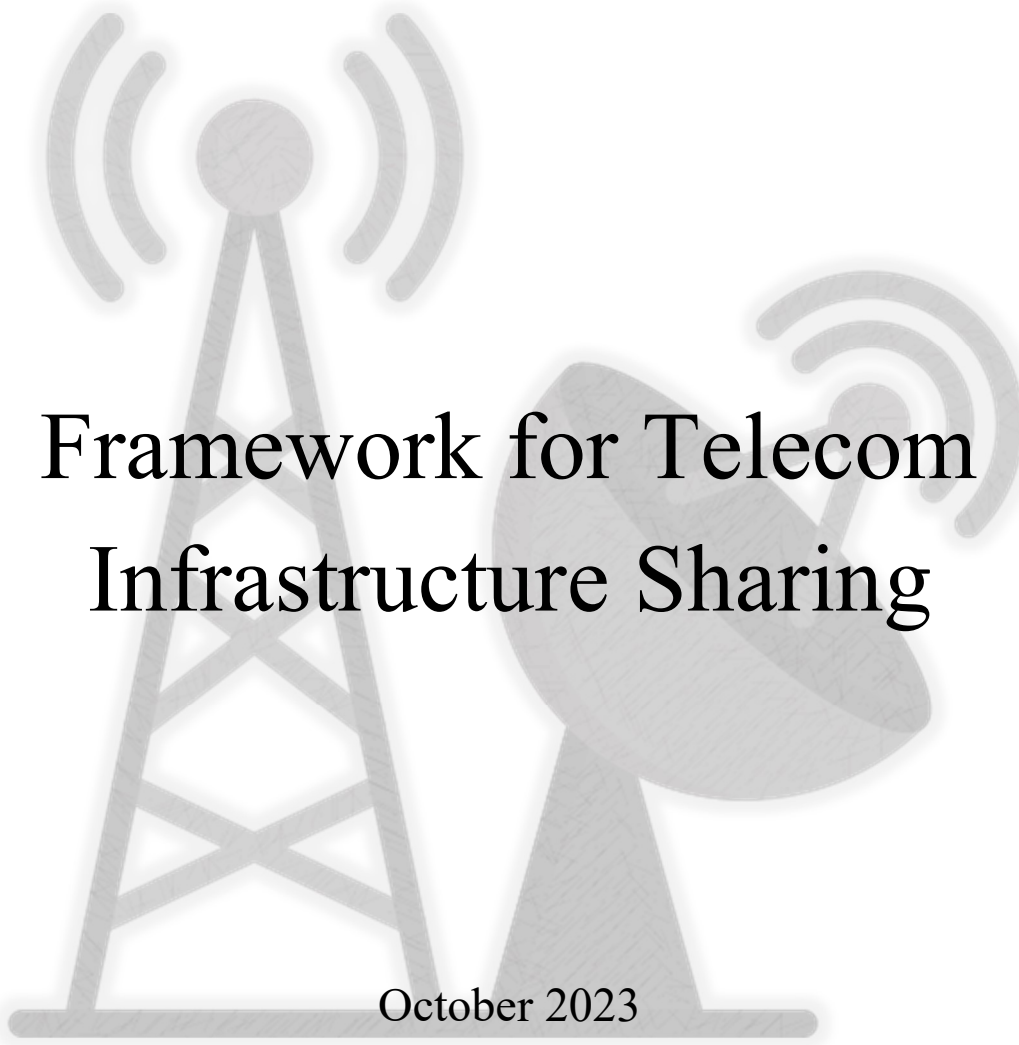**Government of Pakistan**
Ministry of Information Technology and Telecommunication

DIGITAL PAKISTAN

Framework for Telecom Infrastructure Sharing

October 2023

Table of Contents

1   Introduction

Telecom infrastructure sharing is a broad range term that generally refers to sharing of telecom network components and associated non-electronic and physical infrastructure. Telecom network can broadly be divided into two major areas namely 'Inside Plant (ISP)' and 'Outside Plant (OSP)'. Inside Plant comprise of network components such as Core Network (CN), Charging / Billing Systems, Intelligent Network (IN), Application Servers for VAS, Content Delivery Network (CDN), Data Centers (DC), Transport Network Management components, etc. (such as ADM, DWDM). Outside Plant mainly comprises of Access Network that involves cable as well as Radio Access Network (RAN) and associated civil infrastructure involved to support deployment of Access Network such as towers, masts, cable ducts / utility corridors, space for collocation of different types of telecom related equipment, etc.

Infrastructure sharing concept promotes resource optimization by better utilization of assets, avoiding duplication of network infrastructure, saves time & costs and accelerate service rollouts. Telecom network deployment involves heavy CAPEX and OPEX liabilities for operators and is considered as a major deterrent for network expansions. Furthermore, delays in rolling out new network infrastructure, which are attributed to procuring Right of Ways (RoW), pose great challenges to licensed operators in terms of time relevance to market for telecom and ICT services. Infrastructure sharing enables operators to focus on the competition in the service layer regardless of the extent of the sharing. Operators can share whole or strategically unimportant parts of its network to share infrastructure costs while providing acceptable performance. Furthermore, these savings can facilitate mobile operators' migration to next-generation technologies.

1.1   Types of Infrastructure Sharing

Infrastructure sharing can be categorized into two (2) broad categories i.e. a) Active Infrastructure Sharing and (b) Passive Infrastructure Sharing.

1.2   Active Infrastructure Sharing

Active infrastructure sharing involves sharing the electronic network components – energized network elements – embodied in mobile and fixed networks, core and access nodes, Operational Support System (OSS), Business Support System (BSS) and elements involved in management of transport network including fiber and radio networks. For the purpose of this document / guidelines it excludes Radio Frequency (RF) spectrum sharing and trading.

1.3   Passive Infrastructure Sharing

Passive infrastructure sharing means sharing of infrastructure such as physical sites, buildings, premises, tower / masts, power supply (including battery, diesel gen-set, any alternate energy means), air-conditioning, etc.

1.4   Drawing Boundaries - Active and Passive Infrastructure Sharing

Due to complex nature and models involved in infrastructure sharing, active sharing includes passive infrastructure components, therefore, boundaries between the two types are often blurred.

Following figures (Figure 1 & 2) provide a high level of understanding to draw boundaries between active and passive elements for mobile and fixed networks infrastructure.

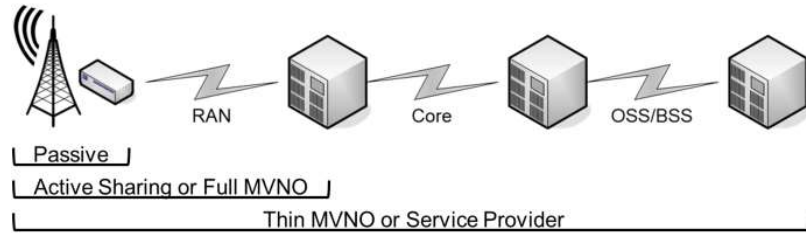## 1.4.1 Mobile Network Infrastructure Sharing

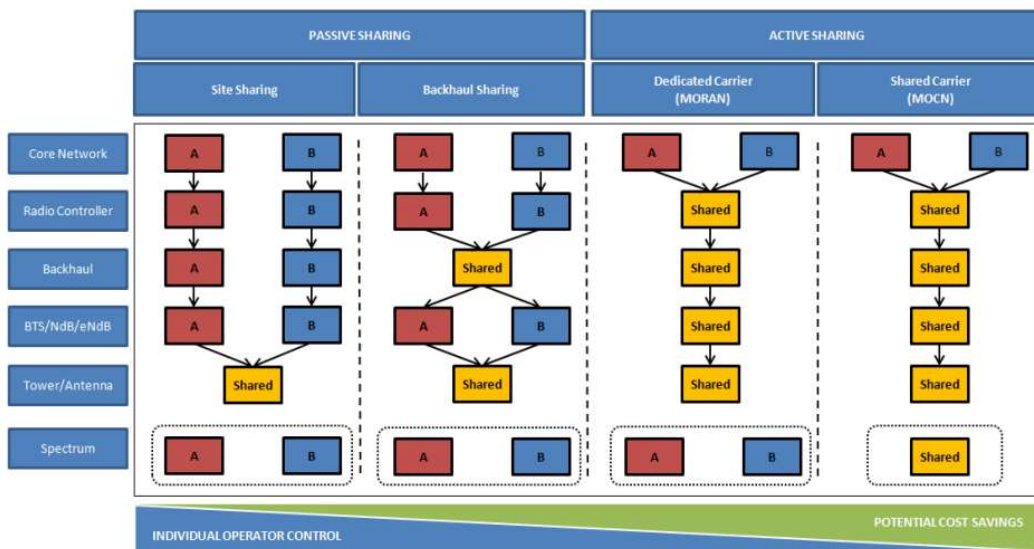**Figure 1: Mobile Network Infrastructure Sharing**

Figure 2: Mobile Network Infrastructure Sharing
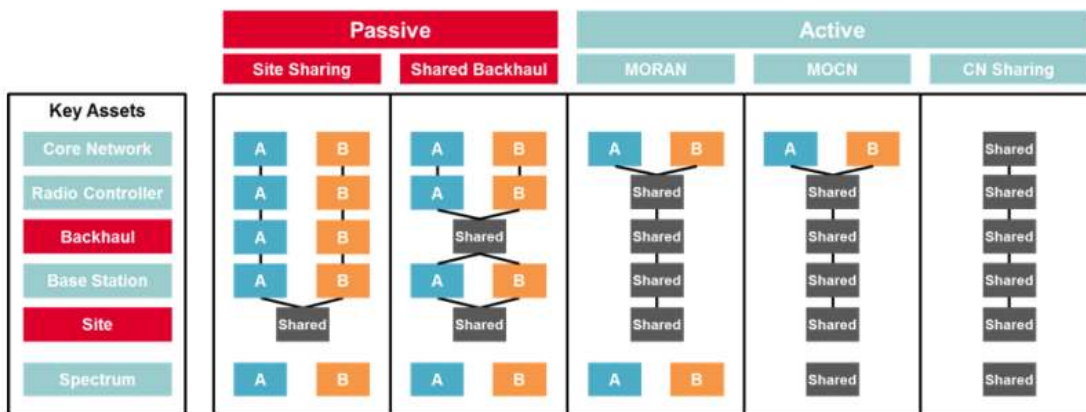Source: adopted from Nokia Siemens Networks NSN

Figure 3: Mobile Network Infrastructure Sharing
Source: GSMA "Infrastructure Sharing: An Overview", 2019

Passive sharing: Sharing of infrastructure such as sites civil infrastructure, towers, poles, masts, ducts, trays, shelters, equipment rooms, power system (including battery backup), Gen Set, HVAC, security, Distributed Antenna System (DAS), etc.

Antenna sharing: Passive sharing and include antenna line components including the antennas, feeders, amplifiers, combiners, etc.

Active sharing: Sharing of active infrastructure in a Radio Access Network (RAN) or fixed access network; see the following definitions for MORAN and MOCN for specific cases of active sharing.

1.4.2 MORAN (Multi-Operator Radio Access Network)

This is a type of active sharing in which Radio Access Network (RAN) nodes are also shared between operators i.e. BTS, Node-B, eNode-B and controllers (BSC, RNC). The Radio Access Network, which can comprise of 2G, 3G and / or 4G technology, is shared physically, however, each operator has its individual logical network. Each operator still has maximum independent control over its logical RAN, thus, ensuring quality and performing necessary optimization activities. The RAN nodes, namely BTS, Node-B, eNode-B, BSC & RNC are physically same but logically split between operators as per their traffic demands. The commercial arrangement and hardware/software dimensioning is based on the distribution of node capacity use. The independent logical RANs are connected to non-shared core networks. Since, spectrum is not shared; each operator uses the frequency in assigned frequency bands and broadcast their own Public Land Mobile Network (PLMN) identifiers, which means the end customers' experience is not affected.

1.4.3 MOCN (Multi-Operator Core Network)

MOCN is a major step up from MORAN and is essentially a MORAN plus the sharing or pooling of spectrum. Operator A can share its spectrum or assigned frequency along with Radio Access Network (BTS, Node-B, BSC, RNC) with Operator B or vice versa. Furthermore, if both operators have dedicated spectrums, they can pool the frequency bands / carriers in an optimized way and share them. With both MORAN and MOCN, the core networks are kept separate and individual operator owned. In terms of resource utilization, MOCN is the most efficient solution. For example, by pooling their spectrum bands, trunking gain is realized.

1.4.4 MVNO (Mobile Virtual Network Operator)

MVNO is an operator licensed to use the Radio Access Network (RAN) and spectrum of another operator, the MVNO does not hold a spectrum license and may or may not own a core network.

1.4.5 National Roaming

Users from one Cellular Mobile Operator (CMO) are able to access the network of a second CMO within the same country, usually limited to a geographical area. For the purpose of this document national roaming is excluded from this framework.

1.4.6 Transmission sharing

Sharing of the back-haul or backbone transmission, front-haul transport including equipment such as microwave, fiber optic cable, network terminating/edge equipment, routers, etc. Transmission sharing can be materialized in Radio Access Network (RAN) between BTS and BSC (2G network), Node-B and RNC (3G network) and eNode-B and core network (4G system). This approach is also sometimes considered part of passive network sharing. For access networks in

metropolitan cities, the "last mile" backhaul links are usually aggregated at transmission rings (for example there may be 8-10 fiber optic based rings in a city) and carried to core network sites. If capacity is available in these rings, these may be shared with other operators.

1.4.7 GWCN (Gateway Core Network) sharing

Gateway Core Network (GWCN) sharing also employs sharing of some core network functionalities i.e. MSC / VLR, SGSN (2G, 3G) and MME (4G). However, functionalities which are more instrumental in service differentiation and confidential information, pertaining to operators' business, is not put up for sharing. Therefore, North-bound nodes like subscriber databases (HLR), authentication (AuC), Business Support Systems (BSS) like billing, charging, CRM are retained by each operator in independent cores.

1.4.8 Fixed Network Infrastructure Sharing
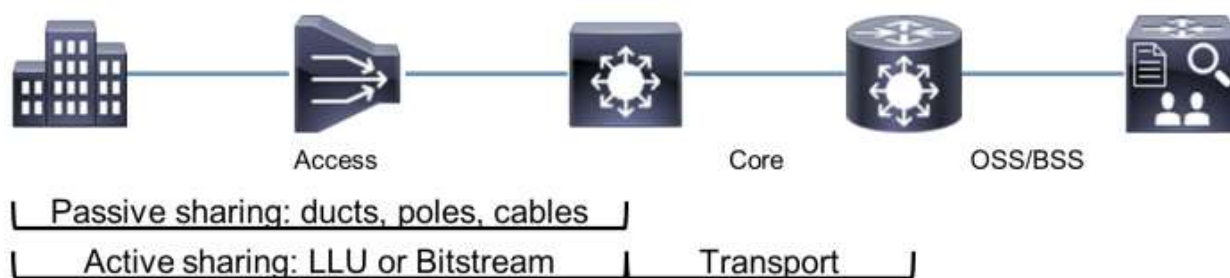
Figure 4: Fixed Network Infrastructure Sharing

Passive sharing: Sharing of passive infrastructure such as sites, towers, poles, ducts, trays, shelters, equipment rooms, power, HVAC, security, etc. In fixed network sharing the "local loop" cabling (copper, coax, fiber optic or HFC) is treated as part of the passive infrastructure.

LLU (Local Loop Unbundling): Use of a fixed access network operator's physical connection between a local exchange and the customer's premises to deliver services by another operator; partial unbundling is where the network operator retains the voice services and the second operator takes over the data services.

Bit stream access: Provision by one fixed access network operator to another of xDSL service between the customer's premises and a handover point.

OAN (Open-Access Network): OAN operator allows multiple telecommunication service providers to deliver services over its network; the OAN operator does not compete with the service providers.

1.5 Need for Telecom Infrastructure Sharing

There are several dimensions driving the need for Telecom Infrastructure Sharing amongst the telecom operators in Pakistan. These dimensions, covering major aspects, are briefly discussed as below:

- **Competition:** Services offered by telecom operators are in constant price war trying to beat competition by offering high value generous bundles at very low prices. Pakistan is a low ARPU market, with ARPU hovering in the range of PKR 200-220 per month.

- **Geography:** Coverage holes exist for operators due to high deployment costs and long ROI in remote / rural areas. There is a great need to maximize network coverage in rural areas. Capacity shortfall is persistent in dense population areas due to high traffic and high speed broadband services in urban areas. Due to spectrum limitations, fill-in sites are needed with associated CapEx and site acquisition challenges.
- **Technology:** Operators are investing heavily to build 4G networks and make their coverage close to ubiquitous 2G coverage. This effort requires large upfront CapEx which can be reduced through a shared 4G network rollout. The same shall be applicable for newer (e.g. 5G & beyond) technologies.
- **Operational:** Joint network deployment increases rollout capacity and results in shorter Time to Market (TTM) for new services & coverage. Site acquisitions are becoming increasingly difficult to acquire new suitable sites in urban areas, cantonments, strategic locations like airports, commercial buildings (malls, residential complexes), etc. Division of shared network operationally results in reduction of OpEx and faster rollout due to split / sharing of responsibilities as compared to stand alone network operations.
- **Financial:** Capital savings realized by sharing of responsibilities (CapEx & OpEx) can be used for strategic spectrum acquisitions & network expansions.
- **Health:** Limiting the Electro Magnetic Radiation (EMR) impact by reducing number of mobile BTS sites as a result of active sharing arrangement.
- **Operator Logic:** Trade-off full service differentiation against lower cost. The extent of trade-off depends on operator strategy.

1.6 Benefits of Telecom Infrastructure Sharing

The network sharing model acts as a jump-start for new services with larger coverage foot print and early TTM. The user uptake of new services is accelerated resulting in increased revenues & profit. Sharing operator enjoys flexibility in new rollout as well as capacity expansion on existing shared network by joint planning, sharing of initial CapEx and subsequent cost of operations (OpEx).

The operator benefits can be summarized as follows:

- **Financial Benefits:** Reduced OpEx from lower operations cost (rental, electricity & fuel bill, maintenance and backhaul). Reduced CapEx from lower deployment costs (civil works, network equipment). Potentially less assets on books of operator.
- **Operational Benefits:** Increase in capacity and coverage to enable operator for data traffic growth. Coverage in rural areas where there is no business case or has long time of Return On Investment (ROI). Access to licenses / spectrum, if licenses are few. Reduced carbon footprint (lesser CO_2 emissions) – shared equipment consuming less power.

According to BEREC's report on infrastructure sharing (2018), which highlighted figures provided by some European Regulators, sharing arrangements which are currently in place in various individual European markets, indicates some significant cost-savings given as below:

- Passive infra sharing 16% to 35% on CapEx and OpEx
- Active infra sharing (excl. spectrum) 33% to 35% CapEx, 25% to 33% OpEx

- Active infra sharing (incl. spectrum): 33% to 45% CapEx, 30% to 33% OpEx

The shared networks approach is beneficial to all the stakeholders, not only for operators, but also for telecom regulator, infrastructure vendors, suppliers and end customers.

From **regulatory perspective,** benefit comes in terms of better survival & growth of mobile network operators, heightened competition among operators to focus on service differentiation and enhancing customer experience, since part of underlying network is common. Operators need to compete on basis of new and innovative products and services which can catch attention of customers.

The **environmental sector** benefit comes in the form of reduced emissions (lesser carbon footprint) due to consolidation of sites as well as the aesthetic beauty of cities is improved.

Finally, the **customers benefit** comes in the form of rapid uptake of technology (4G, LTE Advanced, and 5G etc.) and provisioning of new & innovative services. Larger coverage footprint means more options available to end consumers as compared to an individual operator's limited capability.

1.7   Challenges and Limitations of Telecom Infrastructure Sharing

Cellular network sharing has got attention of majority of mobile network operators worldwide and many of them have already embraced passive infrastructure sharing for many decades now. To reap additional benefits of network sharing, operators need to step-up the network sharing arrangements like active sharing, joint venture to handle operations, etc. The initial discussions on network sharing are easy and promising but are very difficult and complex to setup and may fall short of anticipated benefits. The key to success is careful and meticulous planning based on extensive deliberations. Some key limitations, risks and challenges for network sharing are summarized below:

- **Risks:** Strategic lock-in, future merger / divestment becomes complex, high termination costs and asymmetric benefits
- **Limitations:** Loss of control & independence, competitive disadvantage, growth limitation and high assets write-off
- **Challenges:** Deal and integration complexity, complex governance, staff resistance, regulatory scrutiny and stringent approval processes

1.8   Telecom Infrastructure Sharing Business Models

The business objectives of licensees in a shared network consider the existing network footprint, market share and position of TSP in the competitive landscape, their wanted position in medium to long term (3-5 years) and its growth strategy. For example, does the operator want to be aggressive in increasing subscriber base or is it focused on improving the subscriber experience & quality of its services? It needs to quantify the extent of competitive loss due to network sharing with other operator and will depend on the type of sharing model as well as the geographic dimension of network implementation.

Does the operator want to weaken its market position by opening network sharing or would it opt for unilateral service by excluding these geographies from network sharing? If the market is mature

and saturated with high cellular tele density, both operators would be more focused on service differentiation and customer experience. They can outsource the planning, rollout, operations to a 3rd party (Managed Services Model) and focus on revenue growth via new products & increased Average Revenue per User (ARPU).

The business drivers are different for each operator due to a variety of diverse factors and parameters, for example, time of start of service, targeted market segment, brand strength, market share, network modernization level, geographic coverage and so on. Closely aligned with business drivers are the **objectives of sharing** for each operator which usually are CapEx savings, OpEx reduction, coverage extension, launch & rapid deployment of new services, shorter TTM, etc.

There can be many models depending upon how the two sharing operators treat settlements, human resources & assets and how far the regulatory framework allows. The operators may take a phased approach, for example, starting with the simplest model and moving to complex model offering better governance and more savings with time. There are three main approaches of infrastructure sharing governance discussed as below, which are being adopted and practiced across the globe with some variations:

1.8.1 Co-operation Approach:

This is the simplest model in which for the mutually developed Joint/Single Grid - Radio Access Network (JG-RAN or SG-RAN), each operator has its own set up to plan, build and operate the network. Asset ownership remains with respective operator. The parties will negotiate and enter into a co-operation agreement to set out the commercial and legal principles which will govern rollout and sharing of the network.

1.8.2 Asset Light Joint Venture (JV) Approach:

Operators setup an organization (a separate legal entity) to plan, build and operate but assets ownership remains with each operator nationwide (independent of assigned areas of operations to each operator). The passive assets belong to access network and can be further categorized into (a) tangible assets i.e. towers / masts on sites, civil works (shelter, equipment pads), Diesel Generator (DG) set and (b) intangible assets i.e. site lease, commercial electricity connection. The active assets are provided by each operator in its area of operations and cost sharing models are implemented.

A core team of staff will be transferred (or seconded) to the JV and will form a JV team, responsible for managing the network and for planning, design, deployment (rollout), operations and maintenance of the shared infrastructure nationwide for the agreed scope of sharing. By establishing Asset Light JV the parties agree to facilitate joint procurement decisions for their RAN infrastructure, in order to optimize the suppliers and network costs.

1.8.3 Asset Heavy Joint Venture (JV) Approach:

This type of JV usually is the next phase of Asset Light JV in which rights of ownership of all shared assets are transferred to the Asset Heavy JV (e.g. a Telecom Infrastructure Provider - TIP Licensee) and the JV provides services back to the parent companies. It is more complex, integrated and difficult to reverse and requires comprehensive regulatory approvals. Asset Heavy JV works like a NetCo.

A Tower Co (e.g. a Telecom Tower Provider - TTP Licensee) is an independent licensed company which owns passive assets in a region / country and leases out tower, site space and DC power (with battery backup) to multiple operators. A NetCo extends this concept to active equipment and leases out coverage & capacity. The NetCo can buy the existing active and passive assets of operators (for example consolidated 2G, 3G network) and / or build additional technological layers (new 4G rollout), expand capacity / coverage. NetCo is responsible for consolidation, transformation and modernization of existing networks with committed time plans and consolidation savings. A NetCo may or may not hold spectrum assets. For example, Malaysia DNB model (holds 5G spectrum & mobile infrastructure) but can only provide coverage & capacity to licensed mobile service providers

Note: In all above models, the TSP license obligations (Rollout, QoS, etc.) do not change hands. The TSP (CMO, LDI, LL, Integrated licensees) may enter into commercial agreement with, for example, TIP or TTP to ensure compliance to its license obligations.

2 Global Trends

2.1 Infrastructure Sharing Outlook

The scope of sharing opportunities ranges from network elements like ducts, poles, tower, and masts, to dark fiber (unused fiber-optic cable) and frequency spectrum. Telecom operators are employing various forms of infrastructure sharing, with different implications in terms of risk sharing, access, ownership, and funding. The most common of these is the sale and leaseback structure. Under this structure, mobile operators sell towers to an independent tower company (Tower Co). The towers are then leased back to the operator as well as other operators. The tower co is then responsible for the operation and maintenance of the tower. The Tower Co model is mature globally, and is gaining further traction across a range of emerging economies. Africa, South America, Myanmar and Indonesia are leading the way in the current environment, as operators and governments align their interests in utilizing and encouraging such models.

As per International Finance Corporation: IFC report "Accelerating Digital Connectivity Through Infrastructure Sharing", sharing in digital infrastructure remains limited and several emerging markets are lagging (Figure 3). At the global scale, an estimated 70 percent of countries reported mandated infrastructure sharing, and just 44 percent in the Asia-Pacific region, the lowest among regions worldwide. Sharing of mobile network elements, including towers and spectrum, is rising but at a slow pace. The report further said that during 2010-2017, only 10 active network sharing agreements were announced across the Middle East and Africa region. Countries including Algeria, Ethiopia, Senegal, Morocco, Zimbabwe, Bolivia, Philippines, the Lao People's Democratic Republic and Nepal have virtually no independent tower company. Fixed broadband network sharing, whereby incumbent operators provide access to their last-mile network to competitors, is virtually absent in most emerging markets. Beyond broadband infrastructure, data centers can also be shared. Most large companies with sensitive customer databanks, healthcare firms, telecoms companies, and government agencies, for example—can share building, connectivity, and power by housing their IT infrastructure with an independent data center operator. Likewise, medium and small businesses can take advantage of cloud-based services to store and process their digital data on remote IT infrastructure without incurring the costs of

installing and maintaining their own data centers. Data centers require high-quality connectivity and can also benefit from shared broadband infrastructure.
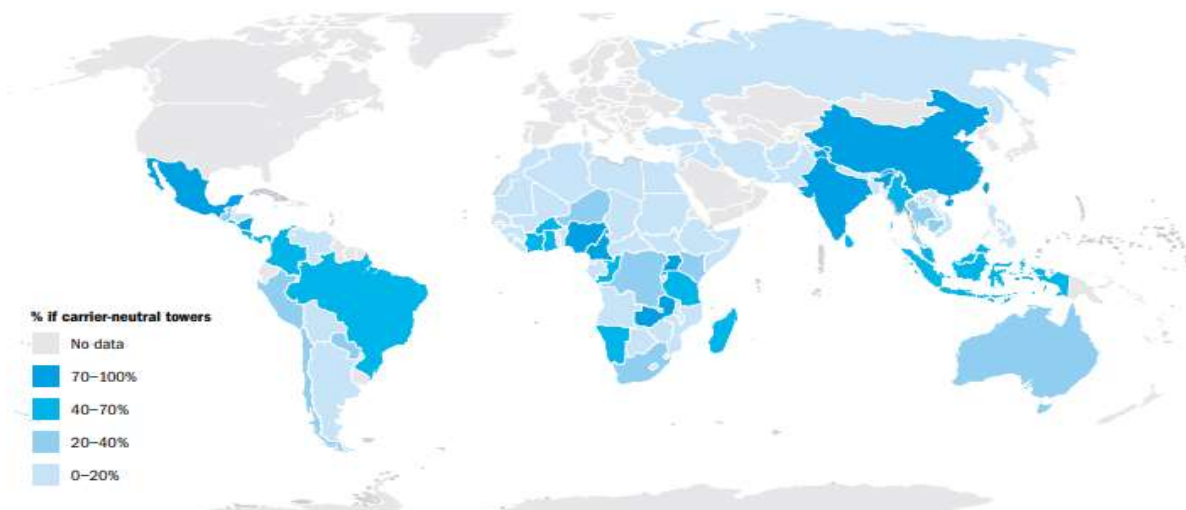
Figure 5: Tower sharing through independent companies in selected markets
Source: IFC report "Accelerating Digital Connectivity Through Infrastructure Sharing", 2020

2.2 Infrastructure Sharing Regulatory Regimes

2.2.1 India

Telecom Regulatory Authority of India (TRAI) issued a consultation paper on the "Review of Scope of Infrastructure Providers Category-I (IP-I) Registration" in August 2019. To discuss infrastructure sharing, TRAI invited stakeholders' comments and conducted an open house discussion. Based on stakeholders' written submissions, issues discussed in the open house and its own analysis, TRAI released its recommendations on enhancing the scope of IP-Is in March 2020.

TRAI recommended that the expanded scope of the IP-I registration should include to own, establish, maintain, and work all such infrastructure items, equipment, and systems which are required for establishing Wireline Access Network, Radio Access Network (RAN), and Transmission Links. The scope of the IP-I Registration include, but not limited to, Right of Way, Duct Space, Optical Fiber, Tower, Feeder cable, Antenna, Base Station, In Building Solution (IBS), Distributed Antenna System (DAS), etc. within any part of India.

TRAI stopped short of recommending spectrum sharing, and Active infrastructure sharing has been permitted amongst Telecom Service Providers (TSP) licensees only. Active sharing is limited to sharing of antennas, feeder cables, Node B, Radio Access Network (RAN) and transmission system, excluding sharing/trading of radio spectrum. IP-Is can also install all these active elements but only on behalf of TSPs.

However, sharing of active infrastructure among TSPs are facing challenges. As TSPs operating in the same geographical area and providing similar telecom services are competitors as well, some TSPs are not willing to share their resources with competitors, if it leads to a competitive disadvantage. Alternatively, TSPs are reportedly more comfortable in leasing telecom infrastructure from a non-competing entity such as an IP-I. This has dual benefits of enabling TSPs

to concentrate on their core competency of providing telecom services and allowing IP-Is to invest and create active as well as a passive telecom infrastructure.

2.2.2 Bangladesh

In Bangladesh, at present passive sharing is promoted through the 'Guidelines for Infrastructure Sharing'. These guidelines were issued in 2008 and amended in 2011. They only allow Passive infrastructure sharing for now. Active infrastructure sharing is not yet approved. Bangladesh Telecom Regulatory Authority (BTRC) is working to prepare the guideline for active sharing.

Permission on active sharing of spectrum is not being issued at the moment in order to verify the feasibility of sharing an active infrastructure first. Under this guideline of active sharing, mobile phone tower (BTS), equipment required to receive and deliver calls and for data transfer, such as Node B, Node E, antenna, feeder cable, RAN and microwave radio equipment, will be permitted to be shared.

BTRC has allowed towers and/or its infrastructure including its "Associate Services". The Scope of Associate Services include services / facilities related to telecom tower including In Building Systems (IBS) and Distributed Antenna Systems (DAS) as well as small cells (not limited to femtocell, picocell, metro cell or microcell), which includes either individually or in combination, physical site, building, associated equipment shelters, combiners, couplers. Splitters, attenuators, coaxial cables, connectors, electric power supply & battery backup, control equipment grounding / earthing, air conditioning, security arrangement, in-house wiring etc.

BTRC is considering to allow active sharing in case to case and phase by phase basis, redefine the definition of active infrastructure and scrutinizing all active components for all stakeholders. Consultation process with every layer from the value chain of the industry is still in process [from submarine cable / ITC operators to mobile operators]

2.2.3 European Union

Sharing is a feature in many European mobile markets and is often but not always concluded on a voluntary basis (i.e. "commercially driven"), and not as a result of regulatory intervention. In some of the countries where mobile infrastructure sharing is already a factor in the market or under active consideration, National Rental Affordability Scheme (NRAS) have adopted guidelines trying to achieve a reasonable balance between incentivizing investment and ensuring a fair and competitive market development through infrastructure-based competition.

There are also differences in terms of providing guidelines or rules with respect to infrastructure sharing with some countries providing detailed guidelines and some providing none at all.

There is some degree of passive infrastructure sharing, but the ways in which infrastructure sharing is managed or assessed differs from country to country. Differences arise from how information about infrastructure sharing agreements is treated and shared between the parties and the authorities and how disputes are dealt with. There are also differences in the approaches regarding the inclusion of rules in spectrum awards that may foster, mandate or prohibit network sharing.

In Denmark, an active sharing agreement on Radio Access Network (RAN) is seen to work fine, although the parties involved are in fierce competition. In France, also RAN sharing is efficient and resulted in better 2G / 3G coverage, as it was a prerequisite for authorization, as defined in the NRA sharing guidelines. Furthermore, Norway describes infrastructure sharing as a prerequisite for newcomers to enter the mobile retail market.

In Sweden, there were three Mobile Network Operators (MNOs) during the 1990s when GSM services were launched: Telia, Comvik and Europolitan. The last two later became Tele2 and Telenor respectively through mergers and acquisitions. Swedish government awarded four 3G licenses in year 2000. Tele2 and Europolitan (acquired by Telenor in 2006) had existing 2G operations and Orange and Three (Hi3G) were new entrants in the market. The regulatory conditions mandated coverage of 99.98% population by end 2003. The license terms and conditions also permitted 3G license holders to share up to 70% of RAN infrastructure to meet the coverage obligations.

Telia, which had 50% 2G market share, was not successful in winning a 3G license (Telia later merged with Finland based Sonera in 2002 and formed TeliaSonera). Tele2 and TeliaSonera decided to build a shared 3G network based on 3G license acquired by Tele2. They formed a Joint Venture (JV) named Svenska UMTS Nät AB "SUNAB" in 2001 which was responsible for planning and deployment of the joint 3G network.

Tele2 and Telenor already had a 3G network sharing arrangement with Telia and Three respectively, they announced plans to build a shared 4G network in April 2009 and established a JV "Net4Mobility" for LTE network deployment. One of the reasons was that though Telia had a partnership with Tele2, Telia had plans to build its standalone 4G network and went on to launch world's first 4G commercial network in 2010.

Despite the level of sharing among operators, the network sharing agreements are limited to joint planning, deployment, operations and procurement. Each operator competes for customers and mobile company front end functions like marketing, customer service, customer relationship management and billing are not shared and are thus controlled by each mobile network operator. Further, individual operators traffic data, network statistics and customer information are also not shared. All the network agreements have exit clauses to end the sharing arrangements, however, such terminations are difficult to execute and can be very costly for the partner operators. The SUNAB network sharing model worked well for participating operators Tele2 and Telia

Despite concerns that such extensive network sharing agreements might affect operators' ability to compete, however, evidence suggests on the contrary that there is healthy competition in the mobile market with subscribers getting the benefit in the shape of economic broadband and full coverage. Overall, network sharing acted as a catalyst to establish dense networks in Sweden enabling early uptake of Mobile Broadband (MBB) services due to improved coverage and wide population reach. It also reduced operators CapEx and OpEx costs resulting in improved profitability and more investment into networks by shareholders of companies.

With a view to the 5G rollout, it is expected that a much larger amount of sites will be needed. As the amount of sites increases, also the number of sharing agreements is expected to increase or at least the complexity of such agreements to become higher.

Operators are obliged to publish information on passive infrastructure sharing opportunities in advance, in a public forum, in nine countries (Belgium, Bulgaria, Croatia, Greece, Italy, Latvia, Liechtenstein, Montenegro and Serbia). In Norway, the obligation applies only to the SMP operator. The obligations can take the form of online publication, notifying the NRA / Ministry or publication via a third-party platform.

2.2.4 United Kingdom

For operators in UK which opt for network sharing, they typically share the sharing agreements terms and conditions with the Ofcom. Passive network sharing (site sharing) has been present in the United Kingdom since the early mobile networks in 1980s. Operators were reluctant to share sites where they had exclusive coverage to maintain the competitive advantage. However, in some areas where market was mature (low growth), operators shared sites on reciprocal basis.

In 2001, telecom sector regulator OfTel (Now OfCom) issued policy for 3G network sharing. However, some limitations were as follows:

- As per the Wireless Telegraphy (WT) Act, the sharing agreements cannot have transfer of frequency assets and spectrum between parties
- Infrastructure sharing encouragement by government should not be at the expense of anti-competitive practices

In Dec 2007, Hutchison (brand name "Three") and T-Mobile announced plan for 3G WCDMA network sharing which was the first network sharing deal in United Kingdom. Both operators' main drivers were to extend coverage, increase capacity & reduce expenditures with the active network sharing arrangement as both did not have fixed line network. A joint management company (50:50) was formed, Mobile Broadband Network Ltd "MBNL" setting a target to cover up to 90% of population with a single grid of BTS sites. The sharing arrangement **did not include spectrum pooling** and consisted of passive infrastructure and active sharing based on MORAN (base stations, transmission and RNC). The governance model was Asset Light JV. Some salient highlights of this sharing arrangement results are given below:

- Pre-consolidation total sites were 18,800 (Q1 -2010)
- Post-consolidation shared sites were 12,400 (Q4-2010)
- 5,500 sites were de-commissioned
- Coverage expansion in rural areas
- Improved indoor coverage in urban areas
- Savings of up to 30% (CapEx & OpEx) with active RAN sharing
- Additional OpEx savings of 15-20% via Managed Services (outsourcing of operations and maintenance)

In 2010, T-Mobile and Orange merged their networks and formed EE (Everything Everywhere) which became the largest mobile network operator in UK. As a result of merger, MBNL also took over assets of Orange and used its RAN infrastructure to further consolidate and improve the joint/ shared 3G network. The current network sharing agreement is between Three (3UK) and EE and presently covers the following under MBNL agreement:

- **Passive network sharing:** Three and EE share the passive infrastructure and existing sites at national level.
- The initial agreement was limited to 3G sites only, however, 4G was launched by both operators in 2013 and passive sharing was extended to 4G sites as well.
- **Active network sharing:** MORAN based solution (excluding spectrum sharing) on national level (3G only)
- Three and EE are not sharing active 4G RAN and co-operation is limited to passive infrastructure sharing.
- Backhaul transmission sharing for both 3G and 4G technologies.
- Core networks are separate for both Three and EE.
- Joint deployment for new sites and expansions. The cost for deployment and network operations is shared proportionally.
- Each operator carries out the deployments in its own region.

In 2012, an agreement was signed between Telefonica (O2) and Vodafone for network sharing resulting in establishment of a Joint Venture (JV) company known as Cornerstone Telecommunications Infrastructure Limited "CTIL". CTIL takes care of the infrastructure and existing sites of both operators at national level covering following areas:

- Owns and manages all cell sites belonging to both operators.
- Active RAN sharing model based on MORAN for all three technologies (2G, 3G and 4G) and **excludes spectrum sharing.**
- Cornerstone agreement stipulates that UK is divided into two geographic regions (East and West) excluding London city. East region is managed by O2 and West by Vodafone. Both operators own active equipment and are responsible for operations and maintenance in respective region. In East region, O2 is host operator and Vodafone is guest and vice versa in West region. For London, North and South geographic division is carried out.
- Since each operator is responsible geographically for half of UK area, so the cost for deployment and network operations is divided in proportion to the area managed by each operator.
- If any operator required a unilateral coverage, the requesting operator needed to provide the investment to other operator if the desired coverage fell into the other operator's managed area.
- Transmission (backhaul) is also shared. Traffic from a cluster of sites is aggregated and backhauled to core sites on joint transmission network.

3   Pakistan's Existing Telecom Infrastructure Sharing Regime

In Pakistan, "Mobile Cellular Policy 2004" encouraged passive infrastructure sharing and the license conditions were supportive of passive sharing. Passive Sharing is in practice, since 2010 after issuance of Standard Operating Procedure (SOP) by PTA and all Cellular Operators signed a MOU with PTA in 2010. The purpose of signing MOU was to increase the Tenancy Ratio to 1.5 by 2013. PTA would facilitate processing of Infrastructure Sharing cases to the extent possible within its jurisdiction. Each operator jointly with other industry players would put in efforts to make commercial arrangements and strive to take up its own and overall industry's tenancy ratio to a level of 1.5 within next 3 years provided that the arrangement is feasible for the operator(s). Tenancy ratio means number of operators sharing one tower. If a tower is used by more than one operator it would improve Tenancy Radio hence decreasing the number of towers installed across the country. If the Ratio increases to 1.5, it would mean that 50 out of every 100 towers are being shared by operators.

Other operators including Long Distance International (LDI) and Local Loop (LL) can also share and lease out their infrastructure through mutual commercial agreements. Some of the relevant sections in terms of sharing of infrastructure, network facilities and services, as provided in respective **license categories** are reproduced below for reference:

3.1   Cellular Mobile Operators

CMPAK NGMS issued in May 2014 & PMCL/Jazz issued in June 2017

Section 2.6.1: *"The Licensee is required to share its existing and future infrastructure with other NGMS Licensees as a matter of first priority. As a minimum, the infrastructure to be shared shall be: site sharing and mast sharing. Licensees may enter into commercial arrangement with each other for active sharing, however, such arrangement shall not take effect till such time the GoP policy is in place and subject to the formal approval and comprehensive framework of PTA. The precise commercial structure of any bilateral or multilateral infrastructure sharing is to be agreed between the Operators involved and then presented to PTA for approval. If no such agreement can be reached after negotiation in good faith by the Licensee and the Operator, then the parties will resolve the matter through mediation and/or arbitration process for an early resolution of the dispute."*

Section 2.8.1 *"The Licensee is free to negotiate a commercial arrangement with one or more Operators for national roaming. The Licensee may seek negotiations to enter into an agreement to purchase national roaming from another Operator so that the Licensee can provide national GSM, GPRS / EDGE and other services if any. If no such agreement can be reached after negotiation in good faith by the Licensee and the Operator, then the parties will resolve the matter through mediation and/or arbitration process for an early resolution of the dispute."*

PMCL/Jazz issued in Oct 2021, Ufone issued in Sep 2021

Section 2.6.1: *"The Licensee is required to share its existing and future infrastructure with other Operators, on request by any other Operator. As a minimum, the infrastructure to be shared shall be site sharing and mast sharing. Licensees may enter into commercial arrangements with each other for active sharing, however, such arrangement shall not take effect until such time as the relevant Guidelines are in place. If no such agreement can be reached after negotiation in good faith by the Licensee and the Operator, then the parties will resolve the matter as per applicable framework."*

Section 2.6.2: *"Licensees may enter into commercial arrangement with each other for Spectrum Sharing and Trading, however, such arrangement shall not take effect until it is approved by the Authority as per the framework developed under the applicable Policy."*

3.2 Long Distance International Operators

Section 2.3.1 *"If the Authority determines, pursuant to the Rules, that a Licensee possesses SMP in a relevant market, the Licensee shall comply with orders of the Authority that are intended to promote competition in respect of that relevant market or markets ancillary thereto, including without limitation orders to provide access to its ducts, poles, towers, space and collocation in switching centers or other similar facilities for use by other Operators."*

3.3 Local Loop Operators

Section 2.2.1 *"If the Authority determines, pursuant to the Rules, that a Licensee possesses SMP in a relevant market, the Licensee shall comply with orders of the Authority that are intended to promote competition in respect of that relevant market or markets ancillary thereto, including without limitation orders to:*

(a)   provide access to its ducts, poles, towers, space and co-location in switching centres or other similar facilities for use by other Operators, or

(b)   make available to its customers, indirect access (carrier selection) to Long Distance And International Public Voice Telephone Services provided by other Operators."

3.4 Telecom Infrastructure Provider and Telecom Tower Provider

Scope of TIP License – Section 1.1: *"**1.1.1** This License authorizes the licensee to establish and maintain the following **Telecom Infrastructure Facilities** in Pakistan to lease, rent out or sell **end to end links** to **Telecom Operators licensed by Authority** on mutually agreed terms strictly keeping in view their license conditions:*
        (a) Earth stations & Satellite Hub;
        (b) Optic fiber cables;
        (c) Radio communications links;

(d) *Submarine cable landing station within fifteen miles of costal area of Pakistan subject to approval by the Authority & clearance of Ministry of Defence and Ministry of Interior;*

(e) *Towers, poles, ducts and pits used in conjunction with other infrastructure facilities; and*

(f) *Such other Telecommunication infrastructure as the Authority may, by Regulation, require*

1.1.2 The licensee shall not provide any telecommunication/ broadcasting service."

Scope of TTP License – Section 1.1: *"1.1.1 This license authorizes a firm/ person to establish and maintain the following **Telecom Infrastructure Facilities** to lease, rent out or sell to **Telecom Operators licensed/ registered by the Authority** on mutually agreed terms strictly keeping in view their license/ license conditions:*

(a) *Telecommunication Towers,*

(b) *Such other Telecommunication infrastructure as the Authority may, by Regulation, require.*

1.1.2 Acquisition of Telecommunication Towers shall also be considered as their establishment.

1.1.3 The Licensee shall not provide any telecommunication service."

As per the rights and scope of TIP licensees, they can establish/install & maintain Telecom Infrastructure facilities in accordance with terms & conditions as per section 1.1 of the license scope. Such Telecom Infrastructure incudes both Active and Passive elements of telecom infrastructures. There may be Active components involved in Telecom Infrastructure facilities for example, establishing/installing a RAN (2G, 3G, 4G, and/or 5G, etc.), transmission/transport system which may involve a DWDM/SDH systems, Microwave Links, etc. or IP backbone components comprising of Layer2/Layer3 switching/router elements along with fiber back haul. Such Active components shall only be energized by authorized Telecom Service Provider (TSP) licensees i.e. licensed CMO, LDI/LL/WLL/Integrated. In summary, TIP acts as telecom infrastructure facility provider and "the licensee shall not provide any telecommunication/broadcasting service."

TTP licensees can only provide Passive Telecom infrastructure such as tower/mast, space, power system (including Battery backup), DG set, equipment grounding/earthing, HVAC, security etc. as per their license scope section 1.1 of the TTP license.

3.5 Regulation of Competition

3.5.1 Pakistan Telecommunication Re-Organization Act, 1996

Section 4(d) "The Authority shall promote the availability of a wide range of high quality, efficient, cost effective and competitive telecommunication services throughout Pakistan;"

Section 4(i) "The Authority shall regulate arrangements amongst telecommunication service providers of sharing their revenue derived from provision of telecommunication service;"

Section 4(m) "The Authority shall regulate competition in the telecommunication sector and protect consumer rights."

Section 6(e) "In exercising its functions and powers under this Act, the Authority shall ensure that fair competition in the telecommunication sector exists and is maintained;"

3.5.2 License conditions

NGMS License condition 2.2.1: "If the PTA determines that a Licensee possesses SMP in a relevant market, the Licensee shall comply with orders / decisions of the PTA that are intended to prohibit abuse of its SMP position through anti-competitive conduct or to promote competition in respect of that relevant market or markets ancillary thereto, including without limitation orders to produce a Reference Interconnection Offer (RIO) detailing the services and tariff they provide to other Operators."

NGMS License condition 8.2.1: "If the PTA determines that the Licensee possesses SMP in a relevant market, the PTA may regulate Licensee's prices, terms and conditions for those Licensed Services in the SMP market and any Licensed Services incidental thereto as determined by the PTA. The method of regulation shall be determined by the PTA and may include a requirement for prior approval of the PTA for any price, term or condition, or the maximum or minimum price, or both, for the Licensed Services."

LL license condition 2.2.1: "If the Authority determines, pursuant to the Rules, that a Licensee possesses SMP in a relevant market, the Licensee shall comply with orders of the Authority that are intended to promote competition in respect of that relevant market or markets ancillary thereto, including without limitation orders to: (a) provide access to its ducts, poles, towers, space and co-location in switching centers or other similar facilities for use by other Operators, or (b) make available to its customers, indirect access (carrier selection) to Long Distance And International Public Voice Telephone Services provided by other Operators."

LDI license condition 2.3.1: "If the Authority determines, pursuant to the Rules, that a Licensee possesses SMP in a relevant market, the Licensee shall comply with orders of the Authority that are intended to promote competition in respect of that relevant market or markets ancillary thereto, including without limitation orders to provide access to its ducts, poles, towers, space and collocation in switching centers or other similar facilities for use by other Operators."

4 Telecom Infrastructure Sharing Policy Framework & Consultation with Stakeholders

4.1 Telecom Policy 2015

Section 7.5 *of the telecom policy 2015 mandated PTA to develop the necessary regulatory framework/guidelines to encourage, facilitate and standardize infrastructure sharing in consultation with Federal Government (MoIT&T) and stakeholders. To this effect, infrastructure sharing framework is developed by PTA based on the principles of neutrality, non-discrimination and equal access. The infrastructure sharing (active and passive) framework/guidelines, has taken international best practices and feedback of all relevant and interested stakeholders into account, which provides a regulatory mechanism to facilitate Telecom Infrastructure Sharing for telecom industry of Pakistan. Relevant policy framework provisions are reproduced as below for ready reference.*

Section 7.5.1: *"To implement cost savings in the telecoms industry and to mitigate the delays incurred in procuring rights of way for new infrastructure, reducing environmental impact, sharing of passive and active infrastructure will be considered before granting a new right of way or space to build towers or for other infrastructure. All licensees may share infrastructure on mutually agreed commercial terms. All licensees with significant market power in a relevant market are obliged to share infrastructure on fair and non-discriminatory terms where practical. To this end, PTA will develop the necessary regulations or amendments to license conditions, codes of conduct and model contracts, subject to consultation with stakeholders, and arbitrate between licensees in disputes over infrastructure sharing. Infrastructure sharing obligations encompass a requirement to lease facilities on a fair and non-discriminatory basis to other licensed service providers. The facilities provided include space, electrical power, air conditioning, security, cable ducts, space on antenna and towers etc."*

Section 7.5.2: *"Infrastructure sharing (passive and active) will be provided based on the regulations and guidelines established by PTA, in consultation with Federal Government (MoIT&T), on the principles of neutrality, non-discrimination and equal access. The guidelines will take account of established international best practices."*

4.2 Consultation with stakeholders

4.2.1 Background

A consultation paper comprising of draft of regulatory framework for Telecom Infrastructure Sharing was floated for consultation with stakeholders in October 2020. Consultation paper was shared with all the licensees and also uploaded on PTA website to gather feedback from all relevant stakeholders. After receiving initial feedback from internal (different divisions of PTA) and external stakeholders (licensees), suggestions were analyzed and a revised version, incorporating appropriate/relevant suggestions, of draft framework was again consulted with external stakeholders (licensees). 2nd round of consultation sessions were held with industry in February / March 2022 and subsequently feedback from industry was received in April 2022.

Initially quite a few stakeholders took interest in the consultation process, despite having given the licensees/telecom operators several reminders, and PTA received inputs of only 06 (six) stakeholders i.e. PTML/Ufone (CMO), Jazz (CMO), Telenor (CMO), Edotco Pvt. Ltd (TTP), Engro Enfrashare Pvt. Ltd (TTP) and Awal Telecom Pvt. Ltd (TTP).

2nd / final round of industry consultation, for finalizing Telecom Infrastructure Sharing framework, was held in February and March, 2022, in which PTA invited all licensees (CMOs, Integrated, LDI, LL, TIP & TTP) in person to have an all-inclusive approach to gather feedback/inputs while finalizing the consultation process by organizing interactive sessions with the stakeholders. Stakeholders from industry who attended the consultation sessions and provided valuable feedback are listed as below:

i. *CMPAK (ZONG) – CMO (TSP Licensee)*
ii. *Telenor Pakistan – CMO (TSP Licensee)*
iii. *PTCL Group – Integrated licensee and also representing Ufone (PTML) CMO (TSP Licensee)*
iv. *Jazz (PMCL AKA Mobilink)- CMO (TSP Licensee)*
v. *Edotco Pvt. Ltd (TTP & TIP Licensee)*
vi. *IBECHS (TIP Licensee)*
vii. *Awal Telecom Pvt. Ltd (TTP Licensee)*
viii. *Associated Technologies Pvt. Ltd (TTP Licensee)*
ix. *e-Access Pvt. Ltd (TTP Licensee)*
x. *Multinet Pakistan Pvt. Ltd (LDI & LL - TSP licensee)*
xi. *Telecard Limited (LDI & LL - TSP licensee)*
xii. *National Telecommunication Corporation (NTC) (Integrated licensee meant to provide Telecom services to designated customers of Government of Pakistan) (TSP Licensee)*
xiii. *Wateen (LDI & LL - TSP licensee)*

In Pakistan, Telecom Infrastructure Provider & Telecom Tower Provider licensing regime was introduced in 2006 with objectives to implement cost savings in the telecoms industry and to mitigate the delays incurred in procuring rights of way for new infrastructure and reducing environmental impact. However, due to lack of understanding between active and passive telecom infrastructure sharing elements, which limited the growth of this sector and is the primary reason that Infrastructure sharing in Pakistan could not reach to its full potential. In the absence of any Framework / Guidelines, there was a need for clarification and elaboration of respective scopes of Telecom Infrastructure Provider & Telecom Tower Provider licensees and their sharing of telecom infrastructure boundaries. This lack of clarity in the current licensing regime further supported the need for development of the framework which systematically provide a comprehensive guideline for the growth of telecom sector.

4.3 Initial round of consultation

The consultation process was initiated by the Authority to encourage sharing of infrastructure and incentivize and facilitate high quality telecom infrastructure development in the country.

In October 2020, consultation paper on Infrastructure sharing, that included active and passive telecom infrastructure sharing draft framework, was circulated officially. In the response to the proposed draft framework only (06) six stakeholders, PTML/Ufone (CMO), Jazz (CMO), Telenor (CMO), Edotco Pvt. Ltd (TTP), Engro Enfrashare Pvt. Ltd (TTP) and Awal Telecom Pvt. Ltd (TTP) shared their remarks and suggestions. A collective summary of responses is given below:

1. All stakeholders agreed on infrastructure sharing in principle, as it limits duplication and gears up investment in telecom infrastructure in underserved areas, product innovation, and improved customer service. Infrastructure sharing 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.

2. All stakeholders were of the view that shared infrastructure can improve service affordability through numerous channels, including cost savings, balance sheet optimization, and competition. Infrastructure sharing spreads the cost of network expansion across multiple market participants and can generate significant capital expenditure (CAPEX) savings for connectivity service providers (telecom network operators), digital infrastructure providers (tower companies and wholesale fixed broadband companies), and IT infrastructure users in the wider economy (businesses in the case of data centers).

3. One of the stakeholders was of the view that "All licensees MUST be obliged to first review existing infrastructure for sharing purpose on mutually agreed commercial terms. Any deviation from existing infrastructure be approved from REGULATOR with plausible reasons."

4. One of the stakeholders was of the view that "All Licensees (TIP/TTP) be directed to optimally utilize existing civil infrastructure (Power Grids, Roads/Railways setups and street furniture). REGULATOR must finalize ROW formalities with major stake holders like NEPRA, NHA, Ministry of communications etc."

5. A stakeholder commented that "TTP acquires NOC along with that of One TSP, however subsequent TSP (tenant) request is again processed through PTA/FAB and board members which again takes its time. All TSPs and their frequency bands (equipment) are already approved and licensed through REGULATORS and equipment is imported under scrutiny. REGULATOR must provide equal and fair opportunity for its Licensees. TTP approved NOC of infrastructure should be bench marked and used as quick reference for subsequent TSP NOCs for speedy deployment."

6. Some stakeholders suggested that framework should include a number of key infrastructure sharing principles including (i) the basis of infrastructure sharing should be non-discriminatory and on commercial terms and (ii) minimum intervention and proportionality.

7. Some stakeholders suggested that "TSPs/TTP/TIP should be mandated to share the in-building infrastructure (IBS, OFC and other cables, ducts etc.) with other TSPs, in large public places like Airports, hotels, multiplexes, etc., commercial complexes and residential complexes."

8. A TTP player claimed that "Infrastructure providers allowed to import active equipment into Pakistan and deploy at the same conditions that apply to MNOs (i.e., without additional charges) to potentially invest in active infrastructure sharing".

9. Stakeholders supported streamlining of processes across the sector to make it easier to share infrastructure; e.g., via process simplification and digitization.

10. Some of the stakeholders pointed out issues regarding 'Right of Way' (RoW). Acquisition of ROW remains a major challenge for TSPs. It was suggested by stakeholders that there should not be any preferential treatment given to any licensee for the RoW, to exclude the possibility of monopoly, in any given geographic area.

11. One of the stakeholders stated "All infrastructure sharing agreements must be on a voluntary basis and entirely up to the concerned parties to decide. An independent, business friendly and market driven approach must be adopted for infrastructure sharing agreements in which all TSPs and TIPs/TTPs will be free to enter into agreements on mutually agreed commercial terms and without any external interventions. For the sake of seamless and quality network connectivity, infrastructure sharing must not be enforced or obligated in any way on any of the TSPs and TIPs/TTPs."

12. Some of the stakeholders argued that it is not possible to share infrastructure details publicly i.e. such information should not be shared publicly or should not be made available on PTA website, pertaining to the availability of active/passive infrastructure elements, physical space etc. as this information is highly dynamic, changes quite often and such information if shared publicly may be misused or result in losing the competitive advantage. Information pertaining to the shared sites along with geographical locations and sharing party details can be provided to PTA after the sharing agreements between the parties, with a surety that the provided business-sensitive information will be kept confidential and not shared with a third party under any circumstances. There should not be any interference in such mutually agreed commercial contracts as this will only discourage infrastructure sharing.

13. Some stakeholders argued that there is no need for PTA to establish unnecessary controls of review and approvals related to business case analysis, risk analysis and mitigation plans.

4.4 2nd round of consultation

In the 2nd round of consultation, which was held during the months of February and March, 2022. PTA invited all licensees (CMOs, Integrated, LDI, LL, TIP & TTP) in person in order to ensure an all-inclusive approach and to gather feedback/inputs of all licensees while finalizing the consultation process by organizing interactive sessions with the stakeholders. Thirteen (13) licensees/stakeholders from industry attended the consultation sessions and provided valuable feedback. A collective summary of responses is given below:

1. All stakeholders suggested that if both sharing parties (licensees) reach a fair mutual agreement then either party will intimate the agreement which is made between the parties to PTA. Authority agreed with this stance, in principle, of sharing the agreements i.e. prior intimation to PTA for new agreement is mandatory, however, sharing agreements already

in field must also be intimated by licensees and shared with PTA after formal issuance of this framework.

2. One major stakeholder stated that "It is encouraging to see that PTA intends to include active sharing in this framework. However, active sharing should not be limited to MORAN only but should also include MOCN. MOCN requires the same investment as MORAN but offers improved efficiency and a better return on investment by opening up possibilities of spectrum sharing and trading in specific areas. Also, MORAN without Microwave/backhaul sharing has limited range of utility for operators. Therefore, the guidelines should clearly include spectrum sharing/trading and MORAN/MOCN modalities". The Authority is of the view that backhaul spectrum sharing shall be subject to implementation of Administrative Incentive Pricing (AIP). However, spectrum sharing of backhaul links shall be covered under Spectrum Sharing Framework.

3. One of the stakeholders suggested that Telecom Infrastructure Provider Licenses (TIP) be allowed to own and operate bandwidth services for Telecom Service Providers (TSP). The key to ensuring a truly differentiated 4G and 5G services lies with the ability of the MNOs to have access to fiberized telecom sites. The Authority is of the view that TIP licensee can lease, rent out or sell its Telecom Infrastructure Facilities/Telecommunication system that include lit fiber and bandwidth to TSP licensee(s). As this approach will create synergy between TIP and TSP licensees in providing access to cost-effective shared infrastructures. The stakeholder further advocated that the provision of bandwidth services by TIP should not just be limited to fiber system and suggested PTA to adopt a more pragmatic and technology-agnostic approach by recognizing that TIP can also provide bandwidth services or Transmission-as-a-Service to its TSP customers using other technologies such as microwave and VSAT. The Authority is of the view that in case of Microwave TIP would need to be assigned backhaul frequencies. For any spectrum assignments from microwave or for backhaul purposes shall be subject to introduction and implementation of a pricing mechanism such as AIP Regime. TIP can lease out/sell VSAT telecom infrastructure facility to LL or LDI licensees subject to respective license geographical areas and applicable license conditions.

4. One stakeholder suggested that "Telecom Tower Provider and Telecom Infrastructure Provider License to be able to own and operate In-Building System (IBS) and small cells. By allowing TTP and TIP licensee to own, install, operate, lease and sell the capacity of IBS to Telecom Service Provider (TSP) at non-discriminatory terms and conditions is consistent with international best practices. The Authority agreed and elaborated the definition of Distributed Antenna System (DAS) / IBS, whose components include Antennas, Cabling(Co-axial, Fiber), Taps, Splitters, Multiplexer, Coupler, Attenuators, Combiners and associated power equipment (if any).

5. Dispute Resolution in sharing agreements was one of the main issue pointed out by most of the stakeholders. The Authority has considered this important aspect and has provided a mechanism to deal with Dispute Reporting & Resolution in the framework.

6. Some stakeholders suggested that the tower site NOCs which is/are already obtained by TTP/TIP/TSP should be used as a quick reference to process subsequent tower sites NOCs by TSPs when going for site sharing to speed up the whole process. This will facilitate Tower Cos/CMOs in acquiring different authority permissions. In order to expedite the process, for a site clearance that is to be shared which is already approved, the Authority has considered this suggestion and is working on simplifying the already established process/norm with relevant quarters, however, that would be taken as a separate work stream.

5 Telecom Infrastructure Sharing Framework

The scope of this document is to provide a regulatory mechanism for licensed operators to share Infrastructure that include Active as well as Passive Telecom Infrastructure facilities. For the purpose of this framework, <u>radio spectrum sharing</u>, <u>radio spectrum trading</u> or <u>leasing and infrastructure owned by utility service providers are out of the scope of this document</u>. Use of infrastructure owned by utility service providers and radio spectrum sharing, radio spectrum trading/leasing will be provided through separate regulatory framework(s), accordingly.

1. This framework is applicable to all licensees of PTA including Telecommunication Services Providers (TSP) and Telecom Infrastructure Providers (TIP/TTP).

2. **Active Infrastructure** means any electrical, electro-magnetic, electronic, optical or optio-electronic system for the emission, conveyance, switching or reception of any intelligence through "Telecommunication System" that may comprise of active components – energized network elements performing intelligent processing – embodied in mobile and fixed networks, core and access nodes, operational support system (OSS), business support system (BSS) and elements involved in management of transport network including fiber and radio access network elements, etc.

3. **Passive Infrastructure** means infrastructure such as tower/pole/mast, space & civil infrastructure, power system (including Battery backup), Gen set, DAS (including combiners, couplers, splitters, attenuators, co-axial cables, fiber optic, connectors, jumpers, etc.), equipment grounding/earthing, HVAC, security, etc. For the purpose of this document/Framework it excludes cable ducts/utility corridors owned by non-licensed telecom operators or other utility infrastructure owners.

4. TSP (CMO, Integrated, LL, LDI), TIP and TTP licensees which own (host) a telecom infrastructure, may share their active (subject to respective license scope) as well as passive infrastructure with other TSP, TIP and TTP licensees, in accordance with respective license conditions and as per the scope covered under respective commencement certificate issued by PTA, on mutually agreed commercial terms subject to prior intimation to PTA. Such intimation shall comprise of high-level details including but not limited to financial/commercial information, infrastructure sharing details and dispute resolution mechanism. Authorized TSP licensees include Cellular Mobile Operators (CMOs), Long Distance International (LDI), Local Loop (LL), Integrated Licensee or any other category of TSP duly authorized/licensed by the Authority, to provide telecom services, from time to time.

5. The Agreements, signed previously which are already in place, for Infrastructure sharing shall be informed / intimated by owner (host of such Infrastructure/ licensee(s)) to PTA within 60 (sixty) days of issuance of this framework, along with the sharing details as mention in Clause 4 above.

6. The Infrastructure Sharing Framework may include MORAN – Multiple Operator Radio Access Network sharing, using the available market transport technologies/solutions for

backhaul purpose. However, sharing of Microwave backhaul spectrum is not allowed under this framework and shall be dealt with under spectrum sharing framework.

7. TIP licensee can establish/install and maintain telecom infrastructure facilities in accordance with the terms and conditions of TIP license.

8. In a situation where Telecom Infrastructure Facility is provided by a TIP to a licensed operator, TSP licensees shall continue to ensure compliance to license obligations pertaining to service provisioning to end user, QoS requirements, roll out and environmental obligations, lawful intercept arrangements, monitoring, Web Monitoring System (WMS) and compliance to all applicable laws, agreements and/or amendment in respective licenses, if required. It is stated that such arrangement, i.e. provisioning of monitoring system, integration with WMS system and ensuring Lawful Intercept compliance, is a shared responsibility, therefore, necessary agreements/SLAs be submitted to the Authority as specified in Clause 4 of Section 5.

9. Similarly, infrastructure sharing arrangement between TSPs (CMO, LL, LDI, Integrated) licensees, both TSP licensees (parties) shall ensure compliance to respective licensed obligations pertaining to service provisioning to end users, QoS requirements, roll out and environmental obligations, lawful intercept arrangements, monitoring, Web Monitoring System (WMS) and compliance to all applicable laws.

10. Modification in respective licenses, where required, shall be undertaken in accordance with Section 22 of Pakistan Telecommunication Re-Organization Act, 1996.

11. There is a high demand of seamless and quality network connectivity inside large public places / commercial complexes / residential buildings etc. In such premises, CMOs may not have a business case to deploy and maintain their own In-building System (IBS), if a Telecom Infrastructure owned by a TSP or TIP is available, CMOs may enter into a sharing agreement with TSP / TIP on mutually agreed commercial basis.

12. TTP licensee shall be authorized for Distributed Antenna System (DAS) for IBS, whose components include Indoor Antennas, Jumpers, Cabling (Co-axial / Fiber), Connectors, Taps / Splitters, Multiplexer, Combiners, Couplers, Attenuators, grounding / earthing and associated power equipment (if any) and including such "Telecom Infrastructure Facility" as the Authority may require by regulation.
    a. The license may be amended / modified in accordance with Section 22 of the Pakistan Telecommunication Re-Organization Act, 1996 (Amended 2006).
    b. Following fee structure shall be applicable:

    - National: US $ 50,000/- (or its equivalent in Pakistan Rupees of the value prior to License Effective Date) for 15 Years
    - Provincial (Excluding Baluchistan): US $ 20,000/- (or its equivalent in Pakistan Rupees of the value prior to License Effective Date) for 15 Years
    - Baluchistan: US $ 5,000/- (or its equivalent in Pakistan Rupees of the value prior to License Effective Date) for 15 Years

Note: Fee(s) of the amended / modified license(s) shall be based on above mentioned schedule. Calculation of the fee(s) for the remaining period of respective license(s) shall be adjusted/reconciled on yearly basis and part thereof, considering already/previously paid Initial License Fee (ILF). Moreover, the Authority in accordance with mandate / powers given under the Act may review, determine and levy fee(s) and other charges as it may specify from time to time.

13. In order to promote fair competition in the sector, the Authority may evaluate competition related aspects and anti-competitive behavior of licensees, which shall be dealt in accordance with applicable legal framework available in Act, Rules, License conditions and any other applicable law/legal instrument introduced from time to time. Agreement or contract, which results in exclusive access or lessening of competition will not be allowed. Indulgence into such a practice, through either formal or informal arrangement, may be treated as violation of this framework.

14. National roaming is also considered to be an example of Active Infrastructure Sharing. However, national roaming is out of scope of this document / framework, PTA may issue a separate framework for infrastructure sharing through national roaming arrangement.

15. Interested sharing parties, including TSP and TIP/TTP licensees, shall maintain Telecom Infrastructure Sharing Database / Atlas with PTA. The required database information shall be determined by the Authority from time to time and shall include, but not limited to, available capacities of Active and Passive Telecom infrastructure elements (including VSATs and Satellite Hubs), physical space, site geographical locations, etc. PTA may share access of the mentioned database with FAB (which include information of satellite hubs, VSAT and telecom towers) for interference/mitigation resolution purpose.

16. The interested licensed parties shall make available, Code of Commercial Practices, Model Contracts and Reference Offers against Active and Passive Infrastructure. Such information shall be made available with PTA on request.

17. **Dispute Resolution**: Following directions of infrastructure sharing with respect to the settlement of disputes amongst licensees shall be complied:

   a) It is understood and agreed that the Parties shall carry out this Infrastructure Agreement in the spirit of mutual co-operation, arrangement and good faith and shall seek to resolve amicably any disputes arising between them.
   b) Without prejudice to the rights of either Party to suspend the provision of Infrastructure sharing arrangement, during any period of dispute, before or until resolution, a Party, without prior approval of the Authority, shall not disrupt Infrastructure sharing arrangements being provided to the other Party, or take any other actions, that might materially and adversely affect that Party's Infrastructure Sharing arrangements. Each Party shall continue to fulfil its obligations under this Agreement during the pendency of a dispute or any procedures.
   c) The procedures set out as under are without prejudice to any other rights and remedies that may be available in respect of any breach of any provisions of this Agreement including urgent interlocutory relief.

d) Any time limits or provisions contained herein may only be varied by agreement of the Parties.

e) Either Party (the "Disputing Party") may invoke the dispute procedure specified in this clause, and if it wishes so to do it shall serve written notice of the dispute ("Dispute") to the Nominated Representative of the other Party (the "Disputed Party"). The notice shall contain all relevant details including the nature and the extent of the Dispute.

f) Following notice under Clause 19(e) the Parties shall consult in good faith to try to resolve the Dispute involving the appropriate senior managers/ steering committee / governance committee, i.e. "Coordination Committee" (with an equal number of appropriate representatives from either Party) within fifteen (15) Business Days of serving the written notice of Dispute.

g) If the Coordination Committee is unable to resolve the Dispute in the timeframe as mentioned in 19(f); either Party may refer the Dispute to the Authority with prior notice of intention to the other Party, such Dispute to be resolved in accordance with Clause 19(h).

h) In the event of a reference to the Authority, both Parties shall compile a detailed dispute report, which shall include origin, nature, extent, issues and any proposals for resolution and make their respective reports available to the Authority and each other within 7 days of the referral.

i) The resolution of a Dispute referred to the Authority shall be conducted in accordance with the applicable provisions of the 'Dispute Resolution Regulations, 2022' and be subject to any final binding resolution imposed on the Parties by the Authority.

j) The Authority will decide whether the case is maintainable or otherwise (to dispose of) within 15 days of submission of report as specified in clause 19(h).

k) The Authority may invite sharing parties for hearing, request further information from Parties and issue determination/decision on the case.

l) If the licensee and the Authority fail to amicably resolve such difference or dispute, either party may make an application to the High Court or a Tribunal established by the Federal Government for the purpose and the High Court or as the case may be, the Tribunal shall exercise exclusive jurisdiction to adjudicate and settle all matters connected therewith and in exercise of such jurisdiction the High Court or the Tribunal as the case may be shall follow the procedure, as nearly as possible, as provided in the Code of Civil Procedure, 1908 (Act V of 1908).

18. Matters pertaining to calculation of annual license fees and allowable deductions, where applicable, on account of **inter-operator** costs and PTA/FAB mandated payments shall be dealt in accordance with the applicable provisions of the Act, Rules, Regulations, License terms & conditions and determinations issued by the Authority from time to time.

6 Acronyms

ADM	Add-Drop Multiplexer
AIP	Administrative Incentive Pricing
ARPU	Average Revenue Per User *(per month)*

AuC	Authentication Center
BEREC	Body of European Regulators for Electronic Communications
BSC	Base Station Controller
BSS	Business Support System
BTS	Base Transceiver Station
CAPEX / CapEx	Capital Expenditures
CMOs	Cellular Mobile Operators
CN	Core Network
CRM	Customer Relationship Management
DAS	Distributed Antenna System
DC	Data Center
DG Set	Diesel Generator Set
DISCO	Distribution Company *(Electricity)*
DWDM	Dense Wavelength Division Multiplexing
EMR	Electro Magnetic Radiation
FAB	Frequency Allocation Board
FPA	Facility Provisioning Agreement
GSM	Global System for Mobile communication (2G)
GWCN	Gateway Core Network
HFC	Hybrid Fiber Coaxial
HLR	Home Location Register
HVAC	Heating, Ventilation & Air Conditioning
HW	Hardware
IBS	In-Building System
ICT	Information and Communication Technology
ILF	Initial License Fee
IN	Intelligent Network
ISP	In Side Plant
JG-RAN	Joint Grid – Radio Access Network
JV	Joint Venture
KPIs	Key Performance Indicators
LDI	Long Distance and International
LL	Local Loop
LLU	Local Loop Unbundling
LTE	Long Term Evolution (4G)
MBB	Mobile Broadband
MME	Mobility Management Entity
MNO	Mobile Network Operator
MOCN	Multi-Operator Core Network
MORAN	Multi-Operator Radio Access Network
MoU	Memorandum of Understanding
MS	Mobile Station / Managed Services

MSC	Mobile Switching Center
MVNO	Mobile Virtual Network Operator
MW	Microwave
NGMS	Next Generation Mobile System
NR	New Radio (5G)
NRAS	National Rental Affordability Scheme
NTDC	National Transmission & Despatch Company
O&M	Operation & Maintenance
OAM	Operations, Administration and Maintenance
OAN	Open Access Network
OPEX / OpEx	Operating expenses
OSP	Out Side Plant
OSS	Operations Support System
PEMRA	Pakistan Electronic Media Regulatory Authority
PLMN	Public Land Mobile Network
QoS	Quality of Service
RAN	Radio Access Network
RF	Radio Frequency (Hz)
RMS	Remote Management System
RNC	Radio Network Controller
ROI	Return on Investment
ROW	Right of Way
SG-RAN	Single Grid – Radio Access Network
SGSN	Serving GPRS Support Node
SMP	Significant Market Player
SNGPL	Sui Northern Gas Pipelines Limited
SOP	Standard Operating Procedure
SSGC	Sui Southern Gas Company limited
SW	Software
TIP	Telecom Infrastructure Provider
TSP	Telecom Service Provider
TTM	Time To Market
TTP	Telecom Tower Provider
UMTS	Universal Mobile Telecommunication System (3G)
VAS	Value Add Services
VLR	Visitor Location Register
VSAT	Very Small Aperture Terminal
WAPDA	Water & Power Development Authority
WCDMA	Wideband Code Division Multiple Access (3G)
WLL	Wireless Local Loop
WMS	Web Monitoring System

xDSL	x Digital Subscriber Line

7 Important Definitions

The following important definitions are reproduced from Pakistan Telecommunication (Re-organization) Act, 1996, (consolidated version along with all amendments) for reference:

"Authority" means the Pakistan Telecommunication Authority established under section 3;

"Intelligence" means any speech, sound, data, signal, writing, image or video;

"License" means an authorization granted by the Authority for the establishment, operation or maintenance of any telecommunication system or provision of any telecommunication service;

"Licensee" means the grantee or holder of a license;

"Scarce resources" means radio frequency spectrum, right of way and numbering;

"Telecommunication equipment" means switches, equipment, wires, cables, apparatus, poles, structures, ducts, man-holes and other tangible property, software and data, other than terminal equipment, comprising any telecommunication system or used in connection with any telecommunication service;

"Terminal equipment" means any apparatus directly or indirectly connected to any network termination point and used for sending, processing or receiving intelligence;

"Telecommunication system" means any electrical, electro-magnetic, electronic, optical or optio-electronic system for the emission, conveyance, switching or reception of any intelligence within, or into, or from, Pakistan, whether or not that intelligence is subjected to rearrangement, computation or any other process in the course of operation of the system, and includes a cable transmission system, a cable television transmission system and terminal equipment;

"Telecommunication service" means a service consisting in the emission, conveyance, switching or reception of any intelligence within, or into, or from, Pakistan by any electrical, electro-magnetic, electronic, optical or optio-electronic system, whether or not the intelligence is subjected to rearrangement, computation or any other process in the course of the service;

8 References

1. ICT and Broadcasting Infrastructure Sharing Guidelines, International Telecommunications Union (ITU), 21 Feb 2016.
2. BEREC Report on Infrastructure Sharing, BoR (18) 116, 14 June, 2018
3. Infrastructure Sharing: An Overview by GSMA, 18 June, 2019
4. Accelerating Digital Connectivity Through Infrastructure Sharing, Davide Strusani and Georges V. Houngbonon, February 2020.
5. Policy paper, Review of the Access to Infrastructure Regulations - call for evidence, Published 12 June 2020