

Introduction

1. *Cross-sector infrastructure sharing* broadly refers to the sharing of infrastructure – primarily real property fixed assets comprising land, improvements and fixtures – across different sectors of the economy. For example, cross-sector infrastructure sharing might encompass the use of the same bridge to carry both a roadway and a railway across a river, or the placement of roadways and electric distribution lines in the same corridors.¹
2. The discussion of cross-sector infrastructure sharing in this toolkit focuses exclusively on joint use of infrastructure by telecommunications network operators and owners of infrastructure developed primarily for purposes other than the provision of public telecommunications services. Intra-sector infrastructure sharing among telecommunications operators has also grown in significance since the introduction of competition in the sector. *Intra-sector infrastructure sharing* is addressed in Module 2 of the Broadband Strategies Toolkit.² Cross-sector infrastructure may, however, include telecommunications facilities whose primary purpose is to support internal communications needs of an infrastructure owner whose primary business is not the provision of telecommunications services.
3. Generally, the opportunity for cross-sector infrastructure sharing to support public telecommunications networks is greatest with infrastructure owners in various network sectors.³ These may include owners of roadways, railways, water and sewer systems, electricity transmission and distribution systems, and petroleum and gas pipelines.⁴
4. Several types of infrastructure used in the network sectors are useful for sharing with commercial telecommunications network operators. The universally appealing assets are the land corridors established for roads, railways, electricity transmission lines and pipelines. In addition, the improvements and fixtures in these corridors are also sometimes good candidates for sharing. These include the ducts, conduits, poles and towers used for electricity lines, the inside of pipes used for water, sewer, steam or gas transport, water towers, radio towers used for the private radio networks of utilities, and excess dark fiber in the internal networks installed by utilities and other infrastructure owners. Such sharable infrastructure can concurrently support telecommunications access and backbone networks. In addition, due to the potential for cross-sector sharing of corridors, many corridors which are controlled by one infrastructure owner are also used by other

¹ For purposes of this toolkit, *real property* generally includes both *land* and all improvements and fixtures on the land. *Improvements* are permanent structures, such as buildings, and other additions and changes to the real property, such as grading or clearing, that typically increase its usefulness and cannot easily be removed. Like improvements, *fixtures* are items of tangible property, such as towers, masts, aerial cable or buried cables, which are permanently affixed to real property, but which may be more easily removed. The distinction between improvements and fixtures is generally not material for the purposes of this discussion of cross-sector infrastructure sharing. A *corridor* refers to a defined lateral tract of land within which improvements and fixtures are or can be installed. Corridors vary in width, and are usually be as wide as required for the intended improvements and fixtures to be installed. For example, a highway corridor is often wider than a railway or pipeline corridor.

² For more information about intra-sector sharing, see sections 2.2.2.4 and 2.2.2.5 in Module 2 of Broadband Strategies Toolkit.

³ As used in this toolkit, *network sectors* generally refers to industries which provide lateral carriage of people, goods and commodities. Cross-sector infrastructure sharing is also possible with other industries on a more limited and *ad hoc* basis. For example, rooftops have long been shared for use as mobile radio base station tower sites. However, this toolkit's focus is on the potential for strategic infrastructure sharing across sectors which have strong synergies with the telecommunications sector.

⁴ Access to *on premises* infrastructure, such as vertical risers, ducts and equipment rooms, is also important for telecommunications operators to reach customers within a building or complex, particularly in landlord-tenant scenarios where the landlord may have entered into exclusive or preferential arrangements with a competing telecommunications operator. These *on premises* access issues, while vitally important, are outside the scope of cross-sector infrastructure sharing as addressed in this toolkit.

infrastructure owners. For example, a roads authority will often control both a road reserve⁵ and the roadway established in the road reserve. With permission from the roads authority, other infrastructure owners may construct or install additional improvements and fixtures within the road reserve. These include water, sewer and gas utilities which may have buried their pipes along or under the road and installed access shafts and manholes in or along the road. They also include electric utilities which have buried ducts for their power lines under or along the road and/or installed poles or towers for overhead electricity lines within the road reserve. Where these layers of separately owned and operated infrastructure exist, cross-sector sharing with the telecommunications sector may require separate formal sharing relationships between a telecommunications operator and each separate owner of infrastructure as well as the controller of the corridor. A broadband operator wishing to hang fiber optic cable on electric utility poles, for example, may need to obtain permission from the roads authority to locate its cables and equipment within the road reserve and permission from the electric utility to attach the cables and equipment to the utility's poles.

5. Sharing of corridors and other infrastructure reduces unnecessary duplication and costs and speeds up deployment. This creates greater efficiencies for the sharing parties, including both the telecommunications operator and the infrastructure owners. Infrastructure sharing also benefits the greater public and the environment. By reducing the frequency, scope and duplication of civil works projects, infrastructure sharing can reduce the proliferation of dedicated corridors, which exclude or limit other uses of land, as well as related improvements and fixtures, which create congestion within those corridors and may adversely impact the enjoyment of adjoining land. By reducing the number and scope of such projects, infrastructure sharing mitigates potential disruption or displacement of economic and social activities (by, for example, disrupting vehicle traffic), population relocation or displacement, health and safety risks, and negative environmental impact.

6. Some of the broadband strategies discussed elsewhere in this toolkit focus on squeezing additional years of life out of *existing* copper-based telecommunications facilities, such as providing DSL over twisted copper pairs or cable modem service over coaxial cable. In this toolkit, the focus of the discussion of cross-sector infrastructure sharing is on building *new* broadband networks by leveraging existing infrastructure from other sectors. This will primarily involve the development of fiber optic networks and, to a lesser degree, wireless tower sites.

7. This toolkit on cross-sector infrastructure sharing is intended as a guide for infrastructure owners, broadband access network and wholesale telecommunications network operators, policymakers, lawmakers, regulators, international economic development institutions and other stakeholders interested in harnessing the potential of cross-sector infrastructure sharing to facilitate broadband development. As in the other Modules of the Broadband Strategies Toolkit, particular emphasis is placed on providing a guide for stakeholders in developing countries.

8. Cross-Sector Infrastructure Sharing Toolkit develops several themes. It first focuses on what, why and how. Introduction section has briefly introduced what is meant by cross-sector infrastructure sharing. Executive Summary section provides a brief summary of all the topics covered in this toolkit, which can provide an introductory overview for the reader who intends to dig in deeper by reading all of the toolkit or a substitute for the reader who seeks only a high level summary of its contents. Module 1 briefly traces the origins and development of cross-sector

⁵ *Road reserve* is a common term used to refer to a corridor established for roads.

infrastructure sharing and provides an overview of cross-sector infrastructure sharing today, in both cases providing some insight into what infrastructure has been shared, why the parties have chosen to share it, and how it has been shared. Module 2 discusses the financial and other motivations of broadband network operators, infrastructure owners, and lawmakers, policymakers and regulators. Module 3 describes some of the more common business models that have been employed in cross-sector infrastructure sharing.

9. The toolkit then turns to the issues and challenges which may suppress the benefits of cross-sector infrastructure sharing in facilitating broadband development. Module 4 identifies and discusses disincentives and impediments commonly encountered by infrastructure owners. Similarly, Module 5 identifies and discusses disincentives and impediments commonly faced by telecommunications network operators. Identifying and exploring these disincentives and impediments is meant to assist market participants in selecting infrastructure sharing business models and strategies which help mitigate or overcome them. Module 6 identifies and develops key approaches which may be adopted by lawmakers, policymakers and regulators to remove or reduce these disincentives and impediments. Module 7 identifies and discusses ways in which international economic development institutions may also help.

10. To supplement the general themes discussed in Modules 0 through 7, this toolkit also includes 18 separate case studies. Module 8 discusses 15 different cross-sector infrastructure sharing businesses or projects covering a diverse range of geographies, infrastructure types, business models, commercial or regulatory challenges and solutions. Countries covered by these case studies include Estonia, Ghana, India, Japan, Kosovo, Lesotho, Malawi, Mali, Mauritania, Poland, Portugal, Senegal, Spain, Tunisia, the United States and Zambia. Infrastructure types include electricity distribution, electricity transmission, piped gas distribution, railways, roadways and sewer systems. Module 9 takes a more holistic look at the cross-sector infrastructure markets and regulatory frameworks in three countries, including Lithuania, South Africa and the United States. In addition to these 18 case studies, the main body of this toolkit includes numerous other examples of specific cross-sector infrastructure sharing scenarios, issues or solutions.

11. Finally, as an aid to the reader and for use as a desk reference, Module 10 provides a glossary of common cross-sector infrastructure sharing terminology used in this toolkit.

Executive summary

12. Cross-Sector Infrastructure Sharing Toolkit is intended as a guide for infrastructure owners, network operators, policymakers, lawmakers, regulators, international economic development institutions and other stakeholders interested in harnessing the potential of cross-sector infrastructure sharing to facilitate broadband development. As in the other Modules in the Broadband Strategies Toolkit, particular emphasis is placed on providing a guide for stakeholders in developing countries.

Origins and development of cross-sector infrastructure sharing

13. From the inception of commercial telecommunications, network operators sought to partner with owners of existing or planned network corridors and infrastructure to reduce costs and accelerate network rollout. Telecommunications networks which share network and infrastructure have also supported the internal communications needs of these network operators.

14. ***The telegraph and railroads paved the way for infrastructure sharing beginning in the mid-Nineteenth Century.*** These two industries become so intertwined they were called *Siamese twins of commerce*. The railways had established corridors with room to accommodate parallel telegraph lines and train stations which could support telegram delivery offices. The telegraph offered significant benefits to railroad owners, enabling telegraph operators to barter services for use of corridors and stations. Sharing was based on mutual interest, without legal mandate.

15. ***The telephone followed the telegraph's example in sharing road corridors and utility poles.*** Because telephone communications require direct connectivity to every user, telephone companies preferred roadway corridors over railway corridors. The introduction of insulated and shielded telephone cable eventually enabled the sharing of utility poles with electric utilities. In some developed countries, coaxial cable television networks later followed the telephone lines – routed along roads and hung from utility poles. These practices have continued until today.

16. Telephone companies initially co-located their intercity long distance lines on telegraph poles in railroad rights of way. After the introduction of insulated and shielded cables, long distance lines were often buried, but still along railway lines. Cable television was fed content by terrestrial antennae or satellite earth stations and therefore had no need for intercity links.

17. ***The growing introduction of wireless communications from the mid-Twentieth Century onward eroded demand for new lateral infrastructure.*** Microwave links replaced telephone cables on major intercity links, and satellite provided connectivity to more isolated locations. The introduction and growth of wireless cellular access networks enabled the proliferation of networks without any new lateral infrastructure. Digital cellular networks led to widespread displacement of fixed-line telephone networks. In some developing countries, mobile networks became the ubiquitous medium and fixed-line networks disappeared. Mobile network operators increasingly built end-to-end wireless infrastructure, comprising cellular access networks, microwave backhaul and transmission links, and satellite international links.

18. ***But the end-to-end wireless trend has not lasted.*** The advent of fiber optic cables and surging demand for bandwidth have renewed the need for infrastructure sharing in a competitive landscape. *Fiber optics has become the new primary medium for every element of fixed networks and all elements of mobile networks except the link from radio tower to end user.*

19. ***Like the early telegraph and telephone, fiber requires end-to-end lateral corridors.*** Cross-sector infrastructure sharing has again become a mainstay of improving economic feasibility and accelerating deployment. However, the landscape is now different. Competing facilities-based network operators aggressively seek infrastructure sharing to keep their costs competitive. Infrastructure owners have greater internal communications needs. Fiber optic technology enables sharing by multiple users across more infrastructure types and conditions.

20. ***Network operators seeking to share infrastructure also face greater challenges and opportunities than in the past.*** Existing land corridors are more congested. Burying fiber optic cable in modern cities is difficult and expensive. Facilities-based competition means more network operators want to share the same infrastructure, adding to congestion. The infrastructure which broadband network operators today seek to share includes the traditional list – corridors, conduits, ducts, towers and poles – plus excess dark fiber controlled by non-telecommunications owners. Creative solutions, such as multiple stakeholders sharing fiber in the same cable, are available and needed.

21. ***Cross-sector sharing has become a component of many national and multinational broadband development policies.*** Policymakers, lawmakers and regulators increasingly seek to require or encourage infrastructure sharing to accelerate deployment, decrease costs and enhance competition. Most countries have begun to address infrastructure sharing in their telecommunications laws. Some efforts have been effective, while others have not. Economic development institutions also increasingly seek to encourage cross-sector infrastructure sharing.

Financial and other motivations for sharing

22. The motivation of broadband network operators to access and use infrastructure built for other sectors is driven by the need for cost-effective upgrades of their networks to satisfy bandwidth demand growth which requires exponential increases in Internet throughput capacity. Meeting this demand requires fiber networks. It also requires additional mobile towers. These investments require extensive new civil works or the use of existing land corridors and infrastructure. Network operators who share infrastructure within or across sectors to support fiber rollout may more quickly achieve benefits of scale by reducing their fixed costs. Sharing existing electricity transmission towers, water towers or other infrastructure for mobile radio base stations can reduce costs and regulatory barriers for new tower sites.

23. ***Cross-sector infrastructure sharing provides significant benefits to infrastructure owners.*** It presents a strategic opportunity for utilities to monetize the latent value of existing infrastructure, including excess dark fiber. It offers public utilities the opportunity to reduce the external capital required to install or upgrade their communications networks.

24. ***Policymakers, lawmakers and regulators often seek to intervene in the cross-sector infrastructure sharing market to stimulate broadband investment and competition.*** Fiber and lateral infrastructure sharing can reduce telecommunications bottlenecks and intra-sector discrimination through fostering competitive market entry by utilities, which are generally more competitively neutral than vertically integrated network operators. Sharing tower space in existing *noxious use corridors*, such as electricity transmission towers and water towers, can mitigate public health, safety and environmental concerns to ease the permitting process for new towers.

Common business models

25. ***The common business models adopted by infrastructure owners for cross-sector infrastructure sharing take many forms and can be designed around the unique circumstances and needs of participating infrastructure owners and network operators.*** These business models are not mutually exclusive, nor is every model appropriate for every infrastructure owner.

26. The ***joint development business model***, where infrastructure owners and network operators coordinate in planning and constructing or refurbishing infrastructure, is the most efficient form of sharing. It is not a business model *per se*, and typically involves another business model to address ownership and use rights. It is only practical if host infrastructure is being developed or refurbished.

27. In the ***hosting business model***, the infrastructure owner hosts third-party telecommunications equipment by authorizing a network operator to install its own telecommunications facilities on the infrastructure. The infrastructure owner serves as a passive landlord.

28. The ***dark fiber business model*** involves the provision of dark fiber by an infrastructure owner to network operators, either on a long-term IRU basis or short-term lease basis. This often is the least risk, highest reward option for a utility. The host provides passive infrastructure only, and neither an operating network nor telecommunications services.

29. In the ***joint venture business model***, the infrastructure owner provides a network operator partner with use of existing infrastructure, including excess existing fiber, to provide commercial telecommunications services on a profit-sharing basis. The financial arrangements between the joint venture parties can vary widely based on commercial and regulatory considerations.

30. In the ***wholesale telecommunications services business model***, the infrastructure owner provides wholesale telecommunications services to network operators. This business model involves much higher risk, in relation to potential rewards, for the utility than other business models. Its chances of success depend heavily on the owner's ability to develop technical and business capabilities to operate in a highly competitive and fast-moving environment.

31. Regardless of the primary business model adopted, infrastructure owners often supplement their lateral infrastructure offerings with ***ancillary services*** such as the provision of co-location space, tower sites and various field crew and on-site support services.

Disincentives and impediments for infrastructure owners

32. ***Infrastructure owners typically face several disincentives and impediments which deter or prevent them from actively pursuing or entering into sharing arrangements.***

33. ***First, their core business regulators often seek to offset sharing revenues by reducing the allowed revenue from the core business.*** In the worst case, all revenue received from infrastructure sharing is deducted from the utility's revenue requirements for setting tariffs in its core business – resulting in a zero-sum outcome which removes all financial incentive to share. Progressive policymakers and regulators can protect utility ratepayers, and increase financial incentives for utilities to share, by aligning the regulatory approaches of the two sectors.

34. ***Second, cross-sector infrastructure sharing provisions of telecommunications laws often deter sharing and investment through a combination of imposing ex ante price regulation absent market dominance, mandating market entry and requiring non-discrimination.*** These provisions do not align with accepted best regulatory practice within the telecommunications sector, which requires a finding of market dominance as a condition precedent to *ex ante*

regulation. The combined impact of utility ratemaking principles and cost-based price regulation of infrastructure sharing can have a draconian impact on the financial incentives of utilities to share infrastructure or invest in making it more attractive to access seekers. Permitting non-common-carrier arrangements without regulatory intervention in the absence of dominance is generally the regulatory approach most conducive to optimizing infrastructure sharing.

35. ***Third, institutional silos for infrastructure investment present additional barriers to engaging in cross-sector planning and construction activities.*** One source of such silos is the disbursement conditions and procurement rules applicable to infrastructure owners which receive donor funding, which currently leave little room for cross-sector planning. Another source is institutional capacity limitations of the owner, such as lack of experience with telecommunications or joint use of infrastructure and lack of a budget to hire experienced personnel within the scope of their regulated revenues and earnings.

36. ***Fourth, state ownership of host infrastructure significantly impacts the potential for cross-sector infrastructure sharing with potential joint users of the infrastructure.*** Establishing infrastructure sharing arrangements with state actors and state-owned enterprises requires the parties to deal with a variety of contracting restrictions, including regulation of public procurement, disposition of public assets, public-private partnerships or public concessions. Political interference further complicates the ability of infrastructure owners and telecommunications operators to enter into long-term, mutually beneficial sharing relationships. State-owned enterprises also have strict limitations on their permitted scope of business activities, which may need to amend their charters before entering an infrastructure sharing business.

37. ***Fifth, tight financial constraints and inflexible governance structures often deprive management of rate-regulated public utilities, particularly state-owned enterprises, of sufficient financial and human resources to pursue infrastructure sharing opportunities.*** They typically do not have any discretionary budget to devote significant internal or external resources to develop a non-core business opportunity such as infrastructure sharing. Senior management's lack of relevant experience and capital, and the sometimes unrealistic or disconnected recommendations of internal communications personnel, often creates a paralysis of indecision. Joint use of infrastructure can be impeded by a lack of standards, particularly where telecommunications equipment can cause operational issues for the infrastructure owner.

Disincentives and impediments for telecommunications operators

38. ***Telecommunications operators also face several disincentives and impediments to entering into sharing arrangements with infrastructure owners.*** These often reflect the impact of institutional restraints and shortcomings of infrastructure owners in pursuing sharing opportunities. They are exacerbated by network operator unfamiliarity with regulated utility culture.

39. ***First, network operators who have attempted to initiate a dialogue about sharing opportunities often report frustration due to lack of a clear path of engagement with the infrastructure owner.***

40. ***Second, insufficiency of a utility's land use rights to cover the access seeker, and the sometimes greater difficulty a telecommunications operator has in perfecting rights outside of road reserves, presents a threshold challenge to deploying telecommunications networks along other lateral corridors.*** In many instances, investor-owned mobile operators in developing

countries do not enjoy rights of eminent domain over private land, or such rights are required to be exercised through a public authority unwilling to support the mobile operator's timetable or business needs. These limitations on land use rights present impediments to piggybacking on existing utility infrastructure. The process of perfecting rights of way, which may require administrative or judicial proceedings, can lead to significant delays.

41. ***Third, telecommunications operators require a high standard of reliability for wholesale infrastructure and services that are key inputs to their retail services.*** The ability of a utility offering wholesale bandwidth services to deliver high reliability, and deploy new routes quickly in response to the evolving needs of telecommunications operators, will require a significant commitment to incur fixed costs – upfront and recurring – *before* signing any customers. Many utilities are therefore not well-positioned to pursue the telecommunications services business model, and may more prudently seek to commercialize excess dark fiber and pole space.

How policymakers, lawmakers and regulators can help

42. ***Policymakers and regulators can facilitate cross-sector infrastructure sharing by using carrots and sticks.*** The carrot approach fosters conditions conducive to voluntary, market-based sharing by replacing disincentives with incentives. The stick approach intervenes where market-based activities fail, and typically involves mandated access or regulation of access terms. An optimal policy and regulatory equilibrium can employ the following carrots and sticks:

43. ***First, infrastructure sharing can be increased by reducing financial disincentives from core business rate regulation.*** One form of *incentive regulation* allows the regulated utility to share infrastructure sharing revenues with its core business rather than allocate sunk core business costs to its infrastructure sharing business. Revenue sharing can be calibrated by adjusting the allocation percentages to properly incentivize management while protecting utility ratepayers.

44. ***Second, reforms can ensure that telecommunications operators have access to land corridors established for other public or private purposes.*** Effective laws affording network operators access to land corridors are a fundamental component of ensuring optimal infrastructure sharing. They should ensure that access is open, non-discriminatory and efficiently administered. The substantive and procedural requirements for access will differ depending on whether public, private or tribal land is involved.

45. ***Access to the corridors established for public roads and highways is critical to the development of almost every broadband network.*** Road reserves often offer the only viable last mile route to the customer premises for wired networks or to towers for wireless networks. Reforms may include one-stop shopping, streamlined and harmonized permitting and approval processes, better planning and coordination, management of congestion, requiring coordination among competing users, and installing ducts during roadway construction or renewal.

46. ***Access to private roads and other private land comprising part or all of an existing corridor has been less adequately addressed in many jurisdictions than access to public roads.*** While a network operator will generally not be prohibited from acquiring private easements or other rights of use in private roads or other private lands, its ability to obtain such rights on fair and reasonable terms can be very tenuous without a right of *compulsory acquisition* of easements on private land.

47. ***Third, policymakers, lawmakers and regulators should tread carefully in regulating cross-sector access to facilities other than land.*** Access to improvements and fixtures, such as poles, ducts, conduits, towers and fiber, generally merits separate treatment from access to land. Access

by a network operator to improvements and fixtures often creates significant burdens for the infrastructure owner and introduces operational risks to the safety, reliability and efficiency of the facilities. Joint use of facilities also requires significantly greater ongoing cooperation and interaction between the network operator and infrastructure owner than does the use of a land corridor. Infrastructure owners and access seekers often have relatively equal bargaining power and can reach voluntary market arrangements. Regulatory intervention presents significant risk of inherent regulatory bias unless the infrastructure owner and network operator are both regulated by the same multi-sector regulator. It is therefore usually better policy to rely to the greatest extent possible on voluntary commercial arrangements, rather than regulated access.

48. ***Treating a utility entering the infrastructure sharing market with the level of regulation appropriate to the nature of the shared use and the owner's market power in the relevant market is generally the most pro-competitive and pro-investment policy.*** Experimental infrastructure sharing should be permitted and encouraged rather than mandated and regulated. For other types of sharing, the key question for policymakers and regulators is when to apply *ex ante* remedies and when to limit regulation to *ex post* remedies. This should be based on a market assessment to define relevant markets and assess market power in relevant markets. Generally, *ex ante* regulation is appropriate only when the infrastructure owner has been found to be dominant and its practices are an abuse of such dominance or where there is evidence of collusion.

49. ***If price regulation is necessary, regulators should not establish prices which force a utility's core business customers to cross-subsidize telecommunications market customers.*** This can cause market distortions by shifting economic value between sectors. Where an infrastructure sharing law is overbroad in allowing price regulation absent dominance, the regulator should consider forbearance from price regulation absent evidence of dominance or collusion.

50. ***Fourth, policymakers, lawmakers and regulators should address regulatory restrictions and institutional structures of state organs and enterprises which hinder infrastructure sharing. Corporatizing state-owned enterprises so they operate under the same principles as private enterprises is a positive first step. Another positive step is to provide some relief from public enterprise laws for qualifying state-owned enterprises. The financial discipline of separate accounting can also ensure that the utility operates more like a business.***

51. ***Fifth, policymakers and other stakeholders can facilitate greater information exchange and dialogue to raise awareness of cross-sector infrastructure sharing opportunities and points of entry into state-owned infrastructure owners.*** Mapping resources can be utilized to create an accessible database of opportunities for infrastructure sharing. Government and state-owned enterprises can collect, compile and supply this information to network operators and establish a process for requests for information. The telecommunications regulator can facilitate requests for information and sharing by publishing a list of government departments and utilities that administer relevant infrastructure. The telecommunications regulator or ministry can support stakeholders in establishing a chamber of commerce or other trade group among telecommunications operators and infrastructure owners.

52. ***All market interventions should be tailored to local conditions.*** One size will not fit all.

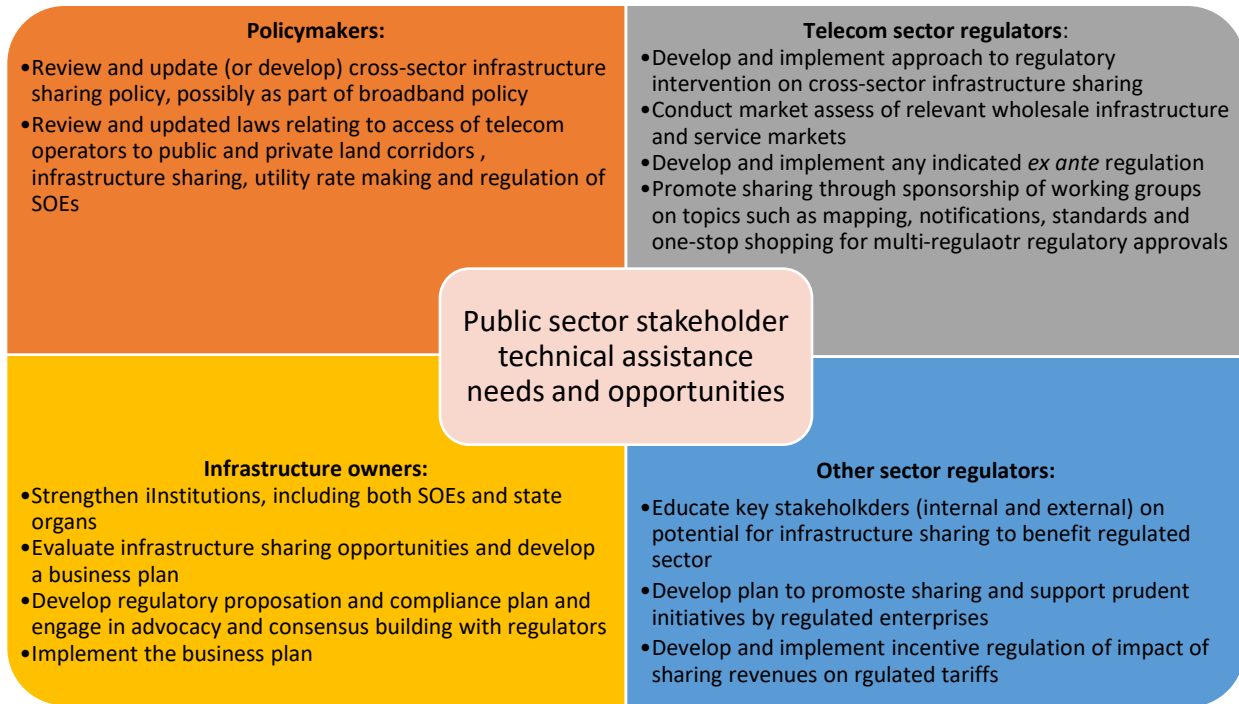
How international economic development institutions can help

53. ***International economic development institutions stand in a key position to encourage cross-sector infrastructure sharing because they provide a significant portion of the funding for sharable infrastructure in developing countries.***

54. ***First, they can encourage neutral and decentralized passive infrastructure ownership.*** They are rightly wary of investing in the establishment of monolithic wholesale providers which create a high risk of either creating significant market concentration or investing wastefully in failed projects. Fiber optic cable, when coupled with a smart approach to cross-sector infrastructure sharing, presents a unique opportunity to continue facilities-based competition for broadband network deployment in an economically viable manner. Development and ownership of the underlying fiber optic cable by utilities in other sectors can offer a competitively neutral landlord which can also benefit from core business uses of fiber and the opportunity to monetize excess capacity and reinvest in its core business. The potential for utilities to possess market dominance in wholesale dark fiber markets is often currently limited. Where utilities are dominant, either a competition authority or an empowered telecommunications sector regulator can step in to regulate pricing and access terms. The infrastructure sharing market thus presents significant checks and balances to ensure that market-based pricing is reasonable and the inherent neutrality of the infrastructure owners vis-à-vis telecommunications operators. Development institutions can optimize continued private sector investment in upgrading telecommunications infrastructure for broadband, while sustaining the facilities-based competition model which has worked so well for wireless networks, by fostering the development and sharing of dark fiber by infrastructure owners whose core businesses or services are not telecommunications. This approach reduces the need for development investment in standalone telecommunications networks and frees up resources.

55. ***Second, international institutions can provide or fund technical assistance to public sector stakeholders.*** By underwriting targeted technical assistance, international institutions can leverage their investments and serve as a catalyst for market-based development of broadband networks. These limited market and regulatory interventions can have a significant positive impact on the availability of shared infrastructure. Relevant stakeholders include state-owned enterprises and government organs which own or manage sharable infrastructure, sector regulators, policymakers and lawmakers. Key disciplines in which infrastructure owners may benefit from technical assistance include legal, regulatory, commercial, technical and financial. Other public stakeholders can benefit from technical assistance in assessing existing policy, legal and regulatory frameworks for friendliness for cross-sector infrastructure sharing and benchmarking them against best practices. Technical assistance can also support development of standards to govern joint use of infrastructure. Collaboration between similarly situated infrastructure owners in a region can also be a useful and efficient way to develop and share standards and best practices. Figure 1 illustrates public sector stakeholder technical assistance needs and opportunities:

Figure 1: Matrix of candidates and topics for technical assistance



56. **Technical assistance from development institutions also needs to be provided in the manner most suitable for the client.** Technical assistance sometimes takes the form of an assignment executed by the development institution itself. At other times, development institutions provide financial support and guidance for recipients to procure and engage their own advisers directly. In the case of advisory services to policymakers and regulators, both approaches can be beneficial. In the case of infrastructure owners, it is fundamentally important to provide for recipient-executed procurement of technical advisers to ensure advice is client-focused, advisers do not have conflicts of interest, and the recipient will respect and trust the advice. Because the development institution’s objectives and agenda tend to be policy-based and look at macro impact, advice provided to infrastructure owners though such institutions is inherently likely to compromise the infrastructure owner’s own interests for the greater good sought. In a market-based approach to development, policy must rely on each individual actor pursuing its own best interest, within a framework of rules to ensure fair play, and therefore each market participant should have its own advisers who are independent, selected by the client and not a third party.

57. **Third, international institutions can plan for cross-sector sharing in all new infrastructure projects.** Opportunities for sharing of new infrastructure can be enhanced by planning for sharing activities when it is developed. This requires proactive and inclusive planning by development institutions which finance the infrastructure and the implementing agencies of the recipient governments. Development institutions have historically organized their approach to infrastructure investments by sector. While useful for other reasons, the sector-based approach has created silos which reduce multi-sector opportunities. The World Bank and other institutions have recently begun to take a cross-sector approach to their institutional structure and their projects. These nascent cross-sector planning efforts would benefit from continued and increased focus on leveraging investments for multiple sectors.