SADC ICT and Broadcasting Infrastructure Sharing Guidelines

Prepared for

Communications Regulators' Association of Southern Africa (CRASA)

International Telecommunications Union (ITU)

21st Feb 2016





coleagoconsulting

Contents

1. Introduction 1

1.1 Background 1
1.2 Objectives of the Guidelines 1
1.3 Structure of the Guidelines 1
1.4 Abbreviations and Acronyms 2
1.5 Definitions 3

2. Overview of network infrastructure sharing 4

2.1 Types of network infrastructure sharing 4
2.1.1 Technology 5
2.1.2 Geography 5
2.1.3 Architecture 6
2.1.4 Partners 7
2.1.5 Sourcing 8
2.2 Benefits and risks of network infrastructure sharing 10
2.2.1 Direct and indirect benefits 10
2.2.2 Challenges/Risks 11
2.3 Status, trends and drivers of network infrastructure sharing 12
2.3.1 Current status 13
2.3.2 Trends 13
2.3.3 Drivers 14

3. Best practice regulatory approach to network infrastructure sharing 15

3.1 Principles 16
3.1.1 (P1) Regulatory framework should address all aspects of infrastructure sharing and apply to all sector participants 16
3.1.2 (P2) All types of sharing should be permitted so long as competition is not adversely affected 17
3.1.3 (P3) All sector participants have the right to request to share infrastructure that has been mandated for sharing 18
3.1.4 (P4) All sector participants when requested are obliged to negotiate sharing of their (mandated) infrastructure 19
3.1.5 (P5) Operators designated as having SMP in a passive or active infrastructure market are required to publish a reference offer approved by the NRA 20
3.1.6 (P6) Commercial terms for infrastructure sharing should be transparent, fair/economic and non-discriminatory 20
3.1.7 (P7) Approval process for new infrastructure should be timely, effective and encourage infrastructure sharing 21
3.1.8 (P8) Dispute resolution process should be cross-sector, documented, timely and effective 22
3.1.9 (P9) Infrastructure sharing regulatory framework takes into account the national broadband plan, USF policy and future technology development 23
3.2 Consultative cross-sector approach 23
3.2.1 Set up project team (or “task force” or “working group”) 24
3.2.2 Prepare project plan 24
3.2.3 Develop infrastructure sharing policy and identify regulatory changes 25
3.2.4 Draft regulatory changes 25
3.2.5 Feasibility Study and Business Case for infrastructure sharing database 25
3.2.6 Review (consultation and finalisation) 25
3.2.7 Implementation 26

© copyright CRASA and ITU 2016

3.3 Pooling SADC experience and resources 26
3.3.1 Continuous improvement 26
3.3.2 Cost sharing 26

4. Bibliography 27

Appendix A: Template Processes 30
Appendix B: Template Agreement 32
Appendix C: Infrastructure Sharing Database/Atlas 34

Exhibit 1: Five Dimensions of Infrastructure Sharing 5
Exhibit 2: Mobile Network Infrastructure Sharing 6
Exhibit 3: Fixed Network Infrastructure Sharing 7
Exhibit 4: Unilateral or Bilateral 8
Exhibit 5: Joint Venture (JV) 8
Exhibit 6: JV outsources to Managed Service Provider (MSP) 9
Exhibit 7: JV outsources back to partners 9
Exhibit 8: Independent third party (“neutral host”) 10
Exhibit 9: Direct and Indirect Benefits from Infrastructure Sharing 11
Exhibit 10: Example Risks for Sharing Parties 12
Exhibit 11: Example Risks for NRAs 12
Exhibit 12: Status of Mobile Network Sharing end-2015 13
Exhibit 13: The Guidelines in Context 15
Exhibit 14: Principle P1 Examples – Cross-sector Co-ordination 17
Exhibit 15: Principle P2 Examples – Sharing Scope 18
Exhibit 16: Principle P3 Examples – Sharing Rights 18
Exhibit 17: Principle P4 Examples – Sharing Obligations 19
Exhibit 18: Principle P5 Examples – SMP Obligations 20
Exhibit 19: Principle P6 Examples – Pricing Guidelines and Models 21
Exhibit 20: Principle P7 Examples – Process for New Infrastructure Approval 21
Exhibit 21: Principle P7 Examples – Infrastructure Sharing Database 22
Exhibit 22: Principle P8 Examples – Dispute Resolution 22
Exhibit 23: Approach 23
Exhibit 24: Regulatory Framework Checklist 24
Exhibit 25: Template Process for Requests to Share 30
Exhibit 26: Template Process for New Infrastructure Approval 31
Exhibit 27: Benefits of an Infrastructure Sharing Database 34
Exhibit 28: Challenges of an Infrastructure Sharing Database 35

© copyright CRASA and ITU 2016

1. Introduction

1.1 Background

The ITU's World Telecommunication Development Conference (WTDC) Africa Regional Initiative 2 aims to strengthen and harmonise policy and regulatory frameworks for the integration of African telecommunication/ICT markets. As part of this Regional Initiative, the Communications Regulators' Association of Southern Africa (CRASA) initiated a project in 2014 to establish guidelines for ICT and broadcasting infrastructure sharing within Southern African Development Community (SADC) countries.

1.2 Objectives of the Guidelines

The main objective of the SADC Infrastructure Sharing Guidelines project is to allow for regional harmonisation in:

- Achieving an enabling policy and regulatory framework conducive to infrastructure sharing;
- Identifying existing platforms (transmission and contribution networks) suitable for infrastructure sharing in SADC;
- Enabling competition in access networks and provide positive environmental impacts;
- Providing positive incentives to roll out to underserved areas;
- Improving quality of service, especially, in the rural areas; and
- Ensuring positive impact on the wholesale and retail ICT and broadcasting services prices.

1.3 Structure of the Guidelines

There are two main Sections to the Guidelines.

The purpose of Section 2 is to ensure that everyone involved in developing the infrastructure sharing regulatory framework has a common understanding of the subject in terms of:

- Types of infrastructure sharing (Section 2.1)
- Benefits and risks of infrastructure sharing (Section 2.2)
- Status, trends and drivers of infrastructure sharing (Section 2.3).

The heart of the document is Section 3 which offers a best-practice approach to developing a regulatory framework for infrastructure sharing. It is structured as follows:

- Section 3.1 describes the key principles that every regulatory framework should embody; guidance on how they might be incorporated; and, numerous examples
- Section 3.2 provides a recommended approach to assess the existing regulatory framework and context, and implement the proposed changes with input from all interested stakeholders including those from outside the sector

© copyright CRASA and ITU 2016

- Finally Section 3.3 recommends specific actions that SADC members might take to share knowledge and resources.

A Bibliography is included in Section 4. References in this document to published documents or websites use the IEEE style and are identified by a sequential number in square brackets, for example, [1], [2], etc.

1.4 Abbreviations and Acronyms

The following abbreviations and acronyms have been used throughout this document:

CRASA ..... Communications Regulators' Association of Southern Africa

EC ..... European Commission

ECC ..... Electronic Communications Committee

EU ..... European Union

ICT ..... Information and Communications Technology

ITU ..... International Telecommunications Union

JV ..... Joint Venture

MNO ..... Mobile Network Operator

MVNO ..... Mobile Virtual Network Operator

NRA ..... National Regulatory Authority

SADC ..... Southern African Development Community

SOE ..... State-Owned Enterprise

SMP ..... Significant Market Power

VNO ..... Virtual Network Operator (includes MVNOs)

The following abbreviations and acronyms have been used regarding ICT and broadcasting infrastructure (see Section 2.1.3 for definitions):

DTT ..... Digital Terrestrial Television

FTTx ..... Fibre To The x, where x is a generic term to summarise all fibre configurations such as FTTP/FTTH/FTTB (Fibre To The Premises/Home/Building) and FTTC/N (Fibre To The Cabinet/Node)

GWCN ..... Gateway Core Network

LLU ..... Local Loop Unbundling

MOCN ..... Multi-Operator Core Network

MORAN ..... Multi-Operator Radio Access Network

OAN ..... Open-Access Network

RAN ..... Radio Access Network

xDSL ..... Digital Subscriber Line, where x is a generic term to summarise all DSL technologies such as ADSL, SDSL, VDSL, etc.

© copyright CRASA and ITU 2016

1.5 Definitions

Infrastructure-sharing terms used in this document are defined in Section 2.1.3.

Terms for entities used in this document are defined as follows:

Broadcaster	organisation licensed to distribute radio or television programmes to customers over the air or a cable network; for the purpose of this report it excludes satellite broadcasters
Telecommunications provider	organisation licensed to provide telecommunications services over a mobile, wireless or fixed access network
Third-party infrastructure provider	owns/leases and operates passive infrastructure used by telecommunications providers or broadcasters; may be a subsidiary or division of a utility (e.g., electricity, gas or water) or transportation (e.g., roads or railways) company; a company specialising in mobile/broadcasting towers is often referred to as a “tower company” or “towerco”

© copyright CRASA and ITU 2016

2. Overview of network infrastructure sharing

The purpose of Section 2 is to ensure that everyone involved in developing an infrastructure sharing regulatory framework has a common understanding of the subject in terms of:

- Types of infrastructure sharing (Section 2.1)
- Benefits and risks of infrastructure sharing (Section 2.2)
- Status, trends and drivers of infrastructure sharing (Section 2.3).

2.1 Types of network infrastructure sharing

Taking a broad view, practically every part of a network is shareable including the operational support systems (OSS) and business support systems (BSS). “Network” here refers to all types of radio and fixed communications networks but for the purpose of this document excludes satellite networks.

One of the simplest ways to categorise infrastructure sharing is into:

- Passive sharing: the sharing of non-electronic infrastructure such as sites, towers, poles, ducts, trays, shelters, equipment rooms, power, HVAC, security, etc.
- Active sharing: the sharing of active (i.e., electronic) infrastructure in the access or core network.

By its nature, active sharing includes passive sharing but the boundary between the two is often confused.

In reality infrastructure sharing arrangements are far more complex than simply which assets are to be shared. Exhibit 1 shows five dimensions (or characteristics) that may be used to define any sharing scenario.

© copyright CRASA and ITU 2016

Exhibit 1: Five Dimensions of Infrastructure Sharing



Source: Coleago Consulting

2.1.1 Technology

The technological dimension identifies the technology to which the sharing applies, for example: 2G, 3G, 4G, WiFi, xDSL, DOCSIS, etc. There are many cases where, for whatever reason, two MNOs have agreed to share 4G but not 2G or 3G. Sweden has a most complex arrangement whereby there are two shared 3G networks TeliaSonera/Tele 2 and Telenor/Hutchison but the shared 4G network is Telenor/Tele 2.

In developing the regulatory framework it is important that, as far as possible, the wording is technology-neutral and will cater for future technology development (see principle P9 in Section 3.1.9).

2.1.2 Geography

The geographical dimension concerns where in the country the sharing will occur. Typically areas are described according to population density (urban, suburban, rural or remote) or administrative boundaries but, in the case of mobile networks, may also differentiate between in-building and outdoor antennas.

Urban areas usually present more valuable opportunities than rural areas for competitive differentiation in terms of network quality, in-building coverage, service features, etc. and so it often makes strategic sense for MNOs not to share in such areas. Sharing urban sites may also present difficulties in terms of space availability, radiation limits, planning restrictions, etc.

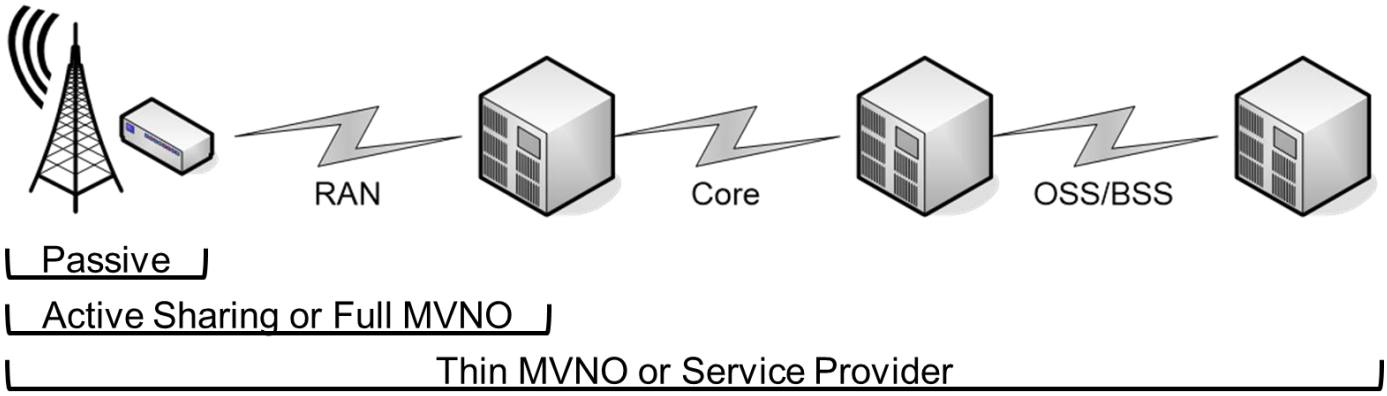
Given that many governments' national broadband policy objectives include providing access in rural areas, infrastructure sharing becomes a critical enabler given the typically high implementation/operating costs and low revenues (see principle P9 in Section 3.1.9).

© copyright CRASA and ITU 2016

2.1.3 Architecture

The architectural dimension is the one that most people use to describe infrastructure sharing. It defines the (passive and active) assets and related activities that are shared; the active assets differ according to the technology scope (see Section 2.1.1 above).

Exhibit 2: Mobile Network Infrastructure Sharing



Source: Coleago Consulting

The main types of mobile network sharing shown in Exhibit 2 are as follows:

Passive sharing ..... sharing of non-electronic infrastructure such as: sites, towers, poles, ducts, trays, shelters, equipment rooms, power, HVAC, security, etc.

Active sharing ..... sharing of active (i.e., electronic) infrastructure in a RAN or fixed access network; see the following definitions for antenna sharing, MORAN and MOCN for specific cases of active sharing

Antenna sharing ..... as “passive sharing” but including the antennas, feeders, amplifiers and combiners

MORAN ..... (Multi-Operator RAN) sharing of active (i.e., electronic) infrastructure in a RAN such as the BTS/BSC, Node B/RNC, eNode B, etc.

MOCN ..... (Multi-Operator Core Network) as “MORAN” but the spectrum is also shared

MVNO ..... (Mobile Virtual Network Operator) an operator licensed to use the RAN and spectrum of another operator; the MVNO does not hold a spectrum licence and may (“heavy/thick/full”) or may not (“light/thin”) own a core network

Roaming ..... users from one MNO are able to access the network of a second MNO within the same country; usually limited to a geographical area; for the purpose of this document international roaming is excluded

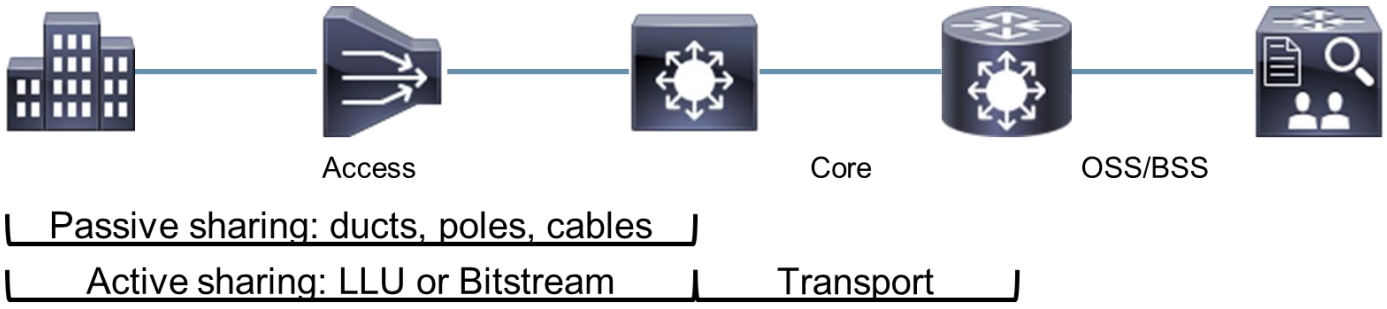
© copyright CRASA and ITU 2016

Transmission sharing .....sharing of the backhaul or backbone transmission network including equipment such as: microwave, fibre optic cable, terminating equipment, routers, etc.

GWCN sharing .....sharing of a mobile core network including equipment such as MSCs and SGSNs

Just over 10% of MNO sharing deals (excluding MVNOs and roaming) involve spectrum sharing (MOCN) between licensed operators. It is most often used if one or both partners lacks sufficient spectrum for their needs. As mobile data traffic continues to grow, spectrum sharing is likely to become more common – see Section 2.3.2 (Trends) and ITU's ICT Regulation Toolkit [1].

Exhibit 3: Fixed Network Infrastructure Sharing



Source: Coleago Consulting

The main types of fixed network sharing shown in Exhibit 3 are as follows:

Passive sharing .....sharing of non-electronic infrastructure such as: sites, towers, poles, ducts, trays, shelters, equipment rooms, power, HVAC, security, etc.; in fixed network sharing the "local loop" cabling (copper, coax or fibre optic) is treated as part of the passive infrastructure

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

Bitstream access .....provision by one fixed access network operator to another of xDSL service between the customer's premises and a handover point

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

2.1.4 Partners

Potential partners in a sharing deal includes any entity such as an MNO, fixed network operator, cable TV operator, terrestrial broadcaster, utility company,

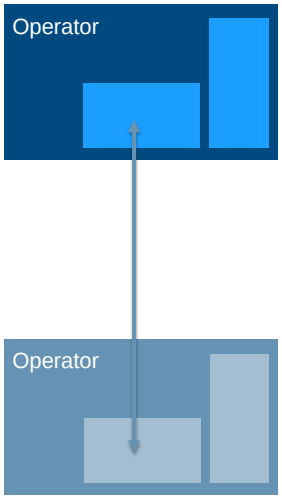
© copyright CRASA and ITU 2016

tower company, etc. that owns or leases the infrastructure assets to be shared. From the regulatory perspective difficulties may arise if the NRA's mandate or the current licensing regime do not apply to an entity – this happens most often in the case of a utility company falling under the mandate of a different regulatory authority – see principle P1 in Section 3.1.1.

2.1.5 Sourcing

There are a number of sourcing possibilities for sharing infrastructure as shown in Exhibit 4 to Exhibit 8. The sourcing arrangement is particularly important when considering the competitive aspects of a sharing agreement – see principle P2 in Section 3.1.2.

Exhibit 4: Unilateral or Bilateral



Unilateral: agreement for one partner to provide assets/services to the other partner.

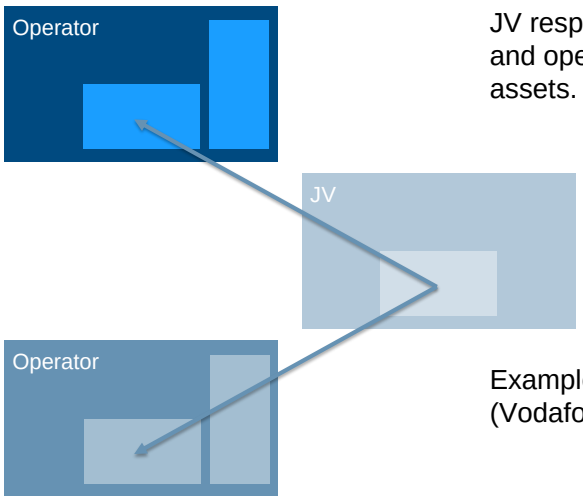
Bilateral: agreement to share assets of both partners.

Typically used for site sharing, roaming, MVNO, LLU, etc.

Examples: T-Mobile and 3 (roaming) in Austria, Celcom and Altel in Malaysia.

Source: Coleago Consulting

Exhibit 5: Joint Venture (JV)



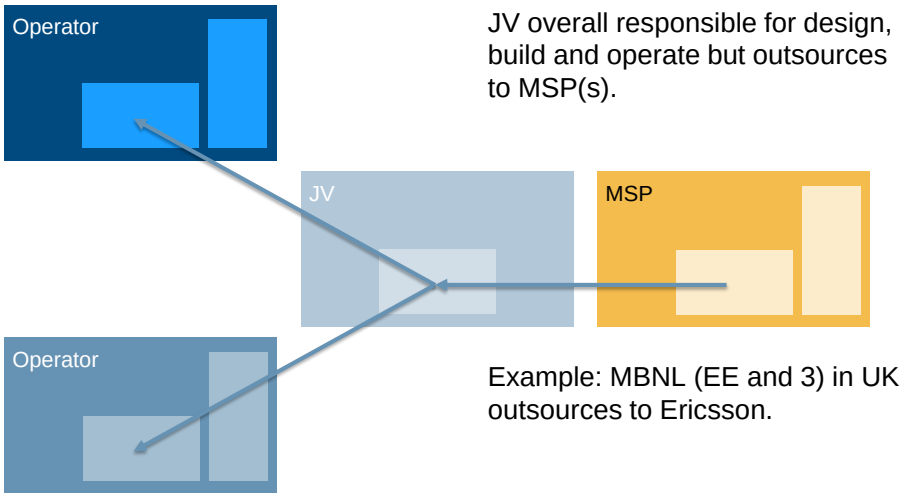
JV responsible for design, build and operate. May or may not own assets.

Example: VICTUS Networks (Vodafone and Wind) in Greece.

Source: Coleago Consulting

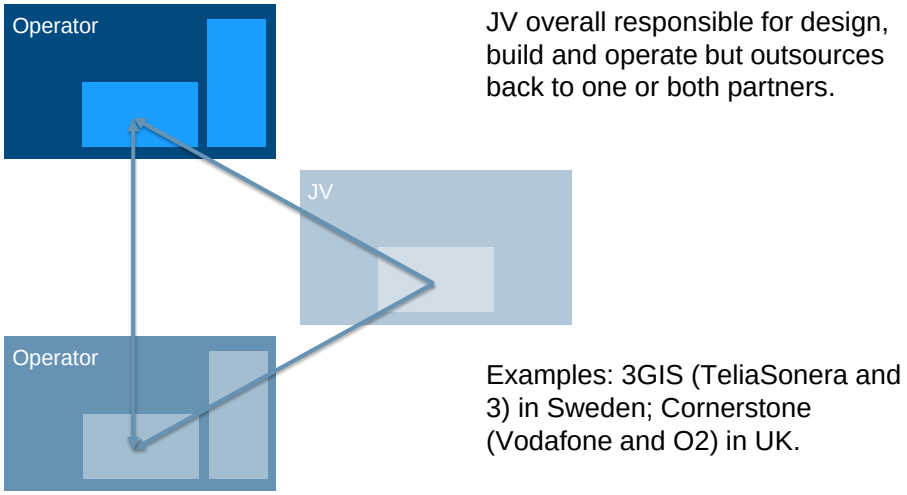
© copyright CRASA and ITU 2016

Exhibit 6: JV outsources to Managed Service Provider (MSP)



Source: Coleago Consulting

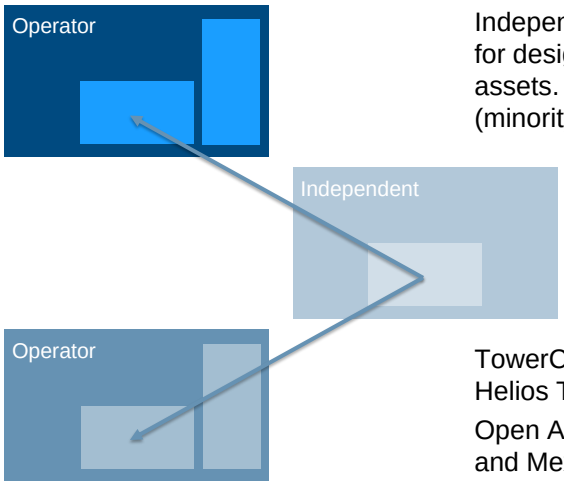
Exhibit 7: JV outsources back to partners



Source: Coleago Consulting

© copyright CRASA and ITU 2016

Exhibit 8: Independent third party (“neutral host”)



Independent company responsible for design, build and operate. Owns assets. Operator(s) may own a (minority) share.

TowerCo examples: Abertis (Spain), Helios Tanzania, TIM (Italy).

Open Access examples: Rwanda and Mexico.

Source: Coleago Consulting

2.2 Benefits and risks of network infrastructure sharing

This Section provides an overview of the direct benefits from network infrastructure sharing for the sharing parties and the indirect benefits for their customers, the government and the nation as a whole. Although the challenges/risks are heavily weighted towards the sharing parties, the NRA(s) and competition authority need to be alert to the possibility of anti-competitive behaviour.

2.2.1 Direct and indirect benefits

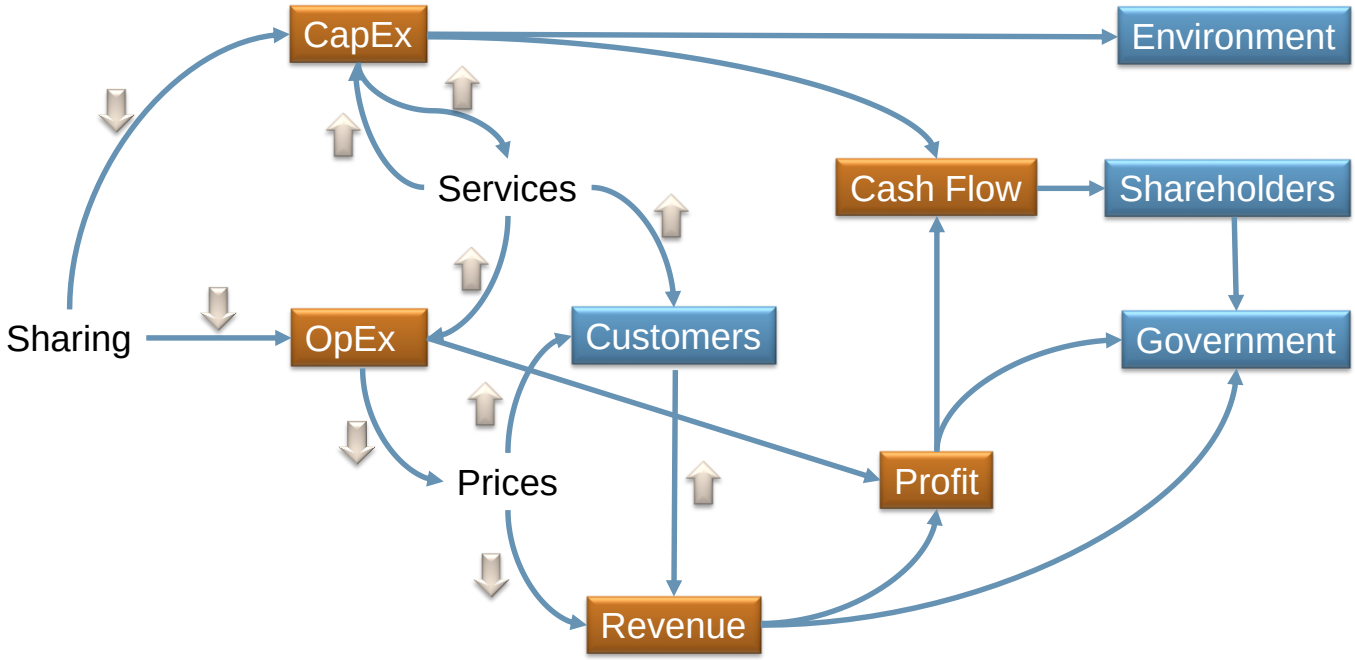
The direct benefit from network infrastructure sharing is a net reduction in capital (CapEx) and operating expenditure (OpEx) for the partners involved. Dependent on the sharing scenario, there may be additional up-front costs, for example, relocating equipment, dismantling sites, transitioning staff to a JV, creating new process/OSS interfaces, etc. but these are usually outweighed by the savings on new CapEx. Typically, after three to five years the cumulative OpEx savings exceed the CapEx savings.

Savings from network sharing are greatest when building new networks rather than merging legacy networks. Rationalising existing (legacy) networks usually requires sites to be dismantled or modified and equipment to be relocated or scrapped, the costs of which will reduce the net savings.

The indirect benefits are many (Exhibit 9) depending on how a company decides to use its savings.

© copyright CRASA and ITU 2016

Exhibit 9: Direct and Indirect Benefits from Infrastructure Sharing



Source: Coleago Consulting

Customers usually benefit from the operators reinvesting the savings in new/enhanced services, further/faster geographic service roll-out, improved service quality or lower prices.

In turn, the government benefits from increased tax revenues resulting from increases in value-added (sales) tax (from higher revenue), corporation tax (from higher profits) and personal income tax (from higher employment, investment, etc.).

Numerous studies (for example, from the ITU [2], EC [3], etc.) have shown that increased (mobile and fixed) broadband penetration and consumption increases national productivity and investment which in turn is reflected in GDP, employment and further tax revenue.

Finally, there are usually environmental benefits such as:

- Reduced carbon footprint due to energy savings, reduced travel by field engineers, reduced road traffic disruption, etc.
- Less visual pollution in the case of radio communications towers.

2.2.2 Challenges/Risks

Infrastructure sharing has potential risks for the sharing parties and the regulatory bodies (NRA(s) and competition authority).

It is the responsibility of the sharing entities to undertake their own risk analysis before entering into an agreement. This is normally a part of their business case approval process. Risks are specific to each deal but typical examples are shown in Exhibit 10; the partners should identify how they will mitigate each risk.

© copyright CRASA and ITU 2016

Exhibit 10: Example Risks for Sharing Parties

Risk	Description
Partner conflict	Distrust, lack of respect or arguments between the partners
Change of ownership	Ownership of one party changes (cf Australia, Ireland and UK)
Proprietary information leakage	Proprietary strategic information is passed to competitor (accidently or on purpose)
Technical incompatibilities	Typically arising from the legacy active equipment
Legacy networks, systems or contracts	Legacy networks, systems or contracts complicate or hinder network sharing leading to a reduction in sharing benefits
Poor customer experience	Breakdown in end-to-end customer experience management
Over-estimation of benefits	Often happens where one or both of the parties lack experience of sharing

Probably the most important challenge for an NRA is the risk of anti-competitive behaviour by a dominant entity, for example, refusing to share infrastructure or imposing discriminatory terms and conditions. As a consequence the benefits described in Section 2.2.1 above are greatly reduced or fail to materialise. The principles described in Section 3.1 and recommended approach described in Section 3.2 have been developed to mitigate as many risks as possible.

Exhibit 11: Example Risks for NRAs

Risk	Description
Delays	Process to request or negotiate sharing is delayed by one party
Refusal	Sharing is refused by one party on unsubstantiated grounds
Discrimination	Terms and conditions offered vary according to the requesting party
High prices	Prices for sharing include unreasonable profits
Disputes	Frequent disputes place an unnecessary burden on the NRA

2.3 Status, trends and drivers of network infrastructure sharing

Network infrastructure sharing is not new. It has been around for decades in one form or another – often encouraged or mandated by regulators to help new entrants – national roaming and cell site sharing in the case of mobile networks; and, pole/duct sharing and local loop unbundling in the case of fixed networks.

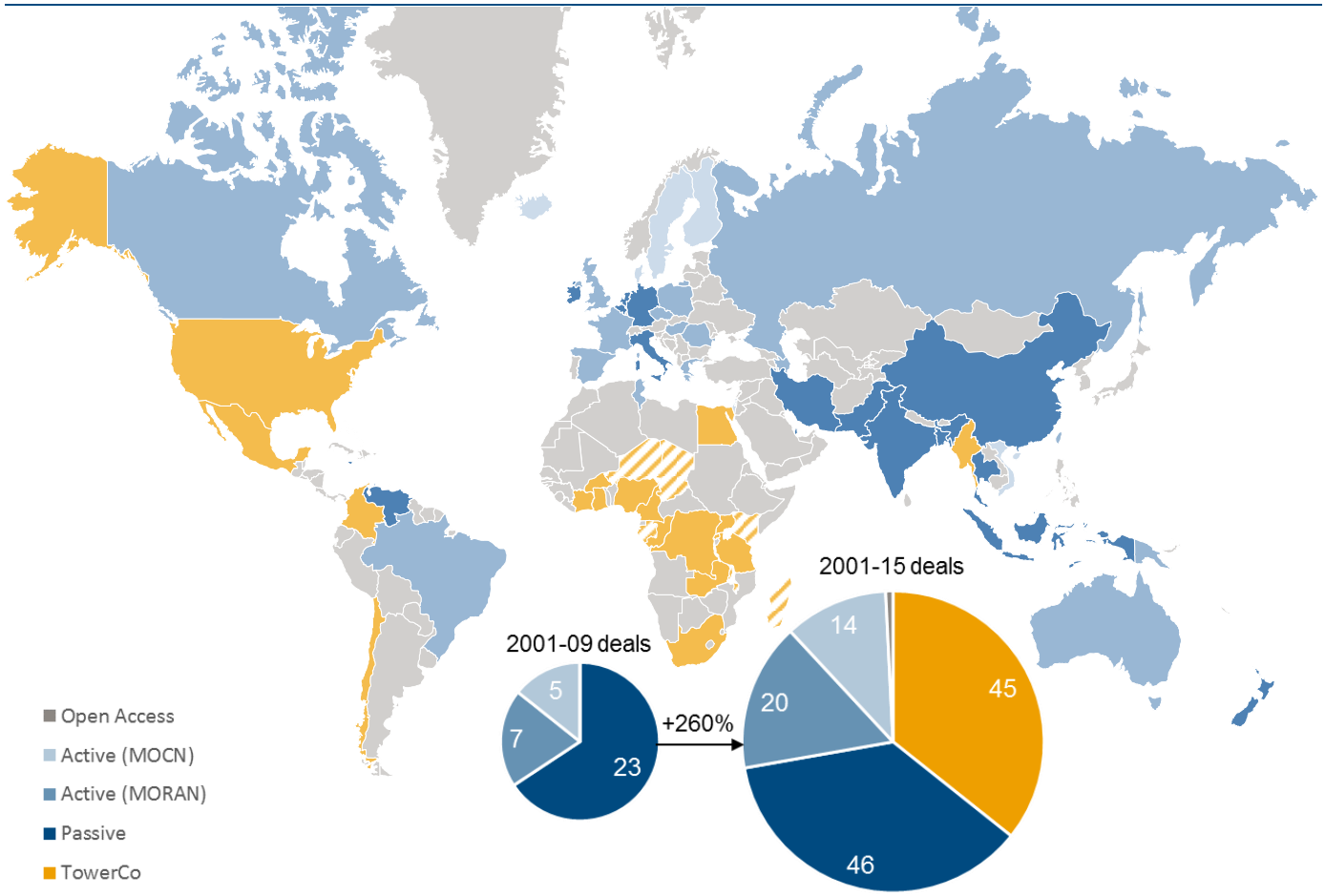
When formulating regulatory policy and developing the regulatory framework, NRAs should take into account the current and expected trends and the likely drivers for sharing.

© copyright CRASA and ITU 2016

2.3.1 Current status

The status of infrastructure sharing is more easily ascertained in mobile than fixed networks. Exhibit 12 shows the status at end-2015 based on public announcements with countries coloured according to the “depth of sharing”. The map does not show national roaming or MVNOs.

Exhibit 12: Status of Mobile Network Sharing end-2015



Source: Coleago Consulting

2.3.2 Trends

In network infrastructure sharing four clear trends have emerged during the last five years:

- Network sharing JVs between MNOs; whereas site sharing started off in many markets as a mutual exchange involving a small percentage of sites, a JV can go much further to maximise the number of shared sites and cost savings, typically 25-40% of the in-scope costs. Furthermore the scope of RAN sharing has been extending from passive to active (MORAN) and, in some cases, to spectrum sharing (MOCN).
- Tower sales; where an MNO sells its towers to a third party (or forms a joint venture) and leases them back. The majority of these transactions have been in Africa (almost 40% of all towers had been sold by end-2014) but similar deals are now taking place in the other regions. Given their long-term secure cash flows and growth prospects, tower companies are

© copyright CRASA and ITU 2016

attracting considerable Private Equity investment thereby facilitating further deals.

- In-market MNO consolidation; undoubtedly discussions about sharing are leading some shareholders to be more radical and consider consolidation.
- Open-access national broadband networks as part of the solution to deliver national broadband objectives; implemented either through a state-owned enterprise (SOE), such as BBNL in India and NBN in Australia, or a public-private partnership, such as the HSBB in Malaysia and the NICTBB in Tanzania.

Three further trends are expected to emerge over the next five years:

- Multi-MNO rural infrastructure sharing. Most MNOs have finished rolling out 2G, and in some cases 3G, coverage as far as is financially feasible. Any further roll-out will be slow and depend on GDP growth and unit cost reductions. Most governments have now developed national broadband plans, supported by the ITU and the Broadband Commission, that include objectives to provide broadband access to rural areas. Probably the most cost-effective solution to achieve such an objective is 3G or 4G infrastructure shared between two or more MNOs using active sharing or roaming. One of the critical barriers is the cost of backhaul which the open-access national broadband networks mentioned above might help to overcome.
- Network Functions Virtualisation (NFV) and Software-Defined Networking (SDN) are emerging technology developments that might enable and encourage further types of network sharing in the future, depending on how standards and OEM products/services evolve.
- Spectrum sharing. There are currently 14 spectrum sharing (MOCN) joint ventures between MNOs. With mobile data traffic doubling every two years, MOCN deals are likely to increase but NRAs will still be under considerable pressure to release more spectrum. Some NRAs such as the FCC in the USA [4] and Ofcom in the UK [5] are evaluating advanced spectrum sharing using “lightly licensed” or unlicensed spectrum.

2.3.3 Drivers

What is driving the huge increase in MNO sharing, tower sales and consolidation? EBITDA pressure is the predominant driver, be it as a result of revenue competition (new entrants, MVNOs or OTT players), regulators reducing termination rates or international roaming fees (Europe and Africa), or the rapid increase in mobile data traffic. The latter is possibly the most significant, with data traffic forecast to double every two years.

LTE roll-out has been the “burning platform” for numerous network sharing deals. LTE creates two major cost pressures for an operator. Initially it requires a major capital investment in licence/spectrum fees, network elements and transmission, with a commensurate increase in operating costs. Later, as take-up increases, LTE users consume two to three times the amount of data compared to 3G users, incurring further capital and operating expenditure but with limited revenue upside.

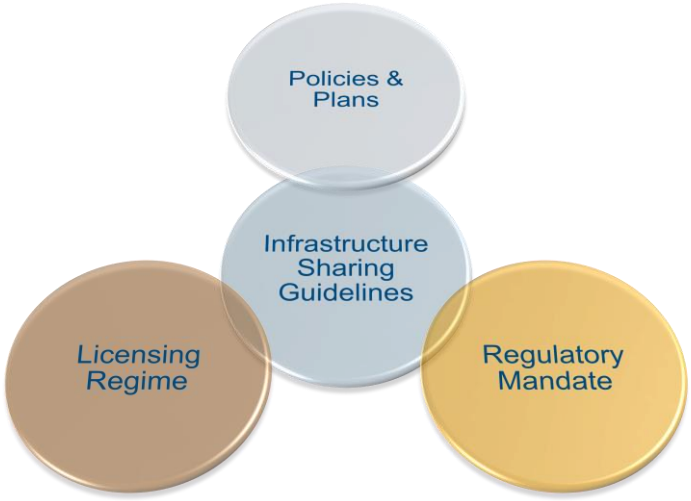
In many markets, sharing is also being driven by limited spectrum availability or government ambition to improve broadband services.

© copyright CRASA and ITU 2016

3. Best practice regulatory approach to network infrastructure sharing

The existing regulatory framework in most countries already embodies some sharing policies and principles. Thus the purpose of this Section is to enable an NRA to identify how to improve its current framework given that the starting point and the context (see Exhibit 13) will always be different from other NRAs.

Exhibit 13: The Guidelines in Context



To use these Guidelines it is critical to start by understanding the current context and how it might change in the foreseeable future. Key areas (not exhaustive) to consider are:

- Policies and Plans: covering subjects such as competition, spectrum, broadband, universal access and fiscal (sector-specific fees and taxes)
- Regulatory Mandate: with respect to the above policies and plans, for example, the broadcasting regulator may be a separate body from the telecommunications regulator; there may be relevant sector-specific taxes controlled by a ministry of finance or local government authorities; price regulation may fall under the aegis of the competition authority; local government authorities are usually responsible for granting planning permission; etc.
- Licensing Regime: in terms of facilities, services, technologies, etc.

Thus the Guidelines provide guidance and examples but cannot be prescriptive regarding their implementation in terms of policy, legislation, regulations, etc.

This Section is therefore structured as follows:

- Section 3.1 describes the key principles that every regulatory framework should embody, guidance on how they might be incorporated and relevant examples

© copyright CRASA and ITU 2016

- Section 3.2 provides a recommended approach to assess the existing regulatory framework and context, and implement the proposed changes with input from all stakeholders including those from outside the sector
- Finally Section 3.3 recommends specific actions that SADC members might take to share knowledge and resources.

It is important to note that, with the IP-driven delayering of telecommunications, most NRAs are shifting their focus from infrastructure-based competition to service-based. As far as possible these Guidelines attempt to remain neutral on the subject, for example the recommended pricing model in Section 3.1.6 is neutral to "build or buy", but do assume this trend continues.

3.1 Principles

The principles have been developed by reviewing best practice from around the world and validating them against the challenges identified in a survey[1] of CRASA members and non-SADC NRAs. Each principle is described here in terms of why it is important and how it should be achieved in practice. Examples highlighted in the tables in light blue are highly recommended.

3.1.1 (P1) Regulatory framework should address all aspects of infrastructure sharing and apply to all sector participants

Regulatory transparency and predictability encourage investment in the ICT sector (see ITU's ICT Regulation Toolkit [6]). Unfortunately many existing regulatory frameworks fail to address all aspects of sharing – for example, some focus on passive or mobile sharing only – thereby creating uncertainty regarding other possible sharing arrangements. Potential sharing partners often spend considerable time and effort trying to clarify unclear regulations resulting in delayed or reduced benefits for the partners, their customers, the government and the nation as a whole.

The situation may be further complicated because the NRA lacks the necessary mandate to regulate all sector participants, for example:

- The broadcasting NRA is a separate body in some countries, for example, Mauritius, Zambia and Zimbabwe in SADC
- In most countries other government departments and regulatory bodies are responsible for sectors such as utilities or transportation whose companies may own infrastructure of interest to ICT and broadcasting companies.

Application of this principle:

- Involve all stakeholders in developing and implementing the changes to the regulatory framework (see Section 3.2 and in particular the checklist of potential stakeholders in Section 3.2.1)
- Establish cross-sector governance, processes (see P4, P7 and P8), standards (see P7) and systems
- Use the "five dimensions of sharing" in Section 2.1 to check that the regulatory framework addresses all potential "technologies", "architectures" and "partners".

[1] CRASA-ITU survey questionnaire dated 8th Nov 2015

© copyright CRASA and ITU 2016

There are various approaches to address the cross-sector issue, for example:

- Brazil issued joint regulations by three sector regulators (see Exhibit 14)
- A single NRA responsible for multiple sectors, for example, Gambia's Public Utilities Regulatory Authority (PURA) and the Rwanda Utility Regulatory Authority (RURA)
- Costa Rica has established a government commission involving the Ministry of Economy and Industry, the Ministry of Science and Technology and SUTEL (the NRA)
- In the UK, the National Joint Utilities Group is a self-regulating trade association focused on street works.

Although there are no known examples, a form of Memorandum of Understanding (MoU) amongst the stakeholders may be the most straightforward approach.

Given that the EC 2014 Directive [7] has a strong cross-sector focus, many more examples of how to resolve this issue may emerge within the EU during 2016.

Exhibit 14: Principle P1 Examples – Cross-sector Co-ordination

Country	Document	Comment
Brazil	Multisector Resolution n° 01 of 24 November 1999 (Regulation of infrastructure sharing between the sectors of Energy, Telecommunications and Oil) [8]	This regulation was issued jointly by three sector regulators. Only available in Portuguese.
EU	Directive 2014/61/EU [7]	Available in all European languages.
Portugal	Decree-Law no. 123/2009, of 21 May 2009 (later amended) [9]	Available in Portuguese and English. Includes local government responsibilities.

3.1.2 (P2) All types of sharing should be permitted so long as competition is not adversely affected

In some countries active sharing or spectrum pooling (MOCN) is not permitted on the grounds that it might harm investment or competition. Given that there is no evidence from any country to support this argument (in fact the opposite is probably true), the recommended approach is to permit all types of sharing but clarify that they must comply with competition legislation and regulations.

Application of this principle:

- Use the "five dimensions of sharing" in Section 2.1 to check that the regulatory framework addresses all potential "technologies" and "architectures"
- The regulatory framework should provide clear guidance on the types of sharing agreements that will require NRA and competition authority approval, along with the process and indicative timetable
- Clarify the principles or requirements that will be used as the basis for evaluation, for example:
  - Control: each partner needs to have independent control of its services
  - Confidentiality: no exchange of competition-related data beyond that needed to design, build and operate the shared infrastructure.

© copyright CRASA and ITU 2016

Exhibit 15: Principle P2 Examples – Sharing Scope

Country	Document	Comment
Brazil	Resolution n° 274 of 05 September 2001 (Regulation of Infrastructure Sharing between Telecommunication Service Providers) [10]	Only available in Portuguese.
EU	Access Directive 2002/19/EC [11]	Available in all European languages.
India	Infrastructure Sharing [12], Spectrum Sharing [13], Virtual Network Operators [14]	Amendments to licence conditions. VNO recommendations in progress – will introduce MVNOs
Malaysia	Mandatory Standard on Access [15], Access List [16] and Guideline on 3G MVNOs	Applies to all forms of sharing and interconnection.
Portugal	Decree-Law no. 123/2009, of 21 May 2009 (later amended) [9]	Available in Portuguese and English.
Singapore	Code of Practice for Competition [17]	Mobile and fixed passive sharing only.

3.1.3 (P3) All sector participants have the right to request to share infrastructure that has been mandated for sharing

This principle works together with P4 and P7 to facilitate and encourage infrastructure sharing.

Application of this principle:

- The NRA must identify the types of infrastructure that are mandatory to share and the operators to whom it applies; typically this access includes:
  - Passive radio and fixed communications network infrastructure including that owned by third parties
  - Active radio communications networks by MVNOS
  - Any infrastructure where the owner has been designated as having SMP (see principle P5 in 3.1.5)
- Use the cross-sector governance created by principle P1 (see Section 3.1.1 above) to develop a standard process (with time limits) which works across industry sectors and national/local government (see templates in Appendixes A and B).

Exhibit 16: Principle P3 Examples – Sharing Rights

Country	Document	Comment
Australia	Facilities Access Code [18]	Process for requesting/responding to (mobile and fixed) passive sharing.
Brazil	Resolution n° 274 of 05 September 2001 (Regulation of Infrastructure Sharing between Telecommunication Service Providers) [10]	Only available in Portuguese.
Canada	Revised Frameworks for Mandatory Roaming and Antenna Tower and Site Sharing [19]	Process for requesting/responding to site/tower sharing and roaming.
EU	Access Directive 2002/19/EC [11] and Directive 2014/61/EU [7]	Available in all European languages.

© copyright CRASA and ITU 2016

Country	Document	Comment
India	Infrastructure Sharing [12], Spectrum Sharing [13], Virtual Network Operators [14]	
Malaysia	Mandatory Standard on Access [15], Access List [16] and Guideline on 3G MVNOs	Applies to all forms of sharing.
Portugal	Decree-Law no. 123/2009, of 21 May 2009 (later amended) [9]	Available in Portuguese and English. See Chapter III regarding sharing existing facilities.

3.1.4 (P4) All sector participants when requested are obliged to negotiate sharing of their (mandated) infrastructure

This principle is necessary for P3 (Section 3.1.3) to function. There are many examples of infrastructure owners taking an inordinate amount of time to respond or rejecting requests outright without discussion – on the grounds of technical or commercial infeasibility. Thus all sector participants when requested should be obliged to negotiate sharing of their (mandated) infrastructure in good faith and within reasonable timeframes, subject to technical/commercial feasibility, unless agreed otherwise by the NRA.

Application of this principle:

- Use the cross-sector governance created by principle P1 (see Section 3.1.1 above) to develop a standard process (with time limits) which works across industry sectors and national/local government (see templates in Appendixes A and B)
- Provide guidelines in the standard process on what constitutes a reasonable basis to reject sharing requests
- Provide a template (see Appendix B) to set a minimum reasonable standard for agreements and thereby reduce the likelihood of disputes; note that a model offer is only a guide.

Exhibit 17: Principle P4 Examples – Sharing Obligations

Country	Document	Comment
Australia	Facilities Access Code [18]	Process for requesting/responding to (mobile and fixed) passive sharing.
Bahrain	Regulation on the Wireless Telecommunications Network Facility Sharing [20] and Sample Sharing Agreement [21]	Includes template for a sharing agreement for mobile towers but could be used for other forms of sharing.
Brazil	Resolution n° 274 of 05 September 2001 (Regulation of Infrastructure Sharing between Telecommunication Service Providers) [10] and Resolution n° 550 of 22 November 2010 (Regulation of Mobile Virtual Network Operation) [22]	Only available in Portuguese.
Canada	Revised Frameworks for Mandatory Roaming and Antenna Tower and Site Sharing [19]	Process for requesting/responding to site/tower sharing and roaming.

© copyright CRASA and ITU 2016

Country	Document	Comment
EU	Access Directive 2002/19/EC [11] and Directive 2014/61/EU [7]	Available in all European languages.
India	Infrastructure Sharing [12], Spectrum Sharing [13], Virtual Network Operators [14]	
Malaysia	Mandatory Standard on Access [15], Access List [16] and Guideline on 3G MVNOs	Applies to all forms of sharing.
Portugal	Decree-Law no. 123/2009, of 21 May 2009 (later amended) [9]	Available in Portuguese and English. See Chapter III regarding sharing existing facilities.
Rwanda	Reference Infrastructure Sharing Offer [23]	Template agreement for duct and fibre sharing
Zambia	Model Access Offer [24] and Model Co-location Offer [25]	Template agreements

3.1.5 (P5) Operators designated as having SMP in a passive or active infrastructure market are required to publish a reference offer approved by the NRA

Application of this principle:

- The NRA:
  - Defines the markets
  - Undertakes a market review to determine whether an operator has SMP
  - Reviews SMP designation at end of (x-years') period; for example, Hong Kong and Romania have deregulated LLU at a later date due to the greatly increased competition that resulted.
- An operator with SMP must publish a reference offer (see template in Appendix B) approved by the NRA within a specified period of time
- The regulatory framework should define:
  - The process and time limits
  - Guidelines on how pricing should be set (see P6 in Section 3.1.6 below) including use of a "glide path" to change from current prices to new regulated prices.

Exhibit 18: Principle P5 Examples – SMP Obligations

Country	Document	Comment
Brazil	Resolution n° 600 of 08 November 2012 (Brazilian Framework for Competition) [26]	Available in Portuguese and English. Includes all types of infrastructure sharing including roaming.
EU	Access Directive 2002/19/EC [11]	Available in all European languages.
Singapore	Code of Practice for Competition [17]	

3.1.6 (P6) Commercial terms for infrastructure sharing should be transparent, fair/economic and non-discriminatory

Application of this principle:

© copyright CRASA and ITU 2016

- This principle should be embodied in the model offer(s) identified under principle P4 (see Section 3.1.4 above)
- The regulatory framework should include pricing guidelines to reduce the likelihood of disputes and to be used in cases of SMP (see P5 in Section 3.1.5 above)
- The recommended approach[2] is to:
  - Use a bottom-up Long-Range Incremental Cost Plus (LRIC+) model
  - Where feasible, use benchmarking across SADC to validate the LRIC model outputs and to assist in dispute resolution
  - Consider moving at a later date to a hybrid model with a top-down FAC model for calibration and reconciliation of the LRIC model.

Exhibit 19: Principle P6 Examples – Pricing Guidelines and Models

Country	Document	Comment
Bahrain	Bottom-up Fixed and Mobile Network Cost Models [27]	
EU	Recommendation on Costing Methodologies 2013/466/EU [28]	Available in all European languages.
Rwanda	Guidelines for Siting and Sharing of Telecom BTS Infrastructure [29]	Mobile only.

3.1.7 (P7) Approval process for new infrastructure should be timely, effective and encourage infrastructure sharing

Application of this principle:

- Use the cross-sector governance created by principle P1 (see Section 3.1.1 above) to develop a process which works across industry sectors and national/local government
- Process should have the following characteristics (see template in Appendix A):
  - Timely: maximum time limits for each step
  - Effective: all stakeholders should be involved in designing the process to ensure that it is as efficient as possible and is continuously improved
  - Encourage infrastructure sharing:
    - Create a cross-sector infrastructure sharing database (see Appendix C)
    - The requester must show that there is no suitable existing infrastructure that can be shared
    - New infrastructure should be designed for sharing, subject to interest from other parties

Exhibit 20: Principle P7 Examples – Process for New Infrastructure Approval

Country	Document	Comment
Canada	Radio-communication and Broadcasting	Mobile only; encourages sharing; simple.

[2] See CRASA-ITU ICT and Broadcasting Infrastructure Sharing Phase II Report, Section 8.

© copyright CRASA and ITU 2016

Country	Document	Comment
	Antenna Systems	
Portugal	Decree-Law no. 123/2009, of 21 May 2009 (later amended) [9]	Available in Portuguese and English. See Chapter II regarding new infrastructure.
Rwanda	Guidelines for Siting and Sharing of Telecom BTS Infrastructure [29]	Mobile only.
UK	Code of best practice on mobile phone network development [30]	Mobile only; detailed process.

Exhibit 21: Principle P7 Examples – Infrastructure Sharing Database

Country	Document	Comment
Belgium	Radio Infrastructure Site Sharing (R.I.S.S.) database	Mobile only. Available in French and Flemish.
EU	Directive 2014/61/EU [7]	Available in all European languages.
Portugal	Decree-Law no. 123/2009, of 21 May 2009 (later amended) [9]	Available in Portuguese and English. See Chapter IV regarding Centralized Information System (SIC).
Rwanda	Guidelines for Siting and Sharing of Telecom BTS Infrastructure [29]	Mobile only. Site database maintained by NRA.

3.1.8 (P8) Dispute resolution process should be cross-sector, documented, timely and effective

NRAs usually have a generic dispute resolution process for resolving any type of dispute within their regulatory mandate. It is important to check and, if necessary, modify it to work in cases of cross-sector disputes.

Application of this principle:

- Check that the standard process is applicable to all disputes arising from infrastructure sharing, particularly if it involves a party from another industry sector or a local government body; although possibly unique, Brazil achieved this through regulations issued jointly by three sector regulators
- The process should be:
  - Documented
  - Timely: maximum time limits for each step
  - Effective: all stakeholders should be involved in designing/reviewing the process to ensure that it is as efficient as possible and is continuously improved.

Exhibit 22: Principle P8 Examples – Dispute Resolution

Country	Document	Comment
Brazil	Multisectoral Resolution n° 02 of 27 March 2001 (Regulation set of the Regulatory Agencies Conflict Resolution of the Electric Power Sector, Telecommunications and Oil) [31]	This regulation was issued jointly by three sector regulators. Only available in Portuguese.
EU	Directive 2014/61/EU [7]	Available in all European languages.
ITU	Dispute Resolution in the	Discussion document regarding all forms of

© copyright CRASA and ITU 2016

Country	Document	Comment
	Telecommunications Sector	disputes but nothing specific on cross-sector.
UK	Dispute Resolution Guidelines	All forms of disputes but nothing specific on cross-sector.

3.1.9 (P9) Infrastructure sharing regulatory framework takes into account the national broadband plan, USF policy and future technology development

As explained at the start of this Section, if it is to be successful, the regulatory framework for infrastructure sharing must work in the context of other government policy, in particular that related to broadband and USF. Furthermore, as far as possible, it needs to be technology-neutral if it is be applicable in the long term.

Application of this principle:

- As far as possible, ensure that the infrastructure sharing regulatory framework (see Section 3.2.3 below)
  - Supports the objectives set out in the national broadband plan and the USF policy, e.g., providing broadband to rural areas
  - Is technology-neutral in order to cope with future developments such as virtualisation (SDN and NFV), 5G, etc.

3.2 Consultative cross-sector approach

Exhibit 23: Approach



- Set up project team
- Prepare project plan
- Identify regulatory changes

- Draft regulatory changes
- Feasibility Study and Business Case for infrastructure sharing database

- Consultation
- Finalise sharing policy and regulations

- Implement process changes
- Implement sharing database
- Undertake SMP review(s), if nec.

The approach shown in Exhibit 23 assumes that the existing regulatory framework already embodies some of the principles set out in the previous Section. It is written from the perspective of the NRA.

Use a best-practice project management approach (for example, the ITU's Project Management Tools [32]) to ensure a successful outcome, for example, it is important to have well-defined deliverables and clear acceptance/success criteria for each stage or the project.

Exhibit 24 provides a checklist of the deliverables and further details are included in the Appendixes as noted.

© copyright CRASA and ITU 2016

Exhibit 24: Regulatory Framework Checklist

Deliverable	Comment
Infrastructure sharing policy	Describes context, objectives, scope, principles and governance
Cross-sector governance	Implementation of the policy in terms of changes to mandates, establishment of organisational bodies, etc.
Cross-sector processes for: • Requests to share • New infrastructure approval • Dispute resolution	See Appendix A
Process for evaluating SMP	
Template agreement(s)	See Appendix B
Pricing guidelines including use of pricing models	
Pricing model(s)	See CRASA-ITU ICT and Broadcasting Infrastructure Sharing Phase II Report, Section 8
Infrastructure sharing database/atlas	See Appendix C

3.2.1 Set up project team (or “task force” or “working group”)

Identify all possible stakeholders who might need to be involved, for example:

- MNOs, MVNOs, fixed network operators, ISPs, cable TV operators, broadcasters, etc.
- Tower companies or other independent infrastructure owners
- Utility and transportation companies and the government bodies that regulate them
- Local government bodies involved in granting planning permission
- Government representatives responsible for the national broadband plan, USF policy, spectrum policy, and relevant licence/spectrum fees or sector-specific taxes
- Competition authority
- Government and non-governmental organisations responsible for environmental protection
- Business and consumer associations.

Organise a workshop for all the stakeholders and present these Guidelines and a summary of the current regulatory framework and context (see Section 3.2.3 below). Outputs from the workshop should include: a draft project plan (see Section 3.2.2), draft sharing policy and implications for the regulatory framework (see Section 3.2.3 below).

3.2.2 Prepare project plan

The NRA may have published a consultation procedure that must be adhered to in all circumstances. If not or if it has some flexibility, it is recommended

© copyright CRASA and ITU 2016

involving stakeholder representatives in the drafting in order to minimise the changes resulting from the official consultation step.

Ideally with input from all the stakeholders, agree the governance, process, schedule and resources for the work. This should be done at the workshop described in Section 3.2.1 above.

3.2.3 Develop infrastructure sharing policy and identify regulatory changes

Analyse the existing regulatory framework and context (see Exhibit 13, The Guidelines in Context):

- Policies and plans such as national ICT/broadband plan, USF policy, spectrum strategy, national infrastructure (energy and transport) plans, etc. to identify objectives on which infrastructure sharing may have an impact and any inhibitors such as licence/spectrum fees or sector-specific taxes
- Regulatory mandate in order to identify issues that are outside the direct responsibility of the NRA
- Licensing regime in terms of structure, obligations, etc. and potential for change.

Draft a brief infrastructure sharing policy document that includes objectives, scope (technologies, geography, architectures and participants), principles and governance.

Compare the existing regulatory framework against the principles (in Section 3.1) and identify specific changes required to legislation, regulations, etc. It may be necessary to phase the changes due to other planned legislative or regulatory changes that are in progress. As legislation takes considerable time to draft or amend, it is most likely that the regulatory framework will require a new or revised regulation. As per Brazil, consider making the regulation joint with other sector regulators.

Update the project plan based on the scope of changes required.

3.2.4 Draft regulatory changes

The previous activity determines the scope of this activity and the stakeholders who need to be involved. It may make sense to break the work up into different streams, e.g., processes, technical, commercial, etc., depending on the knowledge required.

3.2.5 Feasibility Study and Business Case for infrastructure sharing database

See Appendix C. Consider whether to undertake this activity in conjunction with the previous drafting activity (3.2.4) or to postpone it until a subsequent phase. The advantage of undertaking it in parallel is to ensure that the regulatory framework includes the appropriate obligations to contribute to and use the output from the database. Implementation (see Section 3.2.7) may then wait until a subsequent phase.

3.2.6 Review (consultation and finalisation)

Although all stakeholders may have contributed to the drafting of the regulatory changes, there should still be a formal public consultation activity in

© copyright CRASA and ITU 2016

accordance with the NRA's normal procedures. Once all comments have been received and analysed, the regulatory changes may be finalised and approved accordingly.

3.2.7 Implementation

The implementation activities will depend on the scope of the changes. It may include changes to existing processes, new processes, implementing the sharing database, undertaking market reviews for SMP, etc.

3.3 Pooling SADC experience and resources

Although one of the main objectives for these Guidelines is to harmonise the regulatory framework across SADC, further benefits will accrue from pooling experience and resources.

3.3.1 Continuous improvement

Infrastructure sharing knowledge and experience has grown immensely over the last decade and will continue to do so. NRAs should strive to improve their relevant regulatory frameworks even after they have applied these Guidelines. Examples of how this might be achieved include:

- Reviewing implementation progress over the next two years at CRASA level
- Sharing information amongst CRASA members about the disputes that have occurred, how they were resolved and recommended mitigation to prevent reoccurrence
- Setting up a benchmark knowledgebase to which all members can contribute and refer (if needed for pricing disputes).

3.3.2 Cost sharing

Two areas for potential cost savings through some form of joint procurement activity are:

- Sharing the cost of implementing a common infrastructure sharing database:
  - Developing a solution once and delivering it to all CRASA members
  - If delivered as a cloud service, implementation and operation costs would be further reduced
  - Training, help desk and maintenance could also be shared
- Sharing the cost of implementing and supporting a common pricing model; this may prove more difficult than the database but should provide some savings.

© copyright CRASA and ITU 2016

4. Bibliography

[1] ITU, “5.4 Spectrum Sharing,” [Online]. Available: http://www.ictregulationtoolkit.org/5.4.

[2] ITU, “The Impact of Broadband on the Economy,” Apr 2012. [Online]. Available: https://www.itu.int/ITU-D/treg/broadband/ITU-BB-Reports_Impact-of-Broadband-on-the-Economy.pdf.

[3] EC, “The socio-economic impact of bandwidth,” 2012. [Online]. Available: https://ec.europa.eu/digital-agenda/en/news/study-socio-economic-impact-bandwidth-smart-20100033.

[4] FCC, “3.5 GHz Band / Citizens Broadband Radio Service,” 17 Apr 2014. [Online]. Available: https://apps.fcc.gov/edocs_public/attachmatch/FCC-15-47A1.pdf.

[5] Ofcom, “A framework for spectrum sharing,” 31 Jul 2015. [Online]. Available: http://stakeholders.ofcom.org.uk/consultations/spectrum-sharing-framework/.

[6] ITU, “1.2.3 Accountability, Transparency, and Predictability,” [Online]. Available: http://www.ictregulationtoolkit.org/1.2.

[7] EC, “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,” 15 May 2014. [Online]. Available: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014L0061.

[8] ANATEL, “Multisectoral Resolution n° 01 of 24 November 1999 (Regulation of infrastructure sharing between the sectors of Energy, Telecommunications and Oil),” 24 Nov 1999. [Online]. Available: http://www.anatel.gov.br/legislacao/resolucoes/resolucoes-conjuntas/84-resolucao-conjunta-1.

[9] ANACOM, “Decree-Law no. 123/2009,” 21 May 2009. [Online]. Available: Decree-Law no. 123/2009, of 21 May 2009 (later amended).

[10] ANATEL, “Resolution n° 274 (Regulation of Infrastructure Sharing between Telecommunication Service Providers),” 5 Sep 2001. [Online]. Available: http://www.anatel.gov.br/legislacao/en/resolutions/16-2001/351-resolucao-274.

[11] EC, “Directive 2002/19/EC of the European Parliament and of the Council of 7 March 2002 on access to, and interconnection of, electronic communications networks and associated facilities (Access Directive),” 7 Mar 2002. [Online]. Available: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32002L0019.

[12] TRAI, “Recommendations on Infrastructure Sharing,” 11 Apr 2007. [Online]. Available: http://www.trai.gov.in/WriteReadData/Recommendation/Documents/recom11apr07.pdf.

© copyright CRASA and ITU 2016

[13] TRAI, “Recommendations on Guidelines on Spectrum Sharing,” 21 May 2015. [Online]. Available: http://www.trai.gov.in/WriteReadData/Recommendation/Documents/Response%20-%20Spectrum%20Sharing=Final.pdf.

[14] TRAI, “Recommendations on Introducing Virtual Network Operators in telecom sector,” 1 May 2015. [Online]. Available: http://www.trai.gov.in/WriteReadData/Recommendation/Documents/Recommendations_VNO_01_05_2015.pdf.

[15] MCMC, “Mandatory Standard on Access,” 14 Aug 2003. [Online]. Available: http://www.skmm.gov.my/skmmgovmy/media/General/pdf/Access-List-2015.pdf.

[16] “MCMC,” 01 Sep 2015. [Online]. Available: http://skmm.gov.my/skmmgovmy/media/General/pdf/Access-List-2015.pdf.

[17] IDA, “Telecom Competition Code 2012,” 23 Apr 2012. [Online]. Available: https://www.ida.gov.sg/Policies-and-Regulations/Code-of-Practice-and-Guidelines/Telecom-Competition-Code.

[18] ACCC, “Facilities Access Code,” 24 Sep 2013. [Online]. Available: https://www.accc.gov.au/regulated-infrastructure/communications/transmission-services-facilities-access/access-codes-telecommunications-facilities/final-decision.

[19] CRTC, “Framework for Mandatory Roaming and Antenna Tower and Site Sharing,” 6 Mar 2013. [Online]. Available: http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/h_sf10290.html.

[20] Bahrain TRA, “Regulation on the Wireless Telecommunications Network Facility Sharing,” 8 Oct 2009. [Online]. Available: http://www.tra.org.bh/en/legal-instruments/regulations/.

[21] Bahrain TRA, “Sample Sharing Agreement,” 13 May 2010. [Online]. Available: http://www.tra.org.bh/en/legal-instruments/regulations/.

[22] ANATEL, “Resolution n° 550 of 22 November 2010 (Regulation of Mobile Virtual Network Operation),” 22 Nov 2010. [Online]. Available: http://www.anatel.gov.br/legislacao/resolucoes/2010/46-resolucao-550.

[23] RURA, “Reference Infrastructure Sharing Offer,” 20 Feb 2012. [Online]. Available: http://www.rura.rw/fileadmin/docs/guidelines/RISO_Rwanda_v12.pdf.

[24] ZICTA, “Model Access Offer,” 01 Nov 2015. [Online]. Available: http://www.zicta.zm/Downloads/publications/MAO%20approved%2029%2010%202015.pdf.

[25] ZICTA, “Model Co-location Offer,” 1 Nov 2015. [Online]. Available: http://www.zicta.zm/Downloads/publications/MCO%20approved%2029%2010%202015.pdf.

[26] ANATEL, “Resolution n° 600 of 08 November 2012 (Brazilian Framework

© copyright CRASA and ITU 2016

for Competition),” 8 Nov 2012. [Online]. Available: http://www.anatel.gov.br/legislacao/en/resolutions/759-resolution-600.

[27] Bahrain TRA, “Bottom-up Fixed and Mobile Network Cost Models,” 19 Oct 2011. [Online]. Available: http://www.tra.org.bh/media/document/MCD1011144PositionPaperonBU-LRICcostmodels.pdf.

[28] EC, “Commission Recommendation of 11 September 2013 on consistent non-discrimination obligations and costing methodologies to promote competition and enhance the broadband investment environment,” 11 Sep 2013. [Online]. Available: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32013H0466.

[29] RURA, “Guidelines for Siting and Sharing of Telecommunication Base Station Infrastructure,” 9 Jun 2011. [Online]. Available: http://www.rura.rw/fileadmin/docs/GUIDELINES_FOR_SITING_AND_SHARING_OF_TELECOM_BTS_INFASTRUCTURE.pdf.

[30] Mobile Operators Association, “Code of Best Practice on Mobile Network Development in England,” 24 Jul 2013. [Online]. Available: https://www.gov.uk/government/publications/code-of-best-practice-on-mobile-phone-network-development.

[31] ANATEL, “Multisectoral Resolution n° 02 of 27 March 2001 (Regulation set of the Regulatory Agencies Conflict Resolution of the Electric Power Sector, Telecommunications and Oil),” 27 Mar 2001. [Online]. Available: http://www.anatel.gov.br/legislacao/resolucoes/resolucoes-conjuntas/85-resolucao-conjunta-2.

[32] ITU, “Project Management Tools,” [Online]. Available: http://www.itu.int/en/ITU-D/Projects/Pages/ToolBox.aspx.

[33] Analysys Mason for the EC, “Support for the preparation of an impact assessment to accompany an EU initiative on reducing the costs of high-speed broadband infrastructure deployment,” 24 Oct 2012. [Online]. Available: https://ec.europa.eu/digital-agenda/en/news/support-preparation-impact-assessment-accompany-eu-initiative-reducing-costs-high-speed.

© copyright CRASA and ITU 2016

Appendix A: **Template Processes**

This Appendix provides high-level template processes for:

- Requests to share
- New infrastructure approval

A.1 Template Process for Requests to Share

This template uses the terms “Access Seeker” and “Access Provider” to represent the two parties: the former being the party requesting to share and the latter being the party that owns or leases the infrastructure.

The template assumes that the two parties have negotiated a Master Agreement based on the template agreement in Appendix B.

Where the volume of requests is likely to be high, an Access Provider should consider using an IT system to assist with the administration and provide management reports.

Examples of the process are listed in Exhibit 16.

Exhibit 25: Template Process for Requests to Share

Step	Comment
Access Seeker requests information regarding infrastructure to be shared	The process should define the standard information to be provided. The Access Seeker may request additional information if needed.
Access Provider provides requested information	The process should define the maximum time period for providing standard information. Typically it will be between 5 and 15 working days. It may take longer to provide additional information.
Access Seeker submits sharing application	The process should define the minimum information required for the application. Access Providers may request additional information if reasonable but ideally this should not be necessary.
Access Provider agrees or rejects sharing application	The process should define the maximum time period for providing a response and reasonable grounds for rejection. Typically the maximum time period will be between 20 to 30 working days depending on the type of infrastructure. In case the parties are unable to agree, the Dispute Resolution process is initiated.
Implement sharing application	The process should define the detailed steps, responsibilities, codes of conduct, maximum time periods, etc. for the implementation activities, depending on the type of infrastructure.

© copyright CRASA and ITU 2016

A.2 Template Process for New Infrastructure Approval

This template process applies to planning permission for new passive infrastructure. Even though permission may be granted by local government bodies, the process should be identical across the country in terms of the steps, information required and maximum time periods. As the volume of applications is likely to be high, the NRA should encourage use of a common nationwide IT system to assist with the administration and provide management reports.

Examples of the process are listed in Exhibit 20.

Exhibit 26: Template Process for New Infrastructure Approval

Step	Comment
Operator investigates sharing existing infrastructure	This is where an infrastructure sharing database (Appendix C) is beneficial. If a database has been established, the process should define the maximum time to receive a response, for example, 15 days.
Operator informs potential sharers of intention to build new infrastructure	The process should define the minimum information to be provided and the maximum time period for a response, for example, typically between 20 and 30 days. Additional time will be required to agree the terms for sharing (see the template process for requests to share).
Operator prepares planning application	The process should define the information to be provided and should be standard for the whole country. It should also include information regarding the outcome of the previous two steps and an environmental impact assessment.
Planning authority undertakes public consultation	The process should define the maximum time period, typically between 30 and 60 days.
Planning authority approves or rejects the application	The process should define the maximum time period, typically between 30 and 60 days. If the operator wishes to appeal against a rejection, the Dispute Resolution process is initiated.

To function effectively, the process also requires clear construction policies and standards for applicants and planning authorities to follow. They should be listed in the process documentation.

© copyright CRASA and ITU 2016

Appendix B: **Template Agreement**

Dependent on the scope of infrastructure sharing the parties should enter into some form of master agreement. Examples of where this type of agreement is applicable include:

- Tower (including rooftop sites) sharing between MNOs or between an MNO and an independent third party
- Ducts and poles shared by an operator or utility with another operator
- LLU and Bitstream access provided by a fixed network operator (with SMP) to another operator.

Although relevant as a checklist it would need further modification for:

- Active sharing (MORAN or MOCN) between MNOs
- An MVNO
- National roaming between MNOs.

Examples of template master agreements are listed in Exhibit 17.

As a minimum the NRA should provide a contents list (see below), as has been done in Australia and Botswana. Alternatively the NRA may choose to provide a complete draft, as has been done in Bahrain, Rwanda and Zambia.

A master agreement should include the following contents:

- Definitions and Interpretations (see Schedule 1)
- Commencement and Duration
- Facilities and Services to be Provided (see Schedules 2-5)
- Charges, Billing & Payment (see Schedule 6)
- Compliance
- Interference
- Health & Safety
- Dispute Resolution
- Breach, Suspension and Termination
- Confidentiality
- Intellectual property rights
- Review
- Force Majeure
- Credit Assessment and Credit Risk Management
- Limitation of Liability
- Assignment of Rights and Obligations
- Notices
- Entire Agreement
- Waiver
- Severability

© copyright CRASA and ITU 2016

- Amendments
- Relationship of Parties
- Governing Law
- Schedule 1: Definitions
- Schedule 2: Facilities and Services Descriptions
- Schedule 3: Service Level Agreement
- Schedule 4: Practices and Procedures, for example:
  - Forecasting
  - Ordering and provisioning
  - Implementation and testing
  - Operation and maintenance
  - Changes to facilities including removal
  - Fault handling
- Schedule 5: Technical Standards and Specifications
- Schedule 6: Charges, Billing and Payment

© copyright CRASA and ITU 2016

Appendix C: Infrastructure Sharing Database/Atlas

Conceptually an infrastructure sharing database (often referred to as an atlas) is a central repository of information regarding passive infrastructure that might be shared. Its objectives and scope might be increased to include other utilities (water, electricity, gas) in order to co-ordinate street works, as in the UK.

There is a wide range of options in terms of the scope of the database and how it is implemented, for example:

- The scope might consist of one of the following:
  - MNO cell sites (towers and rooftops) only
  - The ducts, poles, towers and cables owned or leased by any telecommunications or broadcasting service provider
  - As above and all infrastructure owned or leased by utility, road or rail organisations
- The database might consist of one of the following solutions:
  - A “flat file” database, for example, in Microsoft Excel
  - A relational database, for example, in Oracle Database
  - A Geographic Information System (GIS), for example, in ESRI ArcGIS

Projects are currently in progress or operational in Belgium, Germany, Netherlands, Poland, Portugal and the UK [33] (see Exhibit 21).

C.1 Benefits

There are a number of potential benefits from an infrastructure sharing database depending on its scope as shown in Exhibit 27.

Exhibit 27: Benefits of an Infrastructure Sharing Database

Benefit	Description
Increase infrastructure sharing	By holding the information in a single location, it is easier for operators to identify potential infrastructure that they might share rather than building new.
Faster and more efficient sharing process for operators and NRAs	Depending on how the solution is implemented, the sharing process should be accelerated, for example, an enquiry changes from a paper or e-mail process taking many days to an online browser-based query taking milliseconds.
Improve cross-sector co-ordination	If the central database includes information from all organisations, it simplifies the need to cross-check between sectors.
Reduce incidents of infrastructure damage	The more information held in the database, the less likely that existing infrastructure will be damaged when new work is undertaken; in Belgium and the Netherlands the number of incidents have been reduced by 5-

© copyright CRASA and ITU 2016

Benefit	Description
	10%.

C.2 Challenges

IT projects are renowned for schedule and cost overruns sometimes a result of weak project management but more often due to inadequate up-front analysis and planning (see next Section) leading to a poor understanding of the requirements and benefits. Assuming that these generic IT risks are addressed, the specific challenges of an infrastructure sharing database are shown in Exhibit 28.

Exhibit 28: Challenges of an Infrastructure Sharing Database

Challenge	Description
Mandatory or voluntary data acquisition from operators?	Ideally it should be mandatory for the input data to be submitted to the database otherwise it is likely to fall into disuse as was the case in the UK (Ofcom's Sitefinder database).
Missing or incorrect data	Initially a considerable amount of the data will be incorrect or missing. How will data be collected and validated? Site surveys are expensive and time-consuming.
Sourcing of other data: mapping, population, etc.	Is it available at the correct resolution? What cost?
Confidentiality and security	What data needs to be kept confidential? Who should have access?
Commercial software or Free Open Source Software (FOSS)?	The total life-cycle costs and benefits of commercial software, such as ESRI's ArcGIS, need to be compared with FOSS products, such as QGIS. Although FOSS is free, it still needs an experienced company to install and maintain it.
Compatibility/interface with operators existing network management systems	Most operators have asset management systems and some have GIS. It will be more efficient for them if an electronic interface (API) is available to transfer data.
Cloud (SaaS) or own infrastructure?	What is the most cost-effective approach to host the system?
Financing	Who will pay for the implementation, operation and maintenance of the system?
Scope	Will the database involve other infrastructure owners: electricity, gas, water, pipelines, etc.? Depending on the availability and quality of their data, it may be worth phasing their introduction.
Other public mapping projects?	Are there other public mapping projects planned or in progress that might help to reduce the costs?

© copyright CRASA and ITU 2016

C.3 Way Forward

Use best-practice project management to mitigate the risks of such a project. The first step should be a Feasibility Study and Business Case which would include:

- High-level requirements and process design
- Potential solutions (e.g., simple database versus GIS) including phased implementation plans and operations/maintenance
- Case studies to:
  - Validate the above requirements and solutions
  - Gather data for the financial and risk analyses
- Requests for Information (RFI) to potential solution providers to:
  - Identify relevant competencies and track record
  - Gather data for the financial and risk analyses
- Financial analysis (10-years) – for the NRA and the operators
- Risk analysis.

© copyright CRASA and ITU 2016