
Office of Utilities Regulation

Notice of Proposed Rule-Making

Infrastructure Sharing

2017 March 30



OFFICE OF UTILITIES REGULATION

**3rd Floor
PCJ Resource Centre
36 Trafalgar Road
Kingston 10
Jamaica
West Indies**

Abstract

The Telecommunications Act and the Office of Utilities Regulation Act establish as objectives for the Office of Utilities Regulation (“OUR/Office”), the encouragement of competition and the promotion and encouragement of the development of modern and efficient utility services respectively. The OUR intends to work towards these objectives by establishing a regulatory framework to govern infrastructure sharing arrangements in Jamaica.

Globally, governments are aware of the importance of broadband for their nations’ development. Infrastructure sharing, one of the main trends in broadband infrastructure deployment, has the potential to reduce costs in network deployments, expand coverage, reduce the rural-urban digital divide, and accelerate broadband take-up. Operators are also voluntarily engaging in infrastructure sharing as a means of reducing Capex and Opex, and they have adopted various sharing methodologies as they seek to optimize the costs of trenching and other related activities. However, in some jurisdictions like Jamaica, there is some reluctance on the part of the operators to engage in infrastructure sharing which necessitates regulatory intervention.

This Notice of Proposed Rulemaking (“NPRM”) covers various types of infrastructure sharing (passive and active) and it also includes a detailed discussion of the benefits and challenges associated with infrastructure sharing. The regulatory options employed globally as well the Jamaican experience with infrastructure sharing are also explored. The NPRM also outlines the proposed regulatory framework for infrastructure sharing.

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Consultation Process

Persons who wish to express opinions on this Notice of Proposed Rulemaking (“NPRM”) are invited to submit their comments in writing to the Office of Utilities Regulation (“OUR”) by post, delivery, facsimile or email addressed to:

**Office of Utilities Regulation
P.O. Box 593
36 Trafalgar Road
Kingston 10**

Attention: Infrastructure Sharing Consultation

**Fax: (876) 929-3635
Email: infrastructuresharing@our.org.jm**

Responses are requested by 2017 April 27

Responses which are not confidential pursuant to sections 7(6) and 7A of the Telecommunications Act will be posted to the OUR’s website (www.our.org.jm). Respondents are therefore requested where possible to supply their responses in electronic form to facilitate such postings.

COMMENTS ON RESPONSES

There will be a specific period for respondents to view other responses (non-confidential) and to make comments on them. The comments may take the form of either correcting a factual error or putting forward counter arguments. As in the case of the responses, comments which are not confidential, pursuant to the Telecommunications Act, will be posted to the OUR’s website.

Comments on responses are requested by 2017 May 11

Arrangement for viewing responses

This NPRM and the responses and comments received by the OUR will also be made available to the public through the OUR's Information Centre ("OURIC"). Persons who wish to view the NPRM, responses and comments should make an appointment by contacting:

Ms. Kishana Munroe
Co-ordinator OURIC/Information Officer
Telephone: (876) 968-6053
Fax: (876) 929-3635
Email: kmunroe@our.org.jm

Individuals with appointments should visit the OUR's offices at:

3rd Floor, PCJ Resource Centre,
36 Trafalgar Road,
Kingston 10

Photocopies of selected responses and comments may be provided on request at a price which reflects the cost to the OUR.

CONSULTATIVE TIMETABLE

The timetable for the consultation on this NPRM is summarized below:

<i>Event</i>	<i>Date</i>
Publish NPRM Document	By 2017 March 30
Responses to NPRM	By 2017 April 27
Comments on Responses	By 2017 May 11
Issue of OUR responses to Stakeholders' Feedback	By 2017 August 23
Submission of Drafting Instructions to Chief Parliamentary Counsel	By 2017 August 23

Glossary

“Act” means the Telecommunications Act as amended from time to time.

“Access” means to obtain the right to use or make use of telecommunications infrastructure belonging to or controlled by an Infrastructure Provider for the purpose of installing telecommunications equipment.

“Access Request” means a request made pursuant to Part 5 herein for access to the facilities of an Infrastructure Provider.

“Active infrastructure sharing” means the sharing of electronic (i.e. active) elements that are used in connection with a public network.

“Connected company” means (a) a holding company or subsidiary of a Licensee; (b) any company which a Licensee has control; (c) any company which a Licensee and persons connected with a Licensee together has control; and (d) any company which together with a Licensee constitute a group.

“Control” by a Licensee of an infrastructure, means the Licensee having the legal right either by virtue of an agreement with the owner or otherwise, to procure the full compliance by the owner of that infrastructure with these Rules, as if that owner were a licensee bound by these Rules.

“Infrastructure” means tangibles used in connection with a public network or intangibles facilitating the utilization of a public network.

“Infrastructure Provider” means any Licensee who owns or is in control of infrastructure amenable to sharing.

“Infrastructure Seeker” means any Licensee desirous of entering into an agreement with an Infrastructure Provider for the purpose of sharing infrastructure.

"Infrastructure Sharing" has the same meaning as set forth in section 29A(4) of the Act.

“Infrastructure Sharing Agreement” means a binding agreement between an Infrastructure Provider and Infrastructure Seeker permitting access by an Infrastructure Seeker to the infrastructure of an Infrastructure Provider.

"Intangibles" has the same meaning as in section 29A(4) of the Act.

“Licensee” has the same meaning as in the Act.

“OUR Act” means the Office of Utilities Regulation Act, as amended from time to time.

“Passive infrastructure sharing” means the sharing of non-electronic and civil engineering elements that are used or usable in connection with a public network.

“Rules” means the proposed Infrastructure Sharing Rules attached hereto as Annex A

"Tangibles" has the same meaning as in section 29A(4) of the Act.

"Working day" comprises the hours between 8:00 a.m. and 5:00 p.m. on a Monday, Tuesday, Wednesday, Thursday or Friday that is not a public holiday in Jamaica.

Abbreviations

BEREC	Body of European Regulators for Electronic Communications
BSC	Base Station Controller
BTS	Base Transceiver Station
FDC	Fully Distributed Cost
FTTH	Fibre to the Home
GSMA	Groupe Speciale Mobile Association
LLU	Local Loop Unbundling
LRIC	Long Run Incremental Cost
MGW	Mobile Gateway
MNOs	Mobile Network Operators
MSC	Mobile Switching Centre
MVNOs	Mobile Virtual Network Operators
QoS	Quality of Service
RAN	Radio Access Network
RNC	Radio Network Controller

Chapter 1: Introduction

1.1 Background

The Telecommunications Act (the “Act”) and the Office of Utilities Regulation Act (the “OUR Act”) under which the Office of Utilities Regulation (“OUR”) regulates telecommunications, have among their objectives the encouragement of competition and the promotion and encouragement of the development of modern and efficient utility services respectively. Section 29A of the Act empowers the OUR to make rules imposing on operators the obligation to share infrastructure.

While there is no universally adopted meaning of ‘infrastructure sharing’, the meaning used in this Notice of Proposed Rule Making (“NPRM”) is that which is found at Section 29A(4) of the Act. In that section, ‘infrastructure sharing’ is defined as *the provision to licensees of access to tangibles used in connection with a public network or intangibles facilitating the utilization of a public network*. Infrastructure sharing has been identified as a means by which developing countries and other emerging economies can extend and improve the quality of Internet access services, especially for those marginalized communities that still remain excluded from pervasive and affordable broadband. The benefits of infrastructure sharing are undeniable and the OUR believes that the creation of such rules will contribute to increased competition and will also promote the interests of all Jamaicans

In Jamaica, whereas the voice network is ubiquitous (penetration rate (fixed and mobile) of 124.28%), the availability of the data network is still mainly concentrated in urban areas (penetration rate (fixed and mobile) of 61%). Currently, there are two established mobile networks providers in Jamaica: Cable and Wireless Jamaica Limited (C&WJ) and Digicel (Jamaica) Limited (Digicel). Both licensees provide voice and data services. A third operator, Symbiote Investments Limited, received mobile carrier and service provider licences in early 2016 and started rolling out service towards the end of the year. Both C&WJ and Digicel have built out their own network infrastructure. In the case of fixed networks, there are three operators: C&WJ which provides both wired and wireless fixed services; Columbus Communications Jamaica Limited (CCJ) which provides fixed services; and Digicel which provides both wired and wireless fixed services. None of the three fixed networks are available on an island-wide basis. Whereas C&WJ and CCJ have been utilizing their own fibre for years, until recently, Digicel was fully dependent on leased fibre capacity but over the past two years, the company has begun rolling out its fibre network.

1.2 Purpose of this NPRM

The purpose of this NPRM is to provide a framework which will be the basis for drafting rules issued pursuant to section 29A of the Act for the provision of infrastructure sharing services. The achievement of Jamaica's development objectives depend on the availability and widespread use of high-speed Internet. A high quality digital infrastructure underpins virtually all sectors of a modern and innovative economy and is one of the flagship initiatives of Jamaica's Vision 2030 Strategy.¹ As stated in Policy Element 10.1 (Accelerate Access and Uptake of High Capacity Networks) of the ICT Policy², *"The ICT infrastructure is a strategic resource; the efficient deployment of high capacity networks and international connectivity are important to stimulate entrepreneurship and accelerate the provision of public and private e-services and m-banking and provide access to worldwide markets."* Policy Element 10.3 (Infrastructure Sharing) noted that *"There is need for greater sharing of essential infrastructure and facilities among Operators..."* and the corresponding policy strategy is the making of legislative provision to govern the optimal utilization of ICT infrastructure. While the telecommunications companies have undertaken significant investments in telecommunications infrastructure, it is evident that the efforts to stimulate broadband rollout need to be reinforced. One such effort would be to make the deployment of high-speed networks cheaper and easier. This can be facilitated by ensuring access to passive and active infrastructure that is suitable for broadband rollout, increased opportunities for cooperation in building and maintaining civil engineering works and streamlined permit granting procedures.

Infrastructure sharing is not an imperative only for policymakers. Globally, operators are also embracing the principle of sharing, as the traditional ownership model where individual network operators owned and/or operated all of the infrastructure required to provide services to their customers has been increasingly challenged. Rapid technology migration (particularly in the mobile segment), increasing capital expenditures and rigorous regulatory requirements have been cited as reasons for the change. These factors have pushed operators into adopting multiple strategies, aimed at substantially and sustainably reducing network costs. Further, network infrastructure sharing has emerged as a key strategy to achieve this objective.

Infrastructure sharing primarily occurs in three ways:

1. Where one or more operators use the resources of other operators;

¹<http://www.vision2030.gov.jm/National-Development-Plan>

² Government of Jamaica Information and Communications Technology (ICT) Policy dated March 2011 [http://www.japarliament.gov.jm/attachments/596_Information%20and%20Communications%20Technology%20\(ICT\)%20Policy.pdf](http://www.japarliament.gov.jm/attachments/596_Information%20and%20Communications%20Technology%20(ICT)%20Policy.pdf)

2. Where a group of operators agree to share ownership and/or use of the network infrastructure; and
3. Where an operator uses the infrastructure of non-telecommunications entities such as power lines and ducts.

The primary object of the Rules outlined herein is to establish a framework within which operators can negotiate infrastructure sharing arrangements which falls within the first two categories as indicated above. More specifically the objective of the proposed regulatory framework is to:

- (a) Ensure that the incidence of unnecessary duplication of infrastructure is minimized or completely avoided;
- (b) Protect the environment by reducing the proliferation of infrastructure and facilities installations;
- (c) Promote fair competition through equal access being granted to the installations and facilities of operators on mutually agreed terms;
- (d) Ensure that the economic advantages derivable from the sharing of infrastructure are harnessed for the overall benefit of all telecommunications stakeholders;
- (e) Minimize capital expenditure on supporting infrastructures and to free more funds for investment in core network equipment.

1.3 Basis of the NPRM

In seeking to formalise arrangements for infrastructure sharing within Jamaica, the OUR engaged the services of Pygma Consulting. The consultant analysed the infrastructure sharing arrangements that existed within Jamaica; examined the regulatory framework related to the deployment of ICT infrastructure; and consulted with stakeholders including agencies that play a critical role in the deployment of telecommunications involved in any proposed ICT related development in the country, such as the parish councils, National Environmental and Planning Agency (NEPA) and National Works Agency (NWA). The regulatory framework proposed in this NPRM is therefore informed by investigations undertaken by the OUR and consultations held with various stakeholders. More specifically, the framework is influenced by:

- discussions with government agencies, consumer organizations and Licensees;
- analysis of complaints to the OUR;
- responses to specific information requests from the OUR to Licensees; and
- review of the international comparisons.

1.4 Structure of this NPRM

The rest of this NPRM is organized as follows:

- ❖ Chapter 2 outlines the Legal Framework that underpins the implementation and enforcement of the Rules.
- ❖ Chapter 3 outlines the different modalities of infrastructure sharing.
- ❖ Chapter 4 examines the benefits and challenges/concerns associated with infrastructure sharing.
- ❖ Chapter 5 provides a summary of the possible regulatory treatment that can be accorded to infrastructure sharing.
- ❖ Chapter 6 presents the Jamaican experience with infrastructure sharing to date as well as outlines the OUR's proposed treatment of some of the elements required under section 29A of the Act.
- ❖ Annex A presents the proposed Rules.

Chapter 2: Legal Framework

2.1 General Provisions

The OUR was established under the OUR Act with power to regulate “prescribed utility services”. Section 2 and the First Schedule of the OUR Act defines “prescribed utility services” to include “*the provision of telecommunication services*”. The power and authority of the OUR to regulate the telecommunications sector is governed by the provisions of the Act and the OUR Act.

Generally, section 4(3) of the OUR Act in particular empowers the OUR to undertake such measures, as it considers necessary and desirable, to *inter alia*:

- (a) encourage competition in the provision of prescribed utility services;*
- (b) protect the interests of consumers in relation to the supply of a prescribed utility service;*
- ...
- (d) promote and encourage the development of modern and efficient utility services; ...”*

The Act also grants specific powers to the OUR to provide regulatory oversight on certain areas of focus in the provision of telecommunications services and facilities. Extracts of some of the relevant provisions of section 4 of the Act are set out below:

4 – (1) The Office shall regulate telecommunications in accordance with this Act and for that purpose the Office shall –

- (a) regulate specified services and facilities;*
- ...
- (d) promote the interests of customers, while having due regard to the interests of carriers and service providers;*
- ...
- (f) make available to the public, information concerning matters relating to the telecommunications industry;*
- (g) promote competition among carriers and service providers;*
- ...
- (3) In exercise of its functions under this Act, the Office may have regard to the following matters –*

- (a) the needs of the customers of the specified services;*

(b) *whether the specified services are provided efficiently and in a manner designed to –*

protect the health and well-being of users of the service and such members of the public as would normally be affected by its operation;

(ii) *protect and preserve the environment;*

(i) *afford economical and reliable service to its customers;*

(c) whether the specified services are likely to promote or inhibit competition.”

2.2 Power to Make Rules

Express provisions regarding the powers of the OUR to prescribe rules addressing infrastructure sharing are set out in section 29A of the Act which reads as follows:

“29A. (1) Subject to subsection (3) the Office may-

(a) impose an infrastructure sharing obligation on a licensee, where the Office considers it to be justified having regard to any of the following considerations –

(i) matters relating to public health or to the environment or town planning or other development considerations;

(ii) economic inefficiencies; or

(iii) physical or technical impracticability;

(b) determine the terms and conditions of any infrastructure sharing obligation pursuant to paragraph (a); and

(c) hear and determine complaints made by licensees and disputes in respect of charges and other terms and conditions of the infrastructure sharing arrangement.

(2) All infrastructure sharing arrangements made by the Office shall include the making of rules, after consultation with the Minister, for the apportionment of the costs of sharing infrastructure; and the rules shall be made in accordance with the principles set out in section 33.

(3) In determining whether to impose an infrastructure sharing obligation on a licensee, or in determining the terms and conditions of an infrastructure sharing obligation imposed under subsection (1), the Office shall consult with licensees, the relevant environmental and planning authorities and the Authority.

(4) In this section-

"infrastructure sharing" means the provision to licensees of access to tangibles used in connection with a public network or intangibles facilitating the utilization of a public network;

"intangibles" includes agreements, arrangements, leases, licences, franchises, rights of way, easements and other similar interests;

"tangibles" includes-

- a) lines, cables and wires;*
- b) equipment and apparatus;*
- c) towers, risers and masts;*
- d) conduits, tunnels and ducts;*
- e) manholes and other holes and pits;*
- f) poles and antennae;*
- g) huts and landing stations; and*
- h) land, building and other real property."*

2.3 Enforcement

The amendments to the Act set out in the Telecommunications (Amendment) Act, 2012 (2012 Amendment) expanded the listing of activities considered offences under the Act, and enhanced the enforcement actions that can be taken by the OUR against Licensees who are in breach of the Act. Consequently, under Section 63(3) of the Act, the OUR is empowered to, among other things take the following actions against a Licensee:

- issue cease and desist orders;
- mandate the payment of compensation to affected persons;
- require remedial steps to be taken;
- order the termination of agreements deemed to be in breach; and
- seek an injunction.

A fixed penalty scheme is also established under section 63B of the Act, pursuant to which Licensees in breach may opt to pay a fine in lieu of criminal court proceedings. The failure of a Licensee to comply with the Act or regulations thereunder are among the offences established

by the 2012 Amendments and to which the new enforcement and fixed penalty provisions are applicable.

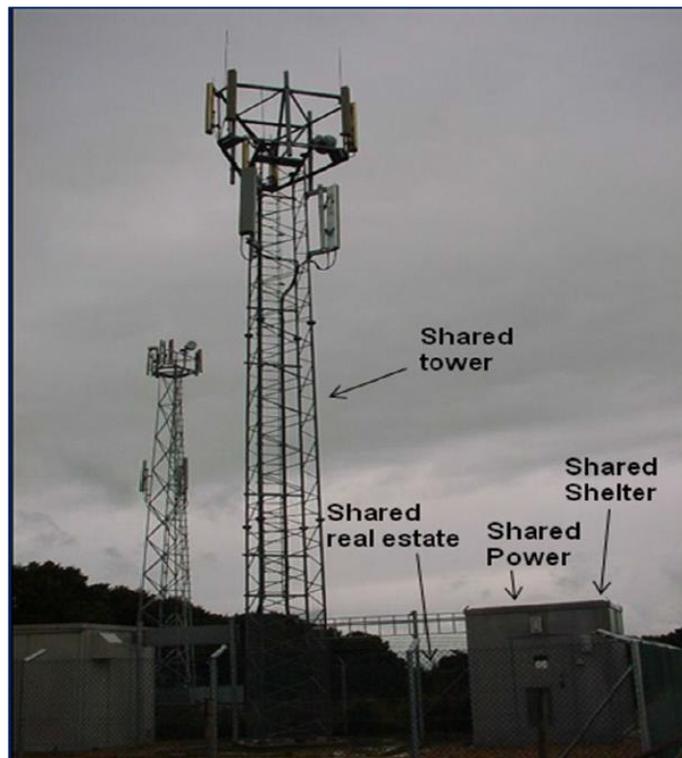
Chapter 3: Modalities of Infrastructure Sharing

3.1 Introduction

The modes of infrastructure sharing are often differentiated based on architectural dimension. Infrastructure sharing can be classified broadly in two categories: (i) Passive infrastructure sharing; and (ii) Active infrastructure sharing.

- i. Passive infrastructure sharing is defined as the sharing of non-electronic and civil engineering elements that are used or usable in connection with a public network such as rights of way or easements, sites, access to rooftops, buildings, towers, poles, ducts, shelters, equipment rooms, security, power, heating, ventilation and air conditioning (HVAC), dark fibre etc. as indicated in Figures 3-1 and 3-2 below. These elements can be shared by several operators while still maintaining distinct networks. The different types of passive sharing will be explored further on in this Chapter.

Figure 3-1: Examples of Passive infrastructure - Mobile Network



Source: ITU³

³ ITU (2008) Trends in Telecommunication Reform 2008
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Figure 3-2: Examples of Passive Infrastructure – Fibre Networks

Passive infrastructure sharing (non-electronic components)		Cables Ducts Splitters Shelters Generators Air-conditioning equipment Diesel electric generator Battery Electrical supply Technical premises Easements, ducts and pylons
		
Ducts	Trenches	

Source: ITU

- ii. Active infrastructure sharing is defined as the sharing of electronic (i.e. active) elements that are used in connection with a public network (see Figure 3-3 below). In a mobile network, active sharing includes the sharing of antenna, radio access network, cables, nodes, transmission equipment and can ultimately include sharing of spectrum that has been allocated to individual service providers. For a fixed network, active infrastructure sharing involves the sharing of the backbone and access network. Whereas one can easily distinguish between operator networks in the case of passive sharing, it is not as easy to discern the networks of individual operators in active sharing. The different types of active sharing will be explored further later in this Chapter.

Figure 3-3: Examples of Active Infrastructure

Active infrastructure sharing (Electronic components)	Optical network unit (ONU) Access node switches Management systems Broadband access remote server (BRAS) Coarse or dense division multiplexing Software (core network systems like billing)
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Source: ITU

3.2 Passive Infrastructure Sharing

The infrastructure involved in passive sharing varies according to the kind of telecommunications network. For instance, mobile networks require tower sites, while fixed networks require rights of way for deploying cables, either on poles or in ducts or in trenches. Other fixed facilities such as dark fibre and submarine cable landing stations are also key potential passive network elements which can be also be opened for sharing/collocation.

In light of the varied elements of the passive infrastructure, countries have adopted different sharing models based on their respective circumstances. For instance, some countries only promote sharing of masts and towers in the mobile network while others promote duct sharing or the sharing of only shelter or equipment rooms. Some of the different modes of passive sharing are discussed below.

3.2.1 Passive Sharing in the Mobile Network

3.2.1.1 *Site Sharing*

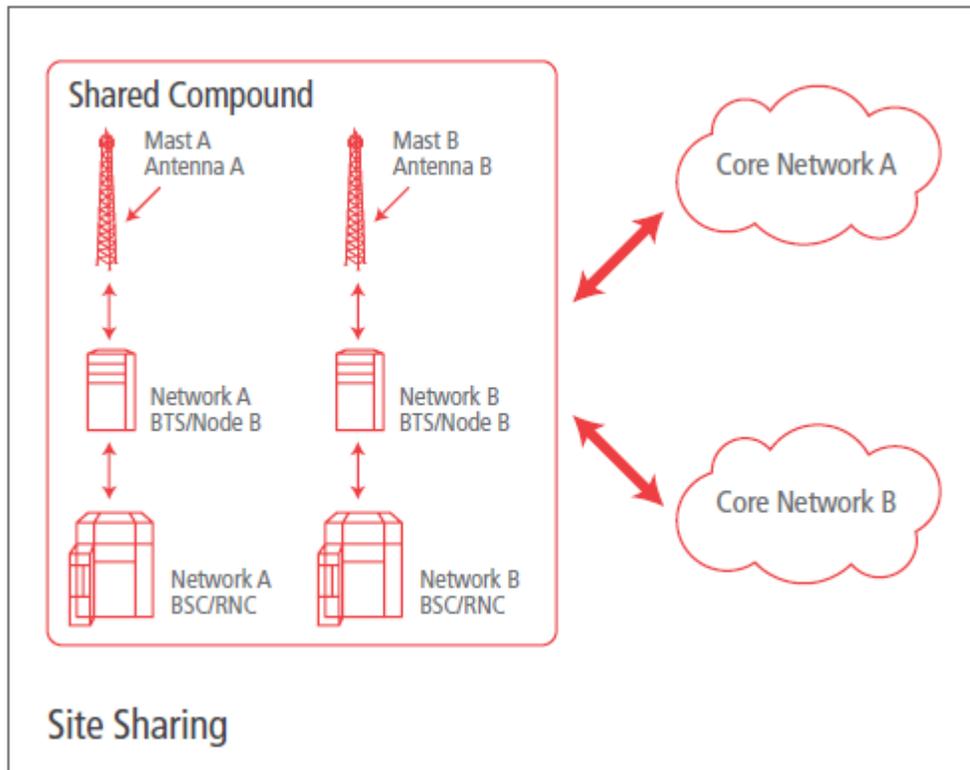
Site sharing is where the network equipment for separate operators are located at the same site (see Figure 3-4 below). Under site sharing arrangements, the operator that owns the site provides secured space for the equipment of its sharing partner. While sharing, the operators may however decide to share all site-related support infrastructure which includes power, water, security services, standby power supplies, and air conditioning. In some cases, the site may be jointly acquired by operators who share the rights of way. Site sharing involves minimal integration between operators' elements but will require some level of coordination on issues such as site access, power and equipment placement within the given area. Exit from site sharing arrangements between service providers is considered easier than other types of sharing and chances of dispute are less.

Site sharing is suitable for densely populated/congested or protected areas with limited availability of space, as well as for rural areas where operators need to provide coverage to sparsely populated areas. In Austria, for instance almost 50% of sites were shared at the end of 2009.⁴ Typical motivations for this mode of sharing include:

⁴ BEREC (2011) BEREC-RSPG report on infrastructure and spectrum sharing in mobile/wireless networks. http://berec.europa.eu/eng/document_register/subject_matter/berec/reports/224-berec-rspg-report-on-infrastructure-and-spectrum-sharing-in-mobilewireless-networks
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- i. The increasingly lengthy and complex process of obtaining government approvals for sites due to environmental and health-related lobbying and the demands of other operators seeking to satisfy their coverage and capacity needs;
- ii. The inability to identify the legal owners of targeted land can make site acquisition a complicated task and a bottleneck to faster roll-out;
- iii. The very significant Capex investment and site payback period for rural sites; and
- iv. Limited supply of potential sites in urban areas when compared to the demand.

Figure 3-4: Site Sharing with Two Operators



Source: GSMA⁵

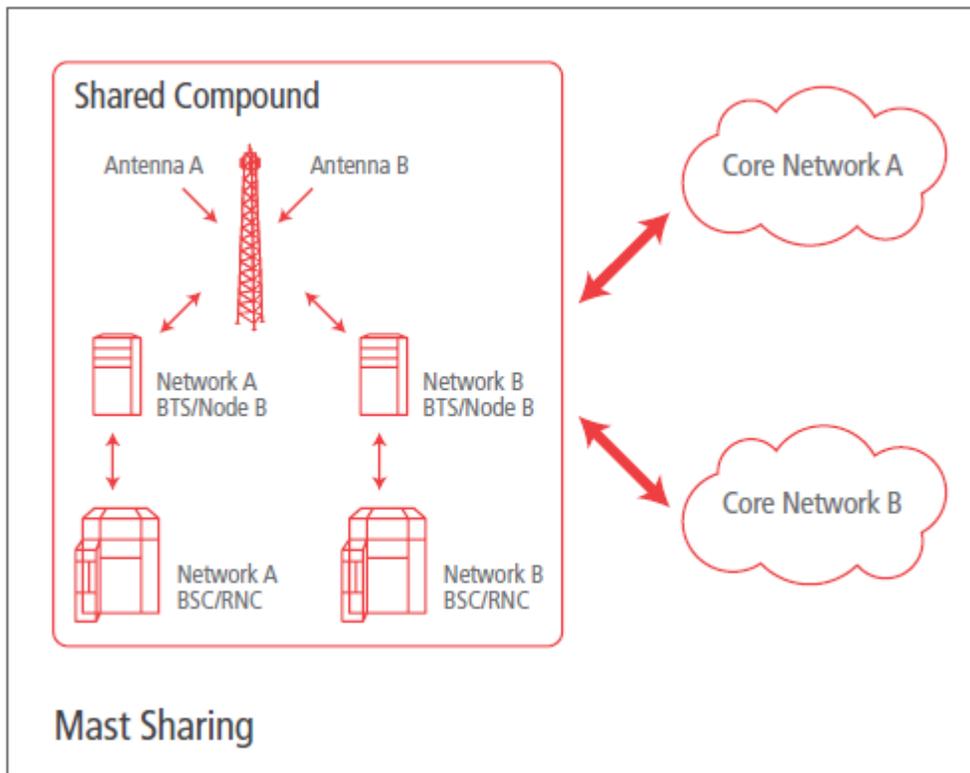
3.2.1.2 Mast/Tower Sharing

Mast Sharing is a little more complex than site sharing and involves more than one operator sharing the same mast, antenna frame or rooftop instead of constructing separate towers next

⁵ GSMA “Mobile Infrastructure Sharing” <http://www.gsma.com/publicpolicy/wp-content/uploads/2012/09/Mobile-Infrastructure-sharing.pdf>
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 2017/TEL/002/NPR.001

to each other (see Figure 3-5 below). As in the case of site sharing, operators may choose to share support equipment. While mast sharing is considered one of the simpler modes of infrastructure sharing, it still requires consideration of issues such as current load bearing capacity of the tower, azimuth angle of different service providers, tilt of the antennae, height of the antennae, before executing the agreement. While the construction of new towers built after the implementation of infrastructure sharing can be designed to take account of the ultimate load bearing capacity, some existing towers may not have been designed for sharing. In the case of roof-top antennae, the load bearing capacity of the building can also limit sharing possibilities.

Figure 3-5: Mast Sharing with Two Operators



Source: GSMA

Mast sharing is typically pursued by operators that are concerned with reducing costs related to site development and limiting their environmental footprint over a given region. By participating in mast sharing, operators are able to avoid all or some of the capital expenditure associated with the deployment of a new site.

As further noted by GSMA, the level of cost savings realized from mast sharing will vary based on the type of sharing arrangement entered into by an operator.

- i. *The use of existing sites and masts* - Mast sharing is done at a pre-existing site and hence there is no need for any Capex outlay. Operators seeking to share will only have to pay a monthly rental to the mast owner. In some jurisdictions, there are third party tower management companies who lease space on towers to different licensees. For example, in Tanzania, Helios Towers Africa leases tower space to service providers such as Airtel, Tigo (Millicom) and Vodacom.⁶ It is estimated that 40% of towers in Africa had been sold to third party management companies by 2014.⁷
- ii. *Existing site requiring new mast* – In this case the cost savings will be based on the existing infrastructure and pricing methodology. For instance, if the mast has to be replaced in order to accommodate multiple operators then the cost savings could be outweighed by the dismantling and reconstruction costs. The level of savings enjoyed by a particular operator will be based on the pricing methodology. Where the incremental cost approach is utilized, the new access seeker may be liable for all of the dismantling and reconstruction costs. These costs would have to be balanced against the costs of site acquisition and the cost of site-support infrastructure.
- iii. *New site and mast* – This type of sharing also allows for capex savings where the cost of erecting the mast is jointly shared by the operators involved.

3.2.2 Passive Sharing in the Fixed Network

3.2.2.1 Trench, Duct and Pole Sharing

Network deployments involving civil works are characterised by very high fixed costs. Trench digging, duct construction, and pole erection are major costs in laying down infrastructure. These activities also cause disruption and inconvenience to the public. Historically, in the telecommunications sector the incumbent operator had ready access to rights of way either because they were government entities, public corporations, or by virtue of their monopoly concession. With liberalization, the demand for access to public rights of way has increased considerably. However, it is not practical for all newcomers in the market to dig trenches, construct ducts and mount poles everywhere especially in crowded areas like cities and towns.

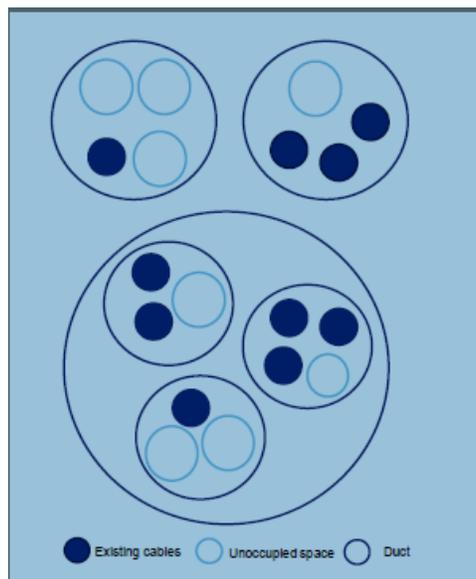
⁶ <https://www.httanzania.com/Customers.aspx>

⁷ Ssemboga, Anne Rita “Competition and Infrastructure Sharing” ITU Regional Workshop on “Competition in Telecommunications Market” Khartoum-Sudan, 24-26 May 2016

Moreover, some operators have pipes or ducts with sufficient space for the running cables of other operators.

Duct sharing is therefore beneficial particularly in cases where there are new entrants that are desirous of providing high-speed broadband services are allowed to use cable ducts of other telecommunications operators (see Figure 3-6 below). By encouraging duct sharing, the costs to new entrants should be significantly reduced and the rapid deployment of national network infrastructure and services can be facilitated. As a passive remedy, trench and duct access provide operators with the freedom to innovate in their network whilst avoiding the high civil costs associated with new build. The shared trench model has been being implemented in South Africa by MTN, Vodacom and Neotel and a consortium of operators in Tanzania, Airtel, Tigo and ZANTEL, have used a similar model to deploy metropolitan fibre optic networks. In Portugal, access to and the dimensioning of ducting are regulated by the regulator under the Electronic Communications Act. The regulator has mandated that providers of public telecommunications services must provide other stakeholders in the market with access to ducts.⁸ In France, the regulator mandated that France Telecom lease its ducts to other operators.⁹ In the UK, operators can receive a licence from BT to install a sub duct in its access duct within which the operators can install their cable.¹⁰

Figure 3-6: Duct Sharing



Source: Deloitte

The commercial models of duct sharing include:

⁸ EU Commission <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52013SC0073>

⁹ Ibid

¹⁰ <https://www.openreach.co.uk/orpg/home/products/ductandpolesharing/ductandpolesharing.do>

- a. Shared investment at the time of survey, procurement, dig and ducting. The project is managed as a joint venture.
- b. Expression of interest at the time of dig followed by duct purchase or lease.
- c. Duct purchase or lease after dig.
- d. Sharing of operational costs.

The operational models of duct sharing are:

- a. Joint or shared network planning
- b. Unrestricted access to manholes and equipment rooms
- c. Managed access to manholes and equipment rooms.

There are other sectors such as railway, television, electricity, and oil where ducts and poles are also deployed and can be shared with telecommunications operators. However, in many countries including Jamaica, the law does not provide for cross-sector infrastructure sharing. In some countries, the operators in the railway, electricity and oil sectors have found it beneficial to enter into voluntary sharing arrangements with telecommunications operators.¹¹ In other countries such as Brazil and Cameroon, regulatory bodies have established a framework to coordinate the sharing of infrastructure elements between television, electricity, railway and telecommunications operators.¹²

3.2.2.2 *Sharing of Dark Fibre*

Dark fibre is optical fibre infrastructure that is currently in place but is not being used, i.e. there is no equipment in place. Fibre networks are required to support all types of last mile access. Like the copper network before it, fibre deployments have the potential to become the next generation of bottleneck facilities. The alternative for an operator that cannot purchase dark fibre to the extent required, is to roll out its own fibre. However, the challenges of rolling out extensive fibre networks remain significant particularly in remote areas and developing countries. Rolling out fibre infrastructure entails considerable investments and a high level of financial risk, which some stakeholders have nevertheless been willing to bear in certain areas. Besides these financial and structural barriers, there are also regulatory barriers, such as difficulties in obtaining the necessary licences, permits and contracts.

¹¹ Deloitte LLP (2015). Unlocking Broadband for All.

<https://www.apc.org/en/system/files/Unlocking%20broadband%20for%20all%20Full%20report.pdf>

¹² Ibid

Where it is economically unviable to deploy fibre or where ducts cannot be accessed, sharing dark fibre has the capability to stimulate competition by lowering barriers to entry for competitors. In dark fibre sharing, operators lease access to fibre pairs/route from the infrastructure owner, on a monthly, annual or indefeasible rights of use (IRU) basis. Lateral and mid-span splices can be offered, giving operators greater flexibility. While the extent of the offering will vary, it will encompass one or more points of interconnection (nodes) in the infrastructure owner's network. In most cases, the offering will often not extend beyond what is known as an optical distribution frame (ODF), which is the destination station.¹³ In addition to the dark fibre, supplementary services such as space in a cabinet, space for a cabinet, and electric power may also be shared. Given that no active infrastructure is being shared, the entity purchasing the dark fibre must provide their own equipment to connect to the network capacity they have leased. Dark fibre sharing has been implemented by Dark Fibre Africa (DFA) in South Africa¹⁴ and Liquid Telecom¹⁵ in eastern, central and southern Africa.

3.2.2.3 *Submarine Cable Landing Stations (SCLS)*

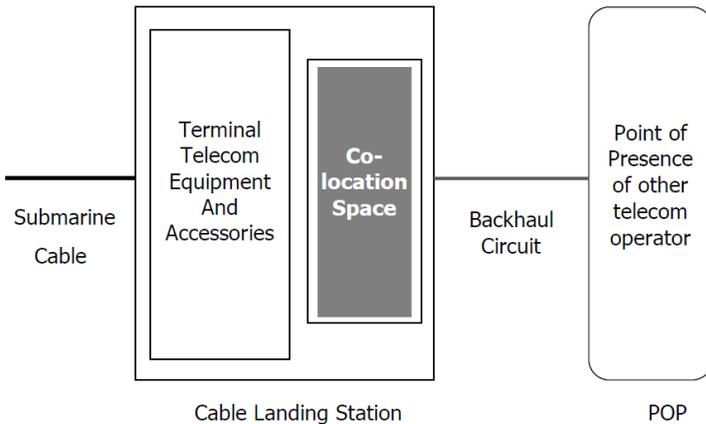
Submarine cable landing stations (SCLSs) are the boundary between the submarine cable side (the wet side) and the terrestrial network (the dry side). They are the point at which international submarine cables come onshore and terminate (see Figure 3-7 below). At these sites, wavelengths on the submarine cable fibres are terminated and each light path connected to transmission equipment on the dry side. Generally, the operator that owns the submarine cable also manages and controls the landing station. Where the cable is owned by a consortium, typically the consortium member in each country where it lands will manage the landing station in that country.

¹³ Bohman Jenny and Blomdahl Thorbjörn (2008) Dark fibre - market and state of competition. <https://www.pts.se/upload/Rapporter/Tele/2008/dark-fiber-2008-9-june-08.pdf>

¹⁴ DFA finances, builds, installs, manages, and maintains a world-class dark fibre network to transmit metro and long-haul telecommunications traffic in South Africa. <http://www.dfafrica.co.za/company/>

¹⁵ Liquid Telecom supplies fibre optic, satellite and international carrier services to Africa's largest mobile network operators, ISPs and businesses of all sizes. <https://www.liquidtelecom.com/about-us.html>

Figure 3-7: Diagram of a Submarine Cable Landing Station¹⁶



Even in instances where significant investment is not required, establishing SCLCs can be a time consuming process due to the various clearances which are required by maritime and civil authorities. This has led some countries to categorize SCLCs as bottleneck facilities to which access is required by other operators in order to backhaul capacity to their own exchange. In Mauritius, the government introduced the 'Open Access Policy' for submarine cable landing stations in 2010.¹⁷ Singapore's Infocomm Development Authority (IDA) also requires the Dominant Licensee to provide collocation at its SCLS.¹⁸ Collocation at SCLCs mean sharing facilities such as: building space, power, environment services, security and site maintenance.

3.3 Active Sharing

The issues involved in active infrastructure sharing are more complex than those involved with passive infrastructure sharing. The active elements of the network are very critical for the delivery of services therefore active sharing requires a thorough understanding of the issues involved and better coordination between the service providers. In the case of mobile networks, active infrastructure sharing may take the form of sharing of the radio access network (RAN), core network, backhaul transmission and spectrum sharing. While for the fixed network, active infrastructure sharing involves the sharing of the backbone and access network.

¹⁶ TRAI (2012). Consultation Paper on Access Facilitation Charges and Co-location Charges at Cable Landing Stations. http://www.trai.gov.in/writereaddata/consultationpaper/document/consultation_paper_on_cls.pdf

¹⁷Ministry of Information and Communication Technology. (2010) Open Access Policy for Undersea Cable Landing Stations in Mauritius <http://mtci.govmu.org/English/Documents/OpenAccessPolicy.pdf>

¹⁸Esselaar, Steve et al (2007) The Regulation of Undersea Cables and Landing Stations. http://www.cablesm.fr/2007_esselaar-et-al-2007-undersea-cables.pdf

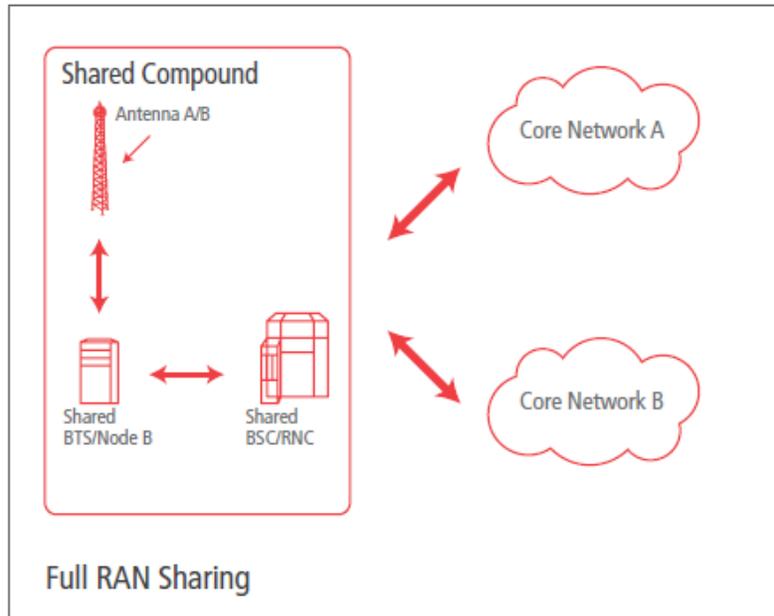
3.3.1 Active Sharing in the Mobile Network

3.3.1.1 *Sharing Radio Access Network (RAN)*

Radio Access Network (RAN) sharing is considered the simplest type of active infrastructure sharing in that the operators keep separate logical networks and the degree of operational coordination that is required is less than for other types of active sharing. In RAN sharing, a single RAN (i.e. the Node Bs and RNCs) serves two or more core networks belonging to different operators. In full RAN sharing, all the elements of the radio access network are shared and operators maintain full control of the spectrum allocated to them. Variances in the practice of RAN sharing are usually based on the ownership of the underlying infrastructure. The infrastructure may be owned by one of the sharing operators, jointly by the sharing parties or by a third-party infrastructure provider.

Sharing part, or all, of the RAN works to reduce Opex, especially in mature markets where there may be downward pressure on the average revenue per user (ARPU). In urban areas where there is a need for denser antenna location, RAN sharing reduces equipment and roll-out cost. It is also an appealing option in rural areas with low subscriber density coupled with lower ARPU. Where networks overlap, operators can utilize RAN sharing to increase their coverage area as they can redeploy existing equipment to previously unserved areas. An example of RAN sharing between two operators is shown in Figure 3-8 below:

Figure 3-8: RAN Sharing with Two Operators



Source: GSMA

In the United Kingdom (UK), Vodafone and Telefonica - O2 entered into a RAN sharing arrangement called “Cornerstone” in 2012 July.¹⁹ Under that arrangement, the UK is divided into two geographic zones outside of London (east and west) with separate treatment of north and south London. Each territory has a “host operator” who owns and operates the single RAN that is used by both parties. The parties cooperate under the terms of a managed network services agreement in each territory.

3.3.1.2 Backhaul Transmission Sharing

Backhaul transmission may be a bottleneck for the deployment of mobile networks in countries with low population density or in sparsely populated rural areas where traffic between the BTS and BSC is very low. With backhaul transmission sharing, operators utilize a common transmission link (radio frequency or optical fibre) to connect with their radio and core network nodes. This mode of sharing also enables operators to share the cost of deploying optical fibre, which may not be economically viable for a single operator. The infrastructure being shared could either be provided via a joint ownership by the sharing parties or via leasing arrangements with a third party. Backhaul transmission sharing can be used in combination with other modes

¹⁹ Organisation for Economic Co-operation and Development (OECD). (2015, January). Working Party on Communication Infrastructures and Services Policy: Wireless Market Structures and Network Sharing. Retrieved from [http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/ICCP/CISP\(2014\)2/FINAL&docLanguage=En](http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/ICCP/CISP(2014)2/FINAL&docLanguage=En)
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of infrastructure sharing. The cost savings will therefore depend on whether there is co-location of the network nodes of the two network operators.

3.3.1.3 *Core Network Sharing*

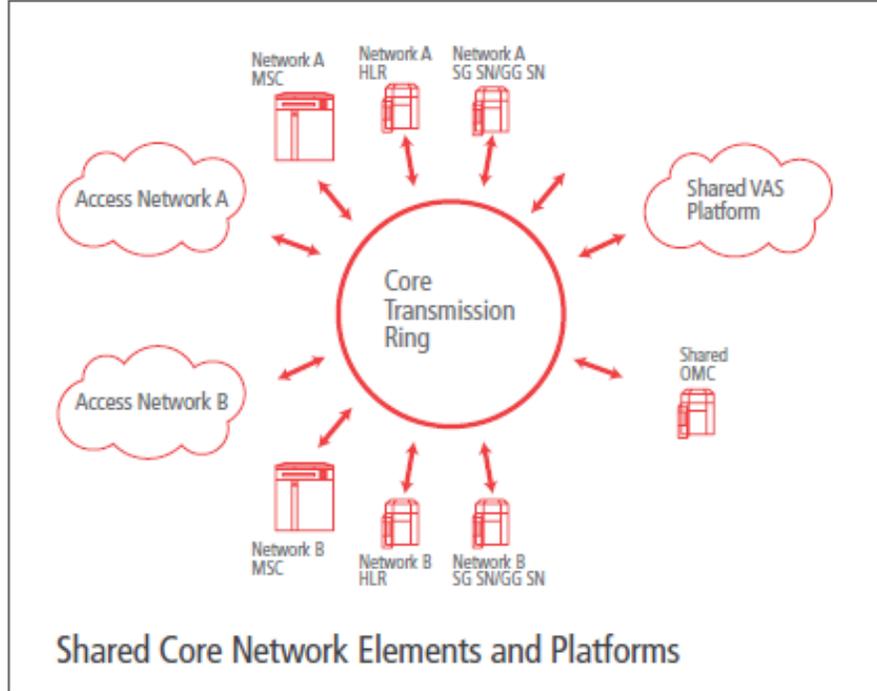
Core network sharing relates to the sharing of servers and the core network functionalities in addition to radio equipment. Given that the core network performs several functionalities that are essential for the performance of an operator's service and contains a large amount of confidential information concerning the operator's business, it may be complicated for competing operators to share a core network.²⁰ This type of sharing involves a deeper level of technical integration and hence requires greater technical planning and coordination between the participating operators. National roaming and MVNOs are other modes of sharing in which operators may use the same core network to provide their services.

The benefits of this mode of sharing while not as clearly defined, tend to be similar to that of RAN sharing but lower in value. Core network sharing allows multiple operators to divide some of the capital costs associated with the build-out of a network amongst themselves. However any savings expected from the sharing of the core network, will have to be weighed against the increased complexity caused by the presence of multiple operators, who may have differing capacity needs based on the growth of their subscriber base. GSMA noted that interviews with leading operators in developed markets, have revealed that they do not think that the cost savings to be realized from sharing of the core network are substantial.²¹ It is believed however, that mobile networks based on IP technology are more likely to benefit from core network sharing as they already have the relevant standards and elements required for sharing. An illustration of core network sharing between two operators is provided in Figure 3-9 below:

²⁰ Meddour, Djamal-Eddine et al. On the Role of Infrastructure sharing for Mobile Network Operators in Emerging Markets. <https://ai2-s2-pdfs.s3.amazonaws.com/6abf/f98c50d7e7088580660e2766890d471927e1.pdf>

²¹ Supra 4
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Figure 3-9: Core Network Sharing



Source: GSMA

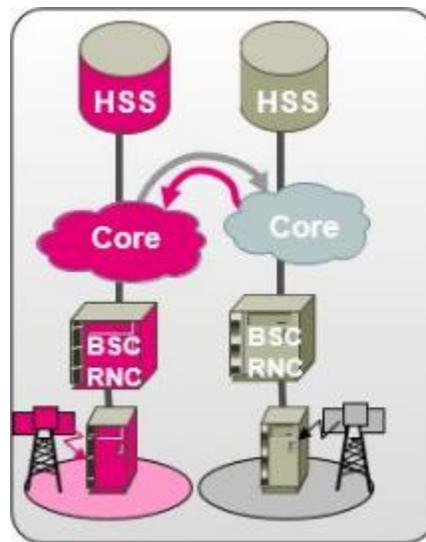
3.3.1.4 National Roaming

Network roaming allow subscribers of one mobile operator to utilize the network of another mobile operator. It is considered a form of infrastructure sharing although the traffic from one operator's subscribers is actually being carried and routed on the network of another operator. National roaming is a roaming arrangement between operators providing service within the same country. Under national roaming, operators agree to use each other's networks to provide services in geographic areas where they have no coverage. It may be an effective way for operators to extend their coverage into rural or remote areas, which are not commercially viable. In such cases, operators may roll-out competing networks in urban areas but allow each other to roam on their networks in rural areas.

By sharing infrastructure through national roaming, operators have the flexibility to either delay or forgo investment in network infrastructure within a given timeframe. National roaming can be attractive to new entrants who can use such arrangements to quickly expand coverage especially in instances where initial cash flows are limited. The potential for roaming has been enhanced by significant technological improvements in mobile handsets. Handsets are now capable of operating in multiple frequency bands which affords greater flexibility to roamers. The availability of multi-band handsets is particularly useful as the frequencies that are used by the subscriber's network may not be the same as those used by their roaming partners due to differences in the

spectrum assigned to each operator. The main drawback to national roaming is that there may be no quality of service differentiation between competing networks and the price competition may be limited depending on the wholesale roaming charge. An illustration of national roaming is shown in Figure 3-10 below:

Figure 3-10: National Roaming



Source: Dr Kim Kyllesbech Larsen²²

Different countries have taken different regulatory approaches in relation to national roaming. In France, new entrants have the right to purchase roaming from existing MNOs on commercially agreed terms. Iliad/Free Mobile has been roaming on Orange's nationwide network since 2012 while rolling out their own network which is expected to be completed in 2017.²³ Columbia has implemented regulations that will require MNOs that own infrastructure and spectrum to provide automatic national roaming services.²⁴ Mexico is actively pursuing the development of a national wholesale network for mobile services.²⁵

²² Larsen, Kim Kyllesbech Phd. (2012, June 15). Fundamentals of Mobile Network Sharing. Retrieved from <http://www.slideshare.net/KimKyllesbechLarsen/fundamentals-of-mobile-network-sharing>

²³ Mobile World Live. *French regulator to review Iliad-Orange roaming agreement – report*. <http://www.mobileworldlive.com/french-regulator-review-iliad-orange-roaming-agreement-report>

²⁴ MVNO Dynamics. (2013, March). Colombian telecommunications regulator CRC to implement national roaming regulations. Retrieved from <http://www.mvnodynamics.com/2013/03/08/colombian-telecommunications-regulator-crc-to-implement-national-roaming-regulations/>

²⁵ Organisation for Economic Co-operation and Development (OECD). (2015). Working Party on Communication Infrastructures and Services Policy: Wireless Market Structures and Network Sharing. Infrastructure Sharing Notice of Proposed Rule-Making 2017/TEL/002/NPR.001

3.3.1.5 *Spectrum Sharing*

Most of the spectrum used in a jurisdiction has been allocated to a dedicated single user. This makes it easier to monitor/manage interference between users, thus allowing high power operation and wide area coverage to be achieved. It also provides operators with certainty of spectrum access which is required in order to secure investment in wireless infrastructure. Spectrum sharing is the simultaneous usage of a specific radio frequency band in a specific geographical area by a number of independent entities. Spectrum sharing matters because communications spectrum is a scarce resource, and demand for this spectrum is growing very fast, both because of the expected exponential increase in new Internet users and because new Internet-enabled devices and apps consume vastly more bandwidth. In some countries for e.g. Jamaica, the relevant legislation(s) do not allow spectrum sharing based on the temporary lease of frequencies.

A review by BEREC revealed that there were no specific spectrum sharing agreements within the EU (based on the temporary lease of frequencies between operators) and that Net4Mobility (the joint venture between Tele2 and Telenor) was the closest arrangement to spectrum sharing in the Union.²⁶ Under the Net4Mobility arrangement the two operators agreed to build an Long Term Evolution (LTE) network and to pool the operators' spectrum holdings in the 900MHz and 2.6GHz bands. Such an arrangement is especially beneficial for LTE, which operates most effectively in wide bandwidths. BEREC also noted that most EU Member States did not have any provisions to address spectrum sharing. In 2015, the Indian government issued recommendations for spectrum sharing between mobile operators.²⁷ One of the reasons given for the decision, is that with as many as twelve MNOs per region and stringent power requirements, spectrum fragmentation is very significant in many areas in India. Spectrum sharing would therefore allow operators in India to provide better coverage and better quality of service. Several restrictions regarding how the spectrum can be shared have been implemented in order to keep competition in the market.

3.3.1.6 *Mobile Virtual Network Operators (MVNOs)*

Mobile Virtual Network Operators (MVNOs) is a special case of infrastructure sharing. MVNOs are not allocated spectrum nor do they manage their own radio access networks. They therefore rely on the presence of mobile networks in order to provide their services²⁸. Mobile network operators (MNOs) also benefit from the existence of MVNOs in that the former can sell spare

²⁶ Ibid

²⁷ <https://www.brookings.edu/blog/techtank/2015/08/18/spectrum-sharing-in-india-confident-baby-steps/>

²⁸ Meddour, Djamel-Eddine et al. On the Role of Infrastructure sharing for Mobile Network Operators in Emerging Markets. <https://ai2-s2-pdfs.s3.amazonaws.com/6abf/f98c50d7e7088580660e2766890d471927e1.pdf>

capacity to the latter. The presence of MVNOs creates the possibility for more affordable services to emerge through unique MVNO offerings.²⁹ OECD noted that as at August 2014, MVNOs were present in all OECD countries, except Greece.³⁰

Table 3-1: Number of MNOs and associated MVNOS in Select OECD Countries³¹

<i>Country</i>	<i>Number of MNOs</i>	<i>Status of MVNO entry</i>
<i>Canada</i>	<i>26 (3 national)</i>	<i>11 MVNOs</i>
<i>Japan</i>	<i>4</i>	<i>354 MVNOs (with approx. 7.5% market share)</i>
<i>United Kingdom</i>	<i>4</i>	<i>33 MVNOs</i>
<i>Israel</i>	<i>5</i>	<i>6 MVNOs</i>
<i>Spain</i>	<i>4</i>	<i>29 MVNOs with market shares of 9.6%(voice) or 8.7%(data)</i>
<i>Germany</i>	<i>4 (going to 3)</i>	<i>152 MVNOs</i>

MVNOs are classified based on the degree of sharing that exists between the host MNO and the MVNO (see Figure 3-11 below). In its simplest form, an MVNO does not own any infrastructure except for a subscriber database. It buys minutes in bulk from an MNO and uses its own brand to resell those minutes to subscribers. The different types of MVNOs are³²:

- i. *Reseller* – This MVNO buys bulk airtime from the mobile operator for resale to target segments. Where resellers can offer their own branded package as distinct from their host, they are referred to as an enhanced reseller.

²⁹Supra 26

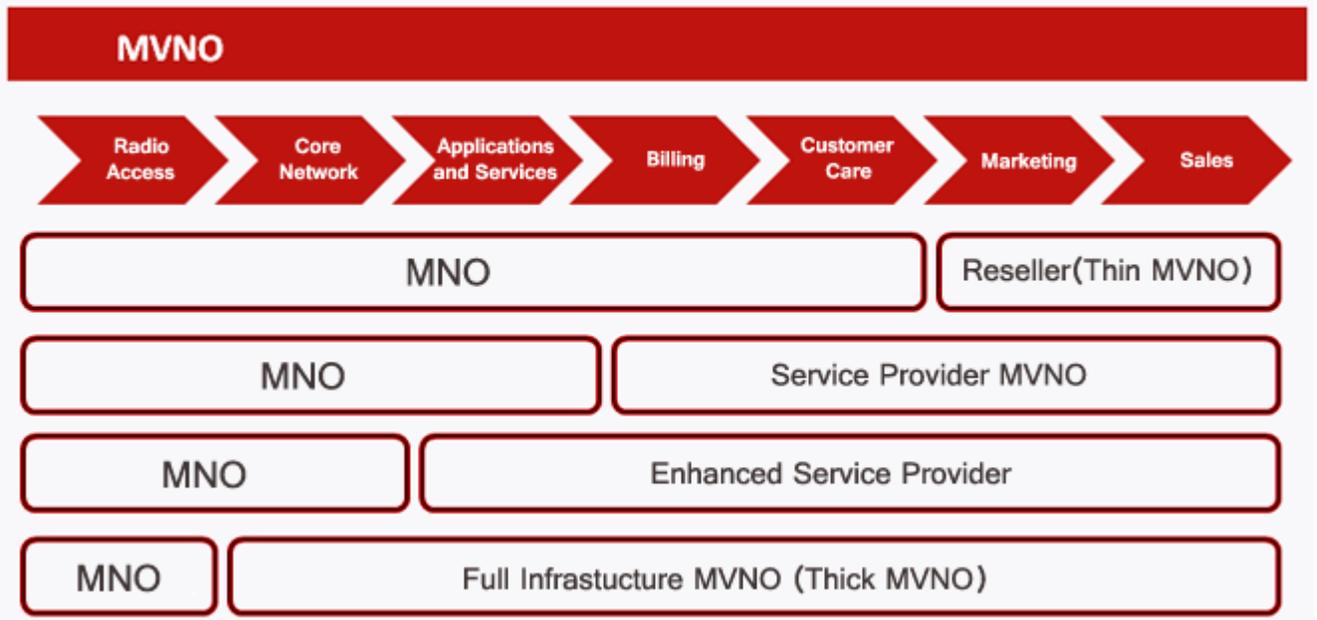
³⁰ Organisation for Economic Co-operation and Development (OECD). (2015, January). Working Party on Communication Infrastructures and Services Policy: Wireless Market Structures and Network Sharing. Retrieved from [http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/ICCP/CISP\(2014\)2/FINAL&docLanguage=En](http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/ICCP/CISP(2014)2/FINAL&docLanguage=En)

³¹ Ibid

³² In some countries, there are mobile virtual network enablers (MVNE) who provide back-office and infrastructure services to MVNO but do not have any relationship with customers.

- ii. *Service Provider* – This MVNO provide billing and customer support, without engaging in any network activity, such as call routing. It is less dependent upon a mobile operator for creating its value proposition in the market.
- iii. *Enhanced service provider*- This MVNO is a step up from the service provider MVNO. It provides additional services such as call and data routing. The enhanced service provider can offer unique services and packages that differentiate it from other mobile service providers.
- iv. *Full MVNO* – This entity operates all its network elements except for the radio access network (RAN). It can terminate calls and develop its own innovative products and services thus creating a more competitive and proactive position in the marketplace. It is also has more flexibility in choosing a host MNO as it can switch hosts without having to send their customers new SIM-cards. From a technical network perspective, full MVNOs are no different from any other network roaming on a host network.

Figure 3-11: MVNO Classification Scheme



Source: <http://www.smartipx.com/acronyms/>

According to Bassayiannis (2008) an analysis of the interactions between MNOs hosting MVNOs revealed that there are three strategic motivations for such sharing arrangements.³³ The three are:

- i. **Segmentation-driven** strategy –MNOs often find it challenging to succeed in all customer segments and view MVNOs as a means to attack specific targeted market segments.
- ii. **Network utilisation-driven** strategy – MNOs can have capacity, product and segment needs in new areas such as 3G and view MVNOs as a means of generating economies of scale thus achieving greater network utilization;
- iii. **Product-driven** strategy – MVNOs can help MNOs access some niche customers that MNOs cannot get to by targeting customers based on specialized service requirements. This can include the provision of specialized data, text or even voice product bundles to the target group.

MVNOs will need to ensure that there is effective delineation of the roles and responsibilities between themselves and the host MNO. The division of such roles and responsibilities can be addressed through the contractual arrangements between the two entities, as well as be informed by specific policy or regulations relating to MVNOs. In India for instance, the telecommunications regulator TRAI recommended that³⁴:

- a. MVNOs be free to determine their own business model.
- b. The model addressing the nature of the relationship between the MNO and the MVNO be left to market forces.

In some jurisdictions, there are regulations requiring that MNOs reserve capacity specifically for MVNOs. Hong Kong is one such jurisdiction where it has been mandated that 3G network operators reserve 30-50% of their capacity for MVNO use.³⁵ MVNOs in Hong Kong were required to:

- a. Issue their own SIM cards;
- b. Maintain their own HLR;

³³ Athens Information Technology: Centre of Excellence for Research and Graduation Education. (Bassayiannis, T). 2008, August. *MBIT Thesis Mobile Virtual Network Operator*. Retrieved from <http://4ezf8ck03yd3zzf6037xez2x.wpengine.netdna-cdn.com/wp-content/uploads/2011/05/38461240-Bassayiannis-08-MVNO.pdf>

³⁴ TRAI (2008) Recommendations on Mobile Virtual Network Operator. <http://www.trai.gov.in/writereaddata/recommendation/documents/recom6aug08952012.pdf>

³⁵ Kiiski, A., Hammainen, H. *Mobile Virtual Network Operator Strategies: Case Finland*. Retrieved from http://www.netlab.tkk.fi/tutkimus/lead/leaddocs/KiiskiHammainen_MVNO.pdf on 14th, July, 2015.

- c. Provide their own switching and gateway infrastructure for circuit and/or packet switched traffic³⁶.

Regulations such as those promulgated in Hong Kong provide MVNOs with certainty as they seek to develop their business cases and bargaining power in their negotiations with MNOs.

3.3.1.7 *Network Sharing*

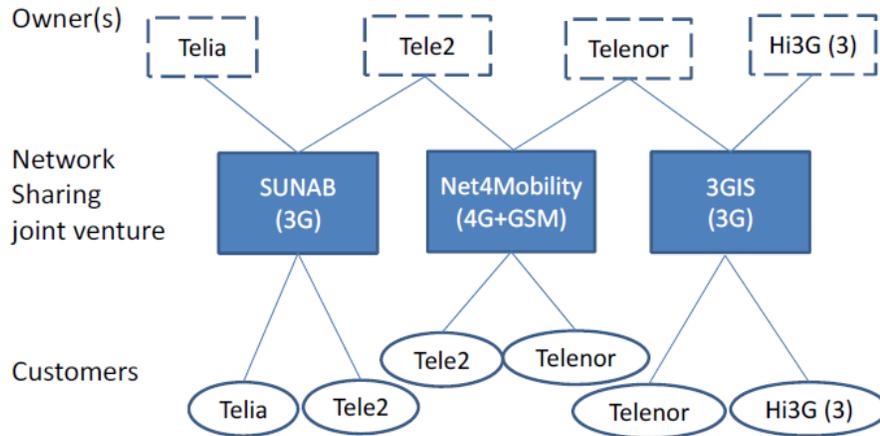
Network sharing occurs where network infrastructure is created specifically for the purpose of sharing resources. This mode of sharing is the most involved and complex form of infrastructure sharing as it involves individual licensees sharing both the radio and core network elements of the network. In this mode of sharing, the common portion of the network effectively operates as a single network company ("Netco") with the licensees becoming roaming or service companies ("Servcos"). The Servcos have roaming agreements with the Netco in the areas only covered by the Netco, while using their own network infrastructure in other areas. The common scenario is that the most densely populated areas will not be covered by the Netco.

The companies will have to agree on pricing and on a service level agreement that includes details on coverage, capacity, QoS and reliability. The agreement will also need to address future issues such as upgrading of the common network and the operations and maintenance of the network. In Sweden for example, 70% of the country is covered by a shared network built as a joint venture between Telenor Sweden and HI3G (Hutchison Investor).³⁷ When a user is in one of the main cities, his calls will be carried by the network infrastructure owned by Telenor or HI3G, while outside of the cities his call will roam onto the shared network provided by the joint venture company, 3G Infrastructure Services (3GIS). As noted earlier in this Chapter, Sweden is also home to Net4Mobility, a 4G joint venture between Telenor and Tele- 2. An illustration of network sharing in Sweden is shown in Figure 3-12 below.

³⁶ Supra 33

³⁷Markendahl, Jan and Ghanbari Amirhossein (2013) Network Cooperation Between Mobile Operators - Why and How Competitors Cooperate? <https://www.kth.se/social/upload/528377c5f276543fa03519a4/IMP2013-%20Markendahl%20Ghanbari%20Molleryd%20-%20July%201.pdf>

Figure 3-12: Mobile Operators and Joint Ventures for 3G and 4G Networks in Sweden



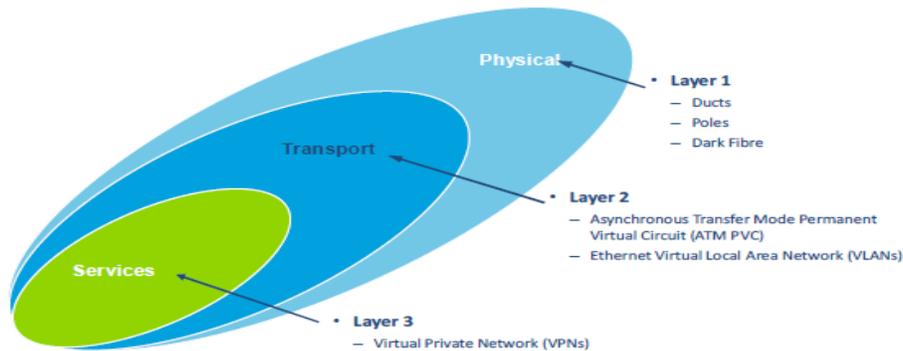
Source: Jan Markendahl et al

3.3.2 Active Sharing in Fixed Networks

3.3.2.1 Fibre Networks

Active sharing of the fibre network involves the sharing of the powered/electronic elements of the network. When an operator leases lit capacity to another operator rather than ducts and dark fibre, the former is effectively providing the latter with shared active network elements for use by its customers. This type of sharing provides significant savings as less of the network will be duplicated. However, it has much higher technical and institutional complexity than the sharing of dark fibre and other passive elements of the fibre network. Active sharing in fibre networks also limits the potential for service differentiation by those sharing the active elements. Owning a dark fibre pair gives an operator more control over its service differentiation as well as the types of electronics it can use and the amount of lit capacity. Active elements in fibre networks are identified in Layers 2 and 3 in Figure 3-13 below.

Figure 3-13: Layered Fibre Network Elements



Source: Deloitte

3.3.2.2 Local Loop Unbundling (LLU)

LLU is the process where an operator's access network is made available to other service providers. Service providers will then have the capability of upgrade individual lines to offer services such as high speed Internet access directly to the customer. The process by which LLU can be imposed is specifically addressed in the Act. As such this type of sharing will not be dealt with in this NPRM.

3.4 Commercial Models of Sharing

Operators have implemented a number of commercial models to facilitate infrastructure sharing. The commonly formed models which range from private corporations to government-led organizations are:

Joint Ventures: - this is a commercial agreement between two or more operators to pool their capital resources to finance an infrastructure project. The funding is usually raised privately by the operators who use the infrastructure to provide services to their customers. On rare occasions they may voluntarily provide other operators with capacity. Examples of this model are MBNL (EE and Three) and Cornerstone (Vodafone and Telefonica) in the UK and Indus Towers (Baharti Airtel, Vodafone and Idea) in India.

Tower Companies: - these are usually not owned by operators. There are owned by independent third parties who do not operate their own network but instead build, manage and lease infrastructure to operators. An example of this model is Helios Towers in Africa.

Fibre Companies: - like tower companies these companies do not operate a network but provide fibre optic resources (dark fibre and ducts) on a wholesale basis to operators. Services are usually provided on an “open access’ basis. In South Africa, companies like Dark Fibre and FiberCo are rolling out country-wide fibre backbones.

Government Network Companies: - this is where government undertakes to deploy fibre backbone resources which are then provided to existing players and new entrants on an “open access” basis. Funding is usually provided by international funding organizations. Examples of this model are the National ICT Broadband Backbone in Tanzania³⁸ and the National Broadband Network in Jordan³⁹.

PPP and Consortia: - this where the government and one or more private companies form a venture to finance a telecommunications project. One example of this the Burundi Backbone System⁴⁰ which was built by the government along with several operators.

Regardless of the commercial model being pursued, stakeholders will have to consider several public policy and commercial drivers when getting involved. These drivers are illustrated in the Figure 3-14 below.

Figure 3-14: Commercial Models and their Drivers

	Joint Venture	TowerCo	Fibre companies	Government-led	PPP & Consortia
Government involvement					
Risk sharing	Operators	Private investors	Private investors	Public sector	Development banks, governments, investors
Access	Operators of the joint venture	Wholesale basis	Wholesale basis	Open Access	Wholesale basis
Ownership	Operators	Private investors	Private investors, operators	Public	Operators, governments and private investors
Fibre					
Mobile/Wireless					
Funding	Private	Private	Private	Public sector, USO funding, multilateral banks	Development banks, governments, investors
Examples	Three operator fibre network in South Africa	Helios Towers, Eaton Towers, IHS Towers	Phase 3	NOFBI-Kenya Broadband Infraco-South Africa	Burundi Backbone System

Source: Deloitte

³⁸ <http://www.nictbb.co.tz/>

³⁹ <https://www.itu.int/net4/wsis/stocktaking/projects/Project/Details?projectId=1354190429>

⁴⁰ <http://www.zegabi.com/articles/7552>

CHAPTER 3 – QUESTIONS:

1. Do you agree with the definition of passive and active infrastructure outlined above? If not, please provide alternative definitions.
2. Are there any other infrastructure (passive and active) that you consider essential for sharing?
3. Given the various forms of passive infrastructure sharing described above, which ones do you think are most suitable for Jamaica? Please provide reasons for your choice.
4. Are there any other forms of passive sharing that are possible between operators? If yes, please provide details.
5. In your opinion, should sharing of the core network be allowed? Give reasons for your answer.
6. Given the various modes of active infrastructure sharing described above, which ones do you think are most suitable for Jamaica? Please provide reasons for your choice.
7. Are there any other forms of active sharing that are possible between operators? If yes, please provide details.
8. What in your view accounts for the failure to attract the entry of MVNOs into the Jamaican market? Is the mandating of active infrastructure sharing a pre-requisite for the emergence of MVNOs? Do you consider MVNOs as a viable option in the Jamaican market?
9. Please provide examples of how active and passive infrastructure is being shared in Jamaica.

Chapter 4: Benefits and Challenges of Infrastructure Sharing

4.1 Introduction

While the greatest benefit of telecommunications infrastructure sharing lies in the power to connect communities and people together at lower cost, there are many other benefits that could accrue to Licensees, consumers, government authorities, general public and the environment. Infrastructure sharing offers an opportunity to share limited resources among service providers, increase coverage in areas without services, reduce costs and time associated with deployment of new structures and decrease in the environmental and aesthetic impact of networks.

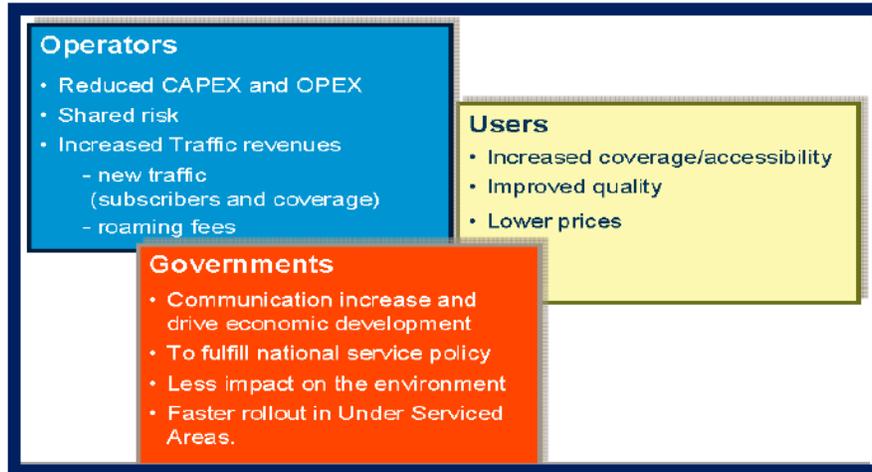
Notwithstanding the benefits that can be had, infrastructure sharing has some restrictive features which can create challenges/constraints. There are many technical, practical and logistical factors involved that requires serious consideration prior to entering into an Infrastructure sharing arrangement. All potential impacts must be assessed and fully understood to ensure that there are no adverse impact on the network and ultimately on the delivery of service. The main benefits and challenges of infrastructure sharing are outlined in the rest of this Chapter.

4.2 Benefits of Sharing

Operators' motives for infrastructure sharing usually differ between countries and according to the level of maturity within a given market.⁴¹ In the early stages of network development, the rationale for entrants is usually faster network roll-out at lower cost and for incumbents it provides new revenue streams as well as lower costs. In later stages of market development, as operators seek to optimize revenues and profits, drivers such as cost reduction become increasingly important. The following diagrammatic presentation (Figure 4-1) highlights some of the benefits from infrastructure sharing that will accrue to the different stakeholders.

⁴¹ Supra 4
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Figure 4-1: Benefits of Infrastructure Sharing

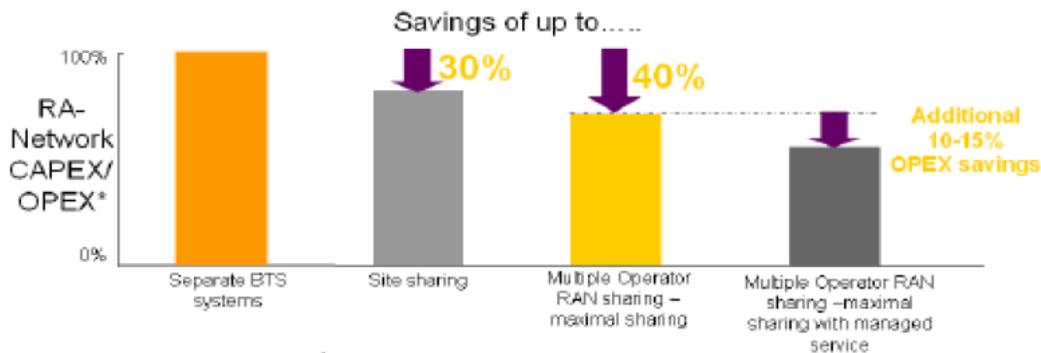


Source: Ericsson

4.2.1 Cost Minimisation

It is well known that telecommunications operators choose infrastructure sharing largely for the purpose of reducing the costs on the network construction and maintenance. By sharing infrastructure, operators are able to save money on construction (Capex) and operation (Opex) of the network. The fixed and sunk investments associated with the deployment of telecommunications networks are high and irreversible and thus these investments are risky and costly. These costs are further compounded by the fact that operators need to continually upgrade infrastructure in order to adopt new technologies. With sharing, the risk of network investments are spread amongst several operators rather than being borne by a single operator. Lower costs will also reduce the operator’s need for external financing which in turn could reduce the financial leverage. Figure 4-2 below shows the relation between Capex and Opex savings.

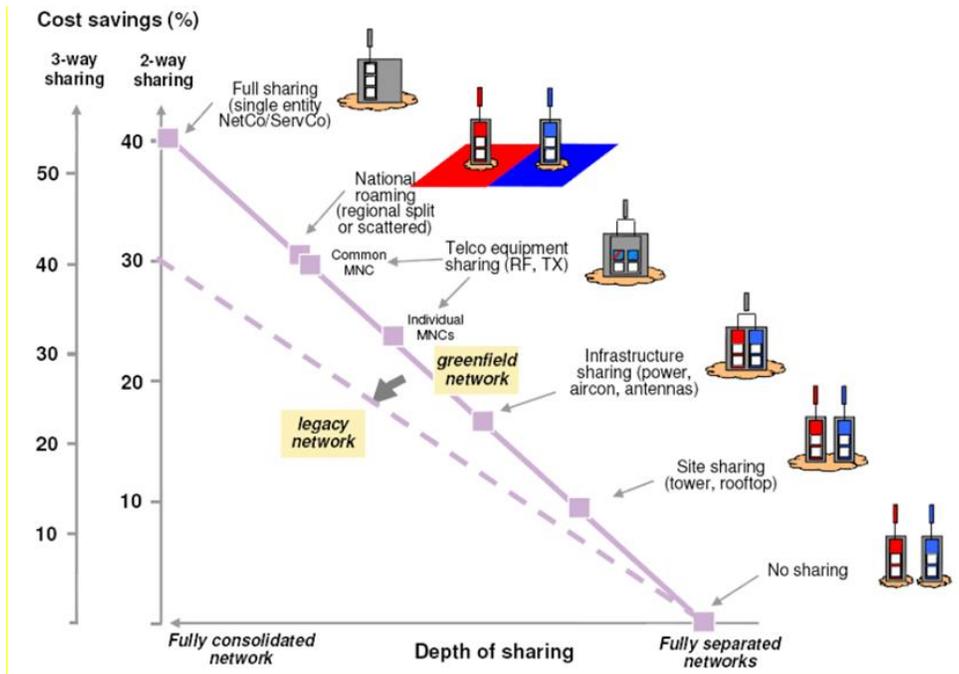
Figure 4-2: Infrastructure Sharing Solutions and Potential OPEX/CAPEX Savings



Source: Nokia 2010

Site sharing for instance, allows operators to reduce both capital (Capex) and operating (Opex) expenditure by reducing their investments in passive network infrastructure and in network operating costs. Site acquisition costs and expenses for civil works account for up to 40% of the initial investment and in terms of recurring costs, site-related costs typically make up 5-20% of network Opex.⁴² Reports on the EU industry indicated that passive infrastructure sharing can potentially yield overall cost savings between 15% and 30%. Some EU sources cited cost savings on annual site Capex of up to 60% in addition to significant savings in operational expenditure (such as site rental, maintenance, personnel and power, air conditioning and fuel expenses).⁴³ Figure 4-3 illustrates one European operator’s estimate of the cost savings to be derived from sharing infrastructure.

Figure 4-3: Estimates of Cost Savings from Sharing - Vodafone



Source: FTTH Council Europe

⁴² Meddour, Djamel-Eddine et al. On the Role of Infrastructure sharing for Mobile Network Operators in Emerging Markets. <https://ai2-s2-pdfs.s3.amazonaws.com/6abf/f98c50d7e7088580660e2766890d471927e1.pdf>

⁴³ BEREC (2011) RSPG report on infrastructure and spectrum sharing in mobile/wireless networks, http://rspg-spectrum.eu/_documents/documents/meeting/rspg25/rspg11-374_final_joint_rspg_berec_report.pdf

It has been estimated that for a typical European operator the cost savings associated with RAN sharing could increase free cash flow by up to 20%. In India, it is estimated that the operators who participate in mast and site sharing activities could realize savings on Capex and Opex in the region of 30%.⁴⁴ In the case of fixed networks, civil works is the main cost component for the deployment of fibre local loops. According to the FTTH Council Europe, trenching and civil works can amount to 60-80% of total project cost.⁴⁵ These costs are associated with opening (and closing) trenches and laying ducts and will depend on the size of the relevant area being covered and the population density. In Germany trenching costs per meter is particularly high, pushing the cost proportion in the business case to > 50%.⁴⁶

4.2.2 Accelerating entry of telecom operators into market

By removing some of the problems that usually confront operators in the construction of their networks, infrastructure sharing encourages increased and faster network roll-out as well as reduces the time to get products and services to market. For instance, site selection becomes increasingly difficult as the market matures and the problem of non-availability of sites in congested or protected areas is common in many countries. In some countries, local authorities have defined very specific areas where telecommunications infrastructure can be placed due to environmental, aesthetic or health concerns. In 2008, OECD reported that the pace of fibre investment in the local loop was significantly slow in Member States due to the costs associated with network construction. In particular, OECD highlighted the costs associated with rights of way and ducts or poles, as well as the associated legal and regulatory difficulties in obtaining permits for access to streets, roads, and other public land.⁴⁷

Participation in sharing schemes removes the need for activities that are related to the establishment of a greenfield site/duct and which may be particularly difficult and time consuming for a new entrant. These activities include acquisition of the requisite development permits; acquisition of cell sites for the installation of equipment; as well as the necessity of completing significant aspects of the installation work before service provision can commence. The issue of site acquisitions can be particularly contentious for new entrants as at times many of the desired locations are already occupied by their competitors. This was the scenario faced by Oceanic Digital Jamaica Ltd., T/A as Claro in Jamaica, who then resorted to the illegal erection

⁴⁴ Supra 4.

⁴⁵ FTTH Council Europe (2013) *Cost Model – Country Analysis Report (CAR) for Germany*
http://www.ftthcouncil.eu/documents/Reports/2013/Cost_Model_CAR_Germany_August2013.pdf

⁴⁶ Ibid

⁴⁷ OECD (2008) Public Rights of Way for Fibre Deployment to the Home.
<https://www.oecd.org/sti/ieconomy/40390753.pdf>

of cell sites when the company faced difficulty getting the requisite approvals to establish sites in their preferred locations.⁴⁸ Sharing also gives operators greater leverage with landlords thus reducing time for negotiations of access rights.

The pooling of existing infrastructure and resources reduces the need to acquire new sites and increase resources to meet the workload of a rollout programme. By combining resources and reducing individual infrastructure needs, network operators can deploy newer technologies faster (3G in emerging markets and 4G broadband wired and wireless access technologies in more developed markets). Operators that provide 2G/3G mobile services can provide space to new entrant 3G/4G operators on their existing towers and masts. This will prove to be a cost effective option, even though later generation mobile networks require a significantly larger number of sites than earlier generation networks.⁴⁹

For fixed networks, access to existing civil works and already laid fibre will hasten the deployment of broadband fibre networks. Where sharing takes the form of a joint-venture for the establishment of new infrastructure, the combined technical know-how and economic resources of more than one operator will greatly increase the speed of the network construction and operationalization. In a survey of infrastructure sharing in the APEC Region, all investigated economies held that infrastructure sharing can accelerate the entry of operators into the market.⁵⁰

4.2.3 New sources of revenue/ Emergence of new business models

Telecommunications carriers that have elected to share their facilities will derive incremental revenue from these activities. New entrants and other sharing partners become a source of revenue to incumbents since they lease capacity from existing infrastructure owners rather than deploy their own networks. Infrastructure sharing can also result in strategic refocusing on the part of the sharing parties. The cost savings from infrastructure sharing enables operators to reallocate their capacities and capital to the development of their core business, i.e. service provision and technical innovation. This ability to refocus resources is particularly important in mature markets, where core businesses are well established and the initial core capital investments already made.

⁴⁸ Jamaica Observer. (2009, August) *Council threatens to tear down Claro cell sites*. Retrieved from http://www.jamaicaobserver.com/mobile/news/149431_Council-threatens-to-tear-down-Claro-cell-sites on July 7th, 2015.

⁴⁹ "Meddour, Djamal-Eddine et al. On the Role of Infrastructure sharing for Mobile Network Operators in Emerging Markets. <https://ai2-s2-pdfs.s3.amazonaws.com/6abf/f98c50d7e7088580660e2766890d471927e1.pdf>

⁵⁰ Asian-Pacific Economic Corporation - APEC (2011). Survey Report on Infrastructure Sharing and Broadband Development in APEC Region http://publications.apec.org/publication-detail.php?pub_id=1184

Another benefit of infrastructure sharing is that it facilitates the development of new business models, including the creation of third party infrastructure providers whose sole purpose is the provision of infrastructure to other operators. Examples of this model includes Helios Towers Africa and IHS Towers⁵¹. Operators are also seeking to cooperate via joint ventures aimed at creating and managing infrastructure on behalf of the parties to the agreement. Examples of this are Net4Mobility in Sweden (between Tele2 and Telenor) and Cornerstone in the UK (between Telefónica and Vodafone). Operators have also banded together to establish independent infrastructure companies. Indus Towers, in India was created as an independent tower company by Vodafone Essar, Bharti Infratel and Idea Cellular for the purpose of providing site and mast sharing services to all Indian operators on a non-discriminatory basis.⁵²

4.2.4 Universal access/service

Infrastructure sharing will help governments realize their objectives of universal access/service for broadband, narrow digital divide among regions and improve the information level of each economy especially in remote areas. The expansion of both voice and data connectivity can create significant economic and social spill over effects across sectors (e.g. health and education) as well as promote e-government and social inclusion. By avoiding duplication of investments, infrastructure sharing makes funds available which can be used for further investment in network deployment. Given that infrastructure sharing reduces the capital and operational costs of deploying new networks, the savings derived from sharing could be channelled to develop and reach out to rural areas that would otherwise be left out in the expansion of the networks. Investment in the rural areas, allows consumers to enjoy improved coverage as well as increased competition through the presence of multiple operators that may have previously shunned infrastructure investment in those areas due to lack of financial viability. The increased competition caused by the presence of multiple operators will also help to drive prices down and improve service quality in these previously unserved or underserved areas.

4.2.5 Competition

Infrastructure sharing will promote market competition. From a regulatory perspective, sharing can be used to encourage the entry of new players where the market exhibits “natural monopoly” characteristics.⁵³ It will restrict the monopolistic position that is held by the traditional operators due to their possession of infrastructure and enable new operators to survive and compete with the creation of the opportunity for equal access. For example, competition in the local loop and

⁵¹ <http://www.ihstowers.com/>

⁵² Supra 4

⁵³ Booz, Allen, Hamilton “Telecom Infrastructure sharing: Regulatory enablers and economic benefits”
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national backbone may be encouraged through infrastructure sharing, where it is not economically feasible to duplicate the networks.

4.2.6 Improved quality of service and innovation

The more efficient and rapid deployment of networks/newer technologies caused by infrastructure sharing, comes with the added benefit of being able to improve the quality of telecommunications services (via improved coverage and/or build out of high capacity sites). In fact, the possibility of improved coverage is a key motivation for some regulators to promote infrastructure sharing. Access to existing fibre networks or the infrastructure necessary for the deployment of such networks can significantly improve the coverage of high-capacity broadband networks. For mobile networks, sharing has the potential to improve quality of service across networks, since operators will be able to deploy more base stations if they share the cost of infrastructure development. Further, in the absence of infrastructure sharing, the non-availability of greenfield sites on which to erect masts in congested areas, can result in impaired QoS such as large number of black spots (spotty coverage) and increased network congestion.

Infrastructure sharing can also have an impact on service innovation. With less investments going into new deployments, operators can focus on consumer needs by offering more variety and choice. Here the focus will be more on service competition than on infrastructure competition in order to meet the ever evolving consumer expectations. In the APEC survey on infrastructure sharing, Thailand's telecommunications regulator noted that the alleviation of some of the burden related to the construction and operation of network infrastructure caused by infrastructure sharing should make operators pay more attention to service levels thus facilitating innovation of services and improvement of service quality.⁵⁴

4.2.7 Efficient use of scarce resources

Infrastructure sharing supports efficient use of scarce and/or difficult to procure national resources such as spectrum, rights of way and occupation rights of private properties such as, rooftop sites in high density areas which are in limited supply due to environmental and health regulatory issues. Non-replicable resources, such as rights of way can be shared by allowing operators to share trenches and ducts, which allows for optimal use and alleviation of the land availability problem. Infrastructure sharing will exert a positive impact on avoidance of resource waste, conservation of limited land resources and reduction of energy consumption. With respect to facilities such as submarine cable landing stations, these can be opened for collocation

⁵⁴ APEC (2011). Survey Report on Infrastructure Sharing and Broadband Development in APEC Region http://publications.apec.org/publication-detail.php?pub_id=1184
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and connection services. In some countries, one operator has been given exclusive rights of way to lay the cables for a backbone and/or access network on the basis that it will be operated on the “open access”⁵⁵ principle.

4.2.8 Environmental/Health benefits

Shared infrastructure also offers environmental and health benefits. Persons are concerned about the potential visual impact and potential health risks associated with exposure to electromagnetic emissions from telecommunication towers. Local residents often resist the installation of towers or antennae by operators especially in densely populated areas because of these concerns. Sharing can reduce the proliferation of base stations across a given geographic area hence reducing public fear about electro-magnetic emissions. Since the erection of some network elements such as towers will be reduced, this will also have a positive impact on the environment by reducing the visual pollution of tower infrastructures and antennae on buildings and landmarks.

The power required to operate mobile and fibre networks can be significant. The networks have to keep running on a continuous basis regardless of the level of traffic that is being carried. While the demand may fall during the night time in particular areas, operators cannot power down the network in that area because they cannot predict the movement of subscribers. The power requirements can be doubled for mobile networks when there is an upgrade to 3/4G services - not only because the existing base stations need more power, but also because more base stations will be required.⁵⁶ According to a 2010 study conducted by Telecom Italia and Huawei, the carbon footprint of fibre networks can be up to 36% lower if the network is deployed using existing infrastructure.⁵⁷ The more infrastructure and power that can be shared the greater the environmental impact from sharing.⁵⁸

⁵⁵ "Open Access" refers to a specialised and focused business model, in which a network infrastructure provider limits its activities only to provision of network access services in order to avoid conflicts of interest. The network infrastructure provider then creates an open market and a platform for third party operators to obtain access on equal terms.

⁵⁶ Deloitte LLP (2015). Unlocking Broadband for All. <https://www.apc.org/en/system/files/Unlocking%20broadband%20for%20all%20Full%20report.pdf>

⁵⁷ Ibid

⁵⁸ It should be noted that in some countries the legislations governing the electricity sector may not allow power sharing in some modes of infrastructure sharing.

4.3 Infrastructure Sharing Challenges/Concerns

Notwithstanding the benefits associated with it, infrastructure sharing, whether passive or active, requires the consideration of many technical, practical and logistical factors some of which give rise to challenges/concerns. The main challenges/concerns associated with the sharing of network infrastructure are summarised below.

4.3.1 Lack of national and cross sector coordination

One of the challenges to achieving more sharing is the lack of coordination in national and local government policies regarding access to rights of way and across regulators of different sectors. The lack of coordination between different government agencies can increase the cost of network construction, upgrades and sharing as well as creates delays. While there may be several infrastructure projects that are being planned or implemented, the data and information associated with these projects are often not in the public domain thus making it difficult for telecommunications operators to incorporate them into their planning. Additionally, sometimes the fees imposed by government entities for the requisite approvals are designed to raise revenues rather than support the development of the ICT sector.

4.3.2 Execution challenges

Sharing agreements have been scuttled after years of discussions when the operators involved realized they could not agree on the structure of the deal despite their conviction that a deal would likely reduce Opex and Capex. Some of the network elements are very critical for competition purposes and operators may be reluctant to share them. For example, operators are reluctant to share network switches holding commercial sensitive information. By sharing, service providers will necessarily cede some of their independence and their control over the network in exchange for cost savings. In one case in Eastern Europe, the sharing agreement fell through because the parties could not agree on the degree of sharing.⁵⁹ One party wanted a more extensive type of sharing, which would have delivered an estimated 25% in cost savings but required the partners to cede more of their independence. The other partner wanted a less extensive type of sharing which allowed it to cede less of its control even though this arrangement would have offered lower (but still meaningful) cost savings.

⁵⁹ Chaudhury, Reuben et al (2011) Delivering on the Promise of Telecom Network Sharing http://www.oliverwyman.com/content/dam/oliver-wyman/global/en/files/archive/2011/OW_EN_CMT_2008_ImplementNetSharing.pdf.
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4.3.3 Technical challenges/concerns

The sharing of network infrastructure requires coordination and cooperation between the involved networks operators and the level required increases as the degree of sharing increases. Such cooperation can give rise to multiple constraints which affect the operational elements in the deployment and operation of networks. A precondition for infrastructure sharing is that the security of equipment, network and supporting infrastructure should be guaranteed. Where the original network may not have been designed to carry the traffic of two networks or new services, the partners may have to upgrade the network infrastructure or incorporate additional equipment to remove the bottleneck. For example, some towers are not designed to carry many antennae. In such cases, the structural safety of towers in terms of load bearing and the wind load of the towers will have to be addressed. Where infrastructure is being placed on top of roofs, the main considerations will be the load-bearing and isolation safety of the respective roofs. Other issues such as site maintenance, repairs etc. will need to be clearly spelt out in the infrastructure sharing agreement so that there is no confusion during the implementation. Table 4-1 below illustrates some of the technical constraints that would apply to the operators based on the expected level of sharing.

Table 4-1: Technical Constraints of Infrastructure Sharing ⁶⁰

Type of Sharing	Modality	Constraints
Passive	Site sharing	<ul style="list-style-type: none"> ▪ Installation/Maintenance of equipment at shared site requires coordination between sharing entities ▪ The decision on the actual sites to be shared may be based on different objectives (2G/3G optimization, site area)
	Antenna Sharing	<ul style="list-style-type: none"> ▪ Need for commonality in antenna selection for effective radio wave propagation ▪ Planning for 3 dB loss created by antenna coupling.
Active	NodeB (3G)	<ul style="list-style-type: none"> ▪ Vendor specific solutions may pose interoperability challenges ▪ Operation and maintenance of shared sites ▪ Limits on number of operators that may be accommodated (3 or 4)

⁶⁰ Adapted from Meddour, Djamel-Eddine et al. On the Role of Infrastructure sharing for Mobile Network Operators in Emerging Markets. <https://ai2-s2-pdfs.s3.amazonaws.com/6abf/f98c50d7e7088580660e2766890d471927e1.pdf>
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<i>Type of Sharing</i>	<i>Modality</i>	<i>Constraints</i>
	RNC	<ul style="list-style-type: none"> ▪ Management of the separation of the RNC functions ▪ Interoperability between equipment from each operator
	Core Network	<p>The sharing of core network elements will necessitate some level of equality which will require:</p> <ul style="list-style-type: none"> ▪ a design choice that will incorporate the use of common equipment to handle traffic originating from services offered by each operator ▪ the support for intelligent network protocols for optimal service delivery while roaming on the shared network

4.3.4 High investment costs and dilution of investment incentives

The investment costs associated with civil works or reconfiguring the network (such as integrating IT systems) are relatively high and the operators may be reluctant when planning, to include the spare capacity necessary to accommodate additional players unless there is some guarantee that it will be rented. The operators may also be reluctant to make network improvements, as their coverage area/service level will always be 'equal' to that of the other sharing party. Additionally, once sharing has taken place, individually the operators may not have full control over network strategy and investments and the decision making on investments will be slowed down thus taking more time and effort.

4.3.5 Risk of anti-competitive behaviour

While reducing cost and increasing efficiency are undoubtedly good for the telecommunications sector, infrastructure sharing can have a negative impact on competition. The possible effects are discussed below.

Unilateral Effects: this is where sharing arrangements give the involved parties both the incentive and ability to reduce innovation, quality or variety or increase prices. An additional concern is that sharing arrangements could result in reduced incentives of each party to supply capacity to other parties. This could increase barriers to entry for potential network operators who may wish to share infrastructure in order to reduce costs and expedite entry into the market. This effect will be even more pronounced with the network sharing modality as the reduction in networks restricts an entrant's ability to negotiate sharing arrangements.

Potential Coordination: The close co-operation between operators which some modes of infrastructure sharing requires, can give rise to tacit collusion between operators on prices and QoS. The close cooperation could allow operators to monitor and punish deviators. Additionally, sharing arrangements could increase the risk of industry-wide co-ordination to deny access to infrastructure to new entrants.

Information Sharing: In some sharing arrangements, the parties will need to exchange competitively sensitive information which, if not adequately restricted, could negatively impact the degree of competition between the parties. The risk of this happening is greater in the case of active infrastructure sharing, in particular sharing of the core network. This risk can be addressed through procedures and protocols which require operators to limit the personnel which is given access to commercially sensitive information, and to prevent marketing and commercial teams from learning of the strategies of their competitor.

4.3.6 Quality of service (QoS)/service innovation limitations

Although QoS improvements are a benefit of infrastructure sharing, QoS may also be a challenge since a failure of one network element may negatively affect the QoS provided by another operator. The failure of shared backhaul transmission links may increase congestion or dropped calls thus affecting the quality of service of all sharing parties. In France, the 2G local roaming solution deployed in the early 2000s, allowed for extended coverage in rural areas but initially with a lower quality of service than own operator networks.⁶¹ However, this concern has to be offset with the risk that these rural areas would not have been covered, or at least not at the same pace, without the existence of such a sharing agreement. Regulatory intervention by way of minimum QoS standards can be used to address this challenge.

Infrastructure sharing may also limit the capability of the infrastructure owner to fully exploit its network capability in terms of service innovation. For example, if an operator has leased backhaul transmission bandwidth capacity to another operator, the infrastructure owner may not be able to offer 4G services from a particular base station unless the backhaul transmission bandwidth is upgraded.

4.3.7 Misalignment of service providers objectives/incentives

The operators may be at different stages of maturity and have different visions and objectives. For example, the operators may have different visions of when and how they will migrate to the

⁶¹ BEREC (2011) BEREC-RSPG report on infrastructure and spectrum sharing in mobile/wireless networks. http://berec.europa.eu/eng/document_register/subject_matter/berec/reports/224-berec-rspg-report-on-infrastructure-and-spectrum-sharing-in-mobilewireless-networks
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next generation of technology to deliver improved services. New entrants may be keen on introducing new generation of technologies, while the incumbent may want to continue with their legacy technologies. Additionally, coverage has been a differentiator between entities offering telecommunication services. As a result of this, incumbent operators are not always keen on entering sharing agreements with new operators against whom they already enjoy a distinct competitive advantage with respect to coverage due to the number of cell sites that they already deployed. Even in situations where the law provides for infrastructure sharing, there is still the risk that some infrastructure owners will delay or frustrate the process. Vigilance from regulatory authorities will be required to ensure that the process is not abused by operators.

4.4 Addressing Infrastructure Sharing Challenges/Concerns

The challenges associated with infrastructure sharing can be addressed by a proper assessment of the market factors and development goals which have made infrastructure sharing an attractive proposition in the first place. Two mechanisms by which these issues can be addressed is the infrastructure sharing agreement and regulatory intervention. In both mechanisms a balancing of interest will be required. In the latter case, the regulator will be required to balance the benefits of infrastructure sharing with the need to prevent a dilution of investment incentives.

4.4.1 Infrastructure Sharing Agreements

In examining the challenges associated with infrastructure sharing, the question of whether some of these can be addressed by the infrastructure sharing agreement will be important. An infrastructure sharing agreement will typically cover the commercial, technical, operational, and legal conditions of the proposed partnership as well as outline the potential risks and obligations that will be placed on each party entering the agreement.⁶² The agreement should give an indication of the potential loss of control that may be experienced by each operator according to the degree of sharing. The operators that will be able to extract the most value from the sharing process will be those who are able to craft agreements which reflect their operating environment, anticipate the challenges involved and incorporate suitable risk mitigation strategies in response to the perceived risks.⁶³

⁶² Meddour, Djamel-Eddine et al. On the Role of Infrastructure sharing for Mobile Network Operators in Emerging Markets. <https://ai2-s2-pdfs.s3.amazonaws.com/6abf/f98c50d7e7088580660e2766890d471927e1.pdf>

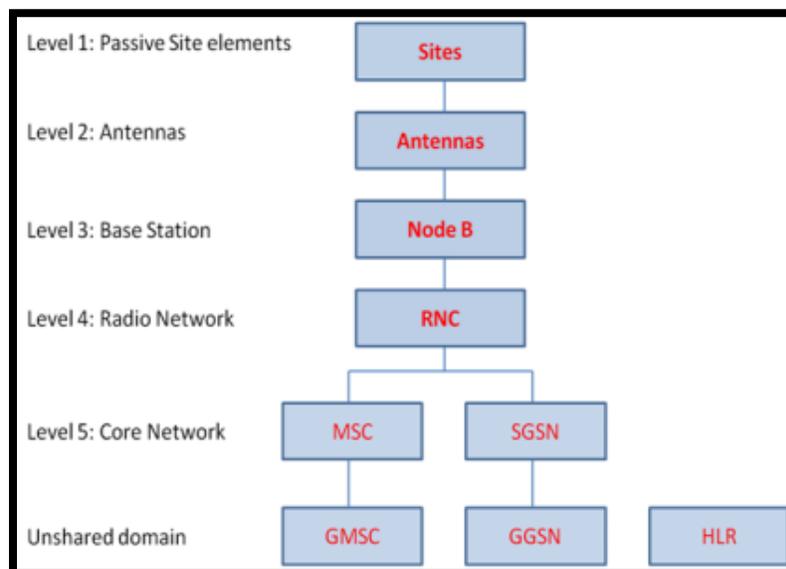
⁶³Chaudhury, Reuben et al (2011) Delivering on the Promise of Telecom Network Sharing http://www.oliverwyman.com/content/dam/oliver-wyman/global/en/files/archive/2011/OW_EN_CMT_2008_ImplementNetSharing.pdf.

4.4.2 Regulatory Intervention

Regulatory intervention can address infrastructure sharing challenges related to anti-competitive effects and negative impact on service delivery within a given market. The nature of the regulatory intervention will depend on the respective market dynamics and degree of sharing proposed. If the regulatory authority is of the view that the negative effects associated with a particular sharing arrangement outweighs the benefits, it may take steps to cancel or modify the arrangement or allow the arrangement with appropriate regulatory safeguards imposed.

The classification system shown in Figure 4-4 below illustrates points of demarcation for the degree of sharing in the mobile network that may or may not be allowed by regulatory authorities. Some regulators do not allow infrastructure sharing beyond level 4, due to their concerns that beyond that level operators would be unable to maintain control of “network logic”⁶⁴ within any proposed sharing arrangement. Additionally, those regulators felt that beyond Level 4 operators would be unable to use their assigned frequencies to control components essential to the determination of network quality and customer service provision.

Figure 4-4 Diagram of Mobile Infrastructure Sharing Classification Scheme



⁶⁴ <http://arxiv.org/ftp/arxiv/papers/1211/1211.7113.pdf>. Accessed July 7th, 2015. Pg. 13
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4.4.2.1 Examples of Regulatory Limits on Sharing

India

In India, the Telecom Regulatory Authority of India (TRAI) at first sought to limit active sharing to only the antennae, feeder cables, Node B, RAN and transmission systems.⁶⁵ The sharing of allocated spectrum by operators was also initially⁶⁶ explicitly forbidden. RAI further recommended that active sharing agreements between service providers were to be based on mutual agreements between the entities.

UK

Ofcom in its deliberations on network sharing expressed concerns that about the potential for chilling of competition. It opined that *“Network sharing could also have undesirable consequences for competition. For example, [mobile network operators] could collaborate on network development and gain information about each other’s costs and plans, which may have a chilling effect on competition in the retail market.”*⁶⁷ Ofcom indicated that in specific instances it may allow operators to engage in network sharing during the initial phase of network deployment in order for them to meet their coverage requirements while still rolling-out their networks⁶⁸.

RAN sharing (level 4) is allowed in the UK and several joint ventures have been created to facilitate sharing. One such arrangement is that between T-Mobile UK and 3UK. The two operators announced an agreement to share their 3G network through the use of MO-RAN technology. The technology allowed the operators to share all of their on-site equipment except for the transceivers which must remain separate due to the ban on spectrum sharing.

The parties claimed that the use of the technology allowed them to retain control of the delivery of services to their customer whilst competing aggressively in the market. The sharing mechanism, although it allowed for antenna sharing, did not prevent the parties from being able to control the optimization of their radio network thereby allowing the operators to maintain coverage differentiation.

⁶⁵ TRAI (2007). Recommendations on Infrastructure Sharing
<http://www.trai.gov.in/WriteReadData/Recommendation/Documents/recom11apr07.pdf>.

⁶⁶ In 2015 TRAI issued recommendations for spectrum sharing,

⁶⁷ OFCOM (2011) Second consultation on assessment of future mobile competition and proposals for the award of 800 MHz and 2.6 GHz spectrum and related issues. <https://www.ofcom.org.uk/consultations-and-statements/category-1/award-800mhz-2.6ghz/summary>

⁶⁸ Ibid.

CHAPTER 4 – QUESTIONS:

1. Do you agree that infrastructure sharing will encourage faster deployment of broadband networks throughout Jamaica? If not, please provide the reason(s) for your answer.
2. In your opinion, how do you think infrastructure sharing will encourage service based competition?
3. Do you feel infrastructure sharing will give rise any competition concerns among the operators? If yes, please identify the concerns and suggest how they should be addressed so as to ensure that there will not be any adverse impact on consumers' benefits regarding choice of service providers, availability of services, service variety, QoS and pricing.
4. Should the sharing of active infrastructure beyond Level 4 in Figure 4-4 above be allowed? Provide reasons for your response.

Chapter 5: Regulatory Options and Trends

5.1 Introduction

There are three main approaches that a regulator can take towards infrastructure sharing: some will leave the issue of infrastructure sharing entirely up to market forces; some will limit their involvement to the approval of sharing agreements or act as an arbitrator when there are disputes; and some are actually involved in deciding which infrastructure should be shared, the degree of sharing and the terms and conditions for sharing. Generally the regulatory treatment accorded will be based on the relevant legislation, the particular market conditions and national priorities. Table 5-1 below summarizes responses to a global survey regarding the regulatory treatment of infrastructure sharing.

Table 5-1 – Global survey of regulatory treatment of infrastructure sharing

Question	Answer	Africa	Arab States	Asia-Pacific	CIS*	Europe	The Americas	Total
Is infrastructure sharing mandated?	Yes	18	12	8	1	24	17	80
	No	13	2	14	5	11	13	58
Is co-location/site sharing mandated?	Yes	14	12	9	2	26	20	83
	No	14	2	11	2	5	9	43
Region size		43	21	38	12	43	35	192

*Commonwealth of Independent States

Source: ITU World Telecommunications Regulatory Database (www.itu.int/icteye).

5.2 Regulatory Treatment of Infrastructure Sharing

5.2.1 Optional Infrastructure Sharing

Policy objectives will play an important role when deciding whether infrastructure sharing should be mandatory or optional. When the policy objective is stimulating operators to invest in the deployment of their own infrastructure, optional sharing may be applied. In many cases, operators may voluntarily opt for infrastructure sharing, in order to attain the benefits outlined in the preceding Chapter. Globally, both passive and active infrastructure sharing are being facilitated through voluntary mutual agreements reached between service providers. Since 2009, a large number of network sharing deals, ranging from cash-generating tower sharing to highly complex RAN-sharing agreements, has been signed. Shared infrastructure companies have also

emerged as key strategic partners to operators as the latter group realize that network coverage is not a sustainable differentiator.

Regulators that wish to be less interventionist may take measures to stimulate sharing, without mandating it. They may consider implementing the following measures to stimulate sharing arrangements:

- **Provide guidance on types of sharing allowed:** It is essential that the operators that may be contemplating sharing have legal certainty about the status of their plans. Regulators can provide this certainty by publishing guidelines on the type of arrangements that are permissible under the applicable laws and regulations.
- **Develop model agreements:** Regulators may draw up model agreements for infrastructure sharing, including standard terms and conditions to be applied by operators that wish to share. Regulators may leave material provisions (such as tariffs) to operators but provide suggestions for standard terms and conditions. In general, sharing agreements should include the standard clauses such as: objective of the agreement; obligations of both parties; term of the agreement; applicable tariffs; billing conditions; service description; access to facilities; operations and maintenance; subletting conditions; termination; penalties; liability; confidentiality; representations and warranties; amendments to agreement; force majeure; applicable law and jurisdiction.
- **Encourage sharing on government-owned facilities:** Where there are infrastructure owned by government agencies or government owned companies that can be used to facilitate the deployment of telecommunications, the sharing of these infrastructure should be encouraged.
- **Promote self-regulation:** In many countries the establishment of self-regulating bodies is a common practice. Such bodies (e.g. associations of operators) can play a key role in stimulating sharing by establishing guidelines for sharing existing infrastructure, for redevelopment of existing sites to facilitate sharing and for joint development of new infrastructure. These bodies can be key in the interaction between the regulator and industry and can assist in addressing population concerns such as the impact of installing mobile towers in their communities.
- **Offer financial incentives for sharing:** Policymakers/regulators may wish to implement measures which provide financial incentives to encourage operators to share infrastructure. For instance, charges levied by local authorities for construction of ducts

and the installation of masts and towers could be reduced in cases where the infrastructure is shared with other operators. The authorities could consider exempting sharing operators from those charges or limit them to just what is enough to recover administrative costs. At a minimum, the authorities should consider reducing those charges in cases where the applicable infrastructure is being shared. In India, TRAI recommended that civic authorities charge such amounts from all service providers sharing infrastructure such that the total amount charged per tower should not be more than 1.2 times of the amount being charged to individual service providers when towers are not shared.⁶⁹

5.2.2 Mandatory Infrastructure Sharing

Policymakers may choose to make infrastructure sharing mandatory for network operators. Before making a decision to mandate infrastructure sharing, policymakers or regulators will need to determine the policy objective to be achieved by requiring the sharing of infrastructure. Policy objectives will include population and geographic coverage, promotion of competition, achievement of universal access objectives and environmental concerns. The objective(s) will determine the modes of sharing. For instance, if the objective is to reduce visual pollution then sharing could be limited to some types of mobile towers. If the policy objective is coverage, then sharing of a wider spectrum of infrastructure would be required in order to achieve this objective.

In jurisdictions where sharing is mandatory, operators are required to allow third parties to share their facilities upon request unless they can provide objective justification. A network operator may refuse to provide access to a specific physical infrastructure where it is not technically suitable, due to circumstances such as a lack of currently available space or due to future needs for space. The latter must be sufficiently demonstrated to the regulator, for example, by the submission of investment plans.⁷⁰ Similarly, where sharing a particular infrastructure is likely to jeopardise safety or public health, network integrity and security, including that of critical infrastructure, or may adversely affect the provision of those services for which the infrastructure is primarily used, the regulator may exempt the infrastructure from the sharing obligation. Where mandatory sharing is required, there are several measures that can be imposed by regulators. These measures will intervene in the freedom of operators to negotiate sharing agreements independently. The degree to which their independence will be impaired will vary based on the

⁶⁹. TRAI (2007). Recommendations on Infrastructure Sharing <http://www.trai.gov.in/WriteReadData/Recommendation/Documents/recom11apr07.pdf>.

⁷⁰ European Union (2014) Directive 2014/61/EU of the European Parliament and of the Council of 15 May 2014 on measures to reduce the cost of deploying high-speed electronic communications networks http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2014.155.01.0001.01.ENG

measure that is imposed and the policy objective informing the measure. The regulator will need to address the following issues:

- **Identify the facilities to be shared:** The regulator will need to determine which infrastructure will be subject to mandatory sharing. For instance, should it be limited to only passive infrastructure, and if sharing of active infrastructure is allowed, to what extent. Will core network sharing and full network sharing be allowed? Another possibility is to impose mandatory sharing only on infrastructure owned by dominant operators or only on infrastructure where there are inefficiencies or bottlenecks related to co-deployment or where there are inefficiencies regarding administrative permit granting.⁷¹ In some cases, the regulator may pre-define critical infrastructure which must be shared and in others, it will make a case by case determination.
- **Set tariffs and other terms and conditions:** Regulators may decide to set the price to be paid for sharing infrastructure or allow operators to negotiate and intervene to impose a price when operators cannot reach an agreement. The price of sharing should have an important impact on the willingness of operators to roll out their infrastructure. Operators may be reluctant to deploy infrastructure if they feel they will be forced to provide access to competitors at cost-oriented rates.

As noted earlier, operators may refuse access on the basis that they need to reserve space for their own future use, in order to improve capacity on their networks or for a third party customer. To counter “space hoarding”, regulators can establish conditions which limit the timeframe within which the operator is allowed to reserve space on their infrastructure for its own use or that of a third party.

- **Identify information to be provided:** Even where sharing is mandatory, operators can stymie the process by refusing to provide access seekers with the information needed to facilitate sharing. For instance, operators seeking to share sites will require access to technical information relating to the sites, including site coordinates and certain technical specifications. It is important to establish whether the operator that owns the infrastructure should provide the coordinates of all its sites, or only of those sites that the infrastructure owner consider adequate for site sharing.

⁷¹ In the European Union, the Framework Directive of 11 March 2002 (Directive 2002/21/EC), requires Member States to impose facility sharing only where undertakings are deprived of access to viable alternatives because of the need to protect the environment, public health, security, or to meet town and country planning objectives

- **Establish time limits:** Regulators should also consider imposing time limits for the provision of the relevant information and for negotiating agreements. In some jurisdictions, a timeframe of thirty (30) days between the first request and the time when actual access is provided is considered reasonable. In other countries, a longer timeframe such as sixty (60) days is imposed.⁷² The longer period takes into account any administrative or other difficulties outside of its control that an operator may experience when negotiating sharing agreements.

5.2.3 Additional Regulatory Measures

5.2.3.1 *Establishing an Efficient Dispute Resolution Mechanism*

Regardless of whether sharing is mandatory or optional, an efficient mechanism for the resolution of disputes in connection with infrastructure sharing should be put in place. The regulator will need to have sufficient powers to take the necessary action in order to make site sharing possible. The regulator should be able to impose interim measures in urgent cases, for example when new entrants depend on site sharing for rolling out their networks and entering the market. In resolving disputes, the regulator should be guided by the policy objective. While the decisions of the regulator should be reviewable, this must be done in an efficient and expeditious manner. The ability to achieve infrastructure sharing objectives will be stymied where decisions can be too easily appealed, and even suspended during appeal.

5.2.3.2 *Streamlining the Role of Local Authorities*

The potential to construct infrastructure in certain areas may be limited due to regulatory restrictions. In most jurisdictions, the approvals for trenching and the installation of ducts, masts and towers will be handled by local authorities. These approvals need to be processed in an expeditious manner. However, in some cases, operators require permits from different agencies and in such instances, the approval process can become protracted and will need to be streamlined. To ensure that permit granting procedures do not act as barriers to investment, the number of permits needed to deploy networks could be reduced and specific deadlines should be established for the different processes. Another option would be to create a one-stop-shop for approvals. The establishment of a single point of contact, while preserving the right of each authority to be involved and maintain its decision making role, could reduce complexity and

⁷² The Brazilian regulator ANATEL has established a term of sixty days for the completion of a site sharing agreement, after the owner of the infrastructure has replied positively to a site sharing request. See Regulation on Infrastructure sharing between telecommunication service providers, Annex to resolution 274 of 5 September 2001.

increase efficiency. This contact point could be responsible for coordinating the different procedures and monitoring whether the decisions are adopted within the set timeframes. It would also be entrusted with the responsibility of providing information about all approval procedures and general conditions applicable to civil works.

Local authorities can also play a role in promoting infrastructure sharing. They can require operators to utilize existing infrastructure, unless this is not possible for technical reasons or require new towers, ducts etc. to be designed and engineered in a manner to accommodate more than one operator. In order for infrastructure sharing to be successful, it is crucial that local authorities work closely with regulators, operators and their representatives. Disputes between operators and local authorities are harmful for the roll out of networks and will lead to increased concern by communities, which may often be unfounded and unnecessary. Local authorities can also work with regulators and operators to create common guidelines for the installation of new sites or new equipment on existing sites. The creation of guidelines will improve the availability of information and create legal certainty for operators willing to roll out their networks. In the UK, the Mobile Operators Associations (MOA) in association with the Department for Communities and Local Government has established a Code of Best Practice which provides guidance primarily to mobile network operators, their agents and contractors, and to local planning authorities.⁷³ According to the Code the operators are committed to work together to locate base stations on existing structures, and to share sites wherever viable in order to reduce the need to build new masts on which to locate their equipment and to minimise the number of base station sites in the UK.

5.2.3.3 *Creation of a Centralized Infrastructure Database*

In many countries, the location and state of current infrastructure, must be requested from the relevant authority or company as and when required. In such a scenario, an operator who is seeking to share infrastructure may need to contact a number of different entities to collate this information, and it may not always be clear which entity is ultimately responsible for recording the data. One way of overcoming these challenges and save some of the related costs is for the regulator to develop and operate a common national database of existing and planned infrastructure of different operators. The database would be a specialized geographic information repository to which telecoms operators send relevant information on their passive infrastructure. Access to the information consolidated in this database would be managed by the regulator and non-confidential information provided upon request to interested parties.

⁷³ MOA et al (2013) Code of Best Practice on Mobile Network Development in England http://www.exmoor-nationalpark.gov.uk/_data/assets/pdf_file/0010/754381/EB85-Mobile-Operators-Association-2013-Code-of-Best-Practice-on-Mobile-Network-Development-in-England.pdf

The common national database can take the following forms:

- A database that contains information on which infrastructure operators are present in a region.
- A map that details the exact route of infrastructure with details of ownership and capacity for infrastructure sharing.

In Germany, the infrastructure database maps existing infrastructure that could be used for the deployment of New Generation Access networks. It covers: wired telecoms infrastructure; wireless telecoms infrastructure; transport networks; and other infrastructure. In Poland, it is mandatory for all organizations that own or operate infrastructure suitable for accommodating electronic communication network elements to provide information on existing and planned deployments.

Advantages of the Centralized Infrastructure Database

- i. It reduces the risk of damage to existing infrastructure during excavation work. Operators and utility companies that are due to carry out civil works are more likely to be informed about where existing infrastructure is located, and therefore less likely to cause damage to that infrastructure when carrying out their own excavation works. In Flanders, Belgium, the frequent damage caused to infrastructure was an incentive to implement the centralized database. Any organization that wishes to undertake excavation work is mandated by law to check the database to see the types of infrastructure that is present in the particular area.
- ii. The database would be an enabler of passive infrastructure sharing, which could reduce the cost of deploying high capacity networks. With the database, operators would be able to find out the exact location of existing ducts and may be able to place new cables and fibres within these ducts, instead of carrying out excavation works for the installation of their own ducts. This should save money and time and reduce unnecessary disruption to civil works.

5.2.3.4 Mandating Functional or Structural Separation

Functional Separation: This is where a vertically-integrated company is required to establish a business unit to service its upstream wholesale customers which is separate from its own downstream operations. The business unit established should have a high degree of autonomy and independence from its parent company. “Chinese walls” are created between the independent unit and other parts of the organisation. Functional separation is seen as a

mechanism to ensure fair competition in markets in which there is a dominant operator. It allows the operator to still enjoy some of the benefits of vertical integration so long as those benefits are not due to its leveraging of dominance derived from monopoly infrastructure or infrastructure that is uneconomical to duplicate. Under functional separation, the independent unit is required to provide infrastructure to its own retail division and third party operators on an equal basis. British Telecom's Open Reach is an example of functional separation.

Structural Separation: This is where an operator with monopoly power is broken-up into various companies with different ownership. For example, the original operator may continue to run the retail unit; whereas the network infrastructure side is run by an independent company. Structural separation is usually used as a last resort to counter what is viewed as serious anti-competitive activity by incumbent operators. The most famous example of structural separation is that of AT&T. However, structural separation is not always the result of a regulatory edict. Several incumbent telecommunications operators have voluntarily undertaken structural separation. In New Zealand, Telecom Corp announced in 2011 that it will proceed with the structural separation of its existing business in order to participate in a Government-funded programme of investment in a new, open-access FTTH network. Telecom Corp was split into two new and separate businesses, "Telecom" (the retail unit) and "Chorus" (the infrastructure unit). Chorus was responsible for network and wholesale business concerning both the copper and fibre network. Telecom undertook retail functions and operated Telecom's mobile networks. Chorus and Telecom have separate functions, staff and boards. They also have separate shares and which are separately listed.

CHAPTER 5 – QUESTIONS:

1. What measures could be introduced to incentivize network operators to voluntarily provide access to their infrastructure?
2. Are there particular telecommunications infrastructure in Jamaica for which you think sharing should be mandated? Please provide reasons for your answer.
3. Do you believe that requiring all operators to provide information to enable OUR to compile a detailed inventory of the nature, location and capacity of Jamaica's telecommunications infrastructure is necessary, or should the information only be required from operators on which sharing obligations have been imposed?

Chapter 6: Infrastructure Sharing in Jamaica

6.1 Introduction

In its Report, Pygma Consulting (Pygma) indicated that there were several challenges regarding infrastructure sharing in Jamaica. One such challenge was that network operators viewed coverage as a key differentiator and competitive advantage, even in the mobile segment where the footprint of the networks are not all that different. Thus there is fierce competition to acquire best site locations and secure rental deals with building owners. Pygma noted that this is not unique to Jamaica, as globally, where operators engaged in frontal competition (same technology, similar footprint, etc.), they tend to be less likely to voluntarily engage in infrastructure sharing.

6.2 Extent of Infrastructure Sharing in Jamaica

Based on the research conducted by Pygma, sharing in the mobile sector is confined to passive infrastructure and is very limited. Data collected during the development of the mobile LRIC Model showed that before Digicel acquired Claro in 2011, only 210 of the more than 1400 sites were being shared. It also showed that the sharing of sites between operators was primarily being conducted on a reciprocal basis. A review of sharing data conducted in early 2013 revealed that sharing was still being carried out in line with the reciprocal scheme as the number of sites owned by C&WJ and shared with Digicel was equal to the number of sites owned by Digicel and shared with C&WJ.

Pygma highlighted that this type of reciprocal sharing will pose a serious barrier to entry for new entrants, who have not yet acquired a significant number of sites and therefore will have not have any sites to barter. Furthermore, most of the prime locations for site hosting would have already have been taken by incumbent operators and the locations they might manage to acquire may not be attractive to the other operators. In the fixed segment, Pygma found that sharing was also limited with CCJ providing active capacity to both C&WJ and Digicel. Telecommunications operators are also sharing infrastructure owned by non-telecommunications entities such as the Jamaica Public Service Company Limited and broadcasting entities.

6.3 Analysis of Sharing Incentives

An analysis of the distribution of shared sites across geotypes showed 46% of the shared sites were in urban areas while 53% were in rural areas (see Table 6-1 below).⁷⁴ This shows that the current practice of sharing sites on a reciprocal basis has not led to a strategy of cost minimization targeted towards low-density areas where it is usually less viable to establish cell sites. In some instances, rural sites may require the establishment of access roads in order to gain access to the proposed site thereby leading to even greater development costs as compared with the costs for developing urban sites.

Table 6-1: Distribution of Shared Sites by Geotype

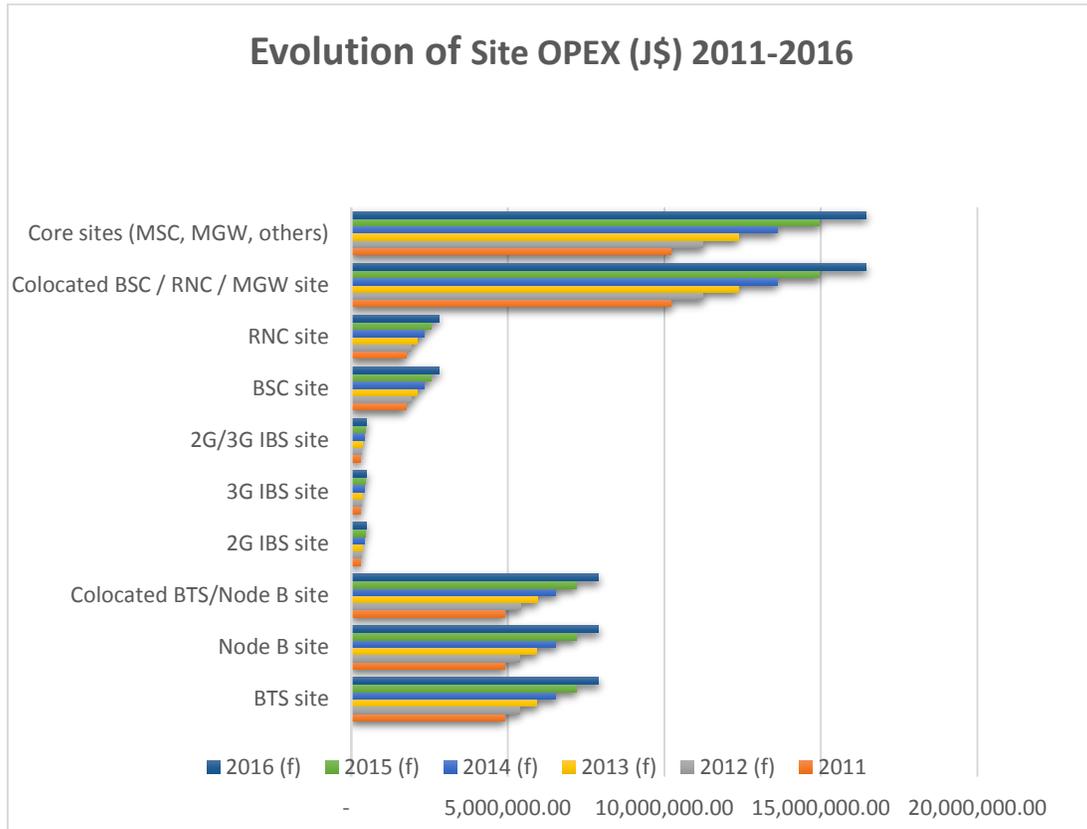
Geotypes	Urban	Rural
Number of shared sites	35	40
Proportion of shared sites	46%	53%

In terms of the types of site designs among shared sites, Pygma found that there is a higher prevalence of urban greenfield sites than rural greenfield sites. It was concluded that this was due to the fact that it is less difficult to find and acquire a new site in rural areas than in the urban areas which are more saturated and thus the incentive to share in rural areas is lower.

The site costs associated with the generic operator modelled in the Mobile LRIC exercise shows a rising trend in Opex (see Figure 6-1 below).

⁷⁴ Pygma Report
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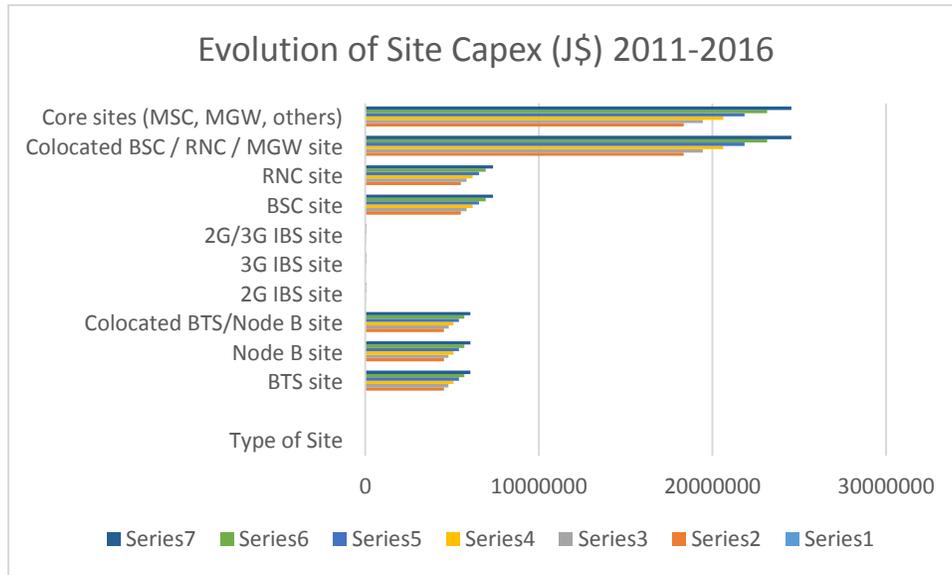
Figure 6-1: Evolution of Site Opex 2011-2016



An additional item which falls under the category of eligible costs that could be shared by operators is the site rental costs. The data also showed that the 2012 average annual site rental costs were 3% higher than the previous year and the 2013 costs were 7% more than the 2012 costs.

The site CAPEX associated with the modelled operator also showed an increasing trend (see Figure 6-2 below).

Figure 6-2: Evolution of Site Capex 2011-2016



Pygma sought to deconstruct the total Capex into main cost categories for the different types of sites. This showed that the costs for constructing the foundation for a typical greenfield site with a lattice or monopole tower as well as the access road accounted for more than a half of the total costs for the site (see Table 6-2 below).

Table 6-2: Capex - Main Cost Categories

Description	Cost Structure		
	Lattice	Monopole	Rooftop
Tower	20%	21%	12%
Foundation	48%	46%	24%
Electrical Work	10%	10%	19%
Diesel Generator	12%	13%	45%
Access Road	10%	11%	-

The review of the cost information shows that some of the same incentives that have led operators in other countries to voluntarily engage in infrastructure sharing also obtain in Jamaica. However, there has been reluctance on the part of all major operators when it comes to the sharing of infrastructure. More recently however, there seems to be heightened interest in the

sharing of particular infrastructure. It should be noted that some operators did indicate that infrastructure sharing could be beneficial to the deployment of LTE as more sites would be needed and it would be more economical to leverage existing facilities especially in the rural areas where demand may not be as concentrated.

6.4 Operators Views on Regulatory Issues

In a meeting to discuss infrastructure deployment and challenges being experienced, operators raised concerns about the management of rights of ways in Jamaica. They indicated that the management of public rights of way has been largely unregulated and uncoordinated and that this has posed difficulties for the providers of telecommunications infrastructure as they sought to expand their respective networks. They indicated that access to rights of way was essential for critical network expansion activities such as the laying of fibre and other forms of cabling. The operators noted that the uncoordinated management of rights of way often result at times in the same roadway being dug up multiple times in a short time span by different operators seeking to lay their cables. This, they say, increases the risk of damage being done to existing cables which could result in complete or partial loss of service to customers of the affected operators. In response to a survey, operators also voiced concerns about the timeframe for getting the authorities' approval. The timeframe ranged from a low of three (3) months to a high of eighteen (18) months, with approvals related to the fixed network seeming to take longer than those related to the mobile network.

The operators made the following suggestions to alleviate the issues regarding rights of ways:

- **Advance notice should be given of any work to roadways etc.:** - This could allow operators to coordinate work on their network with the planned roadwork thus minimizing the need for multiple excavations as well as allow them to minimize the possibility of damage to existing infrastructure.
- **Reduce the need for duplication of infrastructure by requiring that operators be given access to existing trenches, ducts and poles:** - This would facilitate coordination amongst entities while allowing for strategic investments in keeping with their individual network development plans.

It was also suggested that Town and Country Planning Authorities give consideration to establishing guidelines for the construction of those passive infrastructure for which their approval is required. For instance, in urban areas there will be need for sharing of rooftop sites. However, the underlying structure of buildings supporting those sites may not be able to support

the weight of cellular equipment from other operators. It was suggested that it may be prudent to make it mandatory for buildings in urban areas to be constructed in a manner which enables them to accommodate rooftops sites capable of hosting equipment from multiple operators. This could be done through regulations such as building codes and also by making specific stipulations when granting development permits for sites within particular areas.

CHAPTER 6 – QUESTIONS:

1. What are the main bottlenecks (practical, behavioural, administrative, technical or legal) that operators wishing to deploy high-speed communication networks have been confronted with when attempting to access existing telecommunications infrastructure in Jamaica?

Chapter 7: Framework for Infrastructure Sharing in Jamaica

7.1 Background

Currently there is nothing in the Act which prevents operators from entering into voluntary sharing agreements. The Act also does not expressly proscribe any of the forms of sharing outlined in Chapter 3 herein although some forms of sharing could trigger investigations under the Fair Competition Act. However, as previously indicated herein, despite the obvious presence of incentive for sharing, operators have been reluctant to do so. Thus one objective of the proposed regulatory framework will be to establish principles which will, it is hoped, enhance voluntary infrastructure sharing among telecommunications operators by putting in place a conducive environment for such sharing.

Another objective, is to provide certainty to operators regarding the basis on which the OUR will mandate infrastructure sharing. In carrying out its infrastructure sharing mandate, the OUR is required to have due regard to the preservation and protection of the environment, the conservation of natural resources and the health and safety of users. These issues, as well as some of the other principles which will guide the formulation of the infrastructure sharing rules, are discussed in the following sections.

7.2 Basic infrastructure sharing principles

The proposed Rules are designed and developed to encourage infrastructure sharing between operators within a predetermined framework to remove uncertainty and create an environment for better co-operation. The following principles shall apply to the provision of infrastructure sharing services

1. The proposed Rules will be applicable to all Licensees who own or control telecommunications infrastructure and/or wish to get access to and make use of such infrastructure. Specific parts of the Rules, however, will apply only to certain Licensees and the infrastructure owned by them.
2. The Office shall not require a Licensee to make telecommunications infrastructure available where such Licensee does not also make such infrastructure available to itself or a connected company or otherwise use such telecommunications infrastructure in offering its own services.

3. Infrastructure sharing services shall be provided in a manner that:
 - a. maximizes the use of telecommunications networks and infrastructure;
 - b. minimizes the potential for negative environmental impacts; and
 - c. enables or does not impede the development of competition in the provision of telecommunications networks and services in a timely and efficient manner.
4. A Licensee on whom an obligation to share has been imposed shall not obstruct or in any way impede another Licensee in the making of any infrastructure sharing arrangement.
5. An Infrastructure Provider on whom an obligation to share has been imposed, shall not refuse to provide infrastructure sharing services, except where it is due to circumstances related to technical feasibility, such as: impairment of the security or reliability of the infrastructure or the infrastructure provider's (or third party's) network; a lack of currently available space; or future needs for space. Any such claim shall be subject to independent verification by the OUR on a case-by-case basis.
6. Licensees shall provide capacity on its infrastructure to other Licensees on a non-discriminatory "first come, first serve" basis.
7. Each Licensee has an obligation to treat requests, to negotiate infrastructure sharing agreements and to provide infrastructure sharing services in good faith.
8. The terms and conditions on which infrastructure sharing is offered should be in compliance with the principles of neutrality, transparency, non-discrimination and fair competition. The infrastructure sharing agreement must not prohibit or frustrate the provision of a telecommunications service or facility that a Licensee is lawfully allowed to provide.
9. Infrastructure Providers shall endeavour to conclude infrastructure sharing arrangements within thirty (30) working days of receipt of a "complete" Access Request.
10. Every infrastructure sharing agreement shall be in writing and shall specify the contractual terms and conditions agreed on by the parties. All such agreements shall be registered with the Office.
11. All infrastructure sharing agreements shall address each of the following matters unless it is not relevant to the type of infrastructure sharing that has been requested:
 - a. Objective of the agreement
 - b. The scope and specification of the infrastructure to be provided;
 - c. Access to all ancillary and supplementary services or access and use of premises or land that are required to support the provision of the infrastructure;

- d. Service levels and the maintenance of infrastructure;
 - e. Charges for the infrastructure
 - f. Billing and settlement procedures
 - g. Ordering, forecasting, provisioning and testing procedure;
 - h. The provision of collocation for facilities and the terms and conditions in accordance with which such collocation is to be provided;
 - i. The provision of information regarding modernization or rationalization;
 - j. Information handling and confidentiality;
 - k. Effective date and duration of agreement and renegotiation and review procedures;
 - l. Grounds for termination
 - m. Dispute resolution procedures
12. Licensees shall, in the first instance, attempt to reach an agreement on infrastructure sharing by negotiation. Any disputes relating to infrastructure sharing shall follow the dispute escalation procedure outlined in the infrastructure sharing agreement and may ultimately be referred to the OUR.
13. Any Licensee that owns or controls any passive network infrastructure will be required to, within a timeframe to be specified, provide the OUR with a complete inventory of its passive infrastructure in order to facilitate the establishment and maintenance of a national database for passive infrastructure. Licensees will be required to provide updates on newly commissioned infrastructure.

7.3 Basis for the Imposition of an Infrastructure Sharing Obligation

7.3.1 Matters relating to the public health or to the environment or town planning or other development considerations

Due to the expansion of the telecommunications industry, the location, siting and development of telecommunications infrastructure can become an issue of particular interest or concern in local communities, with debate focusing on visual amenity and public health. As was noted earlier

in the document, there are concerns about the effect on the health and wellbeing of the public of human exposure to radio frequency radiation (RFR) emissions transmitted from towers. While the global bodies such as the World Health Organization (WHO) have indicated that they have found no convincing scientific evidence that weak RFR signals, such as those emanating from base stations and wireless networks, adversely impact health, the WHO itself has acknowledged that human exposure to RFR emissions increases with an increase in the number of base stations and wireless networks.⁷⁵ Additionally, the permits for construction of some infrastructure such as ducts and landing stations which may have been easily obtained when there was a sole operator in the market, may no longer be readily available due to changing development objectives.

Jamaica has several pieces of primary and secondary legislations related to environmental protection and planning and development. The main legislations are: the Natural Resources Conservation Authority Act; the Town and Country Planning Act; the Land Development and Utilization Act; the Beach Control Act; the Watersheds Protection Act; the Wild Life Protection Act; and the Endangered Species (Protection, Conservation and Regulation of Trade) Act. Environmental permissions are the remit of the Natural Resources & Conservation Authority (NRCA) who utilises a system of permits and licensing to protect the environment. Planning permissions, falls under the Town and Country Planning Act and are the remit of three public bodies: the Town and Country Planning Authority (TCPA), the Local Authorities (also known as the Parish Councils) and the Government Town Planner. The technical (functional) and administrative mandates of the NRCA and the TCPA are carried out by the National Environment and Planning Agency (NEPA).

While the primary environmental and planning legislations do not make any specific reference to the treatment of telecommunications infrastructure, the Development Orders established under the Town and Country Planning Act make mention of telecommunications infrastructure. The Development Orders set out the framework, guidelines and policies for planning and development in parishes and communities. The Government plans to establish Development Orders for all parishes and select communities by 2017.⁷⁶ To date Development Orders have been promulgated for Portland, Manchester, Trelawny and Negril/Green Island.

The Town and Country Planning Authority, recognising the importance of facilitating the growth of telecommunications in Jamaica, has established planning guidelines for telecommunications. The Telecommunications Planning Guidelines are intended to achieve the following:

- i. balance the deployment needs of telecommunications providers with the protection of the environment for public welfare;

⁷⁵ World Health Organization Factsheet on Electromagnetic Fields and Public Health available at <http://www.who.int/peh-emf/publications/facts/fs304/en/>

⁷⁶ http://www.jamaicaobserver.com/news/Development-orders-for-all-parishes-expected-by-2017_19238307

- ii. assist community understanding of the issues involved in the design and installation of telecommunications infrastructure and provide opportunities for community input in the decision making process;
- iii. promote a consistent approach in the preparation, assessment and determination of applications for planning approval of telecommunications infrastructure;
- iv. minimize disturbance to the environment and loss of amenity in the provision of telecommunications infrastructure; and
- v. ensure compliance with all local government regulations and health and safety standards in the erection of telecommunications infrastructure.

According to the Telecommunications Planning Guidelines, the policy objective is keeping the number of masts to a minimum and encouraging mast sharing where appropriate. To that end, Planning Authorities are tasked with encouraging the use of existing building and reuse of existing sites to site new antennae rather than supporting new installations. Planning Authorities shall require that the operators/applicants demonstrate that all reasonable steps have been taken to:

- a) investigate mast sharing before seeking to erect new mast.
- b) pursue the possibility of cooperating with another operator to erect new mast for joint usage.

Where an operator has been refused a permit to construct telecommunications infrastructure by any of the responsible authorities, the OUR may mandate the sharing of existing infrastructure that will provide the rejected operator with the same/similar facilities as the infrastructure for which permission was not granted. Additionally, where an operator's request to share has been rejected, the OUR will consult with the relevant authorities to determine whether there is grounds to mandate sharing on the basis of 29A(1)(a) of the Act. The OUR plans to establish a protocol with the relevant authorities in order to streamline the process by which mandatory sharing may be triggered due to "matters relating to the public health or to the environment or town planning or other development considerations".

7.3.2 Economic Inefficiencies

The deployment of high-speed wired and wireless telecommunications networks across Jamaica requires substantial investments. It is an accepted fact that there are various inefficiencies and bottlenecks associated with the process of rolling out and wireless telecommunications networks that lead to high costs and heavy administrative burdens for undertakings wishing to deploy such networks. Limiting or removing some of these inefficiencies would make the roll-out of broadband networks more effective and reduce costs. Some of these inefficiencies which lead to

high financial barriers are: inefficiencies or bottlenecks concerning the use of existing infrastructure; bottlenecks related to co-deployment or coordination of civil works and inefficiencies regarding permit granting procedures.

The overall cost of deployment as well the cost components will differ based on the technology being deployed. The main cost components for mobile broadband networks are the base stations and microwave backhaul. In the case of fibre networks, the main cost components are the costs of ducting, and the cost of installing the fibre. In both networks, the costs of civil works (ducting and physical infrastructure) are usually the dominant component of the overall network deployment. By using existing infrastructure suitable for broadband rollout, operators can greatly reduce cost by using existing physical infrastructures.⁷⁷ In an EU study it was estimated that using existing physical infrastructure as opposed to building from scratch can bring significant cost savings of up to 75% of civil engineering works in case of shared only deployment.⁷⁸ It is widely accepted that it can be significantly more efficient for telecommunications operators, in particular new entrants, to re-use existing physical infrastructures in order to deploy telecommunications networks, in particular in areas where no suitable telecommunications network is available or where it may not be economically feasible to build-out a new physical infrastructure.

Despite the benefits to be derived from sharing, there are several bottlenecks or barriers that prevent the sharing of infrastructure from happening at full potential. Some of the main barriers are: technical infeasibility; lack of appropriate legal basis/institutional framework; and lack of business interest/anti-competitive behaviour. Where key existing infrastructure, to which access is required, is owned by a dominant operator, it will often question the commercial rationale for providing others access to its infrastructure. In such cases, the dominant infrastructure operator becomes an obstacle to the development of new infrastructure, the entry of new competitors and ultimately the growth of the market. Given the limited amount of sharing that has taken place in Jamaica, coupled with reports of refusal of requests to share, the OUR has little confidence that there will be an increase in infrastructure sharing if it is left up to the operators.⁷⁹

The OUR thinks it reasonable that dominant operators be required to provide access to their infrastructure where technically feasible. In this regard, where a Licensee is declared to hold a dominant position in a relevant market, the Office may impose a general obligation requiring it to share its network infrastructure with other Licensees. If at any time a party can demonstrate that a particular infrastructure should or should not be included in the list of infrastructure to

⁷⁷For example, instead of a greenfield investment, where civil engineering works can take the costs very high, alternative operators can use the existing infrastructure (such as ducts) of incumbent operators to deploy their networks.

⁷⁸ EU Commission <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52013SC0073>

⁷⁹ In a 2012 study conducted on behalf of the EU Analysys Mason noted that there has been a growing trend across Europe of mandating infrastructure owners to allow access to telecoms operators for the purpose of broadband deployment. http://ec.europa.eu/information_society/newsroom/cf/document.cfm?doc_id=1103

which sharing has been mandated, such a party should file a written request with the Office accompanied by supporting evidence which establishes a reasonable basis for such a request.

7.3.3 Physical or Technical Impracticability

This particular element can be the reason for imposing an obligation to share, as well as a reason not to mandate sharing. The physical or technical impracticability of replicating an existing telecommunications infrastructure can be grounds for mandating the sharing of the infrastructure. Here the OUR will assess whether there are any real or potential substitutes for the infrastructure or whether it can be replicated by any reasonable means. Physical and technical impracticability could mean that there may not be any appropriate location for the siting of alternative infrastructure. This could be due to reasons such as the designation of protected areas based on heritage or environmental reasons which makes it possible to only locate the infrastructure of a single operator in those areas. Additionally, it may be physically or technically impracticable to replicate a particular infrastructure where the magnitude of the cost associated with its replication is high enough that it renders the replication of the infrastructure unreasonable. In both scenarios, first mover advantage could impact the efficient provision of telecommunications services. Where such cases occur, the OUR will mandate sharing of the particular infrastructure if it is technically feasible to do so.

The assessment of the physical and technical impracticability element is also required where the OUR is making a determination of whether it is technically feasible to share a particular infrastructure. Determinations of physical or technical impracticability will be made by the Office on a case by case basis. Therefore, where a general obligation to share infrastructure has been imposed on a Licensee and it is of the view that a particular infrastructure cannot be shared due to physical or technical impracticability, it will have the option to make an application to the Office to remove the particular infrastructure from the “mandated list”. It is likely however, that the issue of technical and practical impracticability may not arise until the infrastructure owner receives a request to share and has conducted its technical assessment. In such cases, the infrastructure owner must inform both the requesting operator and the OUR as soon as possible and provide both with the appropriate technical rationale. The requesting operator can also ask the OUR to render a decision on technical feasibility.

In assessing physical and technical impracticability the Office will consider issues such as:

- whether the infrastructure meets the technical parameters of the requesting party’s network?

- the availability of space to host the requesting provider, including the network operator's future needs for space (this must be sufficiently demonstrated);
- safety and public health concerns;
- impact on the operational integrity of the infrastructure provider's network or any existing equipment at the collocation or sharing site under the control of infrastructure provider or any other third party?
- the risk of serious interferences of the planned telecommunications services with the provision of other services over the same physical infrastructure.

In the mobile market for example, some of the infrastructure were created specifically for utilization by its owner. Many towers erected in the initial stages of network roll-out were not designed with the possibility in mind of sharing with other operators. Issues such as the load-bearing capacity of towers; space within sites; effects on quality of service when antennae are combined can make it physically and technically impractical to share a particular tower. Where a tower does not have sufficient strength to handle the increased weight and wind loading caused by the additional antenna head frames, or have sufficient space to accommodate additional antenna head frames or microwave link equipment, then the tower cannot be shared unless it is strengthened and/or extended. Also, if a base station site uses all of its available channels to support a particular carrier's subscribers during peak periods, then it cannot handle additional traffic from a rival carrier this eliminating the possibility of inter-carrier roaming.

7.3.4 Consultation regarding the imposition of obligation

Prior to issuing a directive under Section 29A (1) the Office shall provide a reasonable opportunity for the operator that owns or controls the infrastructure, and any other interested party, to make representations on the matter and shall give consideration to all representations made before deciding whether or not to issue the directive.

7.3.5 Responsibilities of Infrastructure Providers on whom a sharing obligation is imposed

Upon receiving a written request from Infrastructure Seekers, Infrastructure Providers shall provide access to their infrastructure and shall not unreasonably withhold or delay access. Infrastructure Providers will be required to negotiate with an Infrastructure Seeker in good faith on matters concerning access to facilities and once already granted, an Infrastructure Provider shall neither withdraw nor impair the agreed access except: (i) where authorized by the Office; or (ii) in accordance with a ruling by an adjudicative body.

7.4 Principles for Cost Apportionment

Section 29A (2) of the Act requires that the Office make rules for the apportionment of the costs of sharing infrastructure. It further requires that the rules be made in accordance with the principles set out in Section 33 of the Act.

Section 33(1) of the Act when repurposed to address infrastructure sharing reads:

- a) Costs shall be borne by the carrier whose activities cause those costs to be incurred;
- b) Non-recurring costs shall be recovered through non-recurring charges and recurring costs through recurring charges;
- c) Costs that do not vary with usage shall be recovered through flat charges and costs that vary with usage shall be recovered through charges that are based on usage;
- d) Costs shall include attributable operating expenditure and depreciation and an amount estimated to achieve a reasonable rate of return;
- e) Prices for infrastructure sharing shall be established between the total long run incremental cost of providing the service and the stand alone cost of providing the service, so, however, that the prices shall be so calculated as to avoid placing a disproportionate burden of recovery of common costs on shared infrastructure services
- f) Where appropriate, costs shall include provision for a supplementary charge, being a contribution towards the access deficit of the provider.

In keeping with the principles of Section 33 of the Act, the setting of infrastructure sharing rates should be based on certain basic principles. Where the Office is called on to settle a dispute regarding the infrastructure sharing charges, it will take the following basic principles into account:

- Charges for infrastructure sharing shall be determined in a transparent manner - details on how charges for infrastructure sharing have been determined, will need to be disclosed to the Office upon request;
- Infrastructure sharing charges must only reflect the unbundled elements that an Infrastructure Seeker wishes to use. Infrastructure Providers must unbundle distinct facilities and corresponding charges sufficiently so that the Infrastructure Seeker need only pay for the specific elements required.

- Costs shall be borne either by the Infrastructure Seeker or the Infrastructure Provider or both based on whether their respective requests and compliance with those requests cause those costs to be incurred. However, the Infrastructure Seeker should not have to compensate the Infrastructure Provider for costs associated with providing existing technical information about the site, including the Infrastructure Provider review of such requests and technical analysis.
- Infrastructure sharing charges shall be cost-based and shall be set to allow the infrastructure provider to recover a reasonable rate of return on its capital appropriately employed, all attributable operating expenditures, depreciation and a proportionate contribution towards the infrastructure provider's fixed and common costs. However, where the Infrastructure Provider and Infrastructure Seeker are providing each other with the same services the related infrastructure sharing charges can be reciprocal for the same service.
- Infrastructure sharing charges shall not include compensation for loss of business as a result of providing infrastructure sharing services to the Infrastructure Seeker.
- Infrastructure sharing charges should serve to promote the efficient use of assets and sustainable competition and maximize benefits for customers. The charge to the Infrastructure Seeker for sharing shall not be more than the cost of owning and operating similar infrastructure.
- Charges must be impartial/non-discriminatory. This means that charges for infrastructure must be no less favourable than those the seller offers a connected company or any other licensed operator.
- The burden of proof that interconnection charges are based on costs shall lie with the Infrastructure Provider in all cases.

7.4.1 Costing Methodologies

When determining the maximum charges for infrastructure sharing, there are three basic approaches:

- i. leaving price-setting to the market, i.e. based on negotiations between licensees
- ii. price-setting based on benchmarking
- iii. cost-based price setting

Negotiation-based price setting is most appropriate where there is an efficient market of players with similar market power. However, in a sector where there is one (or few) dominant player(s), negotiation-based charges will lead to suboptimal results, as dominant players can exert their market power to determine actual price levels. In addition, negotiation-based price setting is often highly non-transparent and the public interest is usually not taken into consideration. The setting of charges by benchmarking is often considered an efficient method e.g. to quickly reduce prices to (international) best-practice prices. The major drawback with benchmarking is the choice of reference countries.

Cost-based price-setting is widely used by regulators to set price levels of an efficient operator. The two main approaches are Long-Run Incremental Cost (LRIC) and Fully-Distributed (Allocated) Cost (FDC).

7.4.1.1 Long Run Incremental Cost (LRIC) Method

In this method, all costs become variable since the model takes a 'long run' view such that all factors of production become variable. It is used for estimating the cost of a total service increment based on a hypothetical model of the actual network. In the model, the network may be re-optimized based on current demand, capital equipment prices and operating costs with certain 'benchmarks'. The actual current costs are used as inputs to modelling. Various forms of LRIC have been adopted in different countries, such as Total element long-run incremental cost (TELRIC) and Total Service Long Run Incremental Cost (TSLRIC).

7.4.1.2 Fully Distributed Cost Approach (FDC)

In this method, all the costs are identified separately for each service/network element. The idea of the FDC approach is to simply divide the total cost that the service provider incurs amongst the services it provides. Both fixed and variable costs are used in providing the services and, therefore, both contribute to the revenue generated by these products or services. Its simplicity in directly relating charges to information that is available in the accounting system makes the model auditable. The charges produced by an FDC approach are influenced to a large extent by the manner in which the costs included in the company's accounts have been generated. That is, the approach that has been employed to value assets including, most importantly, whether an historical cost or a current cost accounting (CCA) methodology has been used.

Current/replacement cost methodologies value assets based on the cost that would be incurred by a new entrant to provide the service. Therefore, where assets are included in the accounts at their current replacement costs – as is typically the approach employed in TSLRIC models – the

approaches may become increasingly similar. Other regulators have noted the similarities between the FDC and LRIC methodologies. According to OFCOM “CCA FAC [current cost accounting fully allocated cost] uses data that can be reconciled to the regulatory financial statements, which are audited and are in the public domain. We also think that the CCA FAC and LRIC+EPMU [equi-proportional mark-up] should provide reasonably similar results, particularly at more aggregate levels, since the overall total of costs to be recovered is the same.”⁸⁰

7.4.1.3 OUR’s Proposal for Costing Methodology

Based on Section 33 (1) (e) of the Act charges for infrastructure sharing should be established between the total long run incremental cost of providing the service and the stand alone cost of providing the service. In the case of price-setting for infrastructure sharing, the OUR is proposing that in setting rates for shared elements, infrastructure providers apply a fully distributed cost methodology, using current cost accounting and the annuities approach to depreciation. Where infrastructure sharing has been mandated based on economic inefficiencies, operators will be expected to issue a Reference Access Offer outlining the infrastructure to be shared and the associated charges.

Where the OUR has been asked to intervene in a dispute on charges related to voluntary sharing arrangements, the Infrastructure Provider shall, within fourteen (14) calendar days of a written request from the OUR, supply the OUR with such data as the OUR may require, for the purpose of determining that the Infrastructure Provider’s proposed charges are set in accordance with the principles set by the OUR, unless OUR expressly extends this period in writing.

The OUR may in consultation with stakeholders, revise the costing methodology for infrastructure sharing.

CHAPTER 7 – QUESTIONS:

1. Do you agree with the basic infrastructure sharing principles outlined in Section 7.2?
2. Do you agree with the proposed factors to be taken into account by OUR in considering when to impose an infrastructure sharing obligation on a Licensee? Should you disagree, kindly provide a detailed explanation for your views and suggest additional or alternative factors.

⁸⁰ Ofcom (2011), Proposals for WBA charge control – Consultation document and draft notification of decisions on charge control in WBA market 1, p.54.
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3. Do you agree with the considerations outlined by the OUR for assessing physical and technical impracticability? If you disagree, please suggest alternative principles which OUR should consider.
4. Do you agree with OUR's proposed costing principles for the setting infrastructure sharing charges? If you disagree, please suggest alternative principles which OUR should consider.
5. Do you agree with OUR's proposal on the costing methodology for determining charges for infrastructure sharing? If you disagree, please suggest an alternative method of cost allocation along with evidence to support the same.

Annex A: Proposed Infrastructure Sharing Rules

1. Purpose of the Rules

- 1.1. The primary object of these Rules is to establish a framework within which Licensees can negotiate infrastructure sharing arrangements, and for that purpose, specifically to: -
- a. Ensure that the incidence of unnecessary duplication of infrastructure is minimized or completely avoided;
 - b. Protect the environment by reducing the proliferation of infrastructure and facilities installations;
 - c. Promote fair competition through equal access being granted to the installations and facilities of Licensees on mutually agreed terms;
 - d. To promote the availability of wide range of high quality, efficient, cost effective, and competitive telecommunication services throughout the country by ensuring optimum utilization of telecommunication resources.
 - e. Ensure that the economic advantages derivable from the sharing of facilities are harnessed for the overall benefit of all telecommunications stakeholders.

2. Interpretation

In these Rules –

“Act” means the Telecommunications Act as amended from time to time.

“access” means to obtain the right to use or make use of telecommunications infrastructure belonging to or controlled by an Infrastructure Provider for the purpose of installing telecommunications equipment.

“Access Request” means a request made by a Licensee for access to the facilities of an Infrastructure Provider.

“Connected company” means (a) a holding company or subsidiary of a Licensee; (b) any company which a Licensee has control; (c) any company which a Licensee and persons connected with a Licensee together has control; and (d) any company which together with a Licensee constitute a group.

“Control” by a Licensee of an infrastructure, means the Licensee having the legal right either by virtue of an agreement with the owner or otherwise, to procure the full compliance by the owner of that infrastructure with these Rules, as if that owner were a licensee bound by these Rules.

“Infrastructure” means tangibles used in connection with a public network or intangibles facilitating the utilization of a public network.

“Infrastructure Provider” means any Licensee who owns or is in control of infrastructure amenable to sharing.

“Infrastructure Seeker” means any Licensee desirous of entering into an agreement with an Infrastructure Provider for the purpose of sharing infrastructure.

"infrastructure sharing" has the same meaning as set forth in section 29A(4) of the Act.

“Infrastructure sharing agreement” means a binding agreement between an Infrastructure Provider and Infrastructure Seeker permitting access by an Infrastructure Seeker to the infrastructure of an Infrastructure Provider.

"intangibles" has the same meaning as in section 29A(4) of the Act.

“Licensee” has the same meaning as in the Act.

“OUR Act” means the Office of Utilities Regulation Act, as amended from time to time.

"tangibles" has the same meaning as in section 29A(4) of the Act.

3. Applicability of the Rules

- 3.1. These Rules will be applicable to all Licensees who own or control telecommunications infrastructure and/or wish to get access to and make use of such infrastructure. Specific parts of the Rules may apply only to dominant Licensees and the infrastructure owned by those Licensees.
- 3.2. These Rules apply to all tangibles used in connection with a public network and intangibles facilitating the utilization of a public network. The Office may however, prohibit the sharing of a particular infrastructure or a particular type of infrastructure sharing where it is of the view that there is a risk of lessening of competition as a consequence of such sharing.
- 3.3. The Office shall not require a Licensee to make telecommunications infrastructure available where the Licensee does not also make such infrastructure available to itself

or a connected company or otherwise use such telecommunications infrastructure in offering its own services.

- 3.4. These Rules may be modified by the Office from time to time in accordance with rule 13.9 or any other procedures provided for in the Telecommunications Act or Office determinations.

4. Duty to share

- 4.1. Where a Licensee has been declared dominant, the Office shall impose a general obligation requiring it to share its infrastructure with other Licensees.
- 4.2. The Office may impose an obligation on a non-dominant Licensee to provide access to a specific, identified infrastructure where the Office considers it to be justified having regard to the considerations outlined in section 29A(1)(a) of the Act.
- 4.3. Where a Licensee has been refused a permit to construct telecommunications infrastructure by any of the responsible authorities, the OUR may mandate the sharing of existing infrastructure that will provide the Licensee with the same/similar facilities as the infrastructure for which permission was not granted.
- 4.4. In considering whether to issue a direction in the public interest to share an infrastructure under rules 4.2 and 4.3, the Office shall take into account relevant matters including, but not limited to the following:
 - i. the existence of technical alternatives;
 - ii. whether the infrastructure is critical to the supply of services by the licensees;
 - iii. whether the infrastructure meets the technical parameters of the Infrastructure Seeker's network;
 - iv. the availability of space to host the Infrastructure Seeker, including the network operator's future needs for space (this must be sufficiently demonstrated);
 - v. safety and public health concerns;
 - vi. the impact on the operational integrity of the Infrastructure Provider's network or any existing equipment at the collocation or sharing site that are under the control of infrastructure provider or any other third party;

- vii. the risk of serious interferences of the planned telecommunications services with the provision of other services over the same physical infrastructure.
- 4.5. Where a sharing obligation is imposed on a non-dominant Licensee, the Office shall provide written reasons to the Licensee.
- 4.6. Prior to issuing a directive under section 29A (1) of the Act to a non-dominant Licensee to share infrastructure, the Office shall provide a reasonable opportunity for the Licensee that owns or controls the infrastructure, and any other interested party, to make representations on the matter and shall give consideration to all such representations.
- 4.7. If at any time a party can demonstrate that a particular infrastructure should or should not be included in the list of infrastructure to which sharing has been mandated, such a party should file a written request with the Office accompanied by supporting evidence which establishes a reasonable basis for such a request.

5. Procedure for Negotiating Access

- 5.1. An Infrastructure Seeker may submit an Access Request to Infrastructure Provider expressing its interest in sharing infrastructure at any time.
- 5.2. An Access Request must be in writing and shall include, at a minimum the following information:
 - i. the infrastructure to which access is required;
 - ii. details of the access required;
 - iii. the date by which access is required;
 - iv. the period for which access is required;
 - v. details of any equipment to be installed, together with details of the security, safety, environmental, loading and spatial requirements of such equipment;
 - vi. the extent to which access is required by the Infrastructure Seeker's personnel to the infrastructure to install, maintain or use the equipment to be installed;
 - vii. contact details for the Infrastructure Seeker; and
 - viii. any other requirement which the Office may from time to time prescribe.

- 5.3. The Infrastructure Seeker shall within two (2) working days of submitting the Access Request to the Infrastructure Provider forward a copy to the Office.
- 5.4. The Infrastructure Provider shall within three (3) working days of its receipt of the Access Request acknowledge receipt and shall at the same time, copy its acknowledgement to the Office.
- 5.5. An Infrastructure Provider shall respond in writing to an Access Request within ten (10) working days of receiving it, either:
 - (a) Stating its minimum requirements for entering into a sharing arrangement;
 - (b) Requesting further information that it may reasonably require in order to process the Access Request.
 - (c) Stating its reasons why the request for infrastructure sharing cannot be accommodated.
- 5.6. The Infrastructure Seeker shall as soon as possible comply with a request under rule 5.5(b) from the Infrastructure Provider for further information. An Infrastructure Provider must shall respond to the Infrastructure Seeker within ten (10) days of the receipt of the further information requested.
- 5.7. An Infrastructure Provider shall use all reasonable endeavours to conclude an infrastructure sharing agreement within thirty (30) working days of receipt of an Access Request or where additional information is requested, the date of receipt of all additional information requested of the Infrastructure Seeker, unless such period has been expressly extended by the Office in writing.
- 5.8. Each Licensee has an obligation to treat requests to negotiate infrastructure sharing agreements and to provide infrastructure sharing services in good faith. The Infrastructure Provider shall not:
 - i. Obstruct, delay negotiations in resolving disputes.
 - ii. Refuse to provide information relevant to an agreement including information necessary to identify the infrastructure needed and cost data.
 - iii. Refuse to designate proper representative to expedite negotiation.
- 5.9. Licensees shall provide capacity on its infrastructure to other Licensees on a non-discriminatory “first come, first serve” basis.
- 5.10. An Infrastructure Seeker may request a site inspection of the infrastructure to be shared if it is deemed necessary for the purpose of aiding the Infrastructure Seeker to reach an informed decision.

- 5.11. Where infrastructure sharing agreement has been concluded, an Infrastructure Provider shall neither withdraw nor impair such agreed access except in the following circumstances:
- i. where authorized by the Office; or
 - ii. in accordance with
 - a. a dispute resolution process under Part 13 of these Rules; or
 - b. an order made by the Telecommunications Appeals Tribunal or by a court of law.

6. Refusal of Access

- 6.1. An Infrastructure Provider on whom an obligation to share has been imposed, shall not refuse to provide infrastructure sharing services, except where it is due to circumstances related to technical feasibility, such as:
- a. impairment of the security or reliability of the infrastructure or the Infrastructure Provider's (or third party's) network;
 - b. unavailability of space to host the Infrastructure Seeker, which can be based on the Infrastructure Provider's future needs for space (this must be sufficiently demonstrated); or
 - c. any other general engineering considerations.
- 6.2. The decision to refuse an application for infrastructure sharing shall be communicated in writing to the requesting Licensee specifying the reasons for such refusal.
- 6.3. Where an Infrastructure Provider refuses to provide infrastructure sharing on grounds of technical infeasibility, such claims shall be subject to independent verification by the Office on a case-by-case basis. The Office may direct the Infrastructure Provider to produce any records and documents in connection with its refusal of an Access Request and the Office or its authorized personnel may enter the premises to inspect the relevant facilities to determine the reasonableness of the refusal of access.
- 6.4. Previous successful access to an infrastructure shall constitute evidence for the purposes of rule 5.3 of technically feasible access to that infrastructure or any similar infrastructure.
- 6.5. Where an Infrastructure seeker is aggrieved by the decision of the Infrastructure Provider, the Office shall review the grounds for refusal and may:
- i. uphold the Infrastructure Provider's decision;

- ii. direct the Infrastructure Provider under these Rules to reconsider its decision to refuse access; or
- iii. impose an infrastructure sharing arrangement on the parties under these Rules.

7. Charges for Infrastructure Sharing

7.1. An Infrastructure Provider shall set access rates in accordance with the following principles:

- a. Charges for infrastructure sharing shall be determined in a transparent manner - details as to how charges for infrastructure sharing have been determined, shall be disclosed to the Office upon request.
- b. Infrastructure Providers shall unbundle distinct facilities and corresponding charges sufficiently so that the Infrastructure Seeker pays only for the specific elements required.
- c. Charges for the provision of infrastructure shall be structured in such a manner so as to distinguish and separately price for the following aspects:
 - i. The implementation of sharing including testing;
 - ii. Rental charges for use of the infrastructure; and
 - iii. Variable charges for ancillary and supplementary services.
- d. Costs shall be borne either by the Infrastructure Seeker or the Infrastructure Provider or both, based on whether their respective requests and compliance therewith cause those costs to be incurred. However, the Infrastructure Provider shall not seek to recover from the Infrastructure Seeker the costs associated with providing existing technical information about the site, including the Infrastructure Provider's review of such requests and technical analysis.
- e. Infrastructure sharing charges shall be cost-based and shall be set to allow the Infrastructure Provider to recover a reasonable rate of return on its capital appropriately employed, all attributable operating expenditures, depreciation and a proportionate contribution towards the Infrastructure Provider's fixed and common costs. However, where the Infrastructure Provider and Infrastructure Seeker are providing each other with the same services the related infrastructure sharing charges can be reciprocal for the same service.

- f. Infrastructure sharing charges shall not include compensation for loss of business as a result of providing infrastructure sharing services to the Infrastructure Seeker.
 - g. Infrastructure sharing charges should serve to promote the efficient use of assets and sustainable competition and maximize benefits for customers. The infrastructure sharing charge offered to the Infrastructure Seeker shall not be more than the cost of owning and operating similar infrastructure.
 - h. Infrastructure sharing charges must be impartial/non-discriminatory. This means that charges for infrastructure must be no less favourable than those the Infrastructure Provider offers its connected company or any other licensed operator.
 - i. The burden of proof that infrastructure sharing charges are based on costs shall lie with the Infrastructure Provider in all cases.
- 7.2. In the setting of its charges an Infrastructure Provider shall utilize the fully distributed cost methodology, using current cost accounting and the annuities approach to depreciation.
- 7.3. Every Licensee shall develop a standard price list which shall provide guidance for determining the price for all sharing arrangements with other Infrastructure Seekers.
- 7.4. The standard price list shall be reasonable, non-discriminatory, and based on the costing methodology as mandated by the Office.
- 7.5. Where the Office has been asked to intervene in a dispute regarding infrastructure sharing charges, the Infrastructure Provider shall, within ten (10) working days of a written request from the Office, supply the Office with such data as the Office may require, for the purpose of determining that the Infrastructure Provider's proposed charges are set in accordance with the principles set by the Office, unless the Office expressly extends this period in writing.
- 7.6. Where the Office has been unable to obtain cost information that it is reasonably satisfied is relevant and reliable from a Licensee it may take into account local and international benchmarks, reciprocity and other approach that in the opinion of the Office is relevant to the setting of charges for infrastructure sharing.
- 7.7. The Office may in consultation with stakeholders, revise the costing methodology for infrastructure sharing.

8. Infrastructure Sharing Agreements

- 8.1. Every infrastructure sharing agreement shall be in writing and shall specify the contractual terms and conditions agreed on by the parties. All such agreements and

any future modifications shall be registered with the Office within fourteen (14) days of execution or amendment by the parties.

- 8.2. The terms and conditions on which infrastructure sharing is offered shall be in compliance with the principles of neutrality, transparency, non-discrimination and fair competition. The infrastructure sharing agreement shall not contain provisions that prohibit or frustrate the supply of a telecommunications service or facility that a Licensee is lawfully allowed to provide.
- 8.3. All infrastructure sharing agreements shall, *inter alia*, address each of the following matters unless it is not relevant to the type of infrastructure sharing that has been requested:
 - i. Objective of the agreement
 - ii. The scope and specification of the infrastructure to be provided;
 - iii. Access to all ancillary and supplementary services or access and use of premises or land that are required to support the provision of the infrastructure;
 - iv. Service levels and the maintenance of infrastructure:
 1. service levels and quality of service obligations;
 2. penalties;
 3. testing and maintenance;
 4. fault reporting and repair;
 5. service level disputes; and
 6. network protection and safety measures;
 - v. Charges for the infrastructure
 1. detailed charges per infrastructure or set of infrastructure shared; and
 2. mechanisms for review of charges;
 - vi. Billing and settlement procedures
 - vii. Ordering, forecasting, provisioning and testing procedure;
 - viii. The provision of collocation for facilities and the terms and conditions in accordance with which such collocation is to be provided;
 - ix. The provision of information regarding modernization or rationalization;

- x. Technical specifications, standards and interoperability tests
- xi. Information handling and confidentiality;
- xii. Approvals received from all relevant authorities
- xiii. Effective date and duration of agreement and renegotiation and review procedures;
- xiv. Grounds for termination and termination procedures
- xv. Dispute resolution procedures

9. Reference Access Offer and Standard Practice List

- 9.1. Every Licensee shall, in relation to infrastructure sharing, develop a Reference Access Offer and ensure that its Reference Access Offer is readily available to other Licensees within sixty (60) days following the promulgation of these Rules.
- 9.2. The Reference Access Offer must outline the infrastructure available to be shared and the standard price list. The Reference Access Offer shall contain sufficient information on issues relevant to the Infrastructure Seeker for negotiation purposes.
- 9.3. Parties may request additional information which may be required in the process of negotiating sharing. Such information should be treated as confidential by the requesting party at all times.
- 9.4. The Office recognizes the right of Licensees to negotiate and agree on terms and conditions of infrastructure sharing. The Office however requires that such negotiation must be within the limits of an existing Reference Access Offer.

10. Reservation of Capacity

- 10.1. The right of a Licensee to reserve capacity for which it has made long term investments will at all times be recognized but balanced against the need to promote competition.
- 10.2. Where available capacity is limited, the right to reserve capacity shall not be exercised by a Licensee.
- 10.3. Where a Licensee with significant investments exercises the option to reserve some rights in circumstances of limited capacity:
 - a. The reserve period shall not exceed two (2) years after which the right will cease from being operational.
 - b. Not more than 20% of spare capacity shall be reserved.

10.4. Information and documentary evidence of the reservation and extent thereof must be held by the Licensee and shall be made available to the Office upon request.

11. Replacement and Re-Development/Re-Location

11.1. Except in emergency situations, the replacement of a shared infrastructure by the Infrastructure Provider, or its modification, may only be undertaken after notifying the Office and upon service of a sixty (60) days' notice to the Infrastructure Seeker.

11.2. An Infrastructure Seeker on whom notice is served may lodge a petition against the removal or modification of an infrastructure with the Infrastructure Provider within fifteen (15) days of receiving such notice, and the Infrastructure Provider shall reply thereto within seven (7) days. The Infrastructure Seeker shall provide the Office with a copy of the petition and reply.

11.3. Where for optimal utilization of facilities a Licensee undertakes redevelopment or re-location (i.e. reconfiguration of network as a result of technological or business reasons), the cost of the re-development or re-location may be jointly assessed by the parties and shared with Infrastructure Seekers at a percentage mutually agreed by parties.

11.4. As a condition precedent for a Licensee to commence any redevelopment or re - location of any infrastructure, notice thereof should first be given to all other Licensees sharing the infrastructure. The notice period should be no less than:

- i. Six (6) months in the case of re-development;
- ii. Twelve (12) months in the case of re-location.

12. Confidentiality

12.1. All confidential information provided by a Licensee to another Licensee in relation to infrastructure sharing must:

- a. Be kept confidential and only used in relation to the infrastructure sharing except where the disclosure is authorized in writing by the other Licensee, authorized or required by law; and
- b. Only be disclosed to employees, agents or advisers who need to know that information for the purpose of the infrastructure sharing or advising thereon.

- 12.2. Confidential information of a Licensee received by the other Licensee in relation to the sharing of infrastructure or information generated by the telecommunications system of a Licensee as a result of infrastructure sharing must not be disclosed to any person involved in the development of retail services of the other Licensee, connected companies or its affiliates.
- 12.3. Except as provided for in the Act, confidentiality provisions of an infrastructure sharing agreement must not prevent or frustrate the public disclosure of any infrastructure sharing agreement including its publication on the Office's website.

13. Dispute Resolution and Enforcement

- 13.1. The Office ~~to~~ may intervene to resolve infrastructure sharing disputes at the request of the Infrastructure Provider or Infrastructure Seeker and to impose infrastructure sharing arrangements between Licensees after consultation with the parties.
- 13.2. Licensees shall, in the first instance, attempt to reach an agreement on infrastructure sharing by negotiation. Any dispute relating to infrastructure sharing shall follow the dispute escalation procedure outlined in the infrastructure sharing agreement and may ultimately be referred to the Office.
- 13.3. Where the Office intervenes in an infrastructure sharing disputes, the Office is empowered to request and receive all such necessary information as may be required to reach a decision.
- 13.4. A Licensee shall furnish to the Office such information, as the Office may reasonably require in relation to infrastructure sharing, in such manner and at such times as the Office may reasonably require.
- 13.5. In resolving infrastructure sharing disputes, the Office may take into account all relevant circumstances, including the Infrastructure Seeker's record of infrastructure sharing with its competitors.
- 13.6. The Office may, in relation to any dispute referred to it under these Rules, direct that the parties to the dispute implement an interim arrangement for access as the Office considers appropriate having regard to the nature of the dispute.
- 13.7. An interim arrangement may include such terms and conditions for access as Office deems appropriate and will remain in force until such time as the dispute has been resolved.
- 13.8. The Office will notify the Licensees and publish its decision in relation to the infrastructure sharing dispute.

- 13.9. The Office may issue decisions or revised/additional rules regarding infrastructure sharing from time to time. The Office shall publish the decisions or revised /additional rules and shall provide a period of at least twenty (20) working days for public consultation prior to adopting same.
- 13.10. Failure to comply with the requirements of these Rules and amendments thereto or the decisions of the Office shall be subject to the enforcement provisions of the Act.
- 13.11. Subject to any transition period or process approved by the Office, any term or condition of an infrastructure sharing agreement that does not comply with the provisions of the Act, these Rules and amendments thereto or the decisions of the Office shall be unenforceable between the parties and shall have no legal effect to the extent of its non-compliance.