Infrastructure Development & Financing

Term Report on

Infrastructure Sharing (Telecommunications)

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**Introduction**

Telecom, being a capital expenditure intensive business, needs huge investment year-on-year for growth and expansion. It involves significantly high cost of setting up and maintaining the networks and high execution risks in installing the active electronic components.

In order to lower the large fund requirements for network deployment, the business in telecom industry is following infrastructure sharing model. The various telecom service providers are becoming partners to minimize the duplication of effort and cost, bringing about significant financial and operational savings and hence better margins.

**Constituents of a Mobile Network**

- *Active Infrastructure*
  The key components include the base tower station, the spectrum, microwave radio equipment, antennas, switches, transceivers etc. (ICRA, 2009)

- *Passive Infrastructure*
  The key components include the antenna mounting structures, base tower station shelter, power supply, invertors and generators, battery bank, air conditioner, fire extinguisher, security cabin etc. (ICRA, 2009)

- *Backhaul*
  This part of the network consists of the intermediate links that transfer data and voice traffic from a remote site to a central site, from where it can be uplinked to the satellite. (ICRA, 2009)

**Industry Structure**

Tower infrastructure industry has four kinds of operator models:

1. *Traditional infrastructure model with no sharing of resources among the operators:*
   Under this model, operators invest in infrastructure and manage it internally. Single
tenancy, which is implied in this model, results in high capital expenditure and operating cost.

2. **Tower infrastructure subsidiaries with 100% ownership by a single telecom operator:**

   Telecom operators set up a subsidiary company that builds and manages tower infrastructure. Funds required to set up this independent division are raised by selling shares to external investors. The subsidiary company serves the infrastructure needs of the host (owner-operator) and the tenants.

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Telecom Operator who owns 100% of this tower company</th>
<th>Tower Portfolio</th>
<th>Clients (Telecom Operators)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliance Infratel Limited</td>
<td>Reliance Communications</td>
<td>44,000</td>
<td>Bharti Airtel, Vodafone, Idea, Aircel, Loop Telecom, Swan Telecom, Datacom</td>
</tr>
<tr>
<td>Bharti Infratel Limited (excl Indus Towers)</td>
<td>Bharti Airtel</td>
<td>27,000</td>
<td>Reliance Communications, other telecom operators also use these towers but their names are not publicly available</td>
</tr>
</tbody>
</table>

   Source: (Angel Broking, 2008), (ICRA, 2009)

3. **Independent Tower infrastructure company jointly set up by a group of operators:**

   Telecom operators, under a joint venture agreement, spin off an independent entity for managing tower infrastructure. Each operator contributes infrastructure to the joint venture and enjoys rights to the shared resources. Apart from the assured occupancy from the parent companies, these independent entities also serve other tenants.

   E.g. Vodafone Essar, Idea Cellular, and Bharti Airtel jointly own Indus Towers Limited, which is India’s largest tower infrastructure company having a portfolio of
around 85,000 towers (ICRA, 2009). This is India’s largest tower company and offers passive infrastructure services on a non-discriminatory basis to all telecom operators (Angel Broking, 2008). The company was formed by merging the passive infrastructure assets of these three operators in 15 of the 22 circles in India (Angel Broking, 2008). This is an interesting concept as it implies cooperation by three of India’s largest operators at the back-end operations while they compete for customers in the front-end.

4. **Independent tower infrastructure companies:**

Operator independent companies build and manage tower infrastructure which is leased out to telecom operators under long term contracts. Multiplicity of tenants increases the profitability for the owner companies. They can have two approaches to their business:

- **Contract approach:** Terms of the contract between the independent company and operator companies are specified at the time of signing it and the infrastructure is built going by the requirements as mentioned in the contract.
- **Anticipatory approach:** The demand for infrastructure is anticipated and tower sites are set up accordingly. Tenants are then invited to set up their network at these sites. This model involves higher business risk.

E.g. GTL, Quippo Telecom Infrastructure Limited, Essar Telecom Infrastructure Ltd

A lot of operators are able to see value in working with independent tower companies and are hiving off their tower to these companies and unlocking value. For example, in January 2010, Aircel hived off 17,500 of its towers to GTL valued at Rs 8,400 crores. These towers were built by Aircel as per their requirements, but with GTL gaining ownership of these assets, GTL will be free to use these assets for Aircel and other operators also (Business Standard, 2010).
Why Infrastructure Sharing?

The telecom industry today is moving towards infrastructure sharing for a variety of reasons and passive infrastructure forms a very important part of the same.

At present the capital cost required for active infrastructure is around 60% while that of passive infrastructure is 40%. However, the prices of land, steel and cement are going up, while those of electronic components are decreasing, leading to steep expected rises in cost requirements (ICRA, 2009).

Costs are expected to rise even further in future, as penetration into rural areas occurs. Issues such as higher cost of land development, insurance costs, power cuts and lack of infrastructure will come to the fore. At the same time, more number of towers will be required to cover the same number of people since population is more dispersed in rural and semi-urban areas.

In a country like India, various clearances are needed before the tower and active infrastructure are set up and ready for use. Given the rapid changes in technology, often the high cost of existing infrastructure is not even covered before operators have to pilot onto newer generations. Sharing will enable faster rollouts and reduce the risk of redundancy. This will prove especially beneficial for new players entering the market.

Passive sharing will enable operators to convert their high capital expenditures into operating expenditures which they can defer over extended rental times. It will enable management to save time and focus on their core tasks.

If an operator has already set up the infrastructure for a cell site, it can easily be leased out, creating a source of income. The tower business can become a profitable one by itself, rather than just serving as a by-product for cost cutting.

Sharing also provides various benefits to end-consumers in terms of reduced costs and increased availability of telecom services across wider geographies.
Environmental and Health issues

Apart from the aforementioned benefits, various social benefits can be achieved through infrastructure sharing. In a country like India, increased telecom penetration can mean spread of tele-education and health awareness. At the same time, sharing can provide various environmental virtues in the form of reduced infrastructure, energy requirements and carbon emissions.

With the need to improve coverage and achieve deeper penetration, the number of telecom towers is growing at a rapid rate. In this light, people have become worried about the health hazards caused by these towers.

Roof top towers (RTTs) are especially cropping up above homes and buildings in congested residential areas, and this is matter of grave concern to citizens. There have been complaints about the noise caused by standby generators, lack of public safety and altering of the city landscape. But more importantly, there are growing concerns over the carcinogenic nature of emissions by these towers. These towers emit radio frequencies (RF) up to a distance of 2-3 miles, which although below acceptable international standards, are speculated as being extremely harmful for human beings, especially children, the elderly people, and pregnant women.

Even at low levels of radiation, studies have shown evidence of genetic mutations, brain tumours, cancer and Alzheimer’s disease, among many others. Recently, some Ghanaian scientists have claimed that these radiations are harmless. WHO too, has said that thousands of studies conducted by the WHO across the world have shown no link between human health and exposure to RF radiation. Nonetheless, vehement debate is still on as to the validity of the studies (WHO, 2006).

However, the RF waves are definitely known to cause interference with electronic equipments and thus need to be placed away from hospitals, laboratories and research institutes (SignIndustry.com, 2004).
The Journey So Far

Passive sharing has been allowed in the telecom sector of India since a long time. In February 2008, the DoT approved TRAI’s proposal of allowing active sharing of infrastructure. This move would enable companies to cut capex by more than 50% while allowing new players to utilise the infrastructure of existing players, further reducing tariffs due to competition. At the same time, it would enable operators to improve their quality and coverage area without additional capital expenditure, as well as give them the option of switching their users to different operators in case of network unavailability. However, until now, the DoT has not allowed spectrum-sharing.

The late acceptance of active sharing in the Indian context was mainly because it requires a deeper integration amongst operators than passive sharing. The result could have been significant loss of competitive differentiation among the operators, discouraging operators from embracing technology and leading to fewer service offerings for customers.
Infrastructure Sharing

Co-operating at the ‘back-end’, competing at the ‘front-end’

Infrastructure sharing involves the sharing of a few or several elements of cellular operators' network infrastructure. Such arrangements lead to faster roll-out time-frames for newer and regional operators. Given vast coverage requirements in a country like India, these operators thus have an urgent need for this. If these operators were to construct their own towers, there would be several negative consequences:

- It would lead to a significant loss of time and opportunity, given that it typically takes several months to erect one tower. Each tower often needs up to as many as 40 clearances from separate authorities like SACFA clearance on detailed technical evaluation, permission from local authorities, state electricity boards, land owners and so on.
- Apart from the hassles in erecting towers, there are issues of loss of time and hence opportunity loss of subscribers and revenues – more so for new players.
- Apart from the time lost and opportunity loss of subscribers and revenues, the capex required would be significant, given that such an activity requires vast financial resources.
- Apart from this, substantial capex is needed to set up a countrywide cellular network. A significant part of the network roll-out is likely to come in the as-yet untapped rural areas, where mobile teledensity is barely in double digits. Consequently, the cost of expansion will also be greater, given that many rural areas are typically far-flung, difficult to access, roads are generally not satisfactory, power supply is erratic (and often non-existent) and personnel are in scarce supply to operate telecommunication towers. A greater number of ground-based towers will also be needed in rural areas, thus further increasing the capex requirements. These towers, depending on their height, typically cost in the region of Rs40-45lakh, as against Rs20-22lakh for a roof-top tower (ICRA, 2009) (Business Monitor International, 2009).
- The execution risks are significant and in the event of poor execution and roll-out, an operator would lose further time, money and potential subscribers and revenues, not to mention the 'sunk costs'.
- On the other hand, for incumbent operators – assuming they open their towers for other players - it enables them to earn additional revenues from a new source, apart from improving capex and opex efficiencies, leading to freeing up of significant resources and
management time to focus on their core business of branding and marketing of telecom services and solutions.

- **Infrastructure Sharing in India - Driven by Cost dynamics, a PAT driver:** Service provider margins are likely to come under significant pressure on account of multiple factors:
  - Falling ARPU due to rural expansion
  - Declining elasticity of demand thus making MoUs less responsive to a change in tariffs
  - Slowing revenue growth
  - Heightened competitive intensity
  - Higher network expansion costs and a possible hike in spectrum charges

Thus, factors on both the revenue and cost fronts are likely to adversely impact the margin profile. Thus, it would be hugely beneficial for new operators to share sites with existing operators who already have a presence in a particular service area. The concept of infrastructure sharing is gaining momentum in India.

**Passive Infrastructure Sharing in India**

The passive infrastructure mainly involves towers and battery back up etc. The telecom tower market is estimated to be Rs. 775 bn with approximately 300,000 towers currently in place, of which 36% are shared and 64% unshared. The market requirement is forecasted to be around 554,000 by 2015 in an IDBI report on Telecom Infrastructure (IDBI, 2009). The business models operating in India in the telecom tower market, as was described in the beginning of the report, are:

- **Captive**
- **Operator controlled subsidiary/entity**
- **Pool and Share/JV**
- **Build and Operate: Independent tower infrastructure companies**
Indian Telecom Operators Overview

Telecom Towers Landscape (FY 2010)

Source: Company presentations and news runs
At the end of FY2008, the country was estimated to have around 1.8lakh towers catering to the 256.2mn mobile subscriber base. These 1.8lakh towers housed a total of 2.17 lakh BTS of different operators. This implied an all-India occupancy rate of 1.20x. However, the low tenancy ratio should be looked at in context of the fact that sharing is only just starting to pick up in the Indian Telecom Sector and consequently, it will take time for the overall tenancy ratio to pick up. The all-India tenancy ratio by FY2011 is estimated to be around 1.82x.

### Tower Base and Tenancy ratios of top telecom tower companies in India

<table>
<thead>
<tr>
<th>Particulars</th>
<th>FY 2008</th>
<th>FY 2010 (3rd Quarter)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indus Towers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tower Base</td>
<td>71,429</td>
<td>104,640</td>
</tr>
<tr>
<td>Tenancy Ratio</td>
<td>1.22</td>
<td>1.66</td>
</tr>
<tr>
<td>BTS (Nos.)</td>
<td>87,215</td>
<td>173,700</td>
</tr>
<tr>
<td><strong>Bharti Infratel</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tower Base</td>
<td>23,083</td>
<td>29,806</td>
</tr>
<tr>
<td>Tenancy Ratio</td>
<td>1.22</td>
<td>1.57</td>
</tr>
<tr>
<td>BTS (Nos.)</td>
<td>28,161</td>
<td>46,795</td>
</tr>
<tr>
<td><strong>Reliance Infratel</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tower Base</td>
<td>36,849</td>
<td>48,139</td>
</tr>
<tr>
<td>Tenancy Ratio</td>
<td>1.16</td>
<td>1.6</td>
</tr>
<tr>
<td>BTS (Nos.)</td>
<td>42,646</td>
<td>77,022</td>
</tr>
</tbody>
</table>
Issues with Outsourcing Passive Infrastructure

In the third-party model, there are typically two types of models - built-to-suit and proactive. In the former, third-party infrastructure providers work together with telecom operators to assess their specific requirements and sharing potential in specific locations. On the other hand, in the proactive model, the infrastructure provider builds out towers without any specific requirements from any operator and then approaches operators to install their electronics on the towers.

Issues

- The operator owned towers start with tenancy of 1 (the anchor tenant). On the other hand the 3rd party operators start with a tenancy of 0 – risks are higher.
- The current trend is that operator-owned tower companies dominate the industry, given their significantly larger scale, strong parent support, deep pockets and the presence of an 'anchor tenant' (the parent).
- Rentals vary depending on whether the tenant is the first / second / third etc. occupant. Usually the rental of the first tenant is significantly higher than the rental of the second tenant and similar logic applies to further tenants. However, the first tenant gets a much higher coverage than other the second tenant because of increased height for its base station; the second tenant gets a much higher coverage than the third tenant and so on. In addition, until the tower has a second tenant, the first tenant has to bear the entire rental. So operators always have a choice of going first and occupying a tower, enjoying much higher coverage at the cost of higher rentals or going second and third and thereby paying less and but enjoying lower coverage. This is at times disadvantageous to new operators, as it is often difficult to become a first tenant in regions where there are several incumbents. The new operator cannot become a first tenant – to enjoy better coverage, even if it is prepared to pay more, as there are no first-tenant-occupancy-slots left.
- Energy pass through is a contentious issue in passive sharing. Energy pass through in passive sharing (as per most contracts in India) is not pay-per-energy use but pay-per-hourly use. This implies that instead of paying for the actual consumption of diesel of
electricity, operators pay for the number of hours the electricity was sent or for the number of hours the diesel generator was on. Since, multiple tenants occupy the tower; the tower infrastructure provider passes the energy for the entire day (24 hours). Thus even if the utilization of a BTS is low, the operator would still end up paying for the energy equivalent to 24 hours. New models such as intelligent power tracking or intelligent power switch-off for selected BTS’ in a tower can potentially avoid this situation.
Sharing in India – A comparison with the US market

While in India, infrastructure sharing is still in its formative stages, in developed telecom markets such as the US, the concept is mature and is one of the few markets globally where infrastructure sharing has succeeded. In this market, a majority of the towers (around 60%) are owned by independent tower companies such as American Tower, Crown Castle International and SBA Communications whereas just 12% of the towers are still owned by wireless operators like AT&T, Verizon and T-Mobile USA. The remaining 28% are leased by leading operators such as AT&T, Verizon to other operators (WikiInvest, 2010). In complete contrast to this, in India, over 90% of the total telecommunication towers are owned by telecom operators. Thus, in this sense, the Indian Telecom Infrastructure Market is fairly unique.

The US market has approximately 2.15 lakh sites available for sharing and occupancy rates are upwards of 2x in that market. Companies like American Tower have recorded strong growth rates in revenues and EBITDA, with margins at impressive levels of nearly 70% in 2QCY2008. This market has numerous similarities with the Indian market in terms of characteristics. Both markets are highly competitive, with the presence of multiple operators and with the top 4-5 operators commanding a majority of subscriber market share. Large coverage requirements are also there in the US market, thus necessitating a greater degree of site sharing between operators. Apart from this, pricing and margin pressure exist in both markets, with high MoUsalso a feature. Thus, there is reason to believe that sharing is likely to succeed in India as well.

A few examples on the state of sharing elsewhere in the world is given below:

<table>
<thead>
<tr>
<th>Country</th>
<th>Passive sharing</th>
<th>Antennae sharing</th>
<th>Base station sharing</th>
<th>Base station controller</th>
<th>Backbone elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>France</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Germany</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>UK</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Malaysia</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Conflicting issues arising in infrastructure sharing

While there has been much lip-service paid to the concept of infrastructure sharing by telcos, third-party infrastructure providers and the government itself, it should be noted that several issues do crop up in the course of taking a decision on this. One issue that could hamper the progress of sharing is the perception by towercos of losing their 'first-mover advantage' that they have in an area. This is a natural and reasonable concern to have.

For example, if Bharti Airtel has a strong presence in major parts of Bihar, a large circle with significant growth potential, it would be natural for it to consider its major network presence in the state as a competitive advantage vis-à-vis other operators. Thus, if another operator approaches Bharti to share its infrastructure, the latter would then lose this 'first-mover advantage' over its rivals. However, talks with operators reveal that this mentality is something of the past and that they are now accepting that this is only a 'short-term advantage' and that over the long-term, they would lose more than they would gain by not sharing. Another factor impacting this is competition. If, for example, Bharti refuses to share its infrastructure with the operator in our example, it is very likely that RCOM may then step in and agree to share its infrastructure, thus in any case leading to Bharti losing its 'first-mover advantage'. Apart from RCOM, large companies like BSNL have also begun to adopt a more liberal attitude to sharing, partly driven by the fact that the PSU itself has been rapidly losing ground in the marketshare sweepstakes on account of bureaucratic hurdles delaying its network expansion plans. Tata Teleservices also has its own tower portfolio available for sharing and the presence of third-party infrastructure providers like GTL Infrastructure, Essar Telecom Infrastructure, Quippo and TowerVision further intensifies the competition in this space.

Therefore, one consequence of the increasing acceptance of sharing by operators is the near-complete loss of 'network presence' as a competitive advantage. Rather, given the greater importance of focussing more on their core business of branding and marketing of telecom services, their attention has now shifted to subscriber acquisition and retention, connecting more with customers, making their brands more relevant, their ability to differentiate their
services through VAS/3G/WiMAX and concentrating on focussed segments of the market place.

Another issue that could crop up is lack of transparency and 'arm's length relationships' between telcos and their subsidiary towercos. While all towercos claim that they offer infrastructure sharing on a non-discriminatory basis and operate on 'arm's length basis' with respect to their parent companies, there is an inherent conflict of interest in this case. While preference may be given to the parent telco in terms of offering it the first tenancy slot available on its towers, in terms of rentals charged from it and from other tenants, issues might crop up in future if the 'loss of first-mover advantage' mentality resurfaces, leading to discriminatory tariffs being charged. This could be an indirect method of avoiding greater sharing with other operators with a view to preserving their network and coverage advantages. However, we believe this is unlikely to happen and competition in this segment from both other operators' towercos and third-party infrastructure providers will likely ensure that such a scenario does not materialise.

**Comparison between sharing captive infrastructure Vs outsourcing passive infrastructure**

India has broadly two kinds of companies in the business of tower infrastructure – third party telcos, which only own infrastructure assets and lease out slots on their towers, and operator owned companies, usually subsidiaries, which lease out slots on the towers that have their own active infrastructure. What follows is a comparative analysis of these two options.

**Estimates Used**

**Tenancy Ratio**

The current average tenancy ratio, number of tenants per tower, is about 1.4 X. Some companies, Quippo for example at 1.6X, have a higher ratio but for the sake of generalization 1.4X has been assumed to be the current ratio. IDFC-SSKI’s report (2007) estimates that tenancy ratios will go up to 2.1X by 2012 and up to 2.9X by 2020. This estimate factors in the tower addition estimates as well as estimates of potential demand for tenancy slots due to 2G and 3G expansion.
**Capital Expenditure**
Setting up a RTT costs about Rs. 1.5-1.8 mn. RTTs have a typical capacity to host two tenants. GBTs with a capacity of hosting 2 BTSs cost Rs. 2.5-3 mn, of 3 BTSs cost Rs. 3-3.4 mn and of 4 BTSs cost Rs. 3.5 mn. Since towers have a life of at least about 20 years and keeping in mind the growth rate of telecom use in the country, it is assumed for simplification that all new GBTs will be constructed with a capacity of hosting 4 BTSs each. The capital expenditure on towers is depreciated over 20 years. For simplicity, we assume straight line method of depreciation.

**Tenancy Rates**
Renting GBTs cost around Rs. 35,000 per tenant per month on an average. For sole tenants it may cost a little higher at about Rs. 40,000 and reduces to about Rs. 30,000 for towers with a tenancy ratio of 3. RTTs are cheaper at Rs. 20,000-23,000 per tenant per month. These rates exclude a direct pass-on of operating costs like electricity etc. For simplicity, these rates are expected to be constant over the years under consideration. For tower companies, the incremental profitability is highly sensitive to tenancy ratio as incremental cash flows are significant while as most incremental operating expenses are passed on and those not passed on are minimal. This is illustrated below:

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Ground-Based Tower</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Capital Expenditure</td>
<td>2,600,000</td>
</tr>
<tr>
<td>Rental per Tenant</td>
<td>34,000</td>
</tr>
<tr>
<td><strong>(A) Sharing Adjusted Revenue</strong></td>
<td>34,000</td>
</tr>
<tr>
<td>**(B) Operating Expenses ***</td>
<td>18250</td>
</tr>
<tr>
<td><strong>(C) Contribution</strong></td>
<td>15,750</td>
</tr>
<tr>
<td>Contribution as % of Gross Revenues</td>
<td>46%</td>
</tr>
<tr>
<td><strong>(D) Other Fixed Expenses</strong></td>
<td>1,000</td>
</tr>
<tr>
<td>Interest** @12%</td>
<td>17,333</td>
</tr>
<tr>
<td><strong>(E) Profit before depreciation &amp; tax (PBDT)</strong></td>
<td>-2,583</td>
</tr>
<tr>
<td>PBDT as % of Gross Revenues</td>
<td>-7.60%</td>
</tr>
<tr>
<td>Depreciation (assuming an asset life of 15 years)</td>
<td>14,444</td>
</tr>
<tr>
<td><strong>(F) Profit before tax (PBT)</strong></td>
<td>-17,027</td>
</tr>
<tr>
<td>PBT as % of Gross Revenues</td>
<td><strong>-50.08%</strong></td>
</tr>
</tbody>
</table>
Economic Comparison

The major economic value-add in outsourcing passive infrastructure is avoiding the high capital expenditure involved in expanding telecom services. By outsourcing to a third party this fixed cost is converted to a variable cost. The rent expense reduces the EBITDA margins but the savings on depreciation, i.e. the high initial capex is of great benefit to telecom companies suffering from thinning margins in the wake of falling ARPUs. Additionally, telecom companies that bid for the 3G license recently are severely cash-strapped to make big investments towards the passive infrastructure required to roll-out 3G services. Outsourcing to a third party also enables faster roll-outs without necessitating immediate financing.

In any case, if a telecom operator has captive towers, it makes economic sense to lease slots to other operators as an additional source for revenue. Some companies may hesitate in allowing competition to set-up operations easily for the fear of losing market share but due to incumbency advantages, increasing size of the market and the scope of additional revenues through tenants, leasing out slots seems to the wise choice. The break-even tenancy ratio for each tower is at 1.7, therefore every operator with its own towers must accept other tenants to avoid losing money on passive infrastructure. According to estimates around 79% of the incremental towers built by BITL over FY2008-18E will be GBTs. The same can be generalized for the industry since majority of the growth going forward is going to be seen in rural and semi-urban areas. And GBTs, given their higher costs and higher tenancy capacities as compared to RTTs, make an even stronger case for infrastructure sharing.
Active Infrastructure Sharing

In April 2008, DoT allowed active infrastructure sharing through master service agreements between interested operators. Sharing was allowed on electronic elements such as antenna, feeder cable, Node B, Radio Access Network (RAN) and transmission system. Sharing of spectrum is not allowed as yet. Active infrastructure sharing allows faster roll-outs as operators can roll out on existing infrastructure.

In RAN sharing, more than one player can use the same RAN. Several vendors, notably Nokia Siemens Network and Huawei have come up with solutions for sharing RANs. It is expected that this business model (RAN sharing) will be used significantly in the 3G arena – 3G RAN sharing. As an example, in UK, Orange and Vodafone share their RANs across the country. The cost benefits in RAN sharing are depicted below.

![Graph showing cost benefits in RAN sharing](image)

Source: Analysys Mason Research Report, 2008

Similarly more than one operator can share antennas. Vendors have come up dual / quad port antenna solutions for this purpose. Spectrum sharing is not allowed in India. In this model, operators can lease their spectrum to other operators. Because spectrum is a scarce resource, it works economically well for operators. This has been tried in international markets.
However, there are several issues in active infrastructure sharing. Some common issues are noted below:

- Active infrastructure sharing is still a nascent subject in India and it needs to be tested on a large scale so that there are no issues in managing the traffic of various players.
- Given that different operators may operate at different frequencies, models and technologies must emerge for allowing sharing of electronic equipments operating at different frequencies.
- Active infrastructure sharing allows faster roll-outs for new players for players entering new regions as they can utilize existing networks for roll-out. However at some point, they would have to build their own network once the existing infrastructure becomes saturated. Thus, it is highly likely that the network expansion may not be linear.
- Tenancy ratios would go down as the revenue of an active infrastructure provider is directly linked to the space occupied by its passive infrastructure. Lower tenancy ratios would adversely hurt the passive infrastructure provider. Thus to a certain extent, passive and active infrastructure sharing’s benefits cancel each other.
- While it may argued that passive infrastructure providers may charge higher rentals once active sharing becomes prevalent, this may not be prevalent. This is especially because several passive infrastructure providers have already set up several towers. Thus this excess supply of towers may prohibit these service providers from charging higher rentals.

**Managed Services of Operations & Management**

Operations & Management (O&M) is the maintenance and management activities of active electronic elements. These services are typically offered by active equipment manufacturers. These services must be purchased separately to the equipment, and they are often a critical process in the overall telecommunication business model. Typically, telecom operators use to purchase O&M services from the same equipment manufacturer, as the manufacturer would have sufficient expertise in handling the equipment manufactured by it. Since operators usually buy equipments from multiple manufacturers (as some equipments are more suited for urban areas and some are more suited for rural areas), they make O&M contracts with several service providers.
Managed Services is a unique concept, where one O&M provider takes up the contract to provide O&M services to all equipments of the telecom provider irrespective of whether the equipment is manufactured by the O&M provider or not. This allows an operator to share its O&M services for different equipments (manufactured by different equipment manufacturers) with one O&M service provider. Thus managed service is a concept of sharing of maintenance services of active electronic elements.

**Regulatory and Policy Implications**

**Regulations Proposed in Passive Infrastructure in Telecom:**

The passive infrastructure part of the value chain of the telecom presents a case of natural monopoly. We theorize that the network effects make a strong case for natural monopoly.

There is an aspect of sub-additivity of costs. In the present scenario there are multiple companies offering passive services. This leads to duplication of infrastructure, as these firms are competing in the same region. The end effect of this is that the tenancy (or occupancy) ratios are lower for all the competing players. In case there was just a single player providing these services, the net cost of the society would have been lower.

\[ C(A) + C(B) > C(A+B) \]

\[ C_{\text{free market}} > C_{\text{sc}} \]

\( C_{\text{sc}} = \) societal costs at engineer’s optimum

However, the other side of the argument is that in case of a monopoly the consumer choice is limited, which is a form of failure as well.

The problem is addressed to an extent by regulation. The regulators can ensure the highest quality and service standards are met by the monopolist and keep the monopolist from charging unreasonably.

**Price Models**

*Cost Plus Model*

The cost plus model has its own set of issues:

a) No incentive to cut costs and inefficiencies being supported by this model

b) Incentive to increase costs for pleasure or by using unnecessary preventive and safety measures (hiring a lot of lawyers etc.)

c) No incentive to provide high quality services
d) The regulator gets inputs only from the regulated and the customers are cut off from the process and unheard eventually.

However, regulated natural monopoly has incentive to provide high quality. There is an incentive to invest in expensive technology. The costs increase in providing higher quality of services, and given the cost plus model, the return is also higher. The wasteful expenditures that inflate costs can be controlled by the regulator.

The drawback here is that the regulator has to monitor the regulated through audits and has to invest in R&D or incentivize R&D for the regulated.

**Regulated Price**

The regulator could set a fixed regulated price based on giving the regulated a reasonable return. The monopolist then has an incentive to cut costs as it means greater profits.

This model has some issues too.

a) Fixing prices for long durations is difficult due to uncertainty in external parameters like inflation that may affect costs.

b) The cost-saving must be passed on, at least in part, to the clients to achieve social optimum. For this, the prices need to be revised downwards. But this revision must be such that the incentive for cutting costs is not cancelled. Additionally, frequent revisions will create problems in contracts since passive infrastructure contracts are usually long term contracts.

**Regulations in Backhaul Sharing**

In regions where mobile traffic is low, backhaul may lie underutilized. In such cases, it makes economic sense to share backhaul. This could be through sharing fibre cable or even microwave.
However, in India, regulatory constraints prevent sharing of radio backhaul. Thus here, operators may need to invest extra antennas and work with underutilized backhaul capacities. One of the key concerns over sharing backhaul is that it leads to sharing of spectrum also as backhaul can be on both microwave and fibre cable. This can be potentially be avoided by asking operators to move to fibre cable over microwave for RAN backhaul and then sharing these backhaul facilities. A single service provider would then invest in the fibre backhaul and share this backhaul with several telecom operators.

With 3G in the picture, players such as Cisco offer RAN backhaul optimization solutions for operators. This allows operators to send more voice and data through this backhaul without the need to add more E1 / T1 lines by increasing backhaul throughput. This optimization, also known as IP RAN optimization solutions increases backhaul throughput between BTS and BSC and Node B. However, technological advancements in this domain – that of increasing backhaul capacity make sense only if the utilization of backhaul is significantly high. Thus in the case of 3G, it makes even more sense to share backhaul, and then invest in technology such as IP RAN optimization to significantly increase backhaul throughput.
Environmental Benefits
As was described earlier, there are several environmental concerns because of the use of telecom infrastructure. Infrastructure sharing can mitigate some of these concerns. Passive infrastructure sharing can reduce the total number of sites in the country and thus can reduce the visual impact on the landscape of mobile networks. In addition, infrastructure sharing reduces energy consumption which is good for environmental reasons. Thus government must set up liberal regulatory policies encouraging or favouring the usage of infrastructure sharing to reduce the environmental impact from the telecom industry (Analysys Mason, 2010).

Conclusions

While there are several issues and benefits with active, passive and backhaul sharing, regulators must find the right balance between the three components. In components where there is a potential for market failure – tower infrastructure, backhaul – adequate regulation is required to regulate the service providers and to ensure that sufficient sharing is done at this end. In addition, managed capacity models / pay-per-use models can be explored in tower sharing and backhaul sharing respectively. Active sharing can be used concomitantly, and makes perfect sense in 3G domain. More particular, 3G RAN sharing in synch with backhaul sharing is a way forward for the Indian industry.
Bibliography


