Deloitte.

Indian Tower Industry
The Future Is Data

May 2015

Contents

Foreword

The Indian telecom industry has undergone a transformational change in the last decade. Mobile operators successfully adopted innovative models to sustain growth followed by focus on operational prudence in recent years. The tower industry has been a key enabler for such models by allowing sharing of infrastructure along with operational excellence.

Considering India is at the cusp of a data revolution, Deloitte India believes that the time is right to look into the future of the Indian Tower Industry. With the increasing proliferation of smartphones among the Indian masses, data will grow exponentially, requiring a significant number of additional data sites over the next few years. An amalgamation of coopetition and competition among telecom operators and tower companies will be required to cater to this next phase of growth.

The story of American Tower Corporation (ATC) with 13000 towers at a market capitalization of $40 billion and enterprise value of $55 billion is perhaps indicative of the exciting story for the Indian tower companies.

In this report, a rounded point of view is provided on the return of stability in the Indian tower industry. Inspired by the impetus coming through the exploding data usage and rollout of next generation data networks (3G/4G rollout), the report tries to assess the new business models and technologies such as in-building solutions, small-cell and Wi-Fi offloading that the tower companies will adopt for this second wave of growth.

While focusing on the growth journey, the report captures the key concerns and challenges that the tower industry might face. Site acquisition and rollout models will be a key area where tower companies will need to innovate to achieve their growth targets. Development of smart ultra-light sites and their deployment on city infrastructure in tie-up with municipal corporations and civic bodies will be key to achieve street level coverage. The report also brings out the expectations and key concerns of the Indian tower industry from tax perspective.

Deloitte India hopes that you will find these insights, based on analysis of inputs from key stakeholders across the telecom value chain – operators, tower companies, telecom equipment manufacturers, energy companies focused on tower and industry practitioners, stimulating and valuable for strategizing and capitalizing on the upcoming data explosion.

Hemant Joshi

Indian Telecom Market Overview

Telecommunication services are known as one of the key driving forces for the socio-economic development of a nation. Mobile telephony has seen a staggering growth in the past 10 years. However, it has been witnessing a slowdown in recent years. Driven by data explosion and rollout of data services (3G and 4G) along with operational prudence, the Indian telecom market is expected to be back on the growth track. With a total of 11 operators serving an active wireless subscriber base of 842.39 million [1] (88.45% of total registered wireless subscriber base), the Indian telecom market is now amongst the most competitive markets in the world. Over the past few years, the revenue market share of larger players such as Bharti Airtel and Vodafone has increased further capturing the revenue share lost by PSUs while that of smaller private players has remained the same.

With increasing market competitiveness, the current focus of the telecom operators in India has moved from increasing the subscriber base to improving the 'active' user base. Moreover, telecom operators are laying emphasis on operational prudence more than ever. There are three key aspects which would continue to fuel growth of tower companies:
• Strong focus on operational excellence
• Data explosion
• Potential in rural areas to add subscribers to the 'active' user bas

Data Usage Landscape in India

India has come a long way from 2001 when there were only about 7 million Internet users to become the second largest market in the world for Facebook and LinkedIn and the third country in the world to have over five internet companies valued at over $1 billion.

India added 43 million internet users (20.5% CAGR) from October 2013 to September 2014 resulting in total internet users crossing 254 million in September 2014. Out of these, 235 million users accessed internet through mobile devices. The growth in internet users was seen both in rural and urban parts of India. India is expected to overtake the US and become the 2nd largest internet user base in the world in 2015.

The low penetration of desktop internet users in India and fast increasing acceptance of cost-effective smart mobile devices has provided favorable growth condition for the mobile internet market. In the mid of 2012, the total mobile internet user base in India overtook the desktop internet user base. By the end of 2014, around 69% of internet users in India used mobile devices to access internet.

The current smartphone penetration in India stands at 13.4% up from 10% in 2014. [2] As per a study conducted by Deloitte across 25 countries, once the smartphone penetration exceeds 25%, data explosion takes a new dimension. This is mostly driven by the data hungry applications and on-demand services. India is likely to follow the global trend and will see tremendous data growth at 30% smartphone penetration with even more adoption of data hungry applications / services on mobile devices. [3]

Figure 1: Projected Smartphone Penetration and Mobile Data Consumption for India
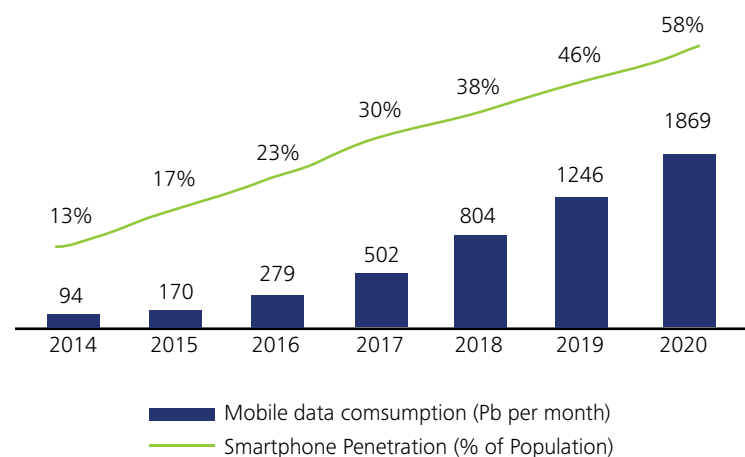
Source: Deloitte Analysis

Average data consumption per user in 2014 was 688 MB per user for 3G and 216 MB per user for 2G. On an average, a 3G user consumed about 3x data payloads as compared to 2G counterparts. Further, with high smartphone usage and lower data tariffs, India has already started experiencing S-curve data growth and this trend is expected to continue in the near future.

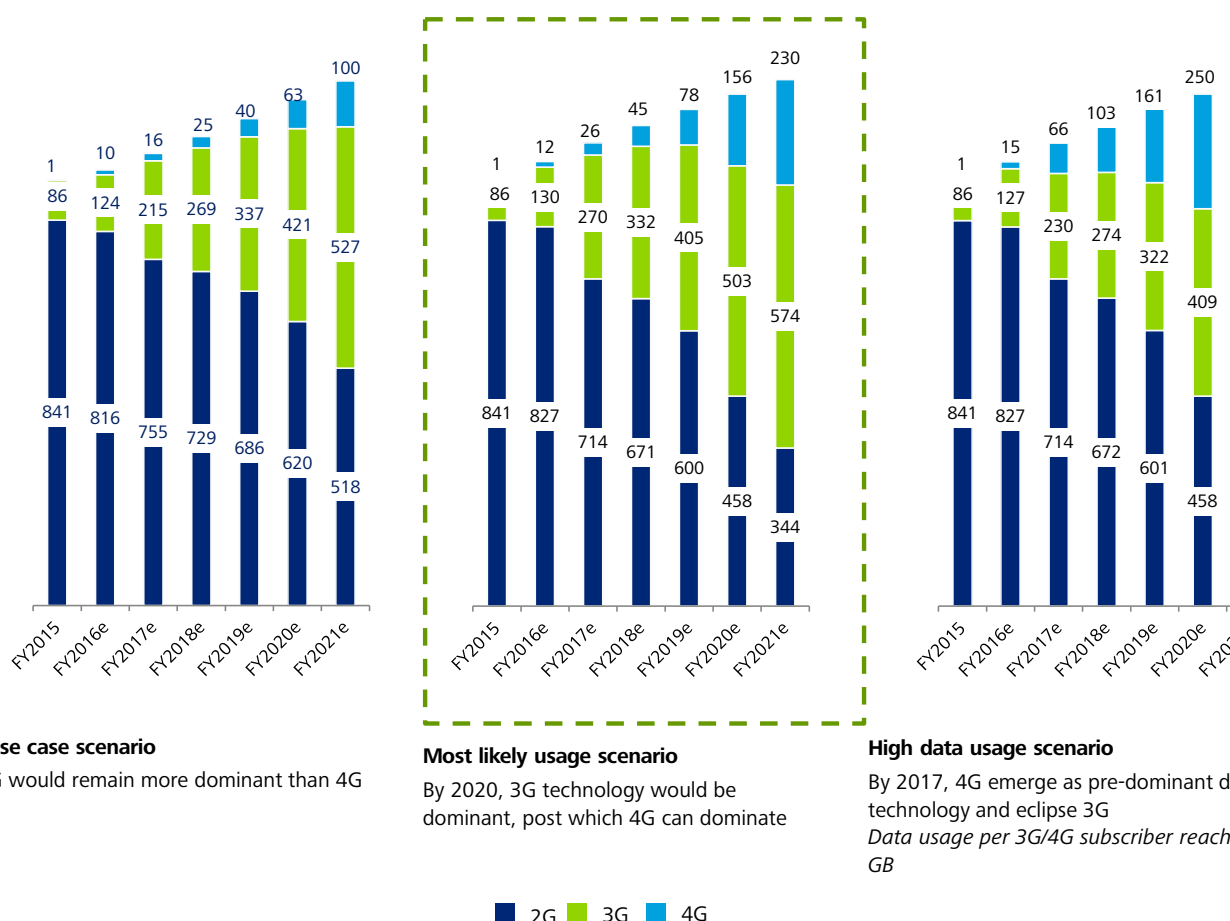### Technology (2G, 3G & 4G) Landscape in India

The 3G subscriber base in India has grown at a CAGR of 144% from 2009 to 2014. In December 2014, 3G subscribers stood at 9% of all mobile subscribers compared to 0.4% in 2012. 4G services were launched in India in 2012 and the subscriber base stood at 0.4 million in December 2014. With increasing network coverage, falling data prices and shifting customer preference for higher connection speed, both 3G and

4G subscription are expected to grow substantially in future.[4]

Expected future trends

The telecommunication growth has gone through multiple generations in a short span of a few decades. With more subscribers using faster access technologies, data consumption has consequently grown faster. By 2020, data technologies (3G and 4G) are expected to be equally dominant. India is currently gearing up for the 4G revolution with 4G services currently available only in selected cities in India. Speedy adoption of the 4G technology is expected to be critical for the success for the Indian government's 'Digital India' initiative. Below chart provides most probable scenarios for the projected connections on various mobile technologies viz. 2G, 3G & 4G.

Figure 2: Subscriber Base by Technology (in million)

Base case scenario
3G would remain more dominant than 4G

Most likely usage scenario
By 2020, 3G technology would be dominant, post which 4G can dominate

High data usage scenario
By 2017, 4G emerge as pre-dominant data technology and eclipse 3G
Data usage per 3G/4G subscriber reach GB

■ 2G ■ 3G ■ 4G

Source: Deloitte Analysis

Indian Tower Industry

The significant growth of the Indian telecom industry over the last five years can be characterized by the operational prudence and exploding data growth along with a decline in tariffs due to the fierce competition. The competitiveness of the Indian telecom market has led the operators to not just focus on operational prudence but also operate in select circles.
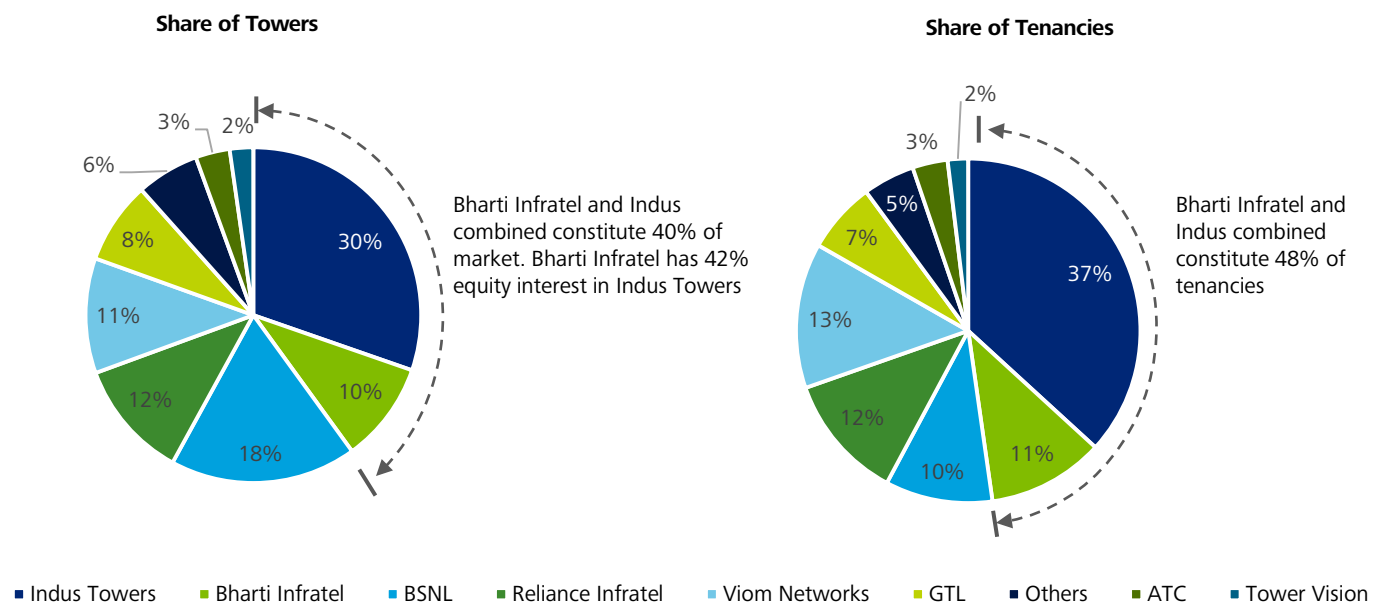
As telecom operators are focusing on increasing market penetration with limited capital expenditure, it is favorable for telecom operators to lease towers from tower companies, reducing costs considerably and allowing telecom operators to focus on core marketing activities. Leasing towers from tower companies also enables new telecom operators to rollout services in record times.

Current Landscape

There are close to 400,000 telecom towers in India at present and are estimated to increase at a CAGR of 3% over next 4-5 years. The decline in growth of voice usage along with industry developments and regulations in India have raised concerns about the growth of independent tower businesses, thereby affecting their cash flows and debt repayments. However, exploding data traffic is leading to in-building solutions and smaller cell sites, and is expected to drive growth of the Indian tower industry in the future.

As early movers, Indian tower companies have become global industry leaders with a large number of towers under management. The following chart provides a snapshot of current tower infrastructure assets with various industry players.

Figure 3: Indian Independent Tower Industry Market share

Share of Towers

Bharti Infratel and Indus combined constitute 40% of market. Bharti Infratel has 42% equity interest in Indus Towers

Share of Tenancies

Bharti Infratel and Indus combined constitute 48% of tenancies

Legend: ■ Indus Towers ■ Bharti Infratel ■ BSNL ■ Reliance Infratel ■ Viom Networks ■ GTL ■ Others ■ ATC ■ Tower Vision
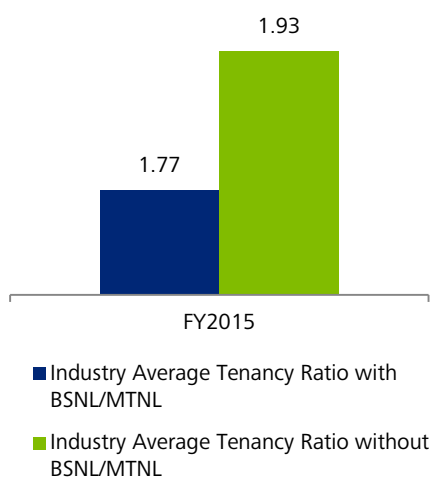
Source: Deloitte Analysis

Bharti Infratel and Indus Towers are independent and operate in different circles except only 4 overlapping circles where they have non-compete agreement.

With 42% equity interest in Indus Towers, Bharti Infratel is second largest tower company in India with ~85,000 towers (including proportionate towers based on 42% equity interest in Indus).

Industry average tower tenancy ratio currently stands at 1.77, however, for only independent tower players i.e. excluding BSNL/MTNL the ratio stands at 1.93.
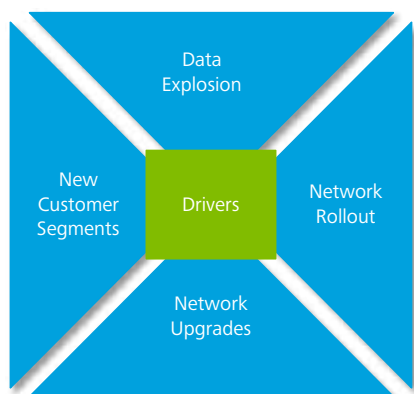
Figure 4: Industry Average Tower Tenancy Ratio

FY2015

■ Industry Average Tenancy Ratio with BSNL/MTNL

■ Industry Average Tenancy Ratio without BSNL/MTNL

Source: Industry Discussions, Deloitte Analysis

Evolving Drivers and Challenges

Figure 5: Key Drivers of the Indian Telecom Tower Industry

Source: Deloitte Analysis

Exponential data growth & spectral scarcity:
India is at the cusp of data revolution and many of the existing sites primarily in dense urban areas are expected to exhaust their data capacity. Thus, additional sites would be required thereby driving the telecom tower industry growth. India being a spectral scarce country, more sites are required to provide adequate capacity across technologies.

**Network upgrades & roll-out of data technology (3G and 4G)**: In India, a significant number of 3G sites need to be added to provide the adequate quality and coverage as there are several gaps in terms of network coverage across the country. Similarly, 4G networks have just started coming up in India. With higher competition among telecom operators, they are expected to invest in quality data networks and drive tower industry growth. New entrants like Reliance Jio are expected to push the tower industry growth. Reliance Jio has already entered in tower sharing agreements with multiple tower companies.

New customer segments: New customer segments such as Government and infrastructure are expected to emerge in the near future. The 'Digital India' initiative presents a gamut of opportunities for the telecom tower companies.

Growing subscriber base: Increasing subscriber base and tele-density especially in rural areas will drive the new site development and additional tenancies for existing towers.

Risks & challenges

Figure 6: Key Risks and Challenges for the Indian Telecom Tower Industry
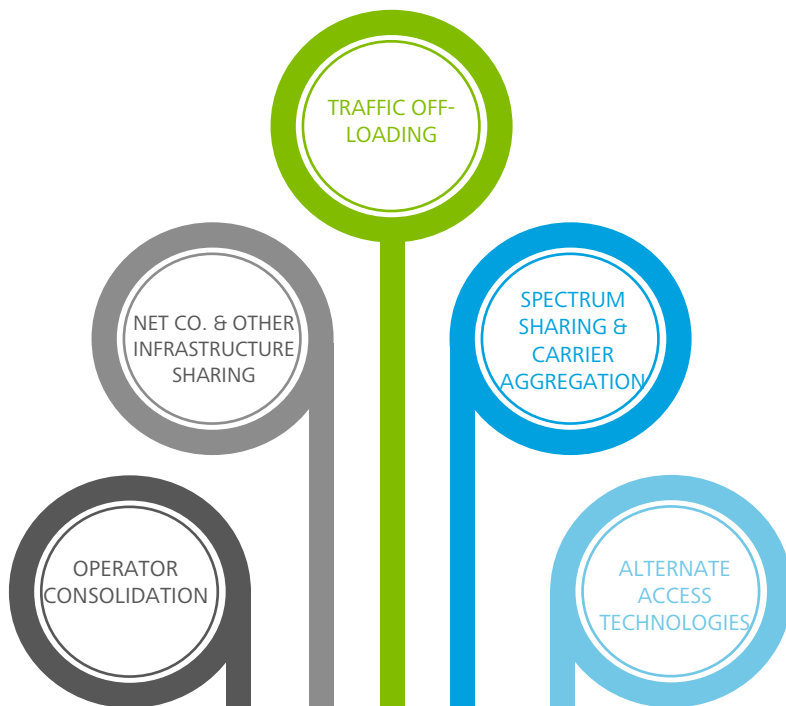
Source: Deloitte Analysis

Operator consolidation: In case of operator consolidation, the requirement of additional sites might get reduced among the consolidating players negatively impacting the tenancies for tower companies. However, consolidation will be restricted to smaller players, thereby having a limited impact on tower companies.

NetCo & other infrastructure sharing: The operators might enter into NetCo agreements wherein they share their networks for cost optimization, as a result of which the site requirement for different operators would be less.
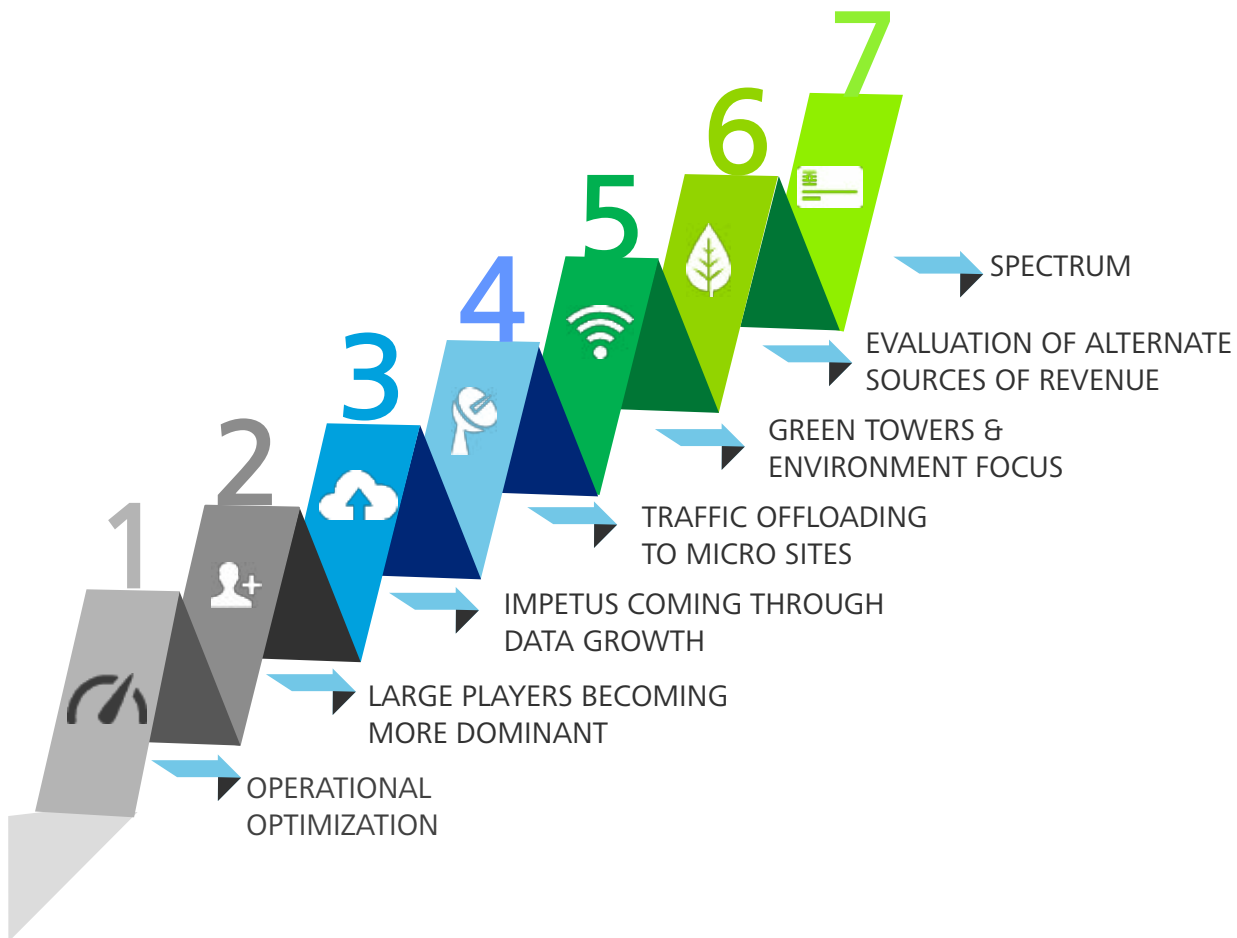
Traffic off-loading: Due to large traffic volumes expected in next 4-5 years, operators are expected to off-load a large amount of traffic on micro sites, small cells and Wi-Fi, which might render the macro site tenancy growth lesser than expected.

Spectrum sharing & carrier aggregation: Currently, spectrum sharing is not allowed in India, however, if allowed it may negatively impact the additional site requirements across the operators. Similarly, carrier aggregation may increase the spectrum utilization and reduce the site requirement.

Alternate access technologies: Entry of new market players such as Comcast and Google can pose further competition to network operators. Technology disruptions like MVNOs using Wi-Fi hotspots and Google's gigabit internet can significantly impact mobile network operators' business and in turn, can reduce tower sites demand as well.

Key Trends in Tower Industry – Current and Future

Figure 7: Key Trends in Tower Industry

7 — SPECTRUM

6 — EVALUATION OF ALTERNATE SOURCES OF REVENUE

5 — GREEN TOWERS & ENVIRONMENT FOCUS

4 — TRAFFIC OFFLOADING TO MICRO SITES

3 — IMPETUS COMING THROUGH DATA GROWTH

2 — LARGE PLAYERS BECOMING MORE DOMINANT

1 — OPERATIONAL OPTIMIZATION

Source: Industry Discussions, Deloitte Analysis

1. Operational optimization

Telecom operators were earlier focussed on rolling out more sites. However, the focus has shifted greatly to operational optimization and prudence. Tower organizations are playing a major role by partnering with telecom operators and helping them optimize operations and therefore reduce costs. With this shift, tower organizations are adopting innovative models, advance fuel management technologies, data analytics and also high efficiency equipment and green energy.

2. Large players becoming more dominant

High cash spend on diesel to power the towers, labor and unpaid dues from operators have resulted in rising debt and low operating cash for tower companies. Hence, the tower industry is moving towards the situation where larger players in the industry (which are promoted by telecom operators) with access to huge amount of capital will use their capital power to expand at a faster pace compared to smaller players. This will lead to large players gaining market share in the years to come.

3. Impetus coming through data growth

With high mobile penetration in India, growth focus of telecom companies is shifting from voice to data. Hence, the tower companies need to quickly evolve from their traditional area of expertise to meet the new requirement of the telecom players that are looking to invest in small cells and Wi-Fi sites. Hence, the tower companies need to assess these new areas and develop expertise around these evolving fields. This will require them to start interacting with new ecosystem partners like Wi-Fi players, cable players, other emerging solution providers, in addition to the already existing telecom and equipment players.

Figure 8: 2015 2100MHz Auction Results

Circle / Band	CircleType	2100MHz
Gujarat	Category A	5
Karnataka	Category A	5
Maharashtra	Category A	5
Tamil Nadu	Category A	5
Haryana	Category B	5
Kerala	Category B	5
Kolkata	Category B	5
Madhya Pradesh	Category B	5
Rajasthan	Category B	5
Uttar Pradesh (East)	Category B	5
Uttar Pradesh (West)	Category B	5
Assam	Category C	5
North East	Category C	5
Orissa	Category C	5
TOTAL SPECTRUM		**70**

Source: DoT

Data growth is not expected to be limited to tier 1 cities but will also come from tier 2 and tier 3 cities. The rapidly penetration of smartphones even in tier 2 and tier 3 cities in India will be a key driver. To cater to this data demand in tier 2 and tier 3 cities, operators have purchased spectrum in 2100 MHz as well across 14 circles, most of which belong to Category B or Category C.

4. Traffic off-loading to micro sites

Telecom operators are expected to off-load traffic from macro to micro sites in order to meet the eminent data demand. Globally, small cells have been outstripping the number of macro base stations shipped since 2010. However, the coverage of these small cells has been limited. On similar lines, in India, data growth is expected to result in more traffic offloading to alternate access technologies from traditional macro sites. Figure 9 provides the key scenarios for mobile data traffic off-loading:

A total of 44% of the mobile traffic is expected to be off-loaded to Wi-Fi and small cells by 2020, where in small cells will contribute to 7% of off-loaded data traffic in most likely scenario. It is expected that tower companies would enter in the small cells product-solution domain to leverage this opportunity. Tower companies in developed markets derive a significant portion of their revenues from small cell network solutions e.g. ATC generates about 2-3% of its revenue and Crown Castle generates about 7% of its revenue through small cell offerings.
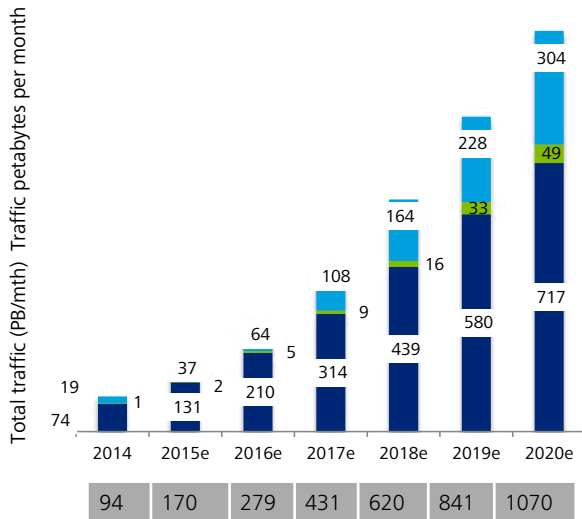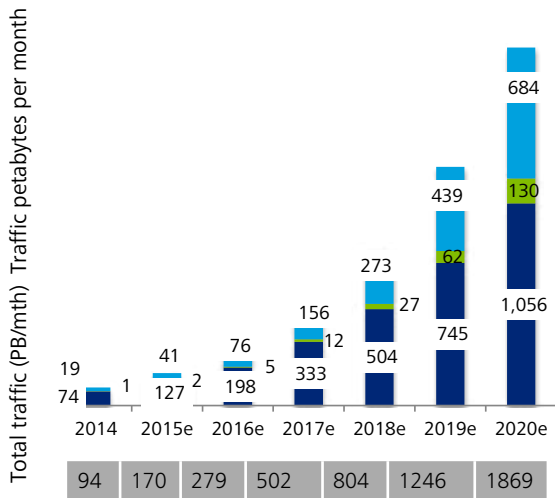
Base case scenario
4G would be less dominant than 3G resulting in lower data traffic through alternate access technology

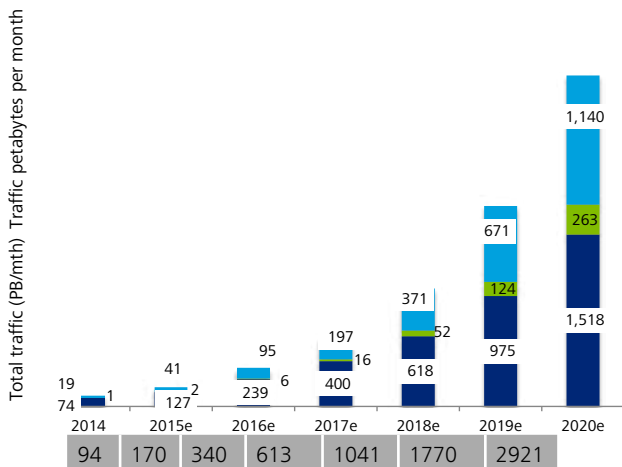| Off-loading	2014	2020e
Wifi	20%	28%
Small cell	1%	5%
Macro	79%	67%

Medium data usage scenario
By 2020, 3G and 4G technology would be equally dominant, resulting in average offloading

Off-loading	2014	2020e
Wifi	20%	37%
Small cell	1%	7%
Macro	79%	56%

High data usage scenario
By 2017, 4G emerge as pre-dominant data technology and eclipse 3G resulting in more data offloading

Off-loading	2014	2020e
Wifi	20%	39%
Small cell	1%	9%
Macro	79%	52%

Source: BMI, Ericsson, Nielsen, Cisco VNI, Media Reports, Deloitte Analysis

5. Green tower and environment focus

Green towers: There is public and regulatory pressure to reduce telecom towers' energy consumption and pollution, especially from diesel generators.

As per the Telecom Regulatory Authority of India (TRAI) Consultation paper on Green Telecommunication published in March 2011, the telecommunications industry in India uses about 2.6 billion liters of diesel fuel worth $1.15 billion per annum. The diesel generators are of 10-15 kVA capacity and consume 2 liters of diesel per hour and produce 2.63 kg of CO_2 per liter. The total emission is approximately 7 million tons of CO_2. This consumption will only increase as more operators expand their network further and launch 4G/LTE services. [5]

Tower companies in India have already started testing and adopting alternative and renewable sources of energy leading to the birth of Renewable Energy Service Companies (RESCOs). Players are adding, to their portfolio, towers that are run by technologies ranging from solar photovoltaic cells to fuel cells to biomass and biofuel.

There are two broad types of ESCOs in the global telecom tower market today:
- **TowerCo Managed**: Refers to tower companies that manage electricity for their tenant telecom operators. Such towerCos own, operate, and bear all operating costs. In recent years, movement away from pass-through costs to a fixed energy model has presented green energy as a cost reduction avenue for towerCos.
- **Independent ESCO (IESCO)**: Refers to standalone energy companies owning and operating energy assets at telecom tower sites. IESCOs can realize similar incentives as 'TowerCo Managed' by reducing energy consumption and adopting greener technology.

Figure 10: Share of the ESCO Market in Asia
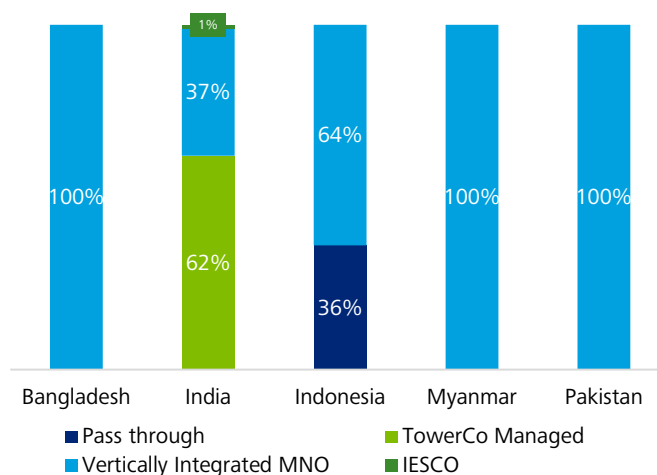
Source: GSMA Country Assessments; TowerXchange

With a holistic approach and collaboration with OEMs and service providers, the tower industry can move to a greener value chain encompassing:

- Low power consuming green active equipment
- High energy efficient green passive configuration and equipment
- Efficient sharing
- Renewable sources of energy

Environment focus: The rise of wireless telecommunication has not come without concerns. The exact impact of Electro-Magnetic Field (EMF) emissions from towers is yet to be confirmed despite several scientific studies. The Department of Telecommunications (DoT) has issued guidelines on EMF emissions to address this concern.
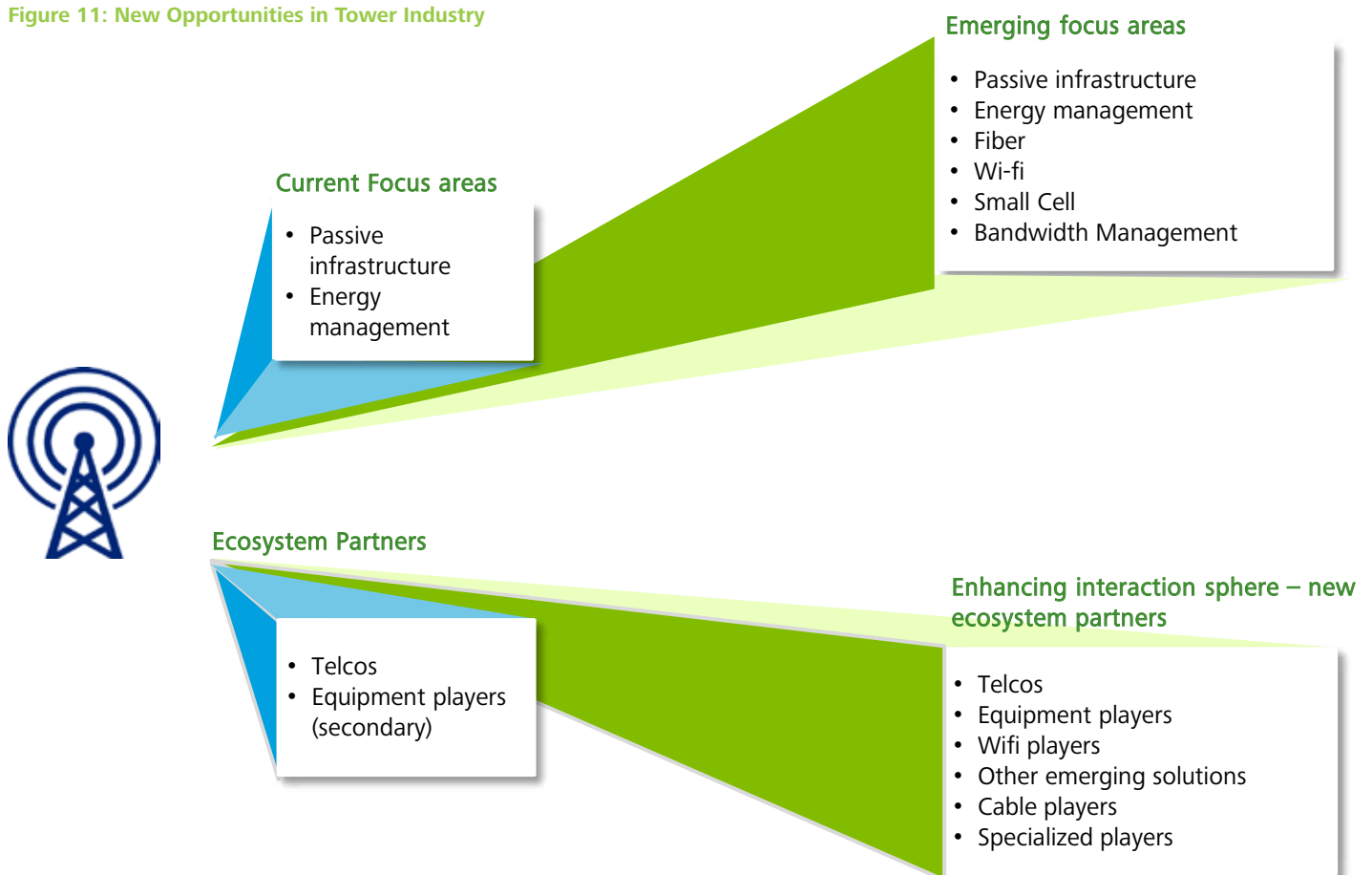
DoT has lowered the EMF exposure limit to one tenth of the ICNIRP exposure level implying that the Indian standards at 10 times more stringent than most other countries. Also, audits are conducted, on the self-certification provided by the operators, by Telecom Enforcement Resource & Monitoring (TERM) Cells. A penalty of INR 500,000 is to be paid per BTS per Operator for non-compliance. According to COAI, all wireless telecom operators are now in compliance with this regulation.

Verizon has invested close to $140 million in on-site green energy. With the recent solar investments and contract with SunPower Corp, Verizon will soon have 25 MW of green energy that is expected to offset 22,000 metric tons of carbon dioxide annually.

6. Evaluation of alternate sources of revenue

Tower companies have started focusing on new areas and interacting with greater number of ecosystem partners as explained in the diagram below.

Figure 11: New Opportunities in Tower Industry

Current Focus areas

- Passive infrastructure
- Energy management

Emerging focus areas

- Passive infrastructure
- Energy management
- Fiber
- Wi-fi
- Small Cell
- Bandwidth Management

Ecosystem Partners

- Telcos
- Equipment players (secondary)

Enhancing interaction sphere – new ecosystem partners

- Telcos
- Equipment players
- Wifi players
- Other emerging solutions
- Cable players
- Specialized players

Source: Industry Discussions, Deloitte Analysis

Leading tower companies have now started looking at the emerging alternate revenue opportunities ranging from energy management, fiberization of backhaul, Wi-Fi and small cell off-loading solutions, to bandwidth management.

7. Spectrum

Spectrum plays a major role in defining an operator's strategy and relative competitive positioning there by impacting tower players as well. Propagation characteristics, ecosystem evolution, current deployment, regulatory environment and spectrum holdings will be the key drivers behind spectrum strategy for various operators. The chart below provides a snapshot of coverage and capacity mapping of various spectrum bands and suitability for various technologies.

**Figure 12: Various Spectrum Bands & Technology Adoption**
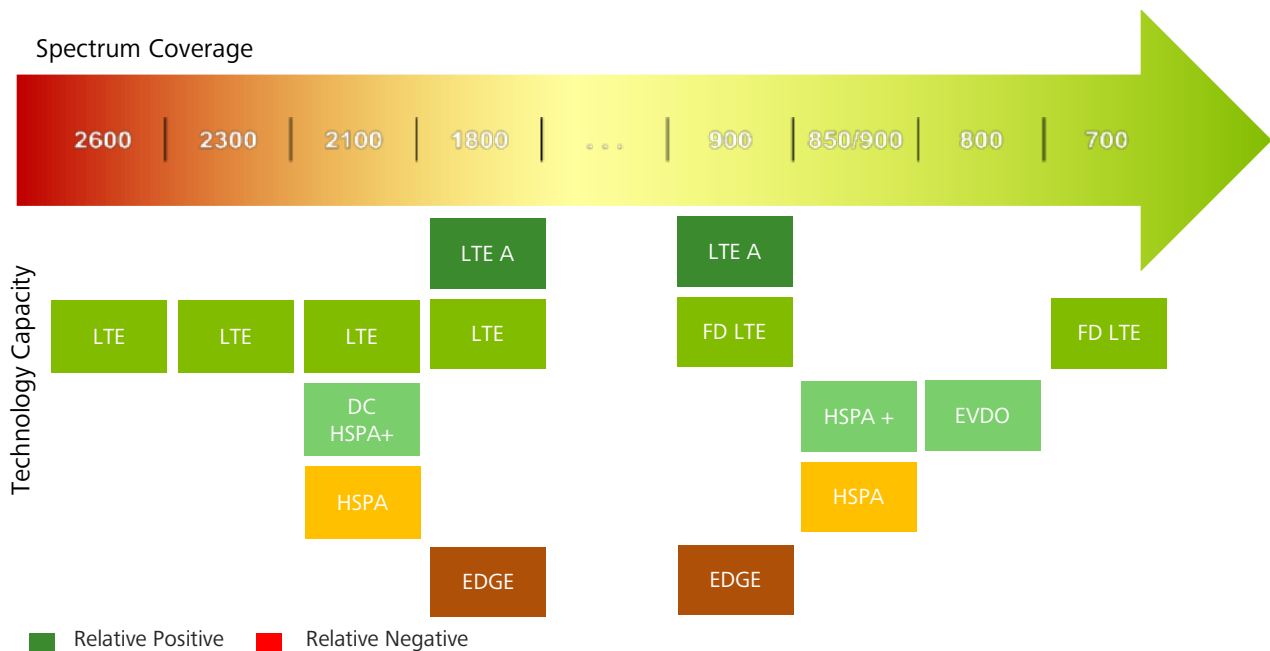
Source: Deloitte Analysis

- In India, 2300 MHz spectrum was auctioned for BWA, however, this band has significant propagation and in-building challenges
- 2100 MHz also faces these challenges and was auctioned for 3G technology in India in earlier auctions while in recent (2015) auctions the spectrum was won on technology neutral basis. Taking into consideration the data growth potential in tier 2 and tier 3 cities operators have purchased the 2100MHz in the 2015 spectrum auction
- 1800 MHz is suitable for 2G Voice as well as LTE ecosystem. Most telecom players have already established operations and equipment for 1800 MHz. In-building characteristics and QoS are relatively inferior to 900 MHz. It would also be used for LTE by some operators
- 900 MHz is suitable for HSPA+ and for other services including voice. It has been noted that players with 900MHz are among top 2-3 leaders in the circles and have distinct competitive advantage. Spectrum re-farming and result of recent auctions will have impact on operators' strategies and investment requirement. It is expected that operators might refarm their existing 1800 MHz spectrum for 2G services and use the 900 MHz spectrum for data services
- 850/900 MHz spectrum is optimized for data speeds that of HSPA providing higher coverage and indoor reach. MTS is the only operator that is currently focusing on this spectrum, however, this spectrum might become important depending on LTE evolution in the country
- 700 MHz spectrum has not been auctioned as yet in India, however, the same is the most suitable for high data capacities

Spectral efficiency and increasing data demand will drive the adoption of data technologies (3G and 4G).

The following table provides the spectral efficiency comparison for various technologies:

Figure 13: Technology Spectral Efficiency Comparison
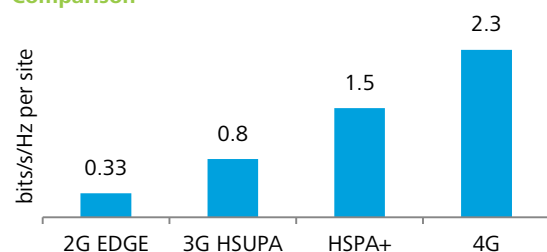
Source: Deloitte Analysis

The following table provides the technologies expected to be used and ecosystem development around various frequency band allocations in India.

Figure 14: Various Frequency Bands, Technology, Coverage, Capacity and Current Ecosystem Development Status

Band (MHz)	Technology Suitability	Migration Multiplier	Coverage (Propagation characteristics, area, in-building)	Capacity (Technology Characteristics)	Current Ecosystem Development Status (Devices, etc.)
2600	LTE	3.7x	Low	High	Limited
2300	LTE	3.2x	Low	High	Medium
2100	3G	1.9x	Low to Medium	Medium to High	Medium
1800	3G/ 2G EDGE	1.6x	Medium	Medium (3G) , Low (2G)	Medium to High
900	3G / 2G EDGE	1.0x	Medium to High	Medium (3G), Low (2G)	High
850/900	3G	1.0x	Medium to High	Medium	High
800	EVDO / LTE	1.0x	High	Medium	Medium
700	LTE	-	High	Medium	Medium

Source: Deloitte Analysis, Analysis Mason

The mobile technologies can also be provided through multiple spectrum bands but for the best quality services, operators need to be able to select the right spectrum bouquet. An appropriate combination of both spectrum bands and access technology is important for cost efficient operations and more advanced service offerings. Each of the spectrum bands have specific performance requirements and can be classified into coverage bands, capacity bands, peak performance bands and dynamic traffic bands.

In recent spectrum auctions, the players have acquired liberalized spectrum bands wherein they can use the allotted spectrum frequencies for any technology i.e. 2G / 3G / 4G. The following tables provide a snapshot of circle wise current spectrum holdings for large players in India (post factoring in the spectrum expiring in 2015 & 2016).

Figure 15: Categorization of Various Spectrum Bands

Coverage Bands	Coverage Bands are fundamental (low frequency)
Capacity Bands	Capacity Bands are essential to satisfy large majority of consumers (medium frequency)
Peak Performance Bands	Essential for fulfilling the demand of peak data traffic
Dynamic Traffic Bands	Needed for providing different and changing traffic patterns in hot-spots

Source: Deloitte Analysis

Figure 16: Spectrum Holding of Key Indian Telecom Operators

Circle / Band	Bharti Airtel				Vodafone India			Idea Cellular			Reliance Jio			Reliance Communications		
	900	1800	2100	2300	900	1800	2100	900	1800	2100	800	1800	2300	800	900	1800
Andhra Pradesh	7.8	11.0	5.0			6.8		5.0	6.0	5.0		5.8	20.0	5.0		4.4
Assam	1.8	5.7	5.0			6.9	5.0		5.0		5.0	5.4	20.0	7.5		
Bihar	6.2	3.0	5.0			6.9			5.7		5.0		20.0	5.0		0.0
Delhi incl. NCR	6.0	7.0	5.0	20.0	5.0	8.0	5.0	5.0	8.6			5.4	20.0	5.0		4.4
Gujarat		6.2			7.8	6.4	5.0	5.0	1.6	5.0		6.0	20.0	6.3		4.4
Haryana		6.2		20.0	6.2	6.2	5.0	6.0	6.0	5.0	5.0	4.0	20.0	5.1		4.4
Himachal Pradesh	6.2	10.2	5.0			5.7			9.2	5.0	5.0	5.4	20.0	5.0	5.0	
Jammu & Kashmir	6.2	2.6	5.0			6.9			5.0	5.0	5.0		20.0	5.0		4.4
Karnataka	7.8	11.0	5.0			13.0	5.0	5.0	6.0			5.0	20.0	5.0		4.4
Kerala		11.2		20.0	6.2	9.3	5.0	6.0	10.0	5.0		5.0	20.0	5.0		4.4
Kolkata	7.0	5.0		20.0	7.0	8.0	5.0		5.0	5.0		10.0	20.0	6.3		6.2
Maharashtra		8.2		20.0	6.2	1.3	5.0	9.0	9.0	5.0		5.0	20.0	5.0		4.4
Madhya Pradesh		13.8				6.9		7.4	7.0	5.0	5.0	6.4	20.0	5.0	5.0	
Mumbai	5.0	15.2	5.0	20.0	11.0	8.2	5.0		6.6		5.0	6.6	20.0	5.0		4.4
North East	4.4	8.8	5.0			6.9	5.0		11.0		5.0	6.4	20.0	7.5		0.0
Orissa	6.2	6.8				6.9			10.0		5.0	5.0	20.0	5.1		
Punjab	7.8	8.2		20.0		7.5		5.6	8.0	5.0			20.0	6.3		4.4
Rajasthan	6.2	10.2	5.0		6.2	0.8	5.0		6.2			10.0	20.0	3.8		4.4
Tamil Nadu	6.2	14.2	5.0		6.2	9.0	5.0		11.4			6.8	20.0	5.0		4.4
Uttar Pradesh (East)	6.2	1.0			6.2	6.5	5.0		6.2	5.0	3.8	3.0	20.0	5.0		4.4
Uttar Pradesh (West)		6.2	5.0		6.2	2.5	5.0	5.0	2.2	5.0			20.0	6.3		4.4
West Bengal	4.4	6.2	5.0		4.4	4.3	5.0		6.3			5.6	20.0	5.1		0.0

Adoption of spectrum usage optimization techniques by the telecom players

Spectrum re-farming: In the recent spectrum auction, some of the players who have acquired liberalized spectrum in 900 MHz and have sufficient spectrum holding in 1800 MHz might re-farm 2G offerings onto 1800 MHz and use 900 MHz for 3G offerings. This would typically reduce the coverage requirement for the 3G sites as compared to that required while using 1800 MHz or 2100 MHz for 3G technology.

Spectrum sharing: Shared spectrum can be used as a complement to dedicated licensed spectrum to provide additional capacity. This is especially effective in cases where spectrum clearing is not possible within a reasonable time frame or where the incumbent does not diminish the value of that spectrum to the mobile operator. Telecom regulators are increasingly looking at this as an effective means of addressing spectrum scarcity, e.g. Telecom Regulatory Authority of India proposed sharing of any category of similar spectrum in a circle between two operators in the country in July, 2014. This has been suggested to ensure efficient use of resources that can lead to cheaper voice and data services for users.

Spectrum sharing may increase the combined spectral efficiency, thereby somewhat reducing the site requirements. However, the guidelines limit the spectrum sharing between only two licensees in a circle subject to the condition that there will be at least two independent networks in the same band. Thus, the impact of spectrum sharing on the site requirement would not be much significant.

Carrier aggregation: Carrier aggregation can be used to meld together disparate or narrower component carrier bands of spectrum for wider channels (up to 100 MHz) to support faster download speeds and additional network capacity. There is limited development in India in this area; however, acquisition of spectrum in 1800 MHz indicates deployment of FD LTE services (in addition to TD LTE on 2300 MHz) in a Carrier Aggregation framework. While CA would help in efficient utilization of spectrum, currently there are limited devices that support this. Tower companies might see a negative impact on 3G site loading, however, new sites would be required when the data demand reaches beyond data

capacity offered by these existing sites.

Further, new technological developments in antenna and base station equipment like multiple technology antennas will impact the tower loading. It is expected that more than 60% operator sites will use multi technology equipment over next 2-3 years. This would further improve the power requirements per site and lead to shrinkage of footprints resulting in higher operational efficiencies.

Emerging Focus Areas

Energy: Energy costs are traditionally treated as a pass-through to operators, leading to limited incentives for tower companies to contain costs. Inefficiencies are typically found in areas such as monitoring electricity and fuel consumption, equipment upkeep, and equipment configuration, including overly powerful diesel generators. In areas with limited grid power, these inefficiencies are compounded and lead to high pilferage and leaks. Significant savings can be realized through better execution by ensuring correct temperature settings, properly maintaining equipment having outdoor sites, and controlling vendor costs. For example, some tower companies in India use prepaid petrol cards to control the diesel filled by vendors and set limits based on each site's "should-be" consumption.

Increasingly, operators are pushing for fixed power and fuel cost arrangements, rather than the traditional pass-through, to preempt pilferage and disputes. This also works in favor of the tower company because it benefits directly from operational improvements.

In addition to the energy consumption and cost model, tower companies are taking various initiatives aimed at achieving sustainability and also support off-grid sites. Some examples are:
- Bharti Infratel has initiated the Green Towers P7 program, as a part of which Bharti Infratel has commissioned more than 1200 solar powered towers, integrated power management systems (IPMS) and Free Cooling Units (FCU) among other environment friendly and efficient equipment.
- Indus Towers' Green Sites project aims to eradicate the consumption of diesel for cell site operations. By October 2014, the initiative had helped transformed 35,000 sites, comprising 30% of Indus' portfolio, to 'Green'.

Operational efficiency: Tower companies are undertaking a gamut of initiatives to optimize operations and achieve new levels of efficiency.

Figure 17: Initiatives for Operational Prudence

Comprehensive Operational Improvements
• Power & fuel
• Operations & maintenance
• Estate management and security

Reduce Cost Structure of Sites
• New site designs
• Existing sites

Incremental Site, Tenancy and Pricing Opportunities
• Bottom-up site opportunity analysis
• New technologies
• Asset utilization

Source: Industry Discussions, Deloitte Analysis

The key initiatives among these include efforts to reduce costs related to power and fuel, maintenance, estate management and tower security. Cost efficient site design is another focus area for the tower companies. This involves staying in constant touch with the latest innovations in design and tower construction techniques. The emergence of lighter carbon fiber towers has allowed for much easier deployment of towers at locations having tough terrain. Similarly, tower foundation and erection processes are also witnessing multiple innovative developments which has made the tower construction much faster and cost efficient.

Many tower players have invested in developing a state-of-art tower operations center from where they can monitor site performance across towers on a real-time basis. Many tower companies are also setting up well-structured maintenance programs in the form of preventive/ predictive and risk based maintenance activities. They are using live site monitoring data to ensure maximum uptime across its sites by having 24X7 Network Operations Center for Site and equipment maintenance. The tower companies are also focusing on training of its technical manpower to ensure minimum equipment breakdown and superior maintenance.
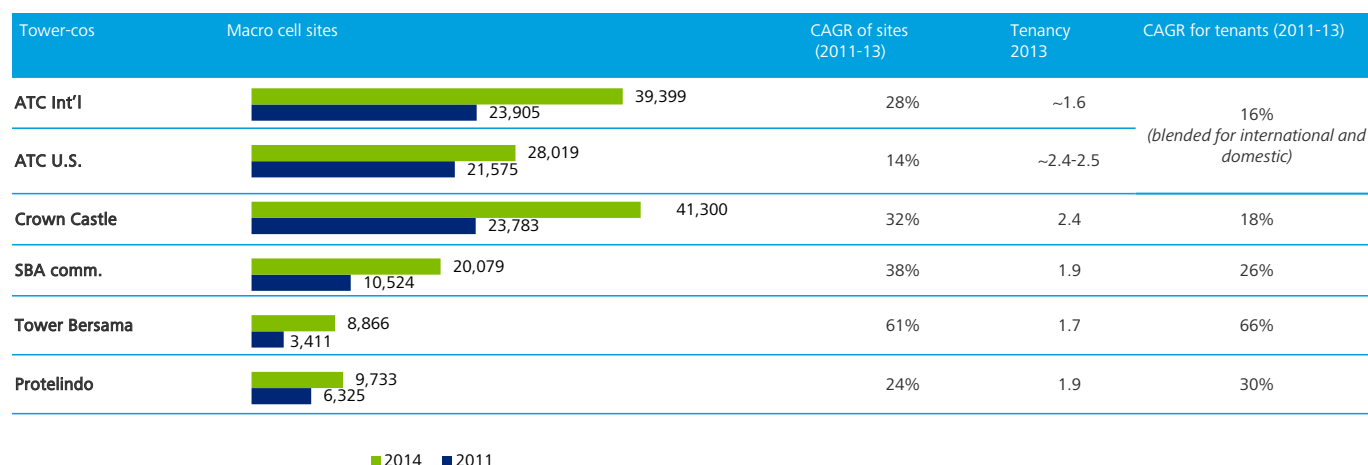
Global Perspective

Tower companies across the globe have evolved their business models and increased focus on cost efficiency and operational prudence.

Several players have leveraged inorganic growth as the primary means of expanding their footprint. For example, ATC added close to 78% sites through inorganic mode and the remaining through organic. In Indonesia, average tower tenancy rates are below India and US levels due to low outsourcing of towers as of now. This is expected to change with increase in tower outsourcing.

Figure 18: Tower Portfolio of Global Companies

Tower-cos	Macro cell sites	CAGR of sites (2011-13)	Tenancy 2013	CAGR for tenants (2011-13)
ATC Int'l	39,399 / 23,905	28%	~1.6	16% *(blended for international and domestic)*
ATC U.S.	28,019 / 21,575	14%	~2.4-2.5	
Crown Castle	41,300 / 23,783	32%	2.4	18%
SBA comm.	20,079 / 10,524	38%	1.9	26%
Tower Bersama	8,866 / 3,411	61%	1.7	66%
Protelindo	9,733 / 6,325	24%	1.9	30%

■2014 ■2011

Source: Company Websites, Analyst Reports

The below table highlights the areas in which global tower companies are taking initiatives:

Figure 19: Global Tower Industry Initiatives

Area	Developed Market Players (such as US)	Emerging Market Players	Summary and Impact
Operational Strategy	• Focus on new products (small cell, Wi-Fi, etc.) • Focus on integrated fiber play	• Focusing on large carriers to leverage site roll-outs due to data growth	Tower-cos are changing their operating model to tap into data growth by either deploying new products or tapping suitable customers
International growth strategy and Geographical Diversification	• Significant international expansion by ATC, followed by SBA in emerging market such as LatAm	• Focused in domestic markets alone due to untapped opportunities	Tower-cos are focusing on emerging markets where tower outsourcing is still under-penetrated or where 3G/4G rollouts are expected in near future (LatAm)
Inorganic Growth	• Significant inorganic growth	• Significant inorganic growth	Acquired sites, especially those from carriers give revenue visibility from day one and reduce management and financial burden of building site
Energy • Energy Analytics and Fuel Management Solution	• Leading players are using analytics and dedicated fuel management solutions to centrally monitor fuel consumption at cell sites and dynamically schedule refueling via optimized routing of diesel trucks	• Non-existent or mostly dependent on specific sites	Indian tower companies can evaluate fuel management solutions depending on their strategic focus
Energy • Green Towers	• Significant progress across use of solar photo voltaic cells and fuel cells. (e.g. AT&T has 15.4 MW capacity from Fuel Cell)	• Players have started adopting alternate sources of energy but use of fuel cells is still in pilot stage	Indian tower companies can explore usage of fuel cells by joining hands with global fuel cell manufacturers like US companies – AT&T

Source: Industry Discussions, Deloitte Analysis

Indian tower industry players have unique business model advantages. The Indian tower industry is not just a pioneer but continues to innovate and growth and presents unique advantages. As early movers, Indian tower companies have become global industry leaders with key players like Indus Towers, Bharti Infratel and Viom managing a higher number of towers than large global players like American Tower (28,500 in US) and Crown Castle (39,700 in US).

Figure 20: Indian Tower Industry Unique Advantages Through Long Term Agreements

Collaboration model
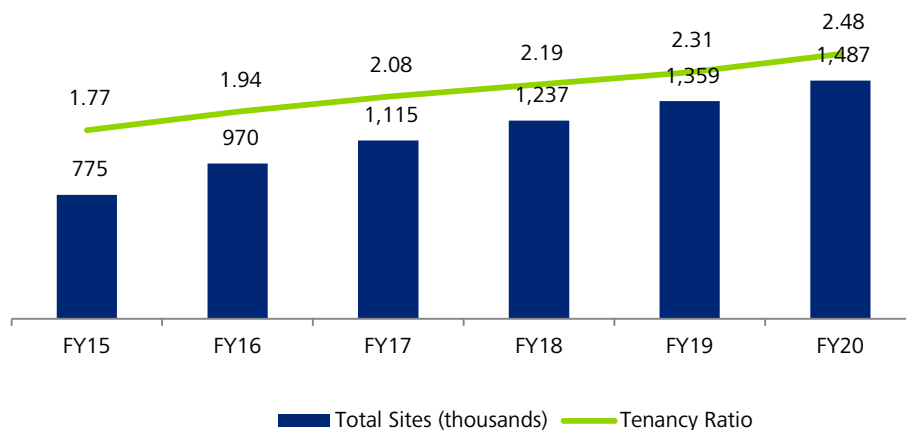
Key feature and result

Unique anchor based partnership model has helped the tower companies grow along with operators. Indian tower companies collaborate by – understanding the needs of the operator, onboarding through attractive pricing models and help the operators grow by working cohesively. Presence of anchor tenant is must for new tower deployments and geographic expansion. This helps mitigate risk as well.

Economic viability

Key feature and result

Long term master service agreements have made is economically challenging for the operators to build new towers themselves

Currently no telecom operators are building their own towers

Entry barrier

Key feature and result

Master Service Agreements with tower companies have allowed operators to leverage the economies of scale and thereby the sliding scale of rent

Also, the sharing of energy cost spend on towers makes sharing all the more economically viable. As a result, it is not economically viable to erect a new tower where a tower is already present.

Volumes and margins

Key feature and result

Minimal value gain sharing has allowed for a large number of towers in the India.

This high volume – low margin strategy has allowed tower companies to scale up thereby providing a strong volume base.

Source: Deloitte Analysis

Going Forward

The rapidly increasing smartphone penetration along with next generation data network rollouts will drive the data explosion and therefore the second wave of telecom growth in India. The tower industry is expected to continue to grow owing to this demand driven by data and adoption of new business models.

Expected Towers & Tenancy Growth Trends

Industry tenancy is expected to grow from 1.77 (FY2015) to 2.48 by 2020 primarily due to focus on data. Network expansion in India is being driven through focus on data in urban areas and coverage expansion in semi-urban and rural areas. Currently, telecom operators have installed 3G base stations only on 20-25% of their leased towers. The 4G sites are very low in numbers and the whole 4G network need to be put in place. There is huge opportunity for the growth of 3G and 4G loading as well as tenancies as the data capacity requirement increases and operators start putting in capacity sites. Number of data sites (3G and 4G) will account for ~66% of all sites which will drive tower growth resulting in additional loading. In case the 3G, 4G technologies keep on being deployed on higher frequencies, the need for standalone 3G, 4G sites would increase as these data networks are not scalable. Overall site tenancies (2G, 3G & 4G all inclusive) are expected to increase to ~1,487,000 by FY2020.

Further, given the high investments in spectrum by operators, they will improve the geographical footprints while making the networks data ready. For this they would need new towers and sites.

Figure 22: Projected Industry Average Tenancy Ratio

Source: Deloitte Analysis

Figure 21: Number of Sites (BTS, enodeB, nodeB) and Tenancy Ratio
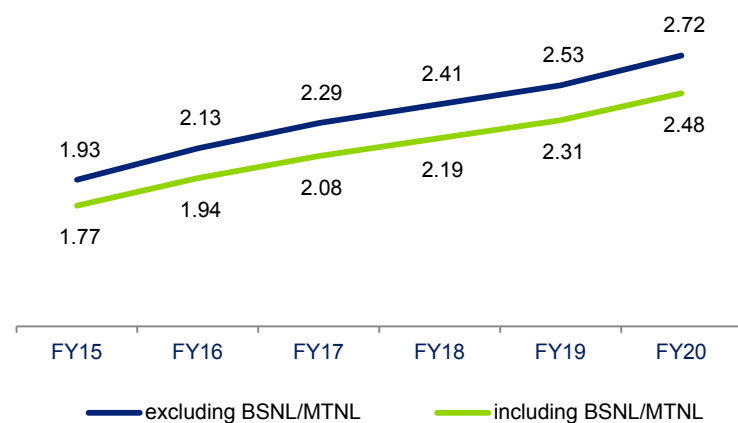
Source: Deloitte Analysis

It is expected that the tenancy ratio for the industry will increase given the focus on operational prudence and cost reduction. Thus, more and more operators will share the towers for site installations as they go along with their network expansion plans, thereby increasing the tenancies of existing towers. Moreover, emerging players are expected to share more towers for reducing their operational cost in order to compete with the incumbents. Though the new tower growth is estimated to be limited to a CAGR of ~3% over next 4-5 years, new towers are expected to be built with an average tenancy of 2 or more to start with, improving the industry tenancy ratio. However, it is to be noted that the resulting macro site tenancies are impacted by the data off-loading that happens on small cells and Wi-Fi networks. In a hypothetical scenario where all data requirements were to be full-filled by the macro sites only, more macro sites especially data sites would be required. In that case, tenancies could be much higher and could cross 3 sites per tower at least for independent tower players and ~2.7 sites per tower for overall industry by FY2020.

3G / 4G site loading

Data networks (3G and 4G) in India are in development phase; in the initial phase of 3G network roll-out, most of the operators loaded their existing 2G BTSs with 3G equipment that led to minimal increase in the tower tenancies. However, increased utilization and data demand would necessitate installation of additional Node B/eNodeB for 3G and 4G resulting in higher tower tenancies.

Following charts provide a snapshot of expected site co-locations and new developments across India:

Figure 24: Projected 3G sites (nodeB)

	FY15	FY16	FY17	FY18	FY19	FY20
3G Sites (thousands)	140	250	322	384	433	461
3G as % of Voice	23%	40%	50%	58%	64%	66%

■ 3G Sites (thousands) ▬ 3G as % of Voice

Source: Deloitte Analysis

Figure 23: Impact of Data Off-loading on Tenancies

Overall Industry Average: 2.48

Independent Players (excl. BSNL/MTNL) Average: 2.72

Increase in tenancy ratio in Hypothetical scenario with no traffic off-loading on to micro / small cells / Wi-Fi sites (not to scale)

Source: Deloitte Analysis

3G sites are expected to increase from current ~460,000 to more than 329,000 in FY2020 and are estimated to be about 66% of voice sites in FY2020. 3G site growth will accelerate over next 2 years before stabilizing. 3G site stabilization will happen as data consumption rises and 4G starts increasing cannibalizing 3G growth.

Figure 25: Projected 4G Sites (enodeB)

	FY15	FY16	FY17	FY18	FY19	FY20
4G Sites (thousands)	40	99	148	192	250	328
4G as % of Voice Sites	7%	16%	23%	29%	37%	47%
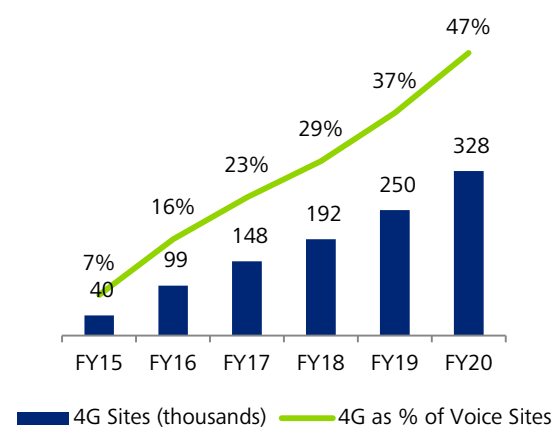
Source: Deloitte Analysis

Currently, 4G technology is in its nascent stage in India. Players like Reliance Jio are expected to launch 4G networks across the country. Other players including Bharti have also started building their 4G networks. Overall, 4G sites are expected to increase to more than 300,000 by FY2020 making 14% of total sites.

Growth in towers

Operators are looking to expand their network coverage by rolling out next generation 4G networks and increasing their 3G presence. Driven by the increasing data usage, standalone data towers are expected to grow with a CAGR of ~125% till FY2020 while other towers are expected to grow with a CAGR of 1.89% over the next 5 years. The chart below provides the expected growth in the number of towers.

At present, the number of standalone telecom tower for 3G and 4G across India are estimated to be only ~700. Towers are expected to grow at 3% CAGR for next 5 years and the total number of towers is expected to grow to more than 511,000 by FY2020, of which 30,000 towers are expected to be only supporting data sites. Standalone data towers will grow as data consumption increases particularly in urban and dense-urban areas. However, a part of this traffic will be taken away by Wi-Fi and micro cell phenomenon as well.

Figure 26: Projected number of towers (thousands)

| Total | 439 | 454 | 470 | 481 | 492 | 511 |

Data labels (Data Standalone Towers, top): 0.7, 3.5, 8.0, 15.0, 24.0, 40.0
Data labels (Towers): 438, 450, 462, 466, 468, 471
X-axis: FY15, FY16, FY17, FY18, FY19, FY20

Legend: ■ Towers ■ Data Standalone Towers
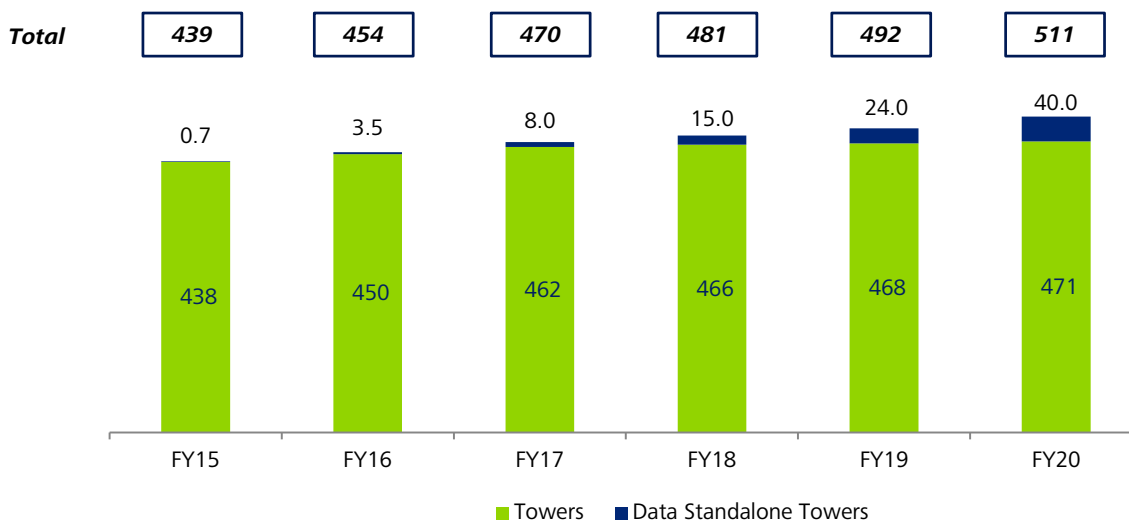
Source: Deloitte Analysis

Figure 27: Projected number of towers (thousands)

Distribution of Towers (2014)

39% / 61%

Distribution of Towers (2020)

45% / 55%
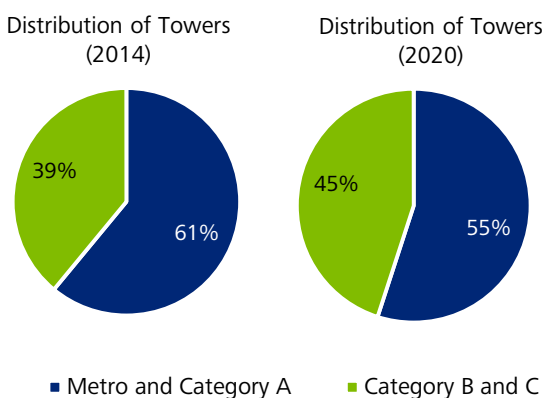
At present, ~61% of the towers are set up in Metros and Category A circles with only 39% catering Category B and C. This mix is expected to shift given focus on rural areas and growth in Tier-2 and Tier 3 regions (particularly large population mass of Uttar Pradesh (W) & (E) in Category B) as more towers are added as a result of which the share of towers in Category B and Category C circles will increase to 45% by the year 2020 indicating impetus in sub-urban and rural growth.

Legend: ■ Metro and Category A ■ Category B and C

Focus on New Business Areas

Infrastructure providers for Digital India

Digital India is one of the biggest focus areas of the Government of India. The Digital India initiative aims at providing universal access to mobile connectivity and internet to the farthest corners of India. Development of Smart Cities is a key initiative area under the Digital India program and the Government has already announced the creation of 100 smart cities. The smart city concept encompasses 8 key areas which are expected to present an investment opportunity of US$ 2 trillion over the next 30 years. The below figure highlights these eight areas:

Figure 28: Smart Cities Concept
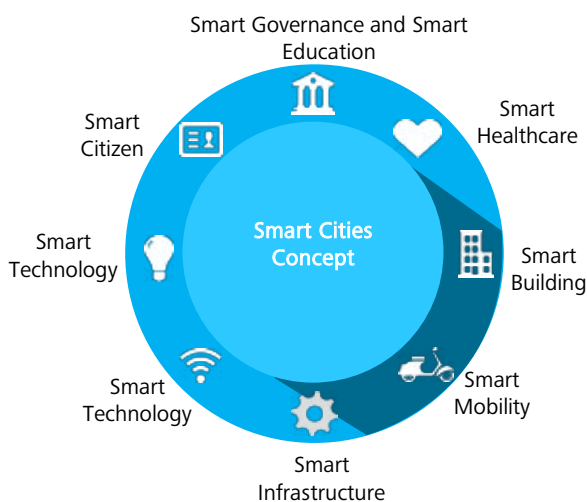
Source: Deloitte Analysis

The primary objectives of the Digital India and smart cities initiative are:
1) To drive citizen engagement through greater access to city services, education, training and job opportunities
2) To improve quality of life and livability, making it easier to attract businesses and talent
3) To enhance situational awareness, real time collaboration, and decision making, which helps optimize city operations and planning, improving the city efficiency
4) To drive intelligent sensor based IoE (Internet of Everything) innovations in transportation, utilities, public safety, and environmental monitoring

To achieve these objectives, a significant investment need to be made in technology and connectivity. The most important technological pieces required to be in place for smart-city functioning are:
- Communication networks
- Intelligent telecom infrastructure
- Compute, data storage, and data centers
- Data analytics
- Cyber security

These would require setting up of telecom infrastructure which will include tower setup, micro site and fiberized backhaul network. Tower organizations can work with the local governments and municipalities to setup the telecom infrastructure smart cities and provide connectivity in the remote areas.

While telecom operators will play a key role in connecting city infrastructure, telecom infrastructure providers will be the backbone of the backbone of the smart city initiatives.

Government of India has approved plans to upgrade existing cities, setup new smart cities in coordination with municipality led developments. Opportunities are expected to come in three phases:
- Industrial corridors
- Revamp of existing cities
- Green field projects

The following figure highlights the areas of focus and opportunities across smart cities in India:

**Figure 29: Smart Cities Investment Areas**

	Cities	Area of focus	Opportunities
Municipality led development	• Municipal Corporations in larges cities like Delhi (NDMC), Mumbai (MMRDA), Bangalore (BBMP), Kolkata (KMC), etc. • Minimum 500 acres in size	• Focus on existing developed area in a municipal ward, along with citizen participation	• Street Pole • Fibre network • CCTV Camera • Wi-Fi • LED lighting

Redevelopment of existing city	• 100 cities to be covered under this area. The timeline for identification of cities are
	  - 2016: 20 cities
	  - 2017: 40 cities
	  - 2018: 40 cities
	• Minimum area for a site in a city - 50 acres in size
		• Replacement of existing built-up area and preparing a new layout plan with enhanced infrastructure by way of mixed land use	• Street Pole
			• Fibre network
			• CCTV Camera
			• Wi-Fi
			• LED lighting
			• IBS solutions

Greenfield townships	• New smart cities like GIFT city and Dholera in Gujarat, Naya Raipur Development Authority • Minimum 250 acres in size	• Introduce smart solutions in a vacant area using innovative planning	• Street Pole • Fibre network • CCTV Camera • Wi-Fi • LED lighting • IBS solutions

Source: Government of India - Ministry of Urban Development

Tower companies need to take up this role of infrastructure provider by building and operating street level infrastructure and also manage overall project implementation.

Figure 30: Roles of Smart Cities Infrastructure Provider
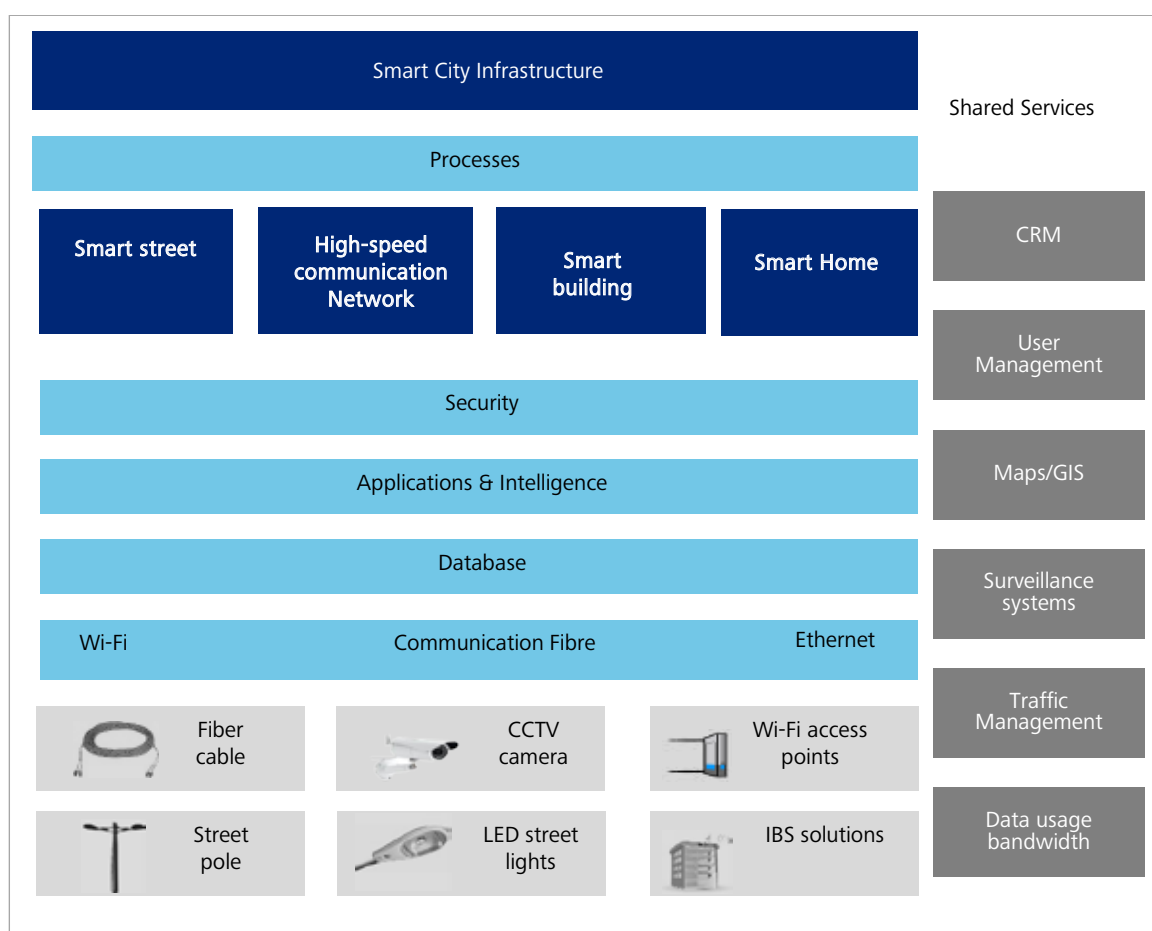
Source: Deloitte Analysis

The solutions offered by tower companies can be a mix of passive infrastructure, small cell solution, Wi-Fi solution, fiber connectivity, etc. The tower companies will need to develop designing, planning and system integration capabilities required for the Digital India initiative.

Tower companies can help develop smart cities by focusing on Build Own Operate (BOO) model.

Figure 31: Digital India Opportunities
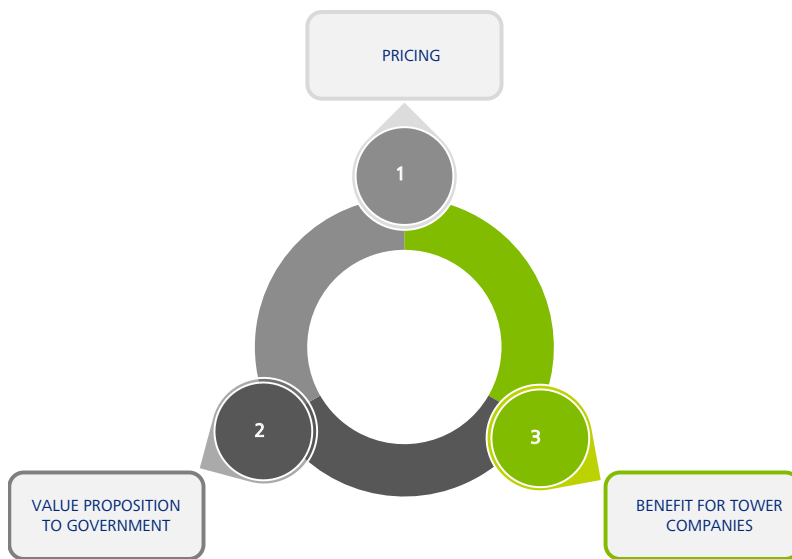
Source: Deloitte Analysis

- **Pricing**. Tower companies need to work on PPP model with Government whereby it would have to work on revenue and cost sharing agreements as per Government requirements:
  - Build Own Operate (BOO)
  - Build Operate Transfer (BOT)
- Value proposition to government. Tower companies need to invest in the digital infrastructure under smart city program. Government would generate additional revenue from tower companies on using the public infrastructure for providing access to private telecom operators
- **Benefit for tower companies**. Ownership of various infrastructure such as OFC network, hi-tech street poles would enable tower companies to lease broadband capacity to private telecom operators and earn attractive revenues. Through the ownership of fiber infrastructure tower companies can earn revenue from other opportunities such as surveillance systems, traffic management systems, etc.

Some emerging opportunities under 'Digital India' initiatives are:

Figure 32: Digital India Opportunities

Key initiatives	Trend description
Universal Access to Mobile Connectivity	• Network penetration & coverage of gaps in remaining uncovered ~42,300 villages by 2018
Public Internet Access Programme	• Content and services, for e-governance, education, health, etc. through Service centers across ~250,000 villages and 150,000 Post Offices
Electronic Delivery of Services	• E-education, free Wi-Fi in 250,000 schools, etc. • e-Healthcare , GIS based planning, financial inclusion, etc.
Smart Cities and Smart Grids	• At least 50 cities (all tier 1 and tier 2) to have some form of smart transport by 2025 • 60-80% penetration of smart grid technology by 2025
Defence Network for Spectrum	• Consists of 7 key elements including optical fibre backbone and n/w management systems • •57,015 km of optical fibre network to be laid in 18 months • BSNL is the nodal agency

Source: Government of India - Ministry of Urban Development

Growth of data traffic opens up number of opportunities

Figure 33: Opportunities for Tower Players
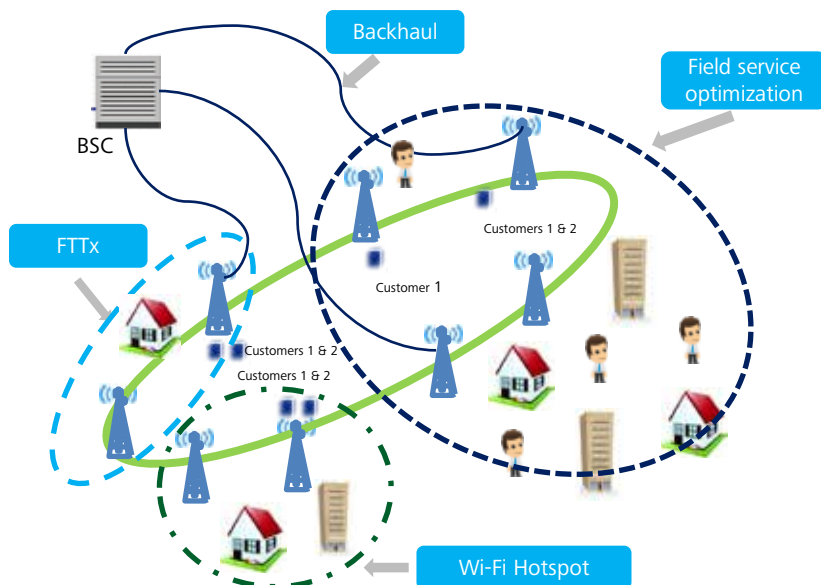
Source: Deloitte Analysis

As the traffic on macro sites increases, operators rather than opting for large number of new sites are likely to off-load traffic and reach the customers through more flexible means that can provide quality, coverage and capacity. In this view, tower companies are expected focus on the new emerging opportunity areas like in-building solutions, small cell solution, Wi-Fi solution, Fiberized backhaul networks, etc. which can provide them higher revenue growth. Moreover, India is about to see the digital revolution and development of smart cities where telecom and bandwidth connectivity will act as backbone of these cities. Telecom tower companies have the requisite skillset and assets that can be leveraged to play a significant role in this development.

Fiberization of backhaul network: An efficient and robust mobile backhaul network that not only ensures seamless voice but also data connectivity across 2G, 3G, and 4G/LTE technologies is very critical for any telecom player today. In India, less than 20% sites are fiberized compared to 70-80% sites in a developed country. Tower companies can consider providing end to end managed services in fiber value chain. They will have to work with government and municipalities for this and develop required skillsets like network O&M across fault, configuration, performance security and monitoring.

Figure 34: Fiberized Sites Around the World
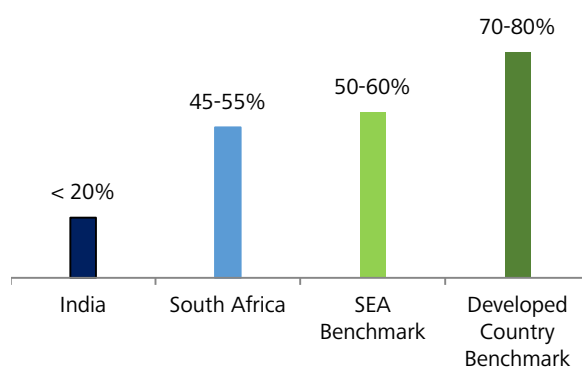
Source: Deloitte Analysis

Fiber assets provide tower companies the ability to deploy LTE solutions with superior economics. With own fiber assets, tower companies can offer fiber backhaul solutions to telecom operators,roll out micro cell sites for LTE services and provide economic last mile tower based solutions for over-the-top (OTT) media.

In Building Solution (IBS): Traditionally, mobile services have been provided mainly by installing macro sites mounted on mobile towers. Around 70-75% of mobile usage occurs from inside a building and these macro sites often fail to provide a good quality service inside buildings. The power radiation of these macro sites also needs to be high to avoid signal loss inside the buildings. In Building Solution (IBS) is a solution that can help overcome this problem. By offloading traffic from macro cell networks, in-building solutions ensure a higher quality of service with fewer dropped calls. Further, IBS sharing reduces the total cost of ownership, since both the investment cost and the maintenance expenses are shared among several operators. Thus, operators who adopt the IBS are likely to share / outsource this infrastructure and hence, it can be a great opportunity for the telecom tower companies.

Small cell solutions: Small cells have evolved to become the smarter, cheaper, less obtrusive and easy to install version of the macro versions of telecom towers. Telecom players are not only using them to bring service to remote locations, but also to expand data capacity in congested urban centers. The fast exploding data traffic is pushing the telecom players to deploy more and more sites in a given area. As a solution to this problem, small cells are being overlaid on the macro network as needed.

It is expected that by 2020, about 7% of all mobile data traffic will be off-loaded to small cells. Thus, small cells present a significant opportunity to tower companies. Small cells can earn higher gross margin due to small pole attachment fees at times and no ground lease payment.

Wi-Fi solutions: It is expected that by 2020, about 37% of all mobile data traffic would be off-loaded to Wi-Fi. This is expected partly due to spectrum scarcity in India. By offloading customers from the 2G/3G/4G networks, mobile operators would reduce the congestion in the network. Wi-Fi solutions can prove to be particularly effective in places with high data consumption such as universities and offices. Despite off-loading, Indian telecom tower industry will continue to see growth in macro-sites.

Passive infrastructure support for the telecom companies can be an area of interest for the tower companies. Providing Wi-Fi infrastructure support to telecom players will require tower companies to develop the right technical skillsets and design capabilities.

These Wi-Fi hotspot services can be potentially provided in retail store, offices, restaurants and other venues.

Evaluating current position in value-chain

Going forward, there is an expansion expected in the value chain by the tower industry players. These players are likely to provide adjacent products and end-to-end managed services. They can also play a system integrator role along with planning, designing and developing the solutions. Further, tower companies are expected to leverage the managed services opportunity which includes network O&M across fault, configuration, performance, security, monitoring, etc.

The opportunity for tower industry players lies both in backward and forward value chain integration. These players are expected to leverage their existing infrastructure while developing businesses as sourcing partners/integrators to deliver turnkey solutions. Advantages to this model include the ability to drive scale/subsidies across existing products and the opportunity to become a one-stop sourcing partner for wireless operators. It also provides the operator with deeper control of vendors and underlying infrastructure. New offerings such as small cells or the existing offerings such as active site management will allow tower companies to play a larger role. For small cells, turnkey solutions include site acquisition, site leasing, attachment rights, utility contracting, backhaul and ongoing backhaul network management. Understanding which circles and areas hold the maximum opportunity and how to position existing assets to win the business will remain the key. Various Digital India initiatives along with the needs of local governments and municipalities will further drive the demand for such end-to-end solutions.

Future Outlook of Tower Industry

Independent tower companies will continue to grow, bolstered by the rollout of 3G/4G networks, exploding data usage and the increased focus of telecom operators on operational prudence. With tower companies no longer just looking at tenancy but also site level profitability, they are exploring other avenues of growth and new business models.

The growth of the Indian telecom tower market is expected to be driven primarily because of

- **Rollout of data networks (3G and 4G) by telecom operators**: The tower companies are going to play an important role in the rollout of the 3G and 4G services in India. The telecom companies will need additional tower infrastructure to rollout these services.
- **Explosion of data usage leading to increased infrastructure requirements and network upgrades**: The data usage has increased many folds in the last few years. This has led to the issue of network congestion for the telecom players. The telecom players are trying to implement technology solutions to meet the data needs of their customers. The tower companies can play a critical role in solving this issue of the telecom players. They can deploy new towers for the telecom players and gain expertise in the new technologies like IBS and micro cells.
- **Increasing subscriber base in tier-2, tier-3 and rural areas**: Regulations from the Indian government have led to an increased number of operators entering the Telecom Services market in India. As the subscriber base of these telecom operators increases, they have to deploy additional telecom towers to provide services to their increased user-base. Telecom operators are targeting the market in rural areas because it offers growth potential for players to expand network coverage and services, which would allow them to increase their revenue despite the decreasing ARPU. Hence, delivery of services to the market in rural area creates additional demand for telecom towers to be deployed in those areas.

Conclusion

The Indian tower industry has witnessed many key changes in the past few years as the focus has shifted from growth to operational prudence. Fuelled by the exploding data usage and the rollout of next generation 3G/4G networks, the Indian tower industry will continue its growth journey.

As the landscape matures, tower companies need to look beyond traditional business models and capitalize on opportunities in adjacent areas such as data traffic offloading and need for end to end managed services to the telecom player while keeping their attention to the new business opportunities that can disrupt the current business model like IBS, small cell solutions, fiberized backhaul network and Wi-Fi solutions.

Moreover, with the 'Digital India' campaign increasing the pool of opportunities, there are plenty of growth avenues in front of the Indian tower industry.
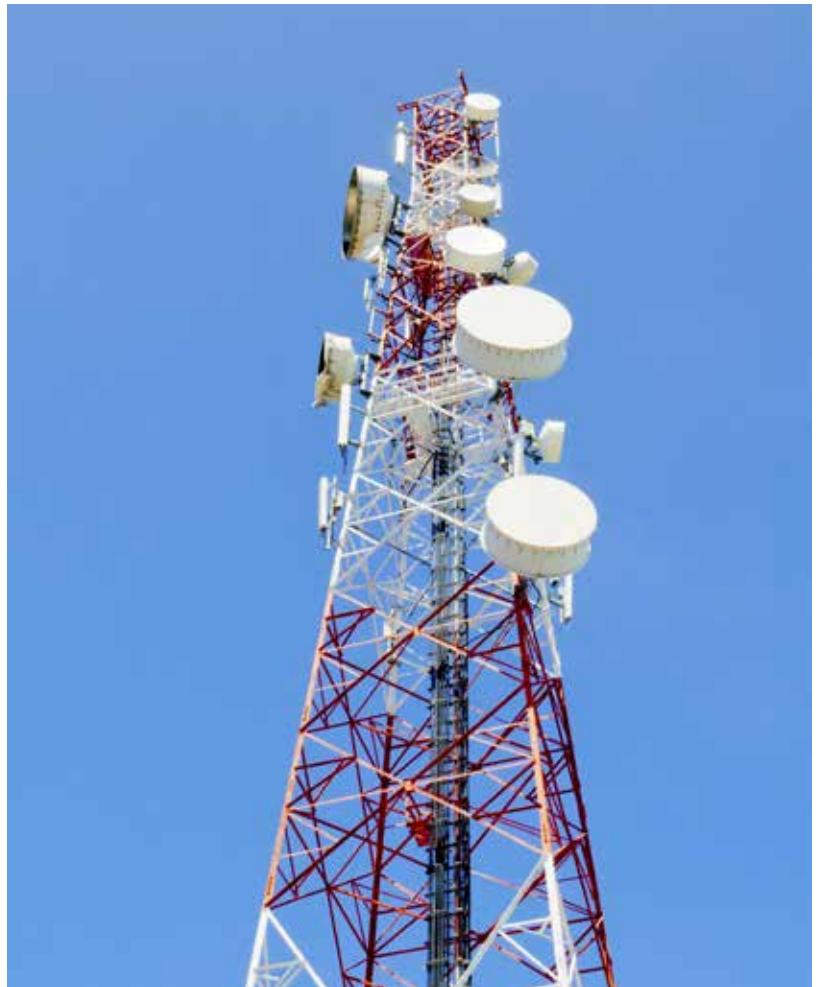
Key Considerations

Going forward, tower companies need to think and undertake initiatives in multiple dimensions to achieve the growth targets. Key focus and consideration areas are summarized below:

To focus on finding and retaining new customers and driving growth in highly competitive telecom ecosystem, the service providers are outsourcing their day to day operations and support services related to the tower network. Thus, tower companies can consider following

new business areas for their growth:
- Development of small cells and Wi-Fi solutions to exploit the off-loaded traffic opportunity
- Fiber optics/Backhaul solutions including fiber to tower and full-IP networks
- Forward integration in the value chain into managed services – can provide higher margin growth
- Tapping into 'Digital India' initiative and providing infrastructure support in the smart-city development

Figure 35: Key Growth Considerations for Tower Companies

New Business Areas	**Innovative Site Acquisition & Rollout Models**	**Commercial Models and Opex Reduction**
• IBS, Small cells, Wifi offloading • Fiberized backhaul network • Managed services	• Site deployment • Acquisition for data roll-out • Street level coverage • network • Managed services	• Pass through vs Fixed fuel cost • Rental cost reduction • Field force utilization
Energy Management	**New Team/Skill Development and O&M Process Automation**	**Newer Concepts like RAN Sharing and Network Cooperation**
• Clean energy sources • Data analytics • Energy efficient equipment	• R&D and innovation skills • Site Analytics management skills • Automation of non intelligent processes	• RAN Sharing • Network Cooperation (NetCo)

Source: Industry Discussions, Deloitte Analysis

New Business Areas

Traditional tower networks (macro sites) encounter issues in relaying telecom signals inside a building which often leads to loss of network or low quality reception for the telecom company's customers. They have also faced similar issues in areas with high density of offices. This is mainly due to the limited bandwidth which is available for a large number of high consumption users. In-building solutions, small cells and Wi-Fi offloading solutions are focused at solving this problem. With increasing focus on developing smart cities in India, a

rise in demand is expected for the deployment of these new solutions.

Rapidly increasing mobile data and voice usage along with the adoption of newer telecommunication technologies like 3G and 4G have led to the need of a strong backhaul network for the telecom companies to provide seamless services to their customers. A large majority of Indian telecom sites use microwave radio technology for backhauling their data to the core network. They have been in place since 2G was the main technology in use. Now that India has moved to

3G, the microwave backhaul has become congested and overloaded with data being backhauled. With 4G technology knocking on the door, this will soon prove to be a highly inefficient way to backhaul data to the core network. Deployment of fiber backhaul networks can provide the tower sites with the required capabilities to backhaul large amount of data to the core network. However, currently only 25% sites are fiberized in India. Fiberization of the remaining telecom sites is urgently needed to support the overhaul requirements for the Indian telecom providers.

Commercial Models and Operating Expense Reduction

Figure 36: Operating Expense of a typical tower company
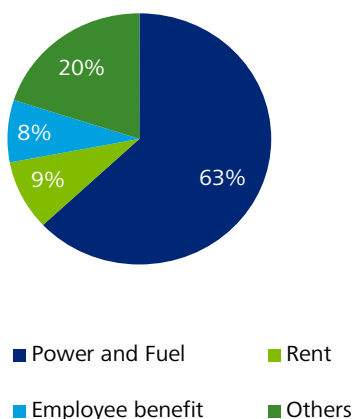
Source: Bharti Infratel Annual report, 2013

Power &fuel and rent are the major operating costs for the tower companies. Most of the tower companies pass-through the power and fuel cost to the telecom players. However, many operators have started pushing for fixed power and fuel cost arrangements. This can also work in favor of the tower company because they will directly benefit through operational efficiencies.

Tower companies can consider:
• Using a mix of pass-through and bundled uniform price for electricity cost and rentals in select markets
• Acquiring land to reduce rentals

• Manage service offerings to improve field force utilization optimizing the space across sites to reduce rental cost

Innovative Site Acquisition and Rollout Models

The growth in data usage and rollout of 3G/4G network are driving the need for new sites. This need for new sites coupled with the limited availability of sites in urban areas and rising rentals is making tower companies reevaluate their business model in search for innovative site acquisition models, product and cost innovation. Finding the right place to erect a tower is always a challenge. To meet this demand for increasing capacity as well as coverage, telecom operators need to densify and add 'smart and ultra-light' small cell sites in dense urban areas and have street level coverage.

In the near future, deployment of small cells sites on city infrastructure will act as a key enabler for networks. This entails new small cell towers with design changes to ensure that the towers are small enough to be deployed on city infrastructure. The deployment of 4G data network will need a significant number of sites in urban areas which requires tower companies to take a differentiated deployment approach with small cells and micro sites.

The success of such deployment will rely on product and cost innovation which include sleeker designs, use of UPS instead of diesel gen-sets, faster deployment methodologies. Tower design plays a critical role in the tower erection process. It has evolved over the last few years. The introduction of rapid erection techniques and improved foundation preparation has hugely reduced the deployment time. However, most Indian players still use the traditional method of tower erection. The introduction of carbon fiber structure and monopole towers in tower design has made the tower deployment easy and fast. Wider acceptance of helical casting and micro piling have further improved the tower erection process. Implementation of these latest innovations related to tower erection can not only speed up the tower erection process but also reduce the total deployment cost.

> **Reliance Jio has been installing 6KVA batteries for their telecom towers which double as lamp posts. These towers neither require any cooling units, nor do they require any manpower to guard them.**

Tower companies like Indus are already in talks with municipal corporations to host these small cell sites across street lights, bus stops, billboards etc. Such sites will be fitted with weatherproof and tamper casings along with LED lights and Wi-Fi access points.

Players across the globe are innovating in this area, such as, Philips and Ericsson have partnered to bring out their connected LED street lighting model.

> **Indus Towers recently won a contract from New Delhi Municipal Corporation (NDMC) to set up a digital network across the NDMC area. While the contract covers ~18,500 street light poles, at least 3000 poles will be fitted with 2G/3G/4G equipment over a period three years. Poles will also be upgraded with power efficient LED lights, CCTV cameras and Wi-Fi access points.**

Energy Management

Energy saving is the key sustainability focus of Indian tower players. Currently, power and fuel cost is the largest expense component contributing to ~63% of the total operating expense of a telecom company. The uncertainty in power availability has compelled infrastructure providers to use diesel generators to ensure a continuous supply of power. Using clean energy sources for power like solar photovoltaic, wind turbines, biomass power and fuel cells has the potential to resolve the key needs of the Indian telecom industry, namely diesel usage reduction, expansion of telecom infrastructure to areas with limited electricity and reduction in carbon emissions.

In addition to the clean energy solutions, careful monitoring of fuel and power consumption can allow cell tower operators to identify inefficiencies related to energy management. Fast evolving analytics tools can collect fuel consumption data from multiple sites and develop an accurate picture of fuel consumption across sites. These tools also reveal when power usage patterns exceed estimates and chances of leaks or loss by thefts.

Tower companies can optimize energy cost by adopting following solutions:
- Fuel cell technology, solar and wind energy solutions
- Improved hybrid lithium–ion batteries combined with existing solutions like diesel, solar options
- Energy Analytics Cell
- Replacement of tower light controllers and incandescent bulb with LEDs

New Teams / Skill Development and O&M Process Automation

Skill Development

With constantly evolving technology deployment in the telecom industry, the skill requirement for the workforce of the tower industry players is also evolving. They need to regularly update the skillsets of their operational teams. A strong product innovation team can give a competitive edge to the tower players by driving the latest technology projects like fiberized backhaul implementation, alternate energy source

installation and other key R&D projects. A new breed of energy managers will also have to be trained on analytics so that they can identify key issues with the energy management at the tower sites. Additionally, tower companies will need to develop new skilled work force in case they plan to enter new fields like managed services and small cell implementation. Tower companies may consider developing skills around:
- Product innovation team to drive alternate access technologies and backhaul related projects
- R&D and alternate energy sources (solar, fuel cell)
- Training programs for Energy Managers across circles on analytics

O&M Process Automation

Efficiencies can be gained in non-intelligent processes related to tower Operations & Maintenance (O&M) through automation to provide more efficient and error free performance tracking. It can involve identification of key processes in equipment monitoring, remote management, alerts monitoring and energy management that can be automated. Regular review of the as-is processes by the tower companies can provide them with the key actions and O&M plans that they need to focus on in order to improve their process efficiency. Remote security and asset management solutions can also be deployed across all tower sites to monitor the tower assets from a central location.

Many routine tasks such as diesel filling, maintenance, and security can be outsourced to other third parties. As such, vendor management is a core competence for avoiding vendors dictating terms or passing on their inefficiencies. Watertight contracts and stringent enforcement are crucial to deriving value from an outsourcing model. Thus, tower companies can consider:
- Key automation areas within equipment monitoring, remote management & alerts and energy management
- As-Is processes review against target operating model across O&M areas and identify key action plans on regular basis for focused O&M efficiency and process automation
- Deploy remote security and asset management solutions across sites

Newer concepts

Indian telecom industry has seen many new developments in terms of policies, technologies and how different telecom players leverage their assets and optimize cost of operations.

RAN sharing

Traditional site sharing, or co-location, usually comprises the shared use of the site itself, the mast, shelters and cabinets, the power supply including backup batteries, air conditioning, and diesel generators, if present; depending on the frequency spectra used, antennas may also be shared. Both capital (CAPEX) and operating (OPEX) expenditures are reduced significantly by sharing these among multiple "tenants". [7]

Under RAN sharing, the operators outsource / share with other operators the passive infrastructure, backhaul and base stations saving on equipment and maintenance cost. Thus, in addition to passive site sharing, access transmission sharing also includes sharing the transmission network between BTS and base station controller (BSC) for 2G and between Node B and radio network controller (RNC) for 3G networks.

Tower companies might see an impact on base station space requirement by operators as well as the skill set required to provide RAN sharing services.

Network cooperation (NetCo)

In a Net Co., a majority of the RAN infrastructure of two or more telecom operators are merged, with or without spectrum pooling, achieving One Network that can efficiently serve the network requirements of the telecom operators. In an asset light NetCo, the RAN assets continue to be owned by existing holders, but the newly formed NetCo jointly manages their operation. In an asset heavy NetCo, the RAN assets are carved out, transferred and merged into a separate NetCo, and the NetCo then jointly manages the operations of these

assets. [8]

A NetCo creates value by optimizing the portfolio of RAN assets through the consolidation of the existing RAN asset base into a smaller, more efficient RAN base, and by avoiding redundant future capex, so called consolidation and joint evolution. Savings result from reduction in duplicate infrastructure and joint operation and maintenance team. However, the sharing of active equipment poses additional challenges to the participating operators, because it involves a far higher and mission-critical degree of operations and maintenance aimed at shared resources compared to passive sharing.

The maintenance of shared active equipment can only be reasonably done by one party in charge and thus provides an opportunity for tower companies to extend and play a role with additional skill sets and provide highest order of quality operations & maintenance (O&M).

Emerging technologies – Self-organizing Networks, Virtualization, Software Defined Networks

There are several new technologies emerging wherein the network elements are virtualized, networking is software defined (SDN) and BTS organize themselves to optimize the network configuration (SON). With these technologies, cell sites can configure themselves and re-organize to provide adequate capacity and coverage in adjacent regions as and when required. This can be done dynamically and hence, might reduce addition in tenancy or site requirement in some cases. However, most of these concepts are at proofing stage and have been adopted by only few large players in developed markets.

These trends especially data explosion will have major implications for the growth of the number of towers as well as tenancy ratio which is the key dimension governing tower business.

Key Government Initiatives and Regulatory Considerations

Recent times have seen many regulatory developments in the telecom industry which are going to impact the tower companies in the years to come. TRAI is working on the telecom infrastructure policy for India which is expected to provide clarity on these regulatory issues.

Indian government is also making investments in expanding the telecom backhaul networks. A key initiative in this regard is the INR 20 billion National Optical Fiber Network (NOFN) project, which involves fiber overhaul installation in the farthest parts of India. The government will lease this network to operators for providing last mile connectivity.

The government has also provided the tower industry with 'infrastructure' status which will help them access higher amount of external commercial borrowings (ECBs), pay less import duties and avail accelerated depreciation benefits.

The telecom department (DoT) has planned to facilitate a mix of subsidies and grants to help the telecom industry to invest in green energy technologies mandated by the government. DoT's green telecom policy mandates mobile operators to migrate 50% of all cell towers in rural areas and 20% in urban areas to hybrid power by 2015.

The government is promoting telecom tower installation in rural areas to bridge the vast differences in the telecom services availability in rural and urban areas. It has created the Universal Service Obligation Fund (USOF) to support design and deployment of telecom services in rural areas.

The Indian government is taking multiple initiatives to speed up reforms in the telecom sector. The key initiatives by the government are mentioned below:

- Indian government's auction of the 3G spectrum in 2015 yielded INR 1.1 trillion. A total of 380.75 MHz of spectrum was put on sale in the premium 900 MHz band, 1800 MHz and 800 MHz, while 5 MHz was up for bidding in the 2100 MHz band, used for 3G mobile services, across 17 out of 22 telecom circles.
- Government has recently cleared 15 MHz 3G swap between defense and DoT. This move will provide additional bandwidth for new telecom operators.
- The telecom players have been asked to implement complete inter-circle mobile number portability by May 2015. It will allow the subscribers to hold onto the same mobile number across states.
- DoT has planned to frame an exit policy for telecom players that will allow the player to leave the business without losing out on the value of business. This move is seen as a step to make Indian telecom sector investor friendly.
- The Government of India plans to roll out free high-speed Wi-Fi in 2,500 cities and towns across the country over the next three years involving an investment of up to INR 70 billion.
- To speed up the national optical fiber network (NOFN) project, the Department of Telecommunications (DoT) has advised officials to use public buildings such as post offices, railway stations and schools.
- The Government of Kerala has decided to allow mobile telecom service providers to set up towers on government land and buildings. This is the first time that a State Government has opened its own land, buildings and offices to mobile companies.
- The Government of Uttar Pradesh has secured investment deals valued at INR 50 billion for setting up mobile manufacturing units in the state.

Tax Perspective

The telecom tower industry was granted infrastructure status by the government in October 2012. In September 2013, telecommunication towers sector was specifically included in the definition of infrastructure sector for the purpose of external commercial borrowings i.e. for obtaining overseas loans. The telecom tower sector has however not been granted infrastructure status or any tax holidays for corporate tax purposes as discussed below.

Demands for corporate tax benefits

The Telecom Regulatory Authority of India in its recom-mendations on telecommunications infrastructure policy in April 2011 had recommended that telecom infrastructure provider companies should be extended tax benefits under section 80-IA of the Income-tax Act, 1961. Section 80-IA provides a 10 year tax holiday to the infrastructure sector. The pre-Budget expectation of the telecom tower industry has always been for the 10 year tax holiday under section 80-IA for the past several years. However, so far, no such benefit has been granted.

Recently, the telecom tower industry has started requesting for tax benefits under section 35AD of the Income-tax Act, 1961. Section 35AD grants a deduction for capital expenditure incurred wholly and exclusively for the purposes of specified businesses. The benefit under section 35AD is akin to 100% depreciation on fixed assets as against exemption for tax under section 80-IA for 10 years. In other words, the tax benefits under section 35AD is significantly lesser than the tax holiday under section 80-IA. However, the benefit under section 35AD has also not been extended to the telecom tower industry.

Another demand of the telecom tower industry is higher tax depreciation on batteries used in telecom infrastruc-ture. As these batteries have a useful life of three years, the telecom tower companies have been requesting for tax depreciation at 65% on such batteries, instead of at 15% which is the present rate for general plant and machinery.

Infrastructure status will ensure congenial posture towards future tower roll-out in terms of tax.

Acknowledgements

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