CONSUMER PROTECTION ASSOCIATION
HIMMATNAGAR
DIST. : SABARKANTHA
GUJARAT

Comments
On

Consultation Paper on
Telecommunication Infrastructure Sharing, Spectrum Sharing, and
Spectrum Leasing

Introduction :

Traditionally, telecommunication development shows economy of scale and telecom operator spending has been dominated by considerable investment of technology and infrastructure. Given that such investments are **fixed**, **sunk** and **irreversible**, they represent a high risk factor. Maintaining and upgrading infrastructure make this risk even higher. For example, fixed network operators are migrating to next-generation networks, after most mobile network operators have already deployed the fourth-generation(4G) infrastructures. Therefore, infrastructure sharing can significantly reduce entrance and development risk.

The basic motive of infrastructure sharing is to reduce the costs of building, operating, and maintaining network infrastructure. In theory, this is expected to encourage the entry of competition into the market.

Infrastructure sharing limits duplication and gears investment toward underserved areas, product innovation, and improved customer service. Infrastructure

sharing is likely to be a key market aspect when 5G is introduced. But Developments in infrastructure sharing should be driven by the market.

Infrastructure sharing also has great impact on competition. Market becomes more attractive to new players for decreased entrance barriers. Such players can enrich the competition while investing effectively. By alleviating pressure of network deployment, sharing allows operators to turn their attention to improved innovation, better customer service and eventually better commercial offerings and healthier competition.

New network technologies such as 5G and the Internet of Things require the installation of a larger number of sites—typically up to ten times the number of mobile base stations. Sharing mobile broadband infrastructure can help optimize the number of sites and reduce the visual impact of network expansion.

Due to economy of scale property of telecommunication industry becoming the requirement and process of business in the telecom industry where competitor, **sharing** of **telecom infrastructure** among telecom service providers are becoming partners in order to lower their increasing investments.

Infrastructure sharing limits duplication and gears investment toward underserved areas, product innovation, and improved customer service.

Infrastructure sharing optimizes the utilization of assets, facilitates quicker roll out and avoids duplication of infrastructure. It has the potential to strengthen competition and promote provision of services in un-served areas, while reducing costs i.e. capital expenditure (Capex) and operating expenditure (Opex) for operators. It is very useful in initial phase of network roll out as it facilitates in building coverage quickly when revenue and traffic demands are low and the costs for network deployment are relatively high. In the long run it assists in providing cost effective coverage in underserved geographic areas.

Infrastructure Sharing can also promote greater service-based competition. It encourages services providers to offer new and innovative services at cheaper costs to

the consumers. Instead of competing on coverage it leads to competing for innovation, service quality and differentiation.

Infrastructure sharing also assists in improving Quality of service (QoS). It can enhance capacity in congested areas where space for sites and towers is limited. In many countries the problem of non-availability of sites in congested areas reducing the coverage and signal strength exists. In order to address this issue some countries have defined such places where acquiring sites and resources are difficult as critical infrastructure (CI). In order to ensure that all service providers get necessary space for putting up of their equipments, allocation of such critical infrastructure is regulated. There is a need to consider if such steps are required to be mandated so that all service providers can have access to such critical sites.

Infrastructure sharing assist in reducing the carbon footprint of mobile networks and also offer environmental benefits, as the sites are most effectively shared including reduced numbers of antennae.

Sharing also facilitates in provision of roaming services wherein two or more service providers can provide service to their subscribers when their subscribers are outside the coverage area of home network.

Substantial network investments are required to meet the ever increasing demand for data usage. With intense competition resulting in pressure on telecom service providers revenues and ever increasing bandwidth requirements for Over-the-Top (OTTs) applications, TSPs should focus more on deriving optimal efficiency by investing on research on higher network layers. Infrastructure sharing assist in deriving optimal efficiencies while reducing costs. It promotes optimal use of scarce resources.

Significant investment required to develop telecom infrastructure is a big deterrent for many small service providers. As per a study, deployment of infrastructure amounts to approximately 60% of total cost for service provisioning. The problem gets further aggravated by fast pace of technological developments that constantly requires upgradation of existing infrastructure. Therefore, there is a need for appropriate policies to encourage sharing of passive and active infrastructure

among TSPs to ensure that wide variety of services are available to consumers at affordable costs.

However, shared infrastructure typically involves several parties, including private operators and central and local governments, thereby raising governance risks. Conflicting interests from stakeholders can result in delayed deployment of the infrastructure or a collapse of sharing agreements, with each individual operator deploying its own infrastructure. Also, when sharing solutions involves active infrastructure such as antennas and servers, access to that infrastructure assumes operation and ongoing investment, complicating governance over time. Government-led infrastructure sharing can also result in poor implementation, especially when new individual licenses are awarded after a sharing agreement.

Q.1. Should passive infrastructure sharing be permitted across all telecommunication service licenses/ authorizations? Kindly justify your response.

Comments :   Yes.

Definition :

Passive Infrastructure means antennae, towers and other supporting structures, ducts, conduits, poles, masts, manholes, cabinets, and associated air-conditioning equipment, diesel electric generators, batteries, electrical supplies, and easements. For the avoidance of doubt, Passive Infrastructure does not include the other electronic communications network elements identified in the definition of Electronic Communications Network, including but not limited to, circuit and packet (including Internet Protocol) switching and routing equipment, wire line transmission facilities (including lit and dark fibre), electricity cable systems, satellites, radio spectrum, radio apparatus and radio stations;

Passive Infrastructure sharing is becoming popular in telecom industry worldwide. Passive infrastructure sharing where non-electronic infrastructure at a cell site, such as

power supply and management system, and physical elements such backhaul transport networks can be shared. This form can be further classified into site sharing, where physical sites of base stations are shared and shared backhaul, where transport networks from radio controller to base stations are shared. Passive infrastructure sharing is the simplest and can be implemented per sites, which enables operators to easily share sites and maintain their strategic competitiveness depending on the sites shared. Operation is also easier with this form of sharing because network equipment remains separated. However, the cost-saving potential of sharing is limited relative to other forms of sharing.

Passive Infrastructure sharing

	Pros	Cons
1.	Significant Capex/Opex Saving	Availability of free space in existing site (if existing site are to be shared)
2.	Lowered risk of site acquisition	Similar cell planning may be required.
3.	Full differentiation and complete control of spectrum.	
4.	Control over site to be shared	
5.	No/Little regulatory obstacles	
6.	Easy migration to other sharing form	
7.	Environmental benefit	

Currently the most commonly shared infrastructure among operators is passive infrastructure, as it is easier to contract its set-up and maintenance. Sharing passive infrastructure only, means that newer operators still need to set up their own transceivers and other transmission equipment. This limits the advantage for new

operators, which means existing operators save in the long term, and still protect their interests in the short term

Regarding the Mast, TRAI should require applicants wishing to apply for Electronic Communications Code powers to illustrate that they are willing to share their apparatus with other providers of electronic communications networks. If a dispute was referred to TRAI by a communications provider seeking to mast share, each such referral to TRAI should be considered on a case by case basis. If TRAI concluded that mast sharing is technically feasible and/or was being refused by the communications provider (mast owner), it could exercise its powers to require mast sharing.

Conditions that will helpful for passive infrstructure sharing :

Market conditions that make passive infrastructure sharing more likely are:

1.   Mature networks:

Network maturity is a very important aspect that drives passive infrastructure sharing. In countries where the war to gain a customer is still being fought on the grounds of better network coverage, operators will not be willing to share passive assets as it would mean giving away the advantage of a wider/better network

2.   Growing market:

Growing markets mean an ever-increasing need to expand network for the operators. If operators have the ability to share passive infrastructure, they will typically be able to roll networks out much faster

3.   High cost regional/rural areas still being rolled out:

Operators tend to have a rollout obligation as part of their licenses. This could mean several unprofitable investments as certain sparsely populated rural areas might need every operator to set up a network. Passive infrastructure sharing can be a good

option for such rollouts as all operators can rely on a single set of infrastructure for their network

4.   New entrants looking to build scale:

Because towers take time to build, new entrants can increase their speed of network rollout by sharing passive infrastructure with existing operators

5.   Pressure on costs:

In an increasingly competitive market, low cost is the key to profitability, and operators can save on Capex and Opex by sharing towers.

Benefits :

Low market penetration and decreasing profit margins for telecom operators in the emerging markets have made passive infrastructure sharing an attractive proposition. The major benefits of sharing passive infrastructure for operators are:

1.   Infrastructure spending:

Allows operators to cut down on capital expenditure. Infrastructure cost for operators is estimated to decline by 16% to 20%.The tower companies, on the other hand, derive regular annuity income. Passive Infrastructure sharing can be instrumental in allowing a number of operators to enter remote regions that would normally have very high rollout costs. Ever-increasing demand to roll out LTE/5G networks has been putting a lot of pressure on the infrastructure spending of operators. Reduced costs of infrastructure can allow more money to be spent on enhancing infrastructure

2.   Network operation cost:

Results in rationalization of operational cost due to reserves produced by sharing site rent, power and fuel expenses.

3.   Enhanced focus on service innovation:

Alleviates pressure of network rollout and cost management from operators, allowing them to focus on customer service in a highly competitive and customer-centric industry. This becomes especially important in a regulatory environment demanding fast rollout of services

4. Lower entry barrier:

Passive infrastructure sharing will result in lower entry barriers, allowing smaller players to penetrate the market.

Possible negative impact :

Although, tower sharing enables new entrants to scale-up faster, it exposes established players to the risk of market share loss. Furthermore, the challenges of monitoring network performance and quality will increase as control over network roll out and equipment maintenance decreases. But these challenges are controllable through appropriate contract governance structures and well-defined service level agreements. TRAI should consider the competitive advantage that sharing of towers could provide in their respective markets. However, what they have to bear in mind is the fact that new and smaller operators will be incurring lease payments as an operating expense with relative lower risk, whilst the large and incumbent operators are still recovering the capital expense incurred in erecting the towers.

In Turkey, there were mandatory provisions for passive infrastructure sharing in larger population areas and provisions for active infrastructure sharing in smaller population areas.

In Belgium, it was observed that only passive infrastructures are part of existing sharing agreements and that such agreements are focused on covering difficult access areas like tunnels or transport routes. Furthermore, it has been observed that less dense areas covered at a minimum level by one operator are quite rapidly exploited by competitors due to the (highly) competitive situation. Operators do not depend on regulatory provisions because existing sharing agreements (which are market-led)

seem to be efficient. In general, according to the Belgian response it seems that due to experiences made, it is not viable to share existing networks, but it is easier to reach sharing agreements with a view to new networks on condition that there is a major change to the existing network, like a large number of new sites and/or new network elements required.

In short :

Passive sharing: Site + tower sharing

What should be shared? :

> Cell site
> Shelters, towers
> Power, A/C
> Security for buildings and systems

Potential advantages :

> Cost sharing for site acquisition, infrastructure, lease, maintenance, power
> Reduced network footprint

Potential drawbacks :

> Entrants may not benefit if they lacks own sites to offer
> Costly to negotiate and implement when established networks are being consolidated

Passive :

What should shared? :

> All elements of site sharing
> Backhaul links: cables/fiber, leased lines, microwave

Advantages :

> Cost savings in equipment cost

sharing: Backhaul

Cost saving in deployment :

➢ Joint-digging of trenches (70-80% of costs)

➢ Microwave links – reduced license fees

➢ Faster deployment timeframe

Q2. Should other active infrastructure elements deployed by service providers under various licenses/ authorizations, which are not permitted to be shared at present, be permitted to be shared among licensees of telecommunication services?

Comments :

Network sharing has become a standard part of the operating model for mobile operators, and the trend is accelerating. Operators have been able to reduce the total cost of ownership by up to 30 percent while improving network quality through sharing a variety of both active and passive equipment.

The cost savings potential for network sharing is even stronger with 5G, as green field deployment is better suited for sharing because it avoids the cost of network consolidation. For example, the cost of small-cell deployment can be reduced by up to 50 percent if three players share the same network. But the rationale for sharing extends beyond cost, as it could solve many practical roadblocks of 5G deployment in urban areas, such as the potential for urban disruption and visual pollution from the installation of excessive equipment and fiber. For many operators, sharing will be a necessity and requires preparation now.

5G deployment will increase cost and disruption to cities :

As operators gear up for the next wave of infrastructure investments to support innovative 5G use cases and ever-growing customer demand for mobile broadband, the numbers look more daunting than previously expected. To proceed alone, network investments would have increase by up to 60 percent with a significant increase in operating expenses, doubling total costs from 2020 to 2025, according to McKinsey analyses in a European context. This is much more expensive than many in the industry
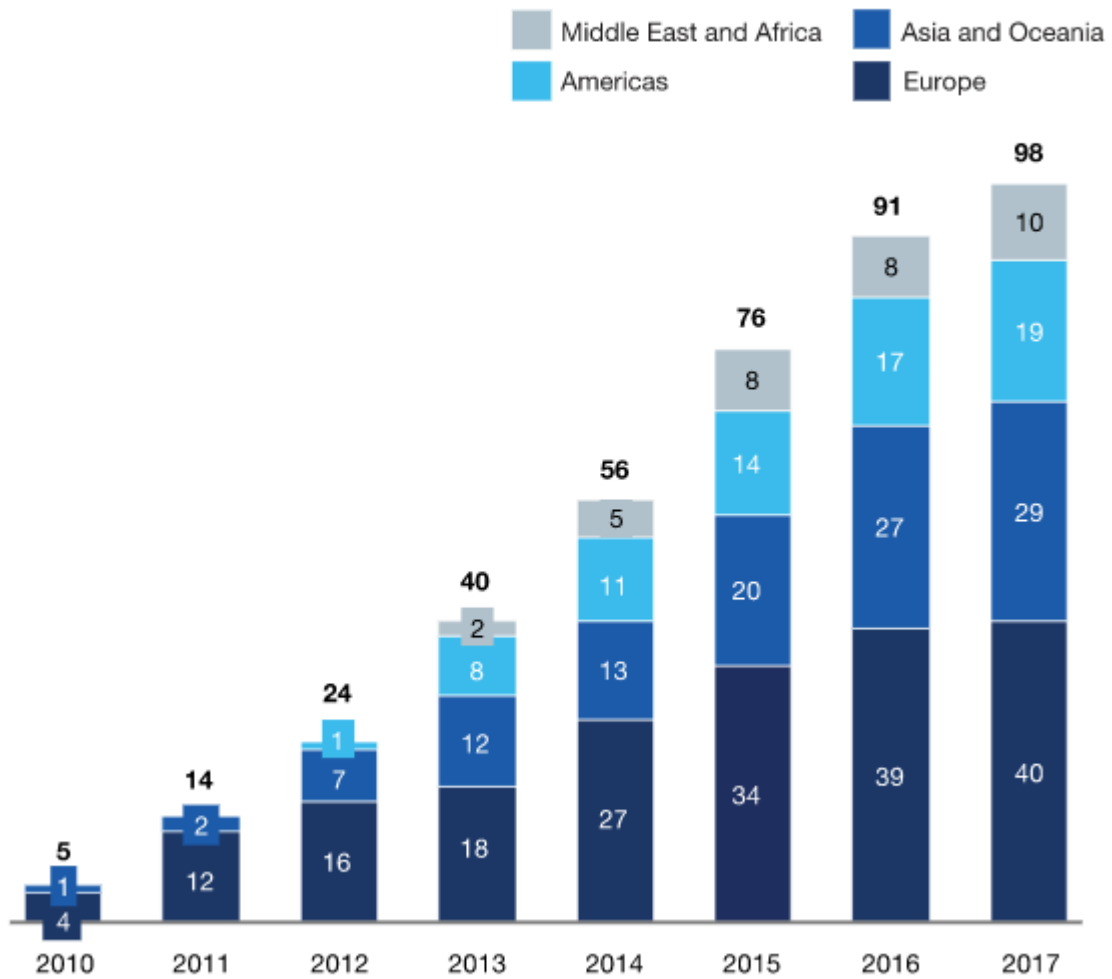
expect. This investment would be required for the deployment of a new, countrywide 5G IoT macro layer, small cells in urban areas, and the evolution of and capacity upgrades to the existing 4G macro network.

In addition to the financial challenges of operating alone, which include the risk of limited revenue upside, operators will face increasing physical constraints when densifying their networks in urban areas. A simulation of a 5G build out from 2018 to 2025 showed that the number of macro sites needed would increase by approximately 20 percent, in addition to new small cells, equal to 100 to 150 percent of the current number of macro sites. Installing the equipment and underground fiber lines required for this level of densification would involve a massive physical disturbance, primarily in already cramped urban settings.

Operators are already contemplating their options for 5G deployment. The approach typically falls into two groups: market leaders that believe in commercial acceleration and the price premium of network superiority, and cost-effective attackers that compete on other dimensions. In Europe, where active network sharing is frequent, we have seen that sharing can be applied in both situations, although with different strategic rationales. Two market leaders in a four-player market might be willing to share a superior network to polarize the market, for example, or two attackers might join forces to improve network quality and compete jointly against the market leader. In fact, network sharing has become increasingly common since 2010.

Active network sharing has become more common worldwide.

Cumulative number of active network-sharing agreements announced 2010–2017

Legend:
- Middle East and Africa
- Americas
- Asia and Oceania
- Europe

2010: **5** (Americas 1, Asia and Oceania 1, Europe 4)

2011: **14** (Americas 2, Asia and Oceania 12)... (Europe 12)

2012: **24** (Americas 1, Asia and Oceania 7, Europe 16)

2013: **40** (Middle East and Africa 2, Americas 8, Asia and Oceania 12, Europe 18)

2014: **56** (Middle East and Africa 5, Americas 11, Asia and Oceania 13, Europe 27)

2015: **76** (Middle East and Africa 8, Americas 14, Asia and Oceania 20, Europe 34)

2016: **91** (Middle East and Africa 8, Americas 17, Asia and Oceania 27, Europe 39)

2017: **98** (Middle East and Africa 10, Americas 19, Asia and Oceania 29, Europe 40)

McKinsey&Company | **Source:** GSMA Intelligence; Ovum; McKinsey analysis

Like in previous generations of sharing, 5G network sharing can be further adapted to support competitors' different needs, such as through depth of sharing (small cell versus 5G IoT macro layer), or setting up different sharing models in competitive urban markets versus rural coverage areas. Tailoring deals to specific situations allows operators with different needs to find common ground and uncover new savings.

In the most extreme cases—to maximize benefits—a single 5G network could be built in which all players in the market gain wholesale access. Entry to the market

would still be controlled through spectrum ownership, and competition for services would remain unchanged. Some regulators, such as in Australia and Singapore, are promoting this idea of fixed networks.

Many players in the value chain have already started betting on network sharing. Tower companies, for example, are predicting densification in urban areas and have already started securing access to lampposts and rights of way, and buying up fiber infrastructure.
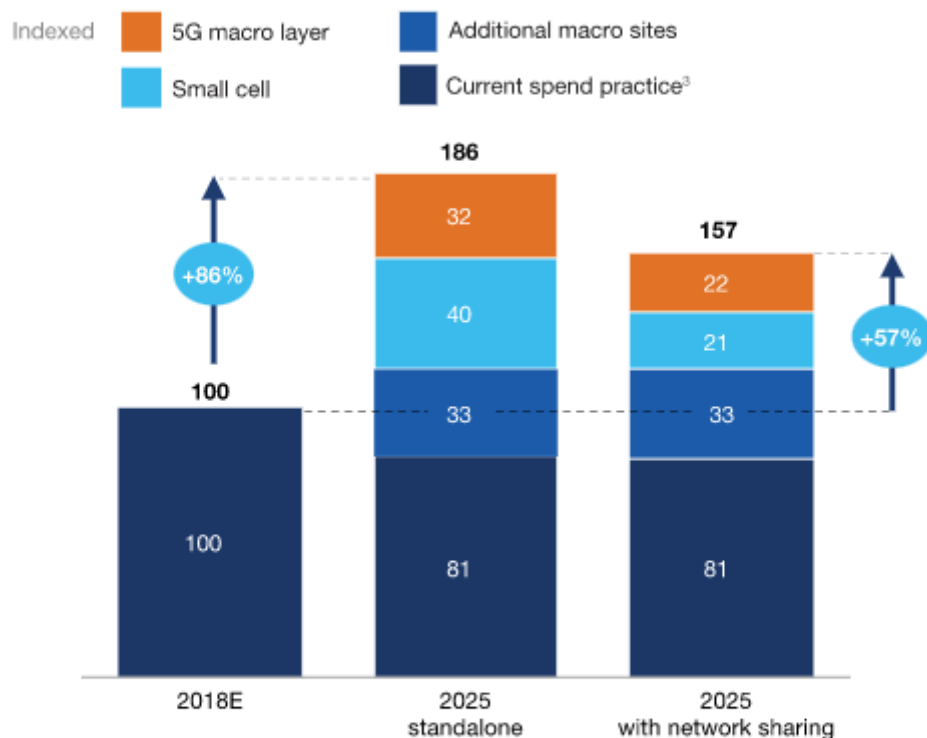
With 5G standards still not yet finalized, the telecom industry has pushed for native design for network sharing. The 5G technologies will build on existing sharing models from the prior generations (MORAN, MOCN) but will be supplemented with new features such as network slicing, which allows dynamic resource allocation to specific traffic or use case groups among operators.

Network sharing also is a means to accelerate 5G deployment, and to minimize disturbances from construction work and visual pollution. While telecom mergers are often blocked or approved only with significant remedies, network-sharing deals have been approved in most cases, and are even encouraged in many markets. Given that we are still in the early days of 5G, operators have the opportunity to participate in regulatory dialogue on alternative development paths and conditions for deployment.

The strongest rationale for sharing will be cost savings and improved network quality. This is especially true for green field deployments such as small cells, where three operators can save up to 50 percent each through sharing, according to the research of McKinsey. Simulations from one case showed that by sharing 5G small-cell deployment and building a common, nationwide 5G IoT macro layer, operators could reduce 5G-related investments by more than 40 percent. At the same time operators could also reduce the risk of their build out plans by sharing access to capacity and paying accordingly.

Network sharing can reduce 5G cost by more than 40 percent.

Access network TCO[1] evolution[2]

Indexed

- 5G macro layer
- Small cell
- Additional macro sites
- Current spend practice[3]

186

32	
40	
33	
81	

+86%

100

100

157

22	
21	
33	
81	

+57%

2018E   2025 standalone   2025 with network sharing

Network sharing is a lever that can reduce ~40% of the cost of 5G-related access-network domains (small cells and 5G macro layer)

[1]Total cost of ownership includes both operational and capital expenditure.
[2]35% annual traffic growth assumed.
[3]Total cost of ownership of current network footprint, including capacity LTE and LTE-Pro upgrades.

McKinsey&Company

The expected costs involved with building out 5G technology are higher than anticipated, according to the research, with network investments for new uses going up as much as 60 percent and a significant increase in operating expenses. Network sharing offers strong potential for cost savings.

Many European operators have also been considering sharing active infrastructure. An example is the agreement between Orange and Vodafone to share infrastructure in the United Kingdom and in Spain, while managing their own traffic independently and remaining competitors at the wholesale and retail level. According to Vodafone the UK, sharing agreement will reduce capital and operating cost by up to

30%. In Spain, the agreement will reduce the operators' number of site by around 40%.

In Jordan, all mobile telephony licenses are required to provide infrastructure sharing and collocation to other licensees, subject to availability. Jordan Telecommunication Regulatory Commission (TRC) reserves right to intervene if mobile companies fail to reach agreement of infrastructure sharing and national roaming. When TRC determines that infrastructure sharing is feasible, it decides the terms and conditions under which this must take place. Operators must also provide each other with national roaming agreement, which must be deposited to TRC.

Challenges and down sides associated with sharing :

If sharing agreement is properly framed by regulation there may not be any issue. Analysis needs to be done on how sharing agreement could hinder competition, especially competition at infrastructural level.

TRAI should be very vigilant to ensure that sharing arrangements do not result in competition being distorted.

As in the case of site sharing, MORAN and MOCN can be implemented per sites and enables strategic differentiation. However, operation of network equipment needs to be shared (or at least issues must be shared with participants) and therefore increases the complexity of sharing relative to site sharing. The cost-saving potential is greater than site sharing. Core network enables greater cost-saving potential but is complicated to operate and to maintain strategic differentiation.

Core Network sharing

	Pros	Cons
1.	Capex/Opex savings	Regulatory approval necessary
2.	Significant investment can be diverted to services	Complexity of operation and tight integration
3.	Maximum sharing for operators Sharing existing infrastructure	Challenging to differentiate quality of service.

	Control over base station to be shared	Require long term commitment between operators
	Reduction of network foot print by sharing operators	Difficult to exist from sharing areeent

One of main challenges of active Infrastructure Sharing includes technical limitations of the networks. Operators may face challenges in implementing a shared network formed from existing networks, as their architectures have evolved independently over a period of time.

Active Infrastructure sharing may discourage investment in the network as operators may prefer to share network of existing service providers for quicker roll out and saving costs.

Infrastructure sharing also limits service provider's independence and their control over the network.

It may reduce the competitive spirit of the service providers and can be considered anticompetitive.

In the case of active sharing, some forms such as GWCN and MOCN configurations, where spectrum pooling is allowed, could decrease the level of competition as partners may not be able to distinguish their services adequately because of similarities in their network coverage and quality of service, at the expense of competition, investment and innovation especially in dense and competitive areas.

It can also require sharing confidential or commercially sensitive information between competitors. Active sharing could have a negative impact on competition if not assessed carefully, presenting risks of collusion between the sharing parties. For these reasons, in France, Arcep states in its 2016 network sharing guidelines that active network sharing would not be acceptable in dense areas and would require a close supervision in less dense areas, because infrastructure-based competition is considered both sufficient and proportional.

When sharing is a result of regulatory obligations, competent authorities should carefully assess whether it leads to a loss of competitive advantage for the operator that was the only one covering that area, otherwise it would not be rewarding the risk taken by the operator.

From an operational viewpoint, sharing could have downsides as it requires an extensive period of planning between the sharing parties. Moreover, sharing, especially active sharing, requires consent and coordination between the sharing parties, making site evolutions more time consuming because of the joint decision-making process. It may also be more complicated to make sure that high QoS is always provided throughout the "data chain" in a shared scenario. Also from a technical viewpoint, if network issues or failures arise, debugging may be more complicated. In a more specific example related to the consolidation of existing networks, there could be an expenditure of capital associated with this. The cost depends on the degree of consolidation, which could entail significant removal costs (Belgium).

Active and passive sharing could increase the electromagnetic field emissions. This would create issues if official electromagnetic field emissions limits were exceeded (as operators would in this case not be able to share networks unless the regulation was subject to a revision). In consequence, legal provisions on the maximum radiation power (non-ionization radiation) reduce the available antenna power (ERP) per MNO on the same mast.

Sharing, especially passive sharing, may significantly load the host network site with the equipment installed by the guest operators, which could limit potential future network development such as the installation of new additional modules related to the introduction of new technologies.

In terms of resilience, with fewer independent mobile networks, infrastructure and mobile coverage as a whole may be more vulnerable as there is less redundancy and less option for connecting to cellular services. Robustness in case of emergencies or natural disasters may be reduced.

The challenges and downsides identified above are mainly resulting from experiences the respondents have been involved in. These go beyond general competition concerns (as existing infrastructure sharing agreements are subject to competition law). In addition to that, some Regulators have observed or are expecting some negative economic effects relating to market structure.

In Austria, the Regulator expects that due to sharing agreements incentives for investment will decrease in the long term.

In Hungary, a potential risk is identified that MNOs, which do not participate in sharing agreements, can suffer competitive disadvantages.

In Belgium, practical examples show that sharing agreements raise issues especially in view of finance, operations and strategy, in particular the relative difficulty of establishing such arrangements relative to the occasionally modest financial benefits. Due to the alignment of competing objectives from different operators, such projects generally become very complex and therefore take significant resources. On the one hand, the scale of an agreement is very important to assess if sharing is worthwhile or not. On the other hand, the larger the agreement is, the more complex the sharing is likely to be.

Barriers to increase infrastructure sharing :

1. Insufficient space on existing masts :

The lack of space on a cabinet or in a tower, as well as spectrum planning to avoid interferences, could be a barrier in spectrum sharing.

2. Landlord Pricing :

The need for more space at sites and the leasing of new sites leads more likely to additional agreements with landlords and therefore potentially to higher rental costs.

3. EMF restrictions

4. Administrative processes :

This includes permits of civil works, slow processing of building permits, local taxes for antennas and pylons and the access granting to (private) large premises and the licensing period per site.

5. Coordination effort

6. Technical issues

7. Competition :

Multiple and/or extensive agreements may raise competition issues. This is because market players do not want to give up market shares or first mover advantage by having active sharing agreements with a competitor.

Q3. **If your response to the Q2 is in the negative, which active infrastructure elements should not be permitted to be shared? Further, which active infrastructure elements should be permitted to be shared with which licensees/ authorization holders? kindly provide details for each authorization with detailed justification.**

Comments :   No Comment.

Q4. **In case it is decided to permit sharing of any additional active infrastructure elements among licensees,**

(a) What precautionary conditions should be put in place to avoid disruption in telecommunication services due to any unforeseen situation? The response may be provided for each active infrastructure element.

Comments :   **Mentioned above.**

(b) Whether there is a need to have a provision for permission from/ intimation to the Licensor before commencement of such sharing? If yes, what provisions and timelines need to be prescribed for each active infrastructure element?

Comments :

Most Regulators gather information on infrastructure sharing agreements in specific circumstances only. This is the case, for example, in Belgium, Germany, Greece, Latvia, Sweden, Italy, Switzerland and Norway (where the Regulator gathers

information in cases of disputes between operators, although for national roaming, there is an obligation on the operator to send a reference offer to the Regulator). In terms of formal requirements for operators to notify Regulators about infrastructure sharing, there are no legal/regulatory requirements in most countries although there is a duty to provide information on request. Where there are requirements to inform regulatory authorities, there are different thresholds that determine requirements. In Cyprus, France, Greece, Romania, Montenegro, Portugal and Turkey, operators are obliged to inform Regulators of any infrastructure sharing plans. In Germany, shared use of certain assets (physical sites, masts, antennas, support cabinets and some degree of RAN sharing provided that there is no pooling of frequencies and logical base stations (e.g. Node B)) is allowed without any notification requirements; all other types of sharing agreements have to be notified to the Regulator. In the United Kingdom (UK), there is no regulatory requirement to provide information on sharing arrangements but as part of their competition law compliance (and risk management), operators typically share terms of agreements with the Regulator.

In Norway, infrastructure sharing obligations have been imposed on the SMP operator following a market review – the dominant mobile operator has been subjected to infrastructure sharing obligations including national roaming.

Q5. Whether any other amendment is required to be made in the telecommunication services licenses/ authorizations with respect to the provisions relating to both active and passive infrastructure sharing to bring clarity and remove anomaly? If yes, clause-wise suggestions in the telecommunication services licenses/ authorizations may kindly be made with detailed justification.

Comments : **No.**

The regulatory framework is appropriate and sharing agreements have to be mainly commercially based and competition law provides a sufficient framework to assess which sharing is desirable (and allowed) and which not.

Competition must be maintained. There may be a risk that MNOs through exclusivity agreements with infrastructure owners could impede the rollout of other MNOs or want to impose the sharing of passive sites.

Q6. **Should there be any obligation on telecom service providers to share infrastructure that has been funded, either partially or fully, by the Government through Universal Service Obligation (USO) Fund or otherwise, with other telecom service providers? Kindly justify your response.**

Comments :   **Yes.**

Q7. **In case it is decided to impose some obligations on telecom service providers to share the infrastructure funded by Government with other telecom service providers, is there a need to provide a broad framework for sharing of such infrastructure? If yes, kindly suggest the key aspects of such framework with detailed justification.**

Comments :   **Yes.**

Q8. **Any other suggestion to facilitate infrastructure sharing may kindly be made with proper explanation and justification.**

Comments :   **Mentioned above.**

Regulatory Safeguards

The TRAI should ensure that infrastructure sharing abides by the general regulatory standards :

- ✓ Transparency,
- ✓ Efficiency,
- ✓ Independence,   and
- ✓ Nondiscrimination.

In more specific terms, the safeguards should ensurethe following:

- Capacity is sold on a first-come, first-served basis, and the regulator

intervenes to ration scarce resources when necessary.

- Unused capacity is returned and operators refrain from ordering excess capacity. Penalties could apply in cases in which orders surpass the utilized capacity by a certain percentage.

- Operators must log infrastructure-sharing activities diligently to keep track of actions undertaken, whether for a potential regulatory audit or simple review.

- Physical separation of shared network components (for example, installing fences between the active components of two operators) can be used to prevent sabotage. However, such precautions should not interfere with efficient sharing.

Jordan and Nigeria, for instance, included regulatory safeguards when introducing infrastructure-sharing regulation. They both advocate appropriate capacity balancing and the adoption of a first-come, first-served approach.

TRAI should carefully consider what infrastructure-sharing forms to mandate. Passive network components are more commonly shared and are considered a good starting point for infrastructure-sharing obligations.

TRAI should introduce necessary safeguards and enforcement tools. To ensure compliance and successful adoption of infrastructure-sharing obligations, TRAI should access and communicate the overall benefit of infrastructure sharing and ready themselves to resolve eventual disputes.

Policy Enforcement :

Disputes and limited compliance are inevitable in today's increasingly complex telecom sector. TRAI should encouraged to manage by incentives, they still need recourse to sanctions when operators fail to comply. TRAI also must have the ability to intervene to resolve disputes, actively working to reach positive conclusions. Regulators should clearly define dispute-resolution procedures, allowing operators to request their intervention in clearly defined circumstances while abiding by a transparent and timely process.

TRAI should continuously monitor compliance and analyze any failure to comply. The typical telecom legislation empowers regulators to sanction operators if a failure to comply is intentional, but the more common modern approach is to incentivize operators toward compliance. Nevertheless, regulators should make use of all the tools

at their disposal.

B. Connectivity Issues Faced by the Subscribers in Remote and Far-flung Areas of the Country

Q9.   What measures could be taken to encourage roaming arrangements among telecom service providers in remote and far-flung areas? What could be the associated regulatory concerns and what steps could be taken to address such concerns? Kindly provide details on each of the suggested measures with justification.

Comments :

TRAI should issue a policy encouraging infrastructure sharing and should collaborate with local authorities and municipalities to support and facilitate the deployment of shared infrastructure.

The policy should encourage incumbent and new entrants to balance their shared network rollout. Incumbents should make the network components to be shared publically available through reference offers that specify the components' available capacity and geographic locations.

Q10. What could be the other ways to ease out the hardship faced by the subscribers in remote and far-flung areas due to connectivity issues of the home network provider? Kindly provide detailed response with justification.

Comments :   Network sharing and leasing. Mentioned above

C. Issues relating to inter-band spectrum sharing among access service providers

Q11. Whether inter-band access spectrum sharing among the access service providers should be permitted in the country?

Comments :   Yes.

Q12. **In case it is decided to permit inter-band access spectrum sharing among access service providers, please provide detailed inputs to the following questions:**

(a) What measures should be put in place to avoid any potential adverse impact on competition and dynamics of spectrum auction? Kindly justify your response.

(b) Considering that surrender of spectrum has been permitted in the country, what provisions need to be included in the guidelines for inter-band access spectrum sharing so that any possible misuse by the licensees could be avoided? Kindly justify your response.

(c) What should be the broad framework for inter-band access spectrum sharing? Whether the procedure prescribed for intra-band access spectrum sharing could be made applicable to inter-band access spectrum sharing as well, or certain changes are required to be made?

(d) What should be the associated charges, and terms & conditions for inter-band access spectrum sharing?

Comments : **No Comments.**

Q13. **Any other issues/ suggestions relevant to the spectrum sharing between access service providers, may be submitted with proper explanation and justification.**

Comments : **No Comments.**

D. Issues relating to Authorized Shared Access (ASA) of Spectrum

Q14. **Whether there is a need to explore putting in place a regime to implement Authorized Shared Access (ASA), wherein an access service provider as a secondary user could use the frequency spectrum assigned to a non-TSP**

primary user (government agencies and other entities) on a dynamic spectrum sharing basis? Kindly justify your response.

Comments :

The continued growth of mobile networks and services depends on the availability of sufficient spectrum resources in harmonized bands. In addition to establishing an appropriate regulatory framework, resolving spectrum scarcity is a pre-condition for leasing; otherwise, it cannot be a viable option for primary license holders, such as operators, and for the market as a whole.

The speed, reach and quality of 5G networks and services depend on governments and regulators supporting timely access to the right amount and type of affordable spectrum, under the right conditions. For initial launches, TRAI should make available 80–100 MHz of contiguous spectrum per operator in prime 5G mid-bands (e.g. 3.5 GHz) and around 1 GHz per operator in high bands (e.g. mmWave spectrum). GSMA analysis shows that a total of 2 GHz of mid-band spectrum, on average, will be required to support the growth of 5G during the 2025–2030 timeframe. This is the average amount needed to guarantee the IMT-2020 requirements for 5G, in turn an enabling factor to spectrum leasing. **In addition to access, transparency around spectrum renewal, underpinned by a forward-looking roadmap from the regulator, will be important to ensure certainty for market participants.**

Guaranteeing spectrum supply and license renewal is a key tool to creating a liquid secondary market for leasing, which can provide an explicit solution to meet vertical demand and presents a practicable alternative to set-asides. Some regulators have adopted a 'use it or lease it' approach, with license conditions and obligations designed to incentivize operators to utilize their spectrum or make it available to others where it will not be deployed or not used within a reasonable timeframe.

Q15. In case it is decided to implement ASA technique for secondary use of frequency spectrum assigned to non-TSP primary users, please provide your response to the following questions with detailed justification:

(a) What are the potential spectrum bands in which ASA implementation can be considered?

(b) What measures should be taken to encourage and motivate the incumbent users for participation in the spectrum sharing through ASA technique?

(c) What should be the broad framework for implementation of ASA technique?

(d) Is there a need for putting in place a mechanism for dispute handling including interference issues in case of ASA? If yes, what should be the framework?

(e) What methodology should be adopted for spectrum assignment to secondary users? What could be the spectrum charging mechanism for such assignment?

(f) Who should be entrusted the work of managing shared access of spectrum?

Comments :   No Comments.

Q16. Whether there is a need to permit the ASA technique-based dynamic spectrum sharing among access service providers? If yes,

(a) What are the possible regulatory issues involved and what could be the possible solutions?

(b) What measures should be put in place to avoid any adverse impact on competition and dynamics of spectrum auction? Kindly justify your response.

Comments :   No Comments.

Q17. In case it is decided to permit ASA technique-based dynamic spectrum sharing among access service providers in the country, please provide your response to the following questions with justification:

(a) Whether there is a need for prescribing any framework for such shared use? If yes, what should be the framework?

(b) Whether access service providers should be required to obtain approval or intimate to DoT before entering into such arrangement?

(c) Whether any fee (one time, or recurring), should be prescribed on the spectrum sharing party(ies)? If yes, what should be the fee and who should be liable to pay such fee?

(d) What should be the treatment of spectrum shared through ASA technique for the purpose of computation of spectrum cap?

(e) Whether there is a need for an independent entity for managing spectrum access? If yes, who should be entrusted this work? If not, how should the spectrum access be managed?

(f) Is there a need for putting in place a mechanism for dispute handling including interference issues or should it be left to the access service providers? If yes, what should be the framework?

(g) What other terms and conditions should be applicable for the sharing parties?

Comments :   No Comments.

Q18. Suggestions on any other spectrum sharing technique(s), which needs to be explored to be implemented in India, may kindly be made along with the relevant details and international practice. Details of likely regulatory issues with possible solutions, interference management, dispute handling etc. may also be provided.

Comments :

In helping to reduce spectrum shortages faced by some operators while ensuring valuable spectrum does not lie fallow, spectrum sharing helps more intensive spectrum use, increased service quality and lower costs of service provision. Spectrum leasing

and trading enable the parties that have the best information on the value of spectrum to determine its price. A buyer or lessee will need to create more value from the acquired spectrum than the seller to justify the sale. Voluntary leasing and trading also reduce risks for operators as they are able to sell or lease unused spectrum while having the opportunity to acquire new capacity as they grow. The ability to trade and lease licenses can ensure that spectrum is used efficiently without any need for further charges to be imposed by government.

Experience with spectrum trading and leasing shows that:

• Trading is more likely to take place where there is substantial available spectrum and where there is predictability on both future spectrum availability and the regulatory framework.

• Trading is more likely to take place where there is available spectrum and where there is a need to support network deployment by the lessee, such as for verticals.

• Long license terms allow the buyer or lessee of the rights to undertake investments to make use of the spectrum.

• Spectrum trading and leasing are made difficult where decisions about whether licenses are to be renewed and the conditions that will be attached to the new licenses are made close to the expiry date of the existing licenses.

• Authorities should be notified of the agreements taking place so that it is clear who holds spectrum usage rights. Notification enables authorities to assess whether a proposed trade would create any risks to competition. Regulatory frameworks that support voluntary spectrum trading can benefit society by ensuring the ongoing efficient use of spectrum.

It should be permitted to facilitate Industry 4.0 use cases like machine to machine communication, mobile edge computing etc. on mutual agreement and terms and conditions.

Both service provider and private companies leasing spectrum have to ensure that there is no interference caused by any public network or any other licensed user of spectrum.

Service provider should submit the details of spectrum bands, quantum of spectrum in each band, period of leasing, geographic area of lease, geo-coordinates of the logical perimeter of the define premises, and use of spectrum to DoT and TRAI within a stipulated days of entering into the leasing agreement.

Those enterprises who are having private captive network can also obtain spectrum directly from the DoT. TSP can also allow to offer captive networks as a service to enterprises through network slicing over its public network.

Suggestions :

Licensing authorities and TRAI should allow voluntary spectrum sharing, leasing and trading amongst operators and facilitate such mechanisms through clearly defined spectrum rights, long license terms, and limited administrative costs.

• In advance of a formal spectrum secondary market framework being established, TRAI should be prepared to assess proposals for sharing, leasing and trading subject to consultation and consider risks to competition or of interference.

• Transparent and well-timed license renewal processes, and information on spectrum availability, pricing, and conditions, facilitate sharing, leasing and trading.

• Competition issues should be assessed considering the specific circumstances of sharing, leasing and trading agreements. Certain safe harbors can be established where the spectrum represents a small share of the market capacity or where a market share is below a certain threshold.

E. Issues relating to Leasing of Spectrum

Q19. Where there is a need to permit spectrum leasing among access service providers? Kindly justify your response.

Comments :   **Can be tried.**

With spectrum leasing, licensed bands that have already been assigned to an organization (such as a mobile operator) on an exclusive basis can be rented by another user, typically for a limited period of time and/or for a portion of the spectrum

included in the license. Examples include leasing spectrum to wireless internet service providers in rural areas or leasing to support localized private networks for use by industry verticals.

Leasing is a key secondary spectrum market initiative in the US, but it is not currently permitted in certain European markets and in most markets in Asia, Latin America, Africa and the Middle East.

There is considerable variation globally in the extent to which spectrum leasing has taken root. Despite consensus among operators that voluntary leasing should be permitted, demand has not been universally strong where licenses have allowed leasing. However, there are some examples that appear to have yielded positive market outcomes in terms of delivering additional coverage and strengthening services for consumers. These have tended to originate from higher income markets, such as the US and Europe. In other regions (e.g. Sub-Saharan Africa), insufficient spectrum availability is cited as a major impediment to leasing. Leases have often been agreed on a regional or local basis where operators are not using their spectrum holdings to full capacity (specifically, certain bands).

Spectrum leasing could expand in the 5G era :

A primary motivation for spectrum leasing is the potential commercial benefit to lessors in terms of revenue generation and cost savings of leasing unutilized frequencies for certain uses or periods. Leasing can provide a flexible opportunity to meet the specific spectrum demands of industrial or enterprise customers, rural telecoms providers or other mobile operators.

Some policymakers also recognize the value of leasing, considering it a means of ensuring efficient use of spectrum resources. By facilitating leasing, regulators can avoid setting aside spectrum for a particular use as a mutually exclusive choice. They can continue to award licenses, thereby ensuring that spectrum is efficiently used, but also allow for alternative users to access and use spectrum in specific geographical areas or over certain periods.

As 5G develops and deployments progress, spectrum leasing could become more attractive and widespread for several reasons, including spectrum supply (e.g. greater availability in mid and high bands), and demand from different users that may want access to spectrum to provide the necessary local capability to realize an unaddressed business opportunity or to establish dedicated networks for industries.

Numerous challenges to engaging in leasing :

There are several challenges to successfully implementing spectrum leasing more widely. Some could be within the scope of operators to overcome; others appear beyond their direct or sole control. Issues include the following:

• **Regulatory barriers:** From outright prohibitions on spectrum leasing to the lack of a clear framework that allows leasing or governs aspects of the process.

• **Technical challenges:** The feasibility of leasing can be impacted by coordination or interference issues, and is dependent on how much spectrum has been brought to market to support the deployment of advanced mobile technologies.

• **The commercial opportunity:** The costs of providing leasing services (for example, network set-up and integration) can be seen to outweigh relatively small revenues from low demand, making for an unattractive business case.

Making spectrum leasing a success may require mobile operators to create a cross-functional team comprising various skill sets to understand the needs of the market and explore opportunities, while managing risks. Commercial departments should work with network-focused colleagues to overcome technical hurdles, including interference or band clearance issues, to establish commercial agreements.

Enabling factors can help overcome the barriers :

The potential enabling factors to capitalize on the spectrum leasing opportunity somewhat mirror the identified challenges. Firstly, the removal of barriers that have prevented or even forbidden leasing occurring to date means mobile operators can make spectrum across different bands accessible to other users, including competitors, for a given period of time and/or in a defined area. In addition, guaranteeing spectrum

supply and license renewal (while foregoing set-asides) can help to create a liquid secondary market for leasing, which can be supported by allowing voluntary and commercial negotiation between parties to establish leasing agreements.

Policymakers and operators can help realize the potential of leasing :

Despite the challenges, there is a clear market opportunity for spectrum leasing, with potential benefits irrespective of the type of lessee. To mitigate the risks and accentuate the benefits of leasing, policymakers and operators can take a number of steps.

Regulators should consider how they put in place the frameworks to facilitate leasing, which should be underpinned in the first instance by market negotiation rather than regulation and supported by sufficient supply of spectrum.

Operators and other market players should consider how they organize internal resources, including collaboration between network and commercial departments, in order to identify situations where they can engage in the secondary access market and realize the business opportunity that spectrum leasing presents.

Regulatory frameworks for spectrum leasing in the US :

The US was a frontrunner in adopting policies and procedures to facilitate leasing. The FCC's 2003 Secondary Markets Order provided for two types of spectrum leasing arrangements intended to "promote more efficient, innovative, and dynamic use of the spectrum, expand the scope of available wireless services and devices, enhance economic opportunities for accessing spectrum, promote competition among terrestrial wireless service providers, and eliminate regulatory uncertainty surrounding terrestrial spectrum leasing arrangements".

Depending on the form of leasing (whether "spectrum manager" or "de facto"), the lessor may remain responsible for ensuring compliance with underlying license requirements and need pre-approval from the FCC to enter into an agreement. In 2004, the FCC clarified that spectrum leasing may include "dynamic" arrangements, where the lessor and lessee share use of the same spectrum through the use of

cognitive radio technologies. In doing so, it put confidence in the ability of the market to find innovative means of enhancing spectrum access and lowering costs. (Ref. Spectrum Trading in the EU and the US – Shifting Ends and Means, Squire Sanders, 2011)

Despite certain prevailing challenges, we feel that there is a clear market opportunity for spectrum leasing, with potential benefits irrespective of the type of lessee. It can be permitted on a voluntary and commercial basis, rather than imposed by regulators. Several operators also believe 5G could drive leasing forward due to greater spectrum supply (e.g. in mid and high bands), as well as demand from industries (for example, manufacturing, ports and utilities) and other service providers.

Q20. **In** case it is **decided to permit spectrum leasing among access service providers, please provide detailed response to the following questions:**

(a) Whether spectrum leasing should be permitted for short-term period only, or for both short-term as well as long-term?

Comments : **Mentioned above**

(b) In case only short-term leasing is to be permitted, what should be the maximum duration for such spectrum leasing? Should there be any restrictions on renewal of such short-term lease?

Comments : **No comments.**

(c) In case it is decided to permit long term leasing, please provide your response to the following questions with justification:

(i) What measures should be put in place to avoid any adverse impact on competition and dynamics of spectrum auction?

Comments :

Establish an enabling regulatory environment :

As we move further into the 5G era, with a shift in focus from maximum coverage for voice services to targeted coverage for various kinds of data services, TRAI should consider permitting voluntary spectrum leasing, whether between a mobile operator and another operator, vertical users using the same or a different mobile technology generation, or other users looking for different types of technologies. Commercial negotiations should be allowed to determine the responsibilities of relevant parties with respect to network coverage and rollout, fees and more. Within this environment, the prospect of arranging a lease will be helped by lower costs, particularly on the lessee side. Specifically, transaction costs to acquire access to spectrum in small geographic areas in less densely populated locations should not be higher than the value of the spectrum to be leased or sold.

Encourage voluntary commercial negotiation :

Spectrum leasing is a dynamic spectrum access technique in which lessors and lessees form a partnership for mutual benefit. With no one-size-fits-all model for leasing, an approach centered on commercial negotiation aids price discovery and helps maximize the benefits and efficient use of exclusively licensed spectrum, while also ensuring it is available to meet the needs of other potential users. In certain situations, competition law reviews could provide for a useful safeguard mechanism but should be as burdenless and quick as possible so as not to inhibit competition or innovation, or limit the prospect of voluntary agreements being reached.

(ii) Whether there should be a maximum duration for which spectrum leasing may be permitted?

Comments :   No Comments.

(d) What should be the applicable roll-out obligations for the Lessee (the access service provider which takes spectrum through leasing arrangement from the Lessor)? Whether the spectrum leasing should have any effect on the roll-out obligations applicable for the Lessor (the access service provider which

has leased out the spectrum)? Whether the provisions for roll-out obligation require to be different for short-term and long-term spectrum leasing?

Comments :

Favour leasing as a more efficient alternative to spectrum set-asides :

Spectrum carve-outs for vertical industries are causing a barrier to meeting growing data demand in some cases, and should be avoided in priority 5G bands. Sharing and leasing are typically better options in these situations. Policymakers should consider assigning mobile spectrum as usual and, where needed, create license terms and conditions to help meet the needs of verticals. If necessary, a 'use it or lease it' approach can incentivize operators either to utilize their spectrum or make it available to others where it will not be deployed or used within a reasonable timeframe.

The choice between transfer and lease will depend on circumstances and preferences, and is for them to decide, but operators should position themselves to be able to realize the potential monetary returns. In the 5G era, there may be a stronger business case for leasing to industries for dedicated, high-performance connectivity, while real-world examples suggest leasing to smaller operators can support rural rollouts where economic viability is uncertain.

(e) Should the spectrum leasing charges be levied on similar lines as applicable for spectrum trading? If no, what charges should be made applicable in case of spectrum leasing?

(f) Should there be a lock-in period, after acquisition of spectrum, to become eligible for spectrum leasing as applicable in spectrum trading? If yes, what should be the lock-in period post which, spectrum holder would become eligible to lease it to another access service provider?

(g) Whether there is a need for an approval from, or intimation to DoT before the proposed leasing of spectrum? If yes, whether prior approval/ prior intimation requirement be different for long-term and short-term spectrum

leasing? What should be the timelines for approval from, or intimation to DoT in each case?

(h) Whether the spectrum held by an access service provider on short-term, or long-term lease be included to calculate compliance to spectrum caps?

(i) Considering that surrender of spectrum has been permitted in the country, what provisions need to be created in the guidelines for leasing of spectrum between access service providers so that any possible misuse by the licensees could be avoided?

(j) What other terms and conditions need to be prescribed in respect of spectrum leasing between access service providers?

Comments :   No.

Q21. Any other issues/ suggestions relevant to the spectrum leasing, may be submitted with proper explanation and justification.

Comments :   No.

           Thanks.

                                                          Yours faithfully,

                                                          (Dr. Kashyapnath)
                                                          President