Urban** *(mn)*	**Total** *(%)*	**Rural** *(%)*	**Urban** *(%)*
Wireline	9.9	5.2	4.7	4.0	3.1	5.9
Cellular	131.2	80.5	50.7	53.2	47.9	64.3
Both	14.8	5.5	9.3	6.0	3.3	11.7
Total	155.9	91.2	64.7	63.2	54.3	82.0
Total Households (India)	247	168	79	100	100	100

Source: House listing and Housing Census Data Highlights - 2011, available at http://censusindia.gov.in/2011census/hlo/hlo_highlights.html, accessed on April 4, 2012

The above achievements in penetration can be contrasted with the perspective in 1991, which is best reflected in the following remarks of the Approach Paper to the sixth five-year plan: *"The primary need of people is food, water and shelter. Telephone development can wait. In place of doing any good, development of the telecommunications infrastructure has tended to intensify the migration of population from rural to urban areas. There is a need to curb growth of telecom infrastructure particularly in the urban areas*"[10]. This perspective has obviously changed and telecom services reach a significant population with a penetration of 75.2% as of March 31, 2014.

2.2 Mobility

Cellular services inherently provided mobility in communications. It also enabled personalized use of phones across geographies. The cellular service segment was the fastest growing in the telecom sector (Table 3). While cellular services contributed nearly 18.3% (Rs 8,600 crores (cr) of the total telecom revenue of Rs 47,100 cr) in 2002-03, it contributed 67.8% (Rs 118,500 cr of the total telecom revenue of Rs 174,800 cr) in 2011-

[10]Approach Paper to the Sixth Plan (1980-85), quoted in Balashankar, 1998, p. 30, accessed on February 19, 2015

12[11]. This was over a total telecom revenue base that itself had a Compounded Annual Growth Rate (CAGR) of 15.7% in 2013-14 over 2002-03.

The revenues from the wireline segment had reached a peak of Rs 34,200 cr in 2005-06 and then have declined to Rs 12,100 cr in 2011-12[12]. The revenues from the cellular segment overtook the wireline segment in 2005-06 and had grown to Rs 1,18,500 cr in 2011-12. From 2012-13, the fixed line and the cellular revenues were clubbed together as access revenues.

The total revenue of the telecom sector increased from Rs 12,518 cr in 1995-96 to Rs 1,16,803 cr in 2009-10 and further to Rs 2,33,815 cr in 2013-14[13].

Flexibility has gone up on a number of dimensions such as ease of obtaining connections, making calls across geographies, and mobile number portability.

[11]From 2012-13 onwards the revenue is reflected as access services which comprises of fixed line and cellular services
[12]Same explanation as above (Footnote 5)
[13]TRAI, The Indian Telecom Services Performance Indicator Report, January – March 2014, http://www.trai.gov.in/WriteReadData/PIRReport/Documents/Indicator%20Reports%20-%20Mar-14.pdf, accessed on February 19, 2015

Table 3: Revenue from Different Services

(Rs in '000 cr)

Services	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13*	2013-14
Fixed Line	25.9	33.0	32.7	34.2	30.2	26.7	24.6	13.3	11.2	12.1		
Cellular	8.6	14.3	22.8	36.0	56.2	76.6	93.5	87.7	102.2	118.5	160.2	174.8
Others**	12.6	11.3	12.0	18.4	21.2	27.2	37.4	43.6	52.7	44.2	52.4	59.0
TOTAL	47.1	58.6	67.5	88.6	107.6	130.5	155.5	144.6	166.1	174.8	212.6	233.8

Source: Voice&Data, from various editions, available at http://voicendata.ciol.com/ , accessed on February 18, 2015

* From 2012-13, data is given as access revenues to include both fixed line and cellular

** Others constitutes National Long Distance (NLD), International Long distance (ILD), Internet Service Provider (ISP)

Data from TRAI Reports

Services	2009-10	2010-11	2011-12	2012-13	2013-14
Access Providers	124.4	131.7	148.2	160.2	174.8
NLD	19.3	25.2	29.2	31.8	34.6
ILD	8.8	9.1	10.5	12.2	14.3
Others	5.4	5.8	7.5	8.4	10.1
TOTAL	158.0	171.7	195.4	212.6	233.8
Difference	13.4	5.6	20.6	0.0	0.0

2.3 Reliability

The reliability of calls improved on various parameters such as call completion rates, network downtimes, etc. For example, the call completion rates measured as a percentage of effective long distance calls in 1995-96 was 83%[14]. Given the growing wireless network, the relevant parameter is call set-up success rate (within licensee's own network). When we examine the service area and operator combinations, 179 out of 183 combinations in 2G service and 92 out of 94 combinations in 3G service were able to achieve the TRAI benchmark of more than or equal to 95% call set-up success rate as of quarter ending September 30, 2014.

2.4 Tariff

The cellular local call tariff in 1990's was Rs 16.40 per minute which had come down to under Rs 1.00 per minute by early 2000. During the same period the National Long Distance (NLD) tariff had reduced from Rs 34.50 per minute to under Rs 1.00 per minute for distances above 1000 km, making them as inexpensive as local calls. The International Long Distance (ILD) tariff had also seen similar reductions[15]. However, there were increase in the tariffs in the recent years. There were also increased usage of data communication, which was relatively more expensive.

This reflected in falling average revenue per minute (ARPM) until the quarters in 2012-13, after which it increased (Table 4). This data refers to the cellular users on the Global System for Mobile communications (GSM) network, which constituted nearly 94% of the total cellular subscriber base, with Code Division Multiple Access (CDMA) contributing to the rest.

The minutes of usage (MoU) per user per month was on the decline until July – September 2011, reaching a low of 331. This was possibly due to new subscribers with

[14]DoT Annual Report, 1995-96
[15]http://www.dot.gov.in/about-us/telecom-glance , accessed on February 19, 2015

lower propensity to pay, multiple subscriptions per user and a significant number of inactive users. The MoU had since risen to 390 in April – June 2014. It dropped to 376 in July – September 2014.

The average revenue per user (ARPU) per month, which was a combined effect of the ARPM and MoU, had declined from Rs 131 in January - March 2010 to a low of 93 in July – September 2011. It had since increased, reaching Rs 119 in April – June 2014. It dropped to Rs 116 in July – September 2014.

Table 4: Revenue and Usage Figures

Quarter	**ARPU** *(Rs per month)*	**MoU** *(Per month, per user)*	**ARPM** *(Rs per user)*
Jan - Mar 2010	131	410	0.32
Apr - Jun 2010	122	401	0.30
Jul - Sep 2010	110	368	0.30
Oct - Dec 2010	105	360	0.29
Jan - Mar 2011	100	349	0.29
Apr - Jun 2011	98	344	0.28
Jul - Sep 2011	93	331	0.28
Oct - Dec 2011	96	332	0.29
Jan - Mar 2012	97	346	0.28
Apr - Jun 2012	95	346	0.27
Jul - Sep 2012	95	342	0.28
Oct - Dec 2012	98	359	0.27
Jan - Mar 2013	105	383	0.27
Apr - Jun 2013	111	388	0.29
Jul - Sep 2013	109	375	0.29
Oct - Dec 2013	112	379	0.30
Jan - Mar 2014	113	389	0.29
Apr - Jun 2014	119	390	0.31
Jul - Sep 2014	116	376	0.31

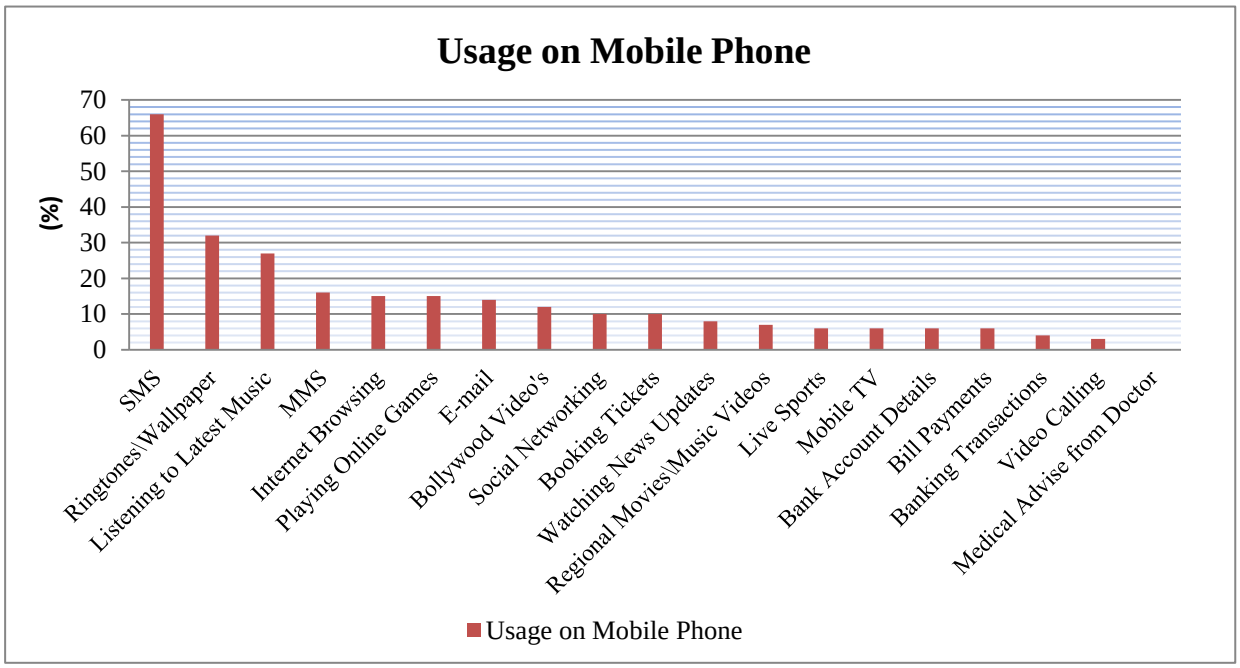
Source*:* TRAI, The Indian Telecom Services Performance Indicator Report, Various Years, http://www.trai.gov.in/Content/PerformanceIndicatorsReports/1_1_PerformanceIndicatorsReports.aspx#skipdiv, accessed on February 19, 2015

2.5 Value Added Services

Value Added Services (VAS) included Short Message Service (SMS), ringtone/wallpaper and listening to latest music downloads etc. (Figure 2). In 2010, out of the population that subscribed to VAS, 66% used SMS, 32% downloaded ringtones/wallpaper, and 27% listened to the latest music. The revenue earned from VAS contributed to about 10% of the total revenue. SMS alone contributed to 4-6% of the total revenue[16].

Figure 3 describes a study of mobile Internet usage for 2015 estimated that 88% would be for e-mails, followed by 76% for social networking, 69% for downloading songs, 60% for downloading applications and so on.

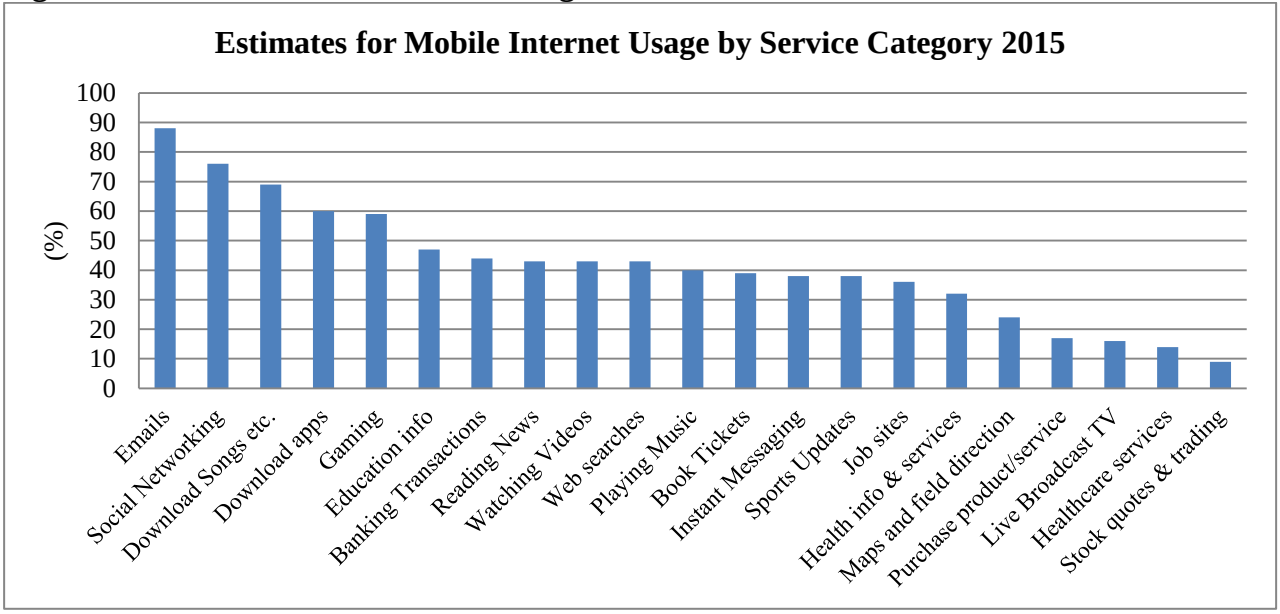
Figure 2: VAS Usage in 2010



Source: Connect with Consumers Value Added Services: The Next Wave, www.pwc.com/india, accessed on January 7, 2012

[16]http://voicendata.ciol.com/content/service_provider/110010505.asp, accessed on January 9, 2012

Figure 3: Mobile Internet Estimated Usage for 2015



Source: Beyond the tip of the iceberg: The multi-billion dollar Indian MVAS market opportunity, http://www.wipro.com/documents/beyond_the_tip_of_the_iceberg.pdf, accessed on January 2, 2015

With the advent of 3G technology and access to cloud storage, cellular services like real time gaming, m-advertising, m-banking, m-health, m-education, m-governance were expected to boost the revenue earned through VAS to 20%[17].

2.6 Creation of Large Companies

Until 1986, Department of Telecommunications (DoT) was the only permitted agency to provide telecommunication services in the country. MTNL and Videsh Sanchar Nigam Limited (VSNL) were corporates created under DoT in 1986, with the objective of providing services in the metros of Mumbai and Delhi, and international segment respectively. With the implementation of the National Telecom Policy 94 (NTP 94) and National Telecom Policy 99 (NTP 99), which allowed private entry, India saw the evolution of various large telecom companies like Bharti Airtel Ltd, Reliance Communications Ltd, Vodafone India, Idea Cellular Ltd etc. On October 1, 2000, the government corporatized its service and operations function into BSNL.

[17]http://www.voicendata.com/in-vas-contribution-operators-revenue/, accessed on February 2, 2015

As of September 30, 2014, Bharti was the largest telecom service provider in India, with a subscriber market share of 25.1%. Vodafone was second with a market share of 23.7%, followed by Idea at 20.2%. The two government incumbents had a total market share of 8.9% (Table 5).

Table 5: Company wise Subscribers

Sr No	Name of Company	As on September 30, 2014	
		Total Subscribers *(mn)*	Market Share *(%)*
1	Bharti	214.9	25.1
2	Vodafone	173.9	23.7
3	Idea	143.6	20.2
4	BSNL	104.1	8.9
5	Reliance	111.3	7.1
6	Aircel	75.9	6.9
7	Tata	65.8	4.2
8	Telewings	41.8	3.4
9	Sistema	9.2	0.6
10	Quadrant	2.7	0.0
11	Loop	1.9	0.0
12	Videocon	5.9	0.0
13	MTNL	6.9	0.0
	Total	957.6	100

Source: TRAI, Performance Indicators Report, July – September, 2014, http://www.trai.gov.in/WriteReadData/PIRReport/Documents/Indicator-Reports29012015.pdf, accessed on February 19, 2015

While BSNL had a market share of 56.2% in 2005, it had reduced to nearly 8.9% by September 30, 2014. Bharti was the largest revenue earning company in the sector since 2008-09. There were seven companies that had revenue of greater than Rs 10,000 cr in 2013-14 (Table 6).

Table 6: Company wise Revenues

(Rs '000 cr)

Sr No	Service Providers	Revenue											Category
		2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14*	
1	Bharti Airtel	5.0	8.0	11.3	17.9	26.4	37.0	41.8	59.5	71.5	80.3	85.7	Fixed, Cellular, NLD, ILD, VSAT, ISP
2	Vodafone	NA	4.4	6.8	10.6	15.5	20.4	23.6	27.3	32.2	35.6	37.6	Cellular, ISP
3	Idea Cellular	1.3	2.4	3.0	4.4	6.7	10.1	12.4	15.5	19.3	22.1	26.5	Cellular, ISP
4	BSNL	31.0	36.3	40.2	40.1	35.3	35.2	32.1	28.8	27.9	26.4	26.5	Fixed, Cellular, ISP, NLD, ILD, ISP
5	Rel. Comm.	2.7	5.4	10.8	14.5	18.6	22.9	22.1	23.1	20.4	21.8	22.3	Fixed, Cellular, ILD, NLD, ISP
6	Aircel	NA	0.7	1.0	1.5	2.5	3.4	3.7	5.4	8.1	9.8	11.3	Cellular, ISP
7	TTSL	NA	1.3	2.6	5.2	6.0	6.7	6.9	8.3	10.5	10.8	10.5	Fixed, Cellular, VSAT, ISP
8	MTNL	6.4	6.1	5.6	4.9	4.7	4.5	5.1	4.0	3.4	3.4	3.4	Fixed, Cellular, ISP
	Total of above 8	**46.4**	**64.6**	**81.3**	**99.1**	**115.7**	**140.2**	**147.7**	**171.9**	**193.3**	**210.2**	**223.8**	

Source: Voice&Data, from various editions, available at http://voicendata.ciol.com/, accessed on February 18, 2015
*Revenue for year 2003-04 till 2012-13 is the actual while for the year 2013-14 is estimates

2.7 Earnings to the Government

The growing telecom sector had not only increased the revenues for the service providers but had significantly contributed to the earnings of the government. Its contribution to the Gross Domestic Product (GDP) had increased from nearly 1.3% in 1995-96 to 2.2% in 2013-14 (Table 7). It had reached a peak of 2.9% in 2007-08, in an economy that was growing at 6-7%. The share had declined after that due to the faster growing economy.

Table 7: Share of Telecom Sector in India's GDP

(Rs '000 cr)

	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
GDP at Current Prices	3,242	3,693	4,294	4,987	5,630	6,477	7,795	8,974	10,020	10,473
Total Telecom Revenue	72	86	105	144	152	158	172	195	212	233
Contribution of Telecom Sector to GDP *(%)*	2.2	2.3	2.4	2.9	2.7	2.4	2.2	2.2	2.1	2.2

Source: The Indian Telecom Services Performance Indicators; TRAI, Annual Report, Various Years and http://www.rbi.org.in/scripts/PublicationsView.aspx?id=15121, accessed on December 23, 2014

The sector revenues had gone up from Rs 12,518 cr during 1995-96 to Rs 2,33,000 cr (adjusted for intra-company payments called pass through) in 2013-14[18]. In comparison, the Indian Railways, which was yet to undergo major reforms, had revenue of Rs 22,418 cr during 1995-96, and Rs 1,40,485 cr in 2013-14[19]. While IR had nearly 80% more revenue than the telecom sector in 1995-96, the telecom sector had been nearly 65.9% more revenue than IR in 2013-14. This reversal was even more

[18]http://www.dnb.co.in/IndianTelecomIndustry/OverviewTI, accessed on January 7, 2012
[19]Indian Railways Year Book, 1995-96

striking when we consider that fares per unit on IR had gone up during this period, while the same for telecom services had decreased.

The revenue surplus over expenses for DoT in 1995-96 was Rs 5,900 cr, and taxes to the Government of India (GoI) from the various subsidiaries were under Rs 1,000 cr[20]. In 2013-14, the earnings to the government from license fee, spectrum charges, and service tax were Rs 31,200 cr (Table 8). There would also be corporate taxes from the profit making telecom companies. In addition, the surpluses of individual companies would accrue to the shareholders.

[20]DoT Annual Report, 1996-97

Table 8: Government Levies

(Rs '000 cr)

Year	Gross Revenue	Pass Through	Adjusted Gross Revenue	License fee	Service Tax*	Spectrum Charge**	Total Government Levies
2002-03	48.0	7.2	40.8	4.1	2.2	0.2	6.5
2003-04	61.0	9.2	51.9	4.8	3.0	0.4	8.2
2004-05	72.0	15.5	56.5	5.2	4.5	0.7	10.4
2005-06	87.0	17.9	69.1	6.3	5.2	1.4	12.9
2006-07	127.0	36.8	90.1	8.2	8.8	2.3	19.3
2007-08	147.5	29.5	118.0	10.7	11.5	3.3	25.5
2008-09	152.4	39.3	113.0	9.6	11.6	3.2	25.0
2009-10	158.0	41.2	116.8	9.8	12.0	6.0	27.8
2010-11	171.7	50.1	121.6	10.0	12.2	3.9	26.1
2011-12	195.4	60.9	134.6	11.2	10.2	4.8	26.2
2012-13	212.6	71.8	140.8	11.5	12.4	5.2	29.1
2013-14	233.8	75.8	158	12.7	12.4	6.1	31.2

Source: India Infrastructure Report 2007 and TRAI, The Indian Telecom Services Performance Indicators, Various Years, http://www.trai.gov.in/Content/PerformanceIndicatorsReports/1_1_PerformanceIndicatorsReports.aspx#skipdiv, accessed on February 19, 2015

**Actual service tax collected has been taken from 2002-03 to 2005-06 and service tax applied to the Adjusted Gross Revenue for the other years as it is not charged on Interconnection Usage Charges, and so on. Service Tax Rate for 2006-08 is 12.2% and for 2009-11 is 10.3%.*

2.8 Foreign Direct Investments

In the past ten years, there had been significant FDI in the telecom sector (Table 9). Besides investments, the participation of the foreign players had enabled use of advanced technologies and Quality of Service (QoS) to international standards. The cumulative telecom inflow constituted 8.3% of total inflows and was the second highest among the various sectors. The services sector was the highest at 20.4%. In contrast, other infrastructure sectors, like power constituted 4.6%, followed by ports at 1.1%.

Table 9: FDI

Year Ending March 31	**Cumulative FDI $ US** *(mn)*
2000-04	1,326
2004-05	1,455
2005-06	2,079
2006-07	2,557
2007-08	3,818
2008-09	6,376
2009-10	8,930
2010-11	10,589
2011-12	12,552
2012-13	12,856
2013-14	14,163

Source: DoT, Annual Report, 2013-14, http://www.dot.gov.in/sites/default/files/AR%202013-14%20English%20%282%29_1.pdf, accessed on February 19, 2015

2.9 Employment

As on March 31, 1996, the Indian telecommunications sector had a direct employment of under 0.5 mn, of which 0.42 mn were in the service provision under the DoT including MTNL, and the balance under the public sector corporations and the fledgling private sector. A study in 2011 highlighted that the direct employment under the service providers was expected to be 0.40 mn, 0.28 mn of which was from the government. The employment in the service and the related segments, including towers, network equipment and services, logistics and retail sales was expected to be 2.8 mn in 2012. The

indirect employment was expected to be 7 mn people. While the direct employment under the service providers had remained steady, the ratio of *subscribers per employee* had gone up from 29 as of March 31, 1996 to 2250 as of September 30, 2011. Subscribers per employee including the service and related segments was 321 as of September 30, 2011.

While the direct employment in the service and related segments had been increasing, it was also accompanied by an increase in productivity. The indirect employment leveraging the sector had also increased.

Table 10: Employment

(mn)

	1996	**2012**
Direct Employment		
- Government	0.42	0.28
- Private	-	0.12
Subscribers per Employee	29	2,250
Service and Related Segments (Towers, Equipments, Retail)	0.08	2.8
Indirect Employment		7

Source: Indian Mobile Service Sector Report, http://www.pwc.com/en_IN/in/assets/pdfs/publications-2011/PwC-COAI-White-Paper-Indian-Mobile-Services-Sector.pdf, accessed on January 7, 2012

3 Sector Structure

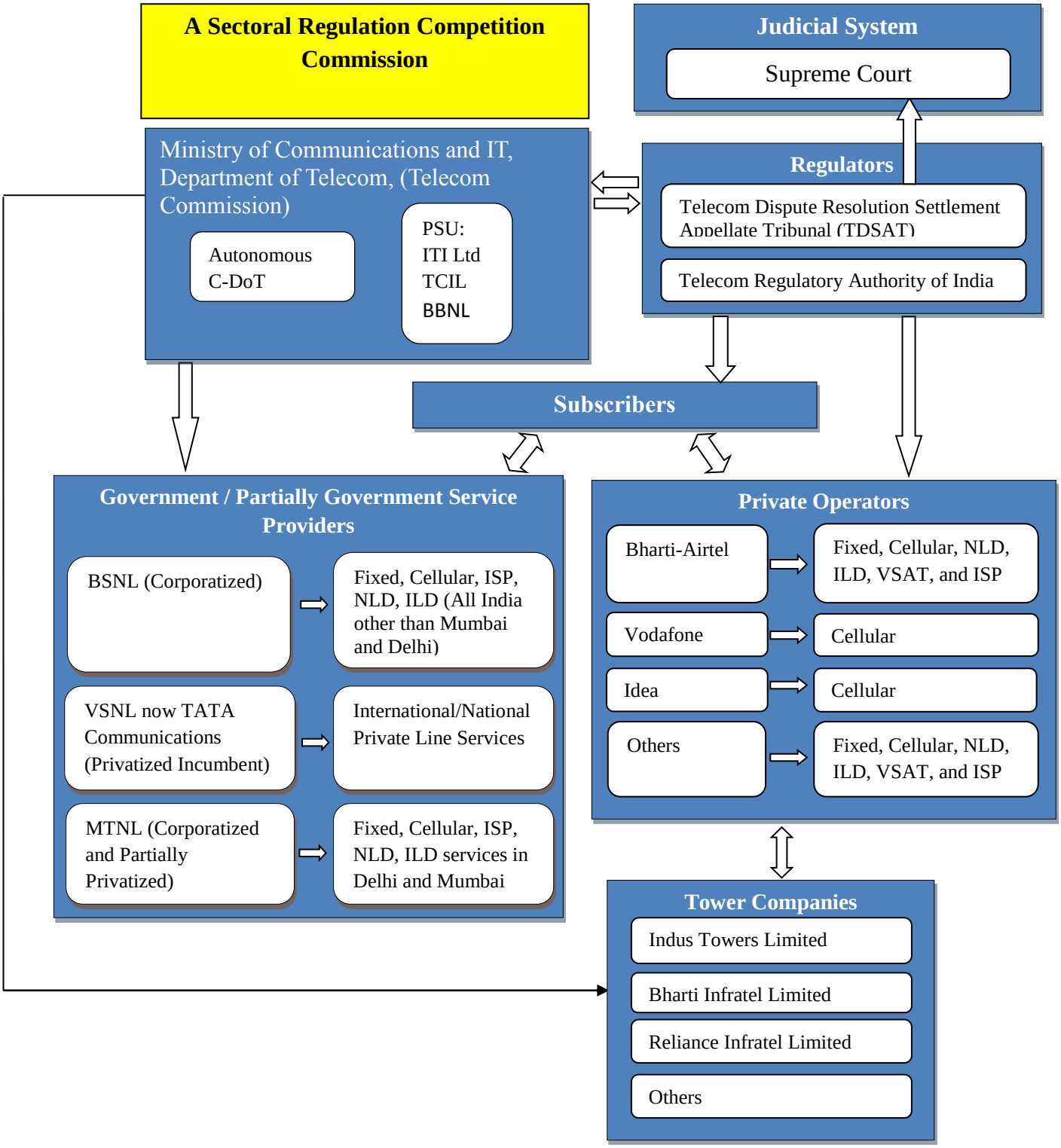
The telecom sector operated under the purview of the DoT, Ministry of Communications and Information Technology. Various PSUs, and an autonomous R&D and manufacturing unit operated under the DoT. The sector structure consisted of government undertakings, multiple and private service providers, regulator, appellate tribunal, corporatized government incumbent, privatized government incumbent, universal service obligation fund administrator, government owned special purpose vehicle for broadband, Indian global players and independent tower companies. The Supreme Court provided recourse to conflicts that could not be resolved at the sector level. The Competition Commission of India was the statutory body that addressed competition related issues, including some that affected the telecom sector. We provide a schematic diagram of the structure of the telecom sector in Figure 4.

3.1 Multiple and Private Service Providers

There were multiple players in all segments and service areas. These segments included fixed line, cellular, NLD, ILD, Very Small Aperture Terminal (VSAT), Internet service, Direct To Home (DTH), and Internet Protocol television (IPTV). By 2014, a few large players that provided services across a variety of segments and service areas had emerged. Examples include Bharti-Airtel, Vodafone, BSNL, and Reliance. Section 2.6 gives a perspective on the large players. More than 30 smaller players, including MTNL, operated in specific segments and service areas.

International players that had come to India were Vodafone (the largest cellular operator in the world), Maxis through Aircel, Telenor through Uninor, and Sistema through Mobile TeleSystems (MTS).

Figure 4: Structure of the Telecom Sector in India



Hundred percent FDI was allowed in the manufacturing of telecom equipment, infrastructure provision and service segment. FDI up to 49% was permitted under automatic route and beyond 49% by the Foreign Investment Promotion Board[21].

Table 11 shows the status of total licensees as on October 10, 2014.

Table 11: No. of Total Licenses

License Type	Total Licenses
Basic Licensees	2
Cellular Mobile Telephone Service (CMTS) Licensees	37
UAS Licensees	118
Infrastructure Provider I	479
ISP (Internet)	350
National Long Distance	30
International Long Distance	23
Total Licensees	1039

Source: DoT, http://www.dot.gov.in/about-us/telecom-glance, accessed on December 23, 2014

3.2 Regulator

TRAI was set up in 1997. Its main functions were tariff regulation, fixing interconnection terms, maintaining quality of services, need and timing for introduction of new service provider, terms and conditions of licence to a service provider, revocation of licence for non-compliance of terms and conditions of licences, facilitation and promotion of efficiency, technological improvements, type of equipment, implementation of measures for development of the sector, and efficient management of available spectrum. The regulation for allocation of spectrum continued to be with the Wireless Planning and Coordination (WPC) wing of DoT.

3.3 Appellate Tribunal

TDSAT, set up in 2000, was a quasi-judicial body that adjudicated and settled disputes

[21]DoT Annual Report 2013-14, http://www.dot.gov.in/sites/default/files/AR%202013-14%20English%20%282%29_1.pdf, accessed on February 19, 2015

between service providers or licensor and licensees, and reviewed appeals against TRAI directions. Appeals against TDSAT lay with the Supreme Court of India.

3.4 Corporatized Government Incumbent

The erstwhile operations of the DoT were corporatized as BSNL, a wholly owned government company, on October 1, 2000. DoT was then responsible for policy making, licensing and promotion of investments in telecom equipment manufacturing, and provision of telecom services, while BSNL became responsible for providing telecom services.

3.5 Privatized Government Incumbent

The Overseas Communication Service (OCS) of the DoT was corporatized as VSNL in 1986 as a government owned corporate. In 2002, VSNL was privatized through a strategic, competitive sale of 74% of shares to the Tatas, who later renamed it as Tata Communications.

3.6 Universal Service Obligation Fund Administrator

The Universal Service Obligation Fund (USOF) was set up by the DoT to support services in rural and remote areas, with effect from April 1, 2002. The Universal Service Fund Administrator was appointed on June 1, 2002 to manage funds. The Indian Telegraph (Amendment) Act, 2003 gave statutory status to the Universal Service Obligation Fund (USOF) in December 2003. The Rules for administration of the Fund known as Indian Telegraph (Amendment) Rules, 2004 were notified on March 26, 2004.

The USOF gave subsidies to both public and private companies for providing infrastructure and services. All telecom service companies were required to contribute five per cent of their aggregate gross revenue to the USOF except the pure value added

service providers like Internet, voice mail, email service providers etc.[22] USOF framework allowed for public private partnership. The USOF was administered by the DOT. While the fund was non lapsable, annual allocations were subject to Ministry of Finance approvals. DoT identified the areas that qualified for USOF support on the basis of non-availability of towers, socio economic profiles, etc.[23] USOF had begun supporting the National Optical Fibre Network (NOFN) since October 2011. NOFN would provide connectivity to 2,50,000 gram panchayats. It would be an incremental network connecting the existing dark fibre from the taluka to gram panchayat.

As of September 30, 2014, the USOF had reached a cumulative collection of Rs 60,449 cr, of which Rs 19,085 cr had been disbursed for various schemes and Rs 6,949 cr had been paid to BSNL towards licensing fee and spectrum charges. The potential available balance was Rs 34,414 cr (Table 12).

[22]http://usof.gov.in/usof-cms/home.jsp, accessed on May 1, 2012
[23]http://www.usof.gov.in/usof-cms/usof_home_contd.htm accessed on December 22, 2011

Table 12: Amount Collected, Disbursed and Utilized Through USOF

(Rs cr)

Financial Year	UAL Collections (Booked Figures as per DoT A/cs)	Funds Allocated	Funds Disbursed	Reimbursement of LF and Spectrum Charges*	FY end USOF Balance#
(1)	(2)	(3)	(4)	(5)	(6)
2002-03	1653.6	300.0	300.0	2300.0	-946.4
2003-04	2143.2	200.0	200.0	2300.0	-356.8
2004-05	3457.7	1314.6	1314.6	1765.7	377.5
2005-06	3215.1	1766.9	1766.9	583.0	865.3
2006-07	3940.7	1500.0	1500.0	0.0	2440.7
2007-08	5405.8	1290.0	1290.0	0.0	4115.8
2008-09	5515.1	1600.0	1600.0	0.0	3915.1
2009-10	5778.0	2400.0	2400.0	0.0	3378.0
2010-11	6114.6	3100.0	3100.0	0.0	3014.6
2011-12	6723.6	1688.0	1688.0	0.0	5035.6
2012-13	6735.5	625.0	625.0	0.0	6110.5
2013-14	7896.4	2163.5	2163.5	0.0	5721.8
2014-15 (30.09.2014)	1869.7	1138.1	1138.1	0.0	731.6
Total	**60449.0**	**19085.9**	**19085.9**	**6948.6**	**34414.5**

Source: Fund Status, 2014-15, www.usof.gov.in, accessed on December 20, 2014

*As per Ministry of Finance letter no F. 1 (20)-B (AC)/2007 dated 04.06.2008 the reimbursement of licence fees (LF) and spectrum charges to BSNL amounting to Rs 6,948.64 crore over the period 2002-03 to 2005-06 for fulfilling rural obligation is required to be taken into account for arriving at the available balance.

#Thus negative fund balance is only notional.

3.7 Government Owned Special Purpose Vehicle for Broadband

The Government created a special purpose vehicle Bharat Broadband Network Limited (BBNL) on February 25, 2012 as a Public Sector Undertaking (PSU) under the Companies Act of 1956 to execute the NOFN project. This project funded by USOF, was initiated on October 25, 2011 with an objective of providing broadband connectivity to 2,50,000 Gram Panchayats in India at an estimated budget of Rs 20,000 cr. Initially, the deadline for finishing the project was set for two years that subsequently extended to June 2016[24]. NOFN project planned to provide broadband access utilizing the existing optical fiber of BSNL, Railtel and Power Grid and extending it to the Gram Panchayats.

3.8 Indian Global Players

Having acquired experience, some Indian players had established presence in international markets. For example, Bharti Airtel provided services in 20 countries including India, Sri Lanka, Bangladesh and 17 countries in Africa. It also provided mobile services in the UK in the Channel Islands as a franchisee of Vodafone. Bharti had a customer base of 307 mn globally as of November 30, 2014[25], of which 214.9 mn were from India as of September 30, 2014[26].

Reliance Globalcom, a division of Reliance Communications, owned and operated 'Fibre Optic Link Around the Globe' (FLAG) an international fibre optic network. It provided retail products and services comprising of global voice, Internet solutions and VAS[27]. Tata Communications had license to operate in South Africa and operated an international fibre optic network to provide a variety of services.

[24]http://timesofindia.indiatimes.com/tech/tech-news/DoT-may-take-two-years-for-completion-of-NOFN-project/articleshow/41260257.cms, accessed on December 20, 2014
[25]http://www.airtel.in/about-bharti/about-bharti-airtel, accessed on February 19, 2015
[26]TRAI, Performance Indicator Report, July – September 2014, http://www.trai.gov.in/WriteReadData/PIRReport/Documents/Indicator-Reports29012015.pdf, accessed on February 19, 2015
[27]http://www.relianceglobalcom.com/Pimkie_extends_partnership_with_Reliance_Globalcom_for_an_additional_4_years.html, accessed on January 7, 2012

3.9 Independent Tower Companies

In response to the business, independent tower companies had emerged, allowing sharing of tower infrastructure. TRAI regulations facilitated this. Apart from third party service providers, some of the tower companies had been hived off from the existing telecom operators (Table 13). The others players included small telecom tower companies like Tower Vision, Aster Infrastructure, KEC International, and India Telkom Infra, etc. The third party nature of this business was reflected in the tenancy ratio of the different players going beyond 1, even to high of 2.3 for Viom Networks. Given international experience, the tenancy ratio was expected to increase further, thus optimizing tower usage.

Table 13: Tower Portfolio and Market Share of Telecom Tower Companies

Market players	**Type of Organization**	**Market Share** *(%)*	**Tower Portfolio** *('000s)*	**Tenancy Ratio**
Indus	Third Party Company	30.1	111.8	1.99
BSNL	Telecom Operator	16.6	61.6	1.0
Reliance Infratel	Captive Company	13.5	50.0	1.7
Viom Networks	Third Party Company	11.3	42.0	2.4
Bharti Infratel	Captive Company	9.4	35.1	1.8
GTL Infra	Third Party Company	7.9	29.5	1.5
American Towers	Third Party Company	3.1	11.5	1.8
Tower Vision	Third Party Company	2.3	8.4	1.6
Ascend Telecom	Third Party Company	1.1	4.1	1.7
MTNL	Telecom Operator	1.1	4.0	1.0
Others*		3.6	13.5	1.0
Total		100	371.5	

*Others include Vodafone, Idea, Aircel, MTS and others,
Source: Voice&Data, June-July 2013, accessed on January 29, 2015

4 Reform Processes

Reforms began in 1984, primarily driven by the then Prime Minister, Mr Rajiv Gandhi through a set of 'missions', one of which was the Telecom Mission. Mr Sam Pitroda spearheaded this mission under which the customer premise equipment manufacturing was delicensed, private operators were given licenses to operate public call offices, and services in Delhi and Mumbai, and the overseas services, were corporatized for better focus and resource mobilization. The *New Economic Policy 1991* set the framework for liberalization, including in the telecom sector. The telecom equipment manufacturing was delicensed in 1991. We describe the major reform processes since then.

4.1 Private Participation in Service Provision (1992)

The basic and value added services were unbundled, allowing private participation in value added services such as radio paging and cellular mobile in 1992. The services were licensed on the basis of service areas called 'circles' that were usually coterminus with state boundaries and were administrative units of DoT and later those of BSNL. The country was divided into 23 service areas consisting of four metro service areas and 19 state based service areas. As a part of the reforms, the sector was further opened for private service provision in the fixed services segment, breaking DoT's monopoly. Two mobile private operators per service area and one fixed line operator were licensed through auctions. The licenses were allocated initially for a period of ten years, which could be extended by five years. In the first round the Delhi and Mumbai metros were auctioned for cellular services. This was followed by Kolkata and Chennai metros and all other service areas for cellular and the fixed line licenses for all the service areas. For cellular services, the operators were required to use the GSM standard in the 900 MHz band. For fixed line, they were required to use wireless in the local loop.

4.2 Formulation of NTP 94 (1994)

The GoI announced the NTP 94 to further liberalize the sector. This policy defined many important objectives like, availability of telephone on demand, provision of services at reasonable prices, availability of basic telecom services in all the villages[28], export promotion, FDI attraction and stimulation of domestic investment. The policy also envisaged India's emergence as a major manufacturing and export base of telecom equipment.

After a competitive bidding process, licenses were awarded to eight CMTS operators in the four metros, 14 CMTS operators in 18 state circles, six fixed line service operators in six state circles and to paging operators in 27 cities and 18 state circles. VSAT services were liberalized for providing data services to closed user groups[29]. The government announced the policy for Internet Service Provision (ISP) and Global Mobile Personal Communications by Satellite (GMPCS) by private operators[30].

Despite the opening of services for private provision, there was poor response. Several circles did not receive bids and some of the winning bidders did not roll out services claiming that they had bid too high for their operations to be commercially viable.

4.3 Separation of Policy and Regulation (1997)

DoT was the policy maker, regulator and operator until 1997. In order to facilitate multiple operators and competition, the TRAI was set up on March 28, 1997. This separated regulation from policy and operations. However, TRAI's budget was to be provided by the DoT.

[28]http://www.dot.gov.in/osp/Brochure/Brochure.htm#status, accessed on January 7, 2011
[29]http://supremecourtofindia.nic.in/outtoday/39041.pdf, accessed on March 26, 2015
[30]http://www.trai.gov.in/TelecomPolicy_ntp99.asp, accessed on January 7, 2012

4.4 Formulation of NTP 99 (1999)

Even with the limited operations, there was recognition of the potential demand of telecom services. The high license fee and operational bottlenecks had been major deterrents for service deployment. In order to remove these constraints, the GoI announced the NTP 99.

NTP 99 allowed the operators to convert their license fee in to a one time entry fee (which was much lower than the license fee) and an annual revenue share for the duration of the license. As a part of migration regime, the GoI introduced the condition that each circle could potentially have any number of operators. The government introduced the state owned operators, BSNL and MTNL as the third mobile operator in the 900 MHz band.

4.5 Restructuring of TRAI (2000)[31]

The existing scope of TRAI did not provide for an independent appellate mechanism to operators affected by TRAI's decisions. Consequently, the functions of TRAI were amended through the TRAI Amendment Act, 2000 on January 24, 2000. This set up the TDSAT and changed the primary role of TRAI to:

i. Recommend
   a. The timing and introduction of new service providers, and license conditions
   b. Measures to ensure efficiency of operations and competition
   c. Technology development and technological improvements in the services

ii. Discharge functions related to
   a. Fixing interconnectivity between licensees

[31] The Telecom Regulatory Authority of India Amendment Ordinance, 2000, http://www.dot.gov.in/sites/default/files/TRAI_amendment_ACT.pdf, accessed on March 25, 2015

b. Ensuring technical compatibility and effective interconnection between different service providers
c. Regulating arrangement amongst service providers of sharing their revenue derived from providing telecommunication services
d. Laying down the standards of quality of service

TDSAT would settle disputes related to any order, decisions, or directions of TRAI.

4.6 Private Participation in National Long Distance (2000)

As a consequence of NTP 99, on August 13, 2000, National Long Distance services was opened for private participation. The licenses fee was structured as an entry fee and a revenue share.. There was no cap on the number of service providers. The total foreign equity could not exceed 74%. The initial license period was 20 years that could be extended by ten years.

4.7 Corporatization of BSNL (2000)

After the separation of regulatory functions from DoT, it continued to have a policy and operations role. With the expansion of the sector, DoT felt the need to have a greater focus on provision of services. Therefore, two new departments, Department of Telecom Services (DTS), and Department of Telecom Operations (DTO) were created out of DoT in late October 1999. This was to separate the services from the rest of the operations[32].

These two were corporatized into a single entity – Bharat Sanchar Nigam Limited as a wholly owned government company under the DoT on October 1, 2000.

[32]D&B, Indian Telecom Industry, http://www.dnb.co.in/Indian.TelecomIndustry/industrystructure.asp, accessed on January 7, 2012

4.8 Introducing Fourth Cellular Operator (2001)

As a consequence of NTP 99, to bring in greater competition, DoT introduced the fourth cellular license in 2001 through an auction. These licenses were in the 1800 MHz band using the GSM standard.

4.9 Development of a Framework for Universal Service Obligation Fund (2002)

Commercial viability of rural telecom services was poor as cost of provisioning them was high and propensity to pay was low. With the onset of private services in both mobile and fixed services, the government was concerned about coverage in rural areas, as these were largely commercially unviable. Therefore, the DoT introduced the requirement of roll out of 10% of fixed lines in rural areas as a part of the licenses. Mobile licenses did not have this requirement. The government's view was that mobile services were expensive and would not be suitable for rural areas. The rural roll out obligations by fixed line operators was perceived to be commercially unviable by them as they claimed they had bid too high. The penalty for breach was lower than their cost of service provision. So, there was little progress in rural roll outs. With the changes in the licenses, consequent to the shift to Unified Access Service License (UASL), and to bring in parity with mobile licenses that did not have this condition, the rural roll out obligation was removed.

Subsequently, DoT came up with the Access Deficit Charges (ADC) mechanism for funding rural roll out. The framework for ADC was based on fixed line deployments in rural areas. BSNL as the incumbent operator, being the only one providing such connectivity. ADC was to be paid to BSNL. ADC was also to be paid to MTNL, even though MTNL, being the incumbent government operator in Delhi and Mumbai, did not provide connectivity in rural areas. The quantum of payment varied by type of call (fixed to fixed, fixed to mobile, mobile to mobile etc.), distance over which the call was carried and whether it was a local, long distance or an international call. Subsequently, with the fixed line private operators deploying their networks, the ADC became payable to them also. However, the ADC regime was complex as it had a variety of slabs for different

types of calls and distances. Further, BSNL did not have a Call Detail Record system that could enable it to keep track of the calls made using its network. Consequently, the payments to BSNL were contested both by the private operators and BSNL. The basis of arriving at ADC was not considered scientific as it had been based on historical costs of BSNL which were considered high. Further, the payments to MTNL could not be justified. There were frequent changes to the rates of ADC, making the implementation challenging.

In this context, the USOF was set up in 2002 by the GoI to address the needs of coverage in rural and remote areas. This was in line with developments in other parts of the world.[33] Initially, the USOF provided support only for fixed line services. Subsequently, through an amendment to the Indian Telegraph (Amendment Act), 2003, in 2006, mobile services were also included.

USOF provided support on the basis of competitive bidding to operators through reverse auctions. The operator seeking the least amount of funding from the government, called viability gap funding, was awarded the bid. The USOF bidding for mobile services was done separately for infrastructure and services.

4.10 Allowing Limited Local Mobility Operators as Cellular Operators (2003)

As a consequence of NTP 99, any number of fixed line operators could be licensed. They were mandated to use wireless in the local loop (WLL) using code division multiple access (CDMA) standard. Over time, owing to technological developments, the distance over which such wireless connectivity could be provided increased considerably. These operators then started providing mobile services using CDMA called WLL with Limited Mobility (WLL (LM)). Due to regulatory disparity in the license fee and interconnection terms between fixed service and cellular, it was cheaper to provide mobile services through CDMA. GSM operators saw this as a "back door" entry by CDMA operators.

[33] Jain, R., and Raghuram, G. (2009). "Role of Universal Service Obligation Fund in Rural Telecom Services: Lessons from the Indian Experience", http://www.iimahd.ernet.in/publications/data/2009-06-03Jain.pdf, accessed on February 21, 2015

After a series of review processes including petition in the TDSAT, GSM operators filed a case in the SC.

On September 27, 2003, the SC referred the matter back to TDSAT and asked it to consider developing a framework which would bring equivalence amongst the license conditions for the two set of operators, an issue which SC found had not been addressed by the TDSAT. It allowed CDMA operators to continue providing services, as it would facilitate growth in teledensity.

4.11 Unification of Access Licenses (2003)

To remove the disparities in the licensing terms of providing wireless in the local loop and cellular mobile services, DoT came out with the UASL regime. Under this regime, operators could provide either mobile or fixed line service using the same license. The entry fee fixed for a pan India UASL was fixed at Rs 1,658 cr. This price was the same as that determined in the auction for GSM license in 2001. The UASL did not specify the total amount of spectrum. Further, start-up spectrum was bundled with the license, which also provided for allocation of additional spectrum.

4.12 Private Participation in International Long Distance (2004)

As a consequence of NTP 99, in 2004, international telephony was opened up for competition. The licenses fee was structured as an entry fee and a revenue share.. There was no cap on the number of service providers. The total foreign equity could not exceed 74%. The initial license period was 20 years with an automatic extension of five years. Private operators were allowed to set up landing facilities that access submarine cables and use excess bandwidth available[34].

[34]http://www.dot.gov.in/about-us/telecom-glance, accessed on February 20, 2015

4.13 Introducing Additional 2G Licenses (2008)

Given the growth in mobile services, there were competing demands from existing operators for additional spectrum above the start-up and from new operators wishing to enter the sector. In order to provide a framework for prioritizing additional spectrum to existing operators, DoT came up with a Subscriber Linked Criteria (SLC) that allocated additional spectrum based on number of subscribers in the respective service areas. By January 2008, DoT had tightened the allocation under SLC for existing operators[35] by increasing the number of subscribers which would enable them to qualify for additional spectrum. This increased the availability of start-up spectrum.

In January 2008, DoT announced that additional players could get UASL licenses with start-up spectrum based on availability. This led to a rush for UASL licenses. 243 licenses were allocated. However, due to spectrum scarcity, start-up spectrum could be allocated only to a few of the applicants. The process of selecting those to whom such an allocation could be made was done on a first come first serve basis. Further only a few companies were informed about the process which enabled them to comply with the payments and formalities ahead of others. This allowed them to get preferential allocation of licenses. This was seen as unfair and cases were filed by eminent citizens in the SC in 2010.

4.14 Bringing in Wireless Broadband (2010)

In line with global trends, the GoI felt that Internet access was an important vehicle for economic growth. Due to the growth of mobiles and poor fixed line infrastructure, mobiles were expected to be the devices by which large part of the population was likely to access the Internet. Therefore, DoT came up with a framework for 3G and Broadband Wireless Access (BWA) spectrum allocation in new bands.

3G Auctions

[35]The subscriber linked criteria was not used anywhere else in the world as operators elsewhere were given fixed amounts of spectrum.

While there was uncertainty regarding 2G allocations, 3G auctions were held in India in May 2010. On an average, three to four operators were allocated 5 MHz spectrum in the 2.1 GHz band for each service area for a period of 20 years. BSNL and MTNL were allocated spectrum without having to participate in the auction but had to pay the market price. 3G services were rolled out subsequent to the auctions.

BWA Auctions

Soon after the 3G auctions, 20 MHz of unpaired BWA spectrum was auctioned in the 2.3 GHz band. MTNL and BSNL were given spectrum under similar framework as for 3G.

4.15 Formulation of NTP 2012 (2012)[36]

The focal points of NTP 2012 were to:

- Increase rural teledensity from the current level of around 39 to 70 by the year 2017 and 100 by the year 2020
- Achieve 175 mn broadband connections by the year 2017 and 600 mn by the year 2020 at minimum 2 Mbps download speed and making available higher speeds of at least 100 Mbps on demand
- Create a corpus to promote indigenous R&D, IPR creation, entrepreneurship, manufacturing, commercialization and deployment of state of the art telecom products and services during the 12th five year plan period
- Provide preference to domestically manufactured telecommunication products
- Reposition the mobile phone from a mere communication device to an instrument of empowerment
- Liberalize spectrum by allowing any service in any technology

[36] National Telecom Policy, http://www.dot.gov.in/sites/default/files/NTP-06.06.2012-final.pdf, accessed on March 25, 2015

- Make available additional 300 MHz spectrum for IMT services by the year 2017 and another 200 MHz by 2020 to ensure adequate availability of spectrum
- Delink spectrum from license
- Ensure mobile number portability
- Provide free roaming
- Enable voice over Internet protocol, cloud computing, next generation network including IPV6.

4.16 Universalizing Broadband Access (2012)

NOFN was a part of strategy for universalizing broadband access. GoI envisaged that NOFN would "transform governance, service delivery and unleash local innovation capacity through rural broadband".[37] The DoT created a high level committee (HLC) under the PM's Office to strengthen skills and applications development to implement the NOFN. There were plans that the Ministries of Rural Development, Panchayati Raj, Human Resource Development (HRD), Health and the National Council on Skill Development would work together. The HLC was responsible for developing a framework for implementation including the technological architecture, budgets and other issues related to NOFN. The NOFN had an estimated cost of Rs 200 bn to be funded by the USOF. NOFN was designed to lease capacity from Railtel, Power Grid and BSNL and build the incremental fibre where it was unavailable. NOFN would thus provide connectivity from the blocks to the gram panchayats.

Table 14 gives a timeline of the various reforms described above.

[37] http://innovationcouncilarchive.nic.in/index.php?option=com_content&view=article&id=318&Itemid=101, accessed on February 20, 2015

Table 14: Key Reforms – Timeline

Sr No	Year	Reforms
1	1991	• *Announcement of the New Economic Policy in July 1991* • *Manufacturing delicensed*
2	1992	• *VAS declared open to the private sector* • *Private participation in service provision*
3	1994	• *Formulation of National Telecom Policy 1994* • *Licence issued for providing mobile phone services in four metros. Two operators given licence per circle for ten years under a fixed licence fee regime.*
4	1997	• *Separation of policy and regulation: TRAI set up on March 28, 1997*
5	1999	• *Formulation of New Telecom Policy 1999* • *The Government replaced the fixed annual licence fee with revenue share regime.*
6	2000	• *BSNL formed October 1, 2000* • *Restructuring of TRAI* • *The Telecom Disputes Settlement and Appellate Tribunal (TDSAT) created* • *Private participation in National Long Distance* • *Corporatization of BSNL*
7	2001	• *Introduction of fourth cellular operator* • *The Communication Convergence Bill 2001 introduced in the Loksabha*
8	2002	• *Development of a framework for Universal Service Obligation Fund* • *VSNL privatized* • *Internet Telephony opened up since April 1, 2002*
9	2003	• *Allowing limited local mobility operators as cellular operators* • *Unification of access licenses* • *Calling Party Pays introduced*
10	2004	• *Private participation in International Long Distance* • *India under the GATS agreed to open up International Telephony* • *Broadband policy announced*
11	2005	• *The FDI limit rose from 49% to 74%.*
12	2008	• *Introduction of additional 2G licenses* • *ADC abolished for all calls*
13	2010	• *Mobile Number Portability implemented* • *3G and BWA Auctions*
14	2012	• *Formulation of National Telecom Policy 2012* • *Universalizing Broadband Access*

Source: Position Paper on The Telecom Sector in India (December 2009), Department of Economic Affairs, Ministry of Finance and Government of India, http://finmin.nic.in/the_ministry/dept_eco_affairs/secy_index.asp, DoT http://www.dot.gov.in/osp/Brochure/Brochure.htm, accessed on January 12, 2015

5 Enabling Principles

Based on the analysis for lessons of the reform processes, we extract eight enabling principles which are competitive bidding, leveraging a wider base of expertise, willingness to restructure license conditions, technical to generalist leadership, technology neutrality, unbundling, strategic natural resource management and political will.

5.1 Competitive Bidding

One of the principles that helped the telecom sector grow consistently was competitive bidding in introducing private players for spectrum, infrastructure and services.

There were anomalies in the competitive bidding process since government operators did not have to participate in the bidding process to get the spectrum. The allocation of spectrum to government operators was made ahead of the bidding for private operators. They were allocated spectrum in all service areas and were required to pay the winning bid amounts. Such anomalies were corrected in the bidding for the infrastructure and service provisioning under the USOF. BSNL participated in these processes. However, under the NOFN, there was no competitive bidding. Three public sector undertakings were allocated geographical areas for laying the cable. This could influence the delivery of the project adversely.

Opening up the sector without a transparent mechanism for selection of operators could lead to charges of unfairness and court interventions, and consequent delays. The DoT adopted open competitive bidding right from the beginning of introduction of private operators in 1992. The only exception was in 2007-08 when licenses were allocated on a first come first serve basis. This led to a cancellation of all licenses awarded through this process. Subsequently, this spectrum was allocated through an auction.

While initial auction designs were simple single round with the highest bidder winning the bid, these had problems of “winner’s curse”. While the opportunity to serve

contiguous areas could have brought in better bids, the auction design did not give scope for this. Over time, DoT had come up with more sophisticated auction designs. In the 3G and subsequent auctions, it adopted the Simultaneous Multiple Round auctions that addressed the above problems. In many of the developed countries (USA, UK, Germany), similar designs had been used since early 2000s.

5.2 Leveraging a Wider Base of Expertise

Allowing private sector participation was the first step in leveraging a wider base of expertise. Recognizing that the domestic telecom sector would not be in a position to enable the required growth, the initial opening up insisted on foreign players being a part of the bidding consortium. The domestic market having developed this capability over time, subsequent bids did not have this requirement, while at the same time, opening up FDI. Recognizing the on-going need for foreign collaborations for financial or technical support, GoI had progressively liberalized FDI norms for the sector from 49%, to 74% and later to 100%.

The government has also involved professionals from other sectors in policy committees, the TRAI and knowledge creation by supporting Telecom Centres of Excellence in academic institutions.

5.3 Willingness to Restructure License Conditions

In the early round of opening of the sector, the license conditions required up front payment of the bid amount. Citing winners curse, lack of experience in a new domain, and delays from the government, the winning bidders did not roll out services. They sought restructuring of their payments to a significantly reduced up front payment and revenue share. This was accepted by the government after due consultation, with a proviso that more players could be brought in for growth of the sector.

Another example of this approach was the incorporation of the WLL-LM players as cellular mobile players and later bringing in the UASL regime. Further, when the SC cancelled the 122 licenses granted in 2007-08, the GoI designed auctions for allocation of spectrum associated with those licenses.

Given the technological and regulatory uncertainties in the sector, the government has been able to move forward by restructuring license conditions, sometimes despite scams.

5.4 Technical to Generalist Leadership

The DoT had traditionally been led by the technical cadre (the Indian Telecom Services) recruited by the GoI. Their perspectives were often more technically and operational. This was not conducive to having a strategic view or bringing in disruptive change. Recognizing this, the government brought in generalist civil servants to lead the change process. Although, there was strong resistance to this move initially from the existing staff of DoT, there has been a slow acceptance of the situation.

5.5 Technology Neutrality

In the initial phase of the reform process, license conditions were specific to the technology, even though from the user perspective, end services rather than the underlying technology. For example, initially, entry fee and revenue sharing quantum were different for GSM and CDMA licenses and were lower for CDMA. This allowed CDMA operators to use this regulatory arbitrage to offer cheaper services and acquire higher number of subscribers. This anomaly was later rectified through the UASL. However, disparities in the spectrum charges across these licenses continued to exist. Similarly, while earlier licenses specified the service (2G, 3G) in the specific spectrum band, since 2012 operators may provide any service in any band.

Those showed recognition that a policy that is based on service parameters rather than the underlying technology could lead to lesser regulatory uncertainty and consequent higher growth.

5.6 Unbundling

Amongst the infrastructure sectors, telecom was the earliest one to unbundle the services functionally, geographically and technologically, and later the regulatory role from policy and operations. For services in rural areas supported by the USOF, DoT separated the provision of infrastructure from services.

Creation of VSNL and MTNL (as early as 1986) were examples of functional and geographical separation between international and domestic services, and the two major metros from the rest of the country respectively. Setting up of TRAI separated the regulatory from the policy and operations. Setting up of TDSAT separated the appellate from the regulatory. The corporatization of operations of DoT into BSNL further unbundled the policy and operations.

Despite the unbundling, the separation of policy and operations is considered weak as BSNL is a wholly owned government corporation under the DoT, and MTNL has dominant shareholding by the government. VSNL, since privatized as Tata Communications, has weaker control by the government at 26%.

The GoI also unbundled the sector by services technologically such as fixed, wireless, VSAT and Internet. This allowed for services to be contestable for providing voice and data services. Unbundling allowed for greater competition for service delivery from a customer's perspective. Subsequently, the 'forced' technology based unbundling was done away with between fixed and wireless when the UASL was created.

Licenses were also functionally unbundled into local, long distance and international services. This allowed for operators with specific expertise to acquire licenses in their chosen domains.

For the rural telecom licenses under the USOF, seeing the opportunity for efficiency in tower infrastructure, the license for towers was unbundled from the services to enable a level playing field between the service providers and tower company.

Unbundling allowed for greater competition, leveraging expertise and providing a level playing field in the sector, thus reducing costs for customers and enabling development of innovative models for businesses and services.

5.7 Strategic Natural Resource Management

Since growth in the sector is increasingly going to be driven by wireless, spectrum is a critical natural resource. In the initial phases, the government had a limited perspective in management of spectrum. This was shown by having regulation for each band separately, which was band and service specific. Focus on refarming was limited. Over time, the perspective has changed and refarming of spectrum for commercial purposes has gained importance. For example, bands used by defence services have been refarmed for commercial services. The pace at which this refarming has happened has not been adequate in comparison to such changes in other countries. For example, the 700 MHz band which has high commercial value, has not yet been refarmed from the current users – the Ministry of Information and Broadcasting. This band has been deployed in several other countries for state of the art commercial services.

There have been several high level committees that have suggested creation of a Spectrum Fund as early as 1999. This was to be funded from the proceeds of spectrum auctions and would have provided financial support for alternative networks to those entities giving up spectrum for refarming. However, there has been a lack of political will to implement this. The most likely reason could be that the government could lose flexibility to use the proceeds of spectrum auctions.

5.8 Political Will

Policy makers and political leaders have shown a political will to address the issues arising out of technological and regulatory uncertainty. This was done in a pragmatic way so that the interests of the citizens, private sector and the government were balanced. For example, wherever existing license conditions were modified in favour of private companies, another set of new conditions that set-off some of the benefits from relaxation were incorporated. This is exemplified in the move to revenue sharing where easier license conditions were offset by more competition. Similarly in moving from WLL (LM) to CDMA services, the concerned operators had to pay a higher license fee.

On the other hand, the political will to manage spectrum as a strategic natural resource has not been very strong as exemplified above.

Table 15 links the above eight enabling principles to the reform processes. The extent of applicability of the principle has been evaluated as high (H), medium (M), low (L) or not applicable (N). For example, in the first reform process: 'Private Participation in Service Provision', the principle of 'competitive bidding' was used to design the process. The requirement of a foreign partner was to be able to 'leverage a wider base of expertise'. The government showed a 'willingness to restructure the license conditions' as the initial set was not commercially viable. Therefore, all the above have been rated high (H). The principle of changing from a 'technical to a generalist leadership' is not relevant and has been marked as not applicable (N). Since the licenses were technology and service specific, 'technology neutrality' has been rated as low (L). Since the 'unbundling' in this case related to separating the fixed and mobile services and licenses were allocated geographically to metros, it has been rated as medium (M). Strategic management of the spectrum though essential, was not considered as critical in the early days. Hence, it is rated low (L). The extent of 'political will' was high (H), as introducing private participation in a context where all services were provided by the government required significant will to push for acceptance from both citizens and employees of DoT.

Table 15: Applicability of Enabling Principles to the Reform Processes

		1	2	3	4	5	6	7	8
	Enabling Principles / Reform Processes	Competitive Bidding	Leveraging a Wider Base of Expertise	Willingness to Restructure License Conditions	Technical to Generalist Leadership	Technology Neutrality	Unbundling	Strategic Natural Resource Management	Political Will
1	Private Participation in Service Provision	H	H	H	N	L	M	L	H
2	Formulation of NTP 94	H	N	N	L	H	H	L	H
3	Separation of Policy and Regulation	N	N	N	L	N	H	L	H
4	Formulation of NTP 99	H	M	H	L	H	H	M	H
5	Restructuring of TRAI	N	N	N	N	N	H	N	H
6	Private Participation in National Long Distance	H	N	N	N	N	H	N	M
7	Corporatization of BSNL	N	N	N	L	N	H	N	H
8	Introducing Fourth Cellular Operator	H	L	N	N	H	N	L	N
9	Development of a Framework for Universal Service Obligation Fund	H	N	N	N	H	H	N	L
10	Allowing Limited Local Mobility Operators as Cellular Operators	L	N	M	N	H	N	L	H
11	Unification of Access Licenses	N	N	M	N	H	N	M	M
12	Private Participation in International Long Distance	H	N	N	N	N	H	N	M
13	Introducing Additional 2G Licenses	L	N	H	N	L	N	L	N
14	Bringing in Wireless Broadband	H	N	N	N	H	N	M	M
15	Formulation of NTP 2012	H	N	N	N	H	H	H	M
16	Universalizing Broadband Access	L	L	L	N	M	L	L	L

H=High, M=Medium, L=Low, N=Not Applicable

6 Implications for other Infrastructure Sectors

Given the growth in the telecom sector consequent to the reforms, we address the issue of applicability of the principles identified above to other infrastructure sectors. We consider roads, ports, airports, railways, urban metro and warehousing.

6.1 Competitive Bidding

Since mid-90's, competitive bidding for introducing private players had been implemented in all infrastructure sectors that we have considered, other than railways. In the ports sector, to further increase competition, bidders are regulated to ensure that there are atleast two different players in terminals addressing similar shipping markets.

Railways had brought in public private partnership (PPP) in a few railway construction projects, which had involved players through a 'strategic partnership' rather than competitive bidding[38]. There had been structural weaknesses in this approach, primarily because agreements have not gone through the same extent of due diligence as would have happened in a competitive bidding process. Railways also sought players for their new locomotive manufacturing units through a global competitive bid. In a few other contexts, railways had brought in private players on a pure licensing model, with no competitive bidding as in the case of container train operations**.**

Competitive bids were used in the urban metro sector. The Hyderabad Metro and Mumbai Metro Line One were the two examples. However in other cities (Ahmedabad, Bangalore, Chennai, Jaipur, Kochi, and Kolkata), it was on a government driven model like the Delhi Metro Rail Corporation (DMRC).

[38]Raghuram, G., and Gangwar, R. (August, 2010). Lessons from PPPs of Indian Railways and Way Forward, Working Paper No WP 2010-08-02, Indian Institute of Management, Ahmedabad

In the warehousing sector, competitive bidding had been used in the private entrepreneur guarantee (PEG) scheme and in the management of state government warehousing[39].

6.2 Leveraging a Wider Base of Expertise

The port sector was the earliest, after the telecom sector to bring in private players for port terminal development[40]. While there was no explicit requirement of attributes of bidders to leverage a wider base of expertise, many of the initial bids were won by international operators who brought in ready world class expertise.

In the case of roads and airports, the initial set of bids required a consortium of a domestic and an international player, with the international player having the required expertise[41,42]. In subsequent bids, such conditions were relaxed. In the case of railways, the two new locomotive manufacturing units were bid out globally. In July 2014, a policy for 100% FDI in all aspects of railways except operations had been enunciated. In general, railways have had to resort to upgradation through imported technology due to lack of indigenous research and development capability.

6.3 Willingness to Restructure License Conditions

The best example of restructuring license condition was in the road sector, where the requirements from the government had been increasingly made explicit, with the objective of facilitating PPPs[43]. This was in terms of making available unencumbered land and all required clearances. Even in a signed agreement, the repayment schedule had been restructured to enable better cash flows for the private party.

[39] Jain, R., and Raghuram, G. (June 2013). RSWC and SSLL:PPP in Agri Warehousing, Case CIPR 0013
[40] Raghuram, G., and Shukla, N. (2014). Issues in PPPs in Ports in India, Working Paper No WP 2014-01-06, Indian Institute of Management, Ahmedabad
[41] Jain, R., Raghuram, G., and Gangwar, R. (2007). Airport Privatization: Bidding for Delhi and Mumbai, Working Paper No WP 2007-05-01, Indian Institute of Management, Ahmedabad
[42] Ramakrishnan, T.S., and Raghuram, G. (July 2012). Evolution of Model Concession Agreement for National Highways in India, Working Paper No WP 2012-07-01, Indian Institute of Management, Ahmedabad
[43] Ibid

However, in general, the authorities had been unwilling to renegotiate contracts, saying that it would open a 'Pandora's box'. Wherever, due to subsequent policy or regulation, the situation had changed requiring a generally agreed modification in contract conditions, the resolution had most often been by resorting to a legal process rather than an administrative one.

In the case of railways, license conditions had been restructured primarily to suit changing policies of the railways. This had had a negative impact on the attractiveness for the PPPs.

6.4 Technical to Generalist Leadership

The willingness to explore new models of infrastructure development through PPPs had been more in all the sectors (except railways) where the policy makers have come from the generalist cadres. In the case of railways, the technical cadres had been more conservative in bringing in new models.

6.5 Technology Neutrality

With more PPPs coming into the different sectors and with a greater confidence on their capability, requirements were specified more in the nature of outputs and outcomes rather than input technology specifications. In many of the construction related PPPs (roads, ports, airports), the PPP model had moved from a build, operate and transfer (BOT) to a design, build, finance, operate and transfer (DBFOT). The increasing reliance on the design of the private party was a move towards technology neutrality.

6.6 Unbundling

In the roads, ports and airports sector, the provision of infrastructure and services had traditionally been separated. Services were open to the private sector with relatively free entry and exit. Consequently, the focus by the government was on developing the

infrastructure sector in the PPP mode. To enable this, there had been a separation over a period of time between policy, regulation and operations. In the roads sector, however, the regulatory capacity, especially in the domain of safety was far from sufficient. A draft bill was still under process.

In the case of urban metro and warehousing, infrastructure and services had been integrated. However, in both these domains, PPPs had been brought in and had been enabled through a separation of policy, regulation and operations. In the warehousing sector, there was an example of PPPs in services, unbundled from the infrastructure, which continued to be with the government.

In the railways, there had been attempts to bring PPPs in services, like in container train operations. The separation between policy, regulation and operations had not happened. This not only affected the performance of the container train operations, but also led to the slow growth of the sector. There had been indications in recent years of a regulator with recommendatory powers. However, the 2015 budget spoke of creating a railway regulator with an appellate process.

6.7 Strategic Natural Resource Management

Land was the critical natural resource for the sectors mentioned above. Initial approach in PPPs was to give the responsibility of land acquisition to the private party. Recognizing the constraints of the private party in managing this, subsequent projects in the road sector had provided unencumbered land to the extent of 80% of the project requirements.

As of early 2015, the land acquisition bill was still struggling to strike the right balance between the land owners' (read farmers') interests and infrastructure (especially corridor based) development interests.

In the 2015 budget, the language being used was of 'plug and play' for the private party. This involved making available all unencumbered land and required clearances at the

beginning of the project. In the airports sector, Mumbai airport was still struggling from having to get rid of encroachments to enable full use of the land, since in their contract, encroachment clearance was the private player's responsibility.

For ports, there was recognition that coastal areas with deep drafts were valuable and should be protected for port development. In the context of warehousing, private parties had to acquire their own land under the PEG scheme.

6.8 Political Will

The political will in the roads, ports and airport sector had evolved over time to be supportive of PPPs. This had led to evolution of regulatory frameworks and policy environment for further growth and reduced the scope for 'political interference' as institutional infrastructure had improved. This had led to better availability and higher quality of service for citizens. In the airport sector, strong political will was exercised in seeing through controversies that had arisen in the privatization of Delhi and Mumbai airports. However, the similar political will was not exercised for privatizing more airports from the Airports Authority of India's basket.

In the railways, the political will for the reforms process had been weak. It had resulted in less than desirable quality of services for the citizen and poor railway infrastructure management. Consequently, even though environmentally undesirable, the road sector continued to increase its share of transportation demand.

Table 16 summarizes the above discussion on the extent of use of the enabling principles on the other infrastructures sectors. We conclude that these eight enabling principles have a significant impact on the development of infrastructure and need to be leveraged appropriately.

Table 16: Use of Enabling Principles on the other Infrastructure Sectors

		1	2	3	4	5	6	7	8
	Enabling Principles / Other Infrastructure structure	Competitive Bidding	Leveraging a Wider Base of Expertise	Willingness to Restructure License Conditions	Technical to Generalist Leadership	Technology Neutrality	Unbundling	Strategic Natural Resource Management	Political Will
1	Roads	H	H	H	H	H	M	H	H
2	Ports	H	H	L	H	H	H	H	H
3	Airports	H	H	L	H	H	H	M	H
4	Railways	L	M	M	L	L	L	H	L
5	Urban Metro	M	H	L	M	L	M	H	M
6	Warehousing	M	L	M	H	L	H	L	M

H=High, M=Medium, L=Low, N=Not Applicable

Glossary of Acronyms:

1	ADC	Access Deficit Charges
2	ARPM	Average Revenue Per Minute
3	ARPU	Average Revenue Per User
4	BBNL	Bharat Broadband Network Limited
5	BSNL	Bharat Sanchar Nigam Limited
6	BWA	Broadband Wireless Access
7	CDMA	Code Division Multiple Access
8	C-DOT	Centre for Development of Telematics
9	CMTS	Cellular Mobile Telephone Service
10	DoT	Department of Telecommunications
11	FDI	Foreign Direct Investments
12	GDP	Gross Domestic Product
13	GoI	Government of India
14	GSM	Global System for Mobile Communications
15	ILD	International Long distance
16	ISP	Internet Service Provider
17	MoU	Minutes of Usage
18	MTNL	Mahanagar Telephone Nigam Limited
19	MTS	Mobile TeleSystems
20	NLD	National Long Distance
21	NOFN	National Optical Fibre Network
22	NTP 94	National Telecom Policy 94
23	NTP 99	National Telecom Policy 99
24	PEG	Private Entrepreneur Guarantee
25	PPP	Public Private Partnership
26	PSU	Public Sector Undertaking
27	SLC	Subscriber Linked Criteria
28	SMS	Short Message Service
29	TDSAT	Telecom Dispute Settlement and Appellate Tribunal
30	TRAI	Telecom Regulatory Authority of India
31	UASL	Unified Access Service License
32	USOF	Universal Service Obligation Fund
33	VAS	Value Added Services
34	VSAT	Very Small Aperture Terminal
35	VSNL	Videsh Sanchar Nigam Limited
36	WLL (LM)	Wireless Local Loop with Limited Mobility