



Inquiry into Co-Investment in Multi-Carrier Regional Mobile Infrastructure

ACCC submission to the Standing Committee on Communications and the Arts

14 November 2022

1. Introduction

The Australian Competition and Consumer Commission (**ACCC**) welcomes the opportunity to provide a submission to the Standing Committee on Communications and the Arts' inquiry into co-investment in multi-carrier regional mobile infrastructure.

The ACCC is an independent Commonwealth statutory authority that promotes competition, fair trading and product safety for the benefit of consumers, businesses and the Australian community. The primary responsibilities of the ACCC are to enforce compliance with the competition, consumer protection, fair trading and product safety provisions of the Competition and Consumer Act 2010 (**CCA**), regulate national infrastructure and undertake market studies.

As Australia's competition regulator, the ACCC assists in lowering the economic barriers to access telecommunications services by promoting competition in the sector. It also seeks to ensure that investment in, and use of, infrastructure is efficient. Competitive and efficient markets can deliver better services and lower prices to consumers.

The ACCC performs industry-specific competition and access functions under the CCA. This includes establishing and monitoring the general regulatory framework for the communications industry.

In particular, Part XIC of the CCA allows the ACCC to declare certain services following a public inquiry, if it is satisfied that to do so, would promote the long-term interests of end-users. Once a service is declared, the ACCC can set regulated prices and other terms and conditions of access.

The ACCC also monitors and enforces compliance with telecommunications-specific legislation as well as the general consumer protection and anti-competitive conduct provisions in the CCA and those protections afforded by the Australian Consumer Law.

The mobiles sector has relatively light-touch regulation consistent with a structure that is characterised by competition at a range of levels including network coverage, pricing and quality. Competition in the mobiles market drives investment, high-quality services and better outcomes for Australian consumers and businesses. This is particularly important given mobile connectivity is now an important, and arguably essential, feature of most Australians' communications needs.

However, Australians living in regional areas pay the same prices for mobile services as metropolitan users but often have less coverage and choice of network operator. In rural, regional and remote areas investment is supplemented by government co-funding (at both federal and state level) to improve and expand coverage in regional and remote Australia.

There are a number of issues that the ACCC has identified in various inquiries that remain pertinent to this inquiry. These are discussed further in this submission.

On 31 March 2022, the Australian Government announced that it had directed the ACCC to conduct an inquiry into access to towers and associated infrastructure in regional, rural, remote and peri-urban Australia that can be used in the supply of mobile telecommunications and other radiocommunications services, and the feasibility of providing temporary mobile roaming during natural disasters or other emergencies.

That inquiry will look at the costs of providing towers and associated infrastructure, including land access, and how these translate into the fee structures for firms that want to access towers to provide mobile and other wireless services. It will also look at the factors that are important for industry in deciding whether to invest in towers and provide better mobile coverage.

The ACCC notes that the main costs involved in extending mobile coverage include the radiocommunications transmission equipment, the towers that support that equipment and the spectrum to enable the communication to devices. All three elements are critical to provide coverage. This is more so in areas where there is poor or no coverage and where the costs of providing coverage are challenging for commercial reasons alone. Given this, co-investment is one tool that can be utilised to improve both coverage and competition outcomes.

2. ACCC inquiries, reports and submissions

Measures to address regional mobile issues (2017)

In 2017 the ACCC concluded an inquiry into whether to declare a wholesale domestic mobile roaming service. At that time, the ACCC was not satisfied that declaration would promote the long-term interests of end-users and decided not to declare a mobile roaming service.

The ACCC considered the relevant question of whether declaration of a mobile roaming service would promote competition, any-to-any connectivity and efficient investment in, and use of, infrastructure.

During the inquiry, the ACCC heard from many regional Australians concerned about inadequate mobile coverage where they live and work. Many individuals, businesses, industry associations and consumer groups were concerned that a decision to declare mobile roaming would result in less future investment in mobile networks, particularly in regional areas where there may not be a direct return from investment. On the other hand, it was also argued that declaration of a mobile roaming service would result in efficiency gains, through more effective use of the available network and may encourage investment in technology upgrades (for example, from 3G to 4G).

The ACCC noted the productivity potential of further investment and network improvements in rural, regional and remote areas is significant. The ACCC also found that declaration may result in some efficiency gains by allowing access seekers to use the excess capacity available on the access provider's existing infrastructure in regional and remote areas. However, the roaming inquiry found that declaration would be unlikely to promote the efficient use of infrastructure more generally.

The ACCC found that Telstra and Optus, and to a lesser extent VHA (now TPG), were competing on network quality (including coverage) and that declaration would have the potential to distort investment decisions that improve quality. It was considered that while Optus and VHA may not have the same incentives to match or better Telstra's network quality, Telstra also may not have the same incentives to invest in extending regional coverage if a mobile roaming service is declared.

It was also considered that, over time, this could degrade the quality of existing networks. The ACCC found that declaration is more likely to distort the competitive dynamics in the mobiles market by reducing mobile network operators' (MNO) incentives to improve network coverage or differentiate their products.

However, given the concerns raised by many submissions to that inquiry, the ACCC considered there was scope to improve outcomes for regional Australians' mobile services using a mix of policy and regulatory measures. Consequently, the ACCC explored whether regional mobile services could be improved through measures designed to:

- increase the transparency of network quality and coverage information so that consumers can make informed decisions
- reduce the costs of deploying and improving mobile networks, and
- ensure that competition issues are considered in the radiocommunications regulatory framework.

The ACCC notes that it has introduced a number of measures to address the issues raised above through:

- publication of the Mobile Infrastructure Report
- changes to the Facilities Access Code to improve the timeliness of access to mobile tower infrastructure, and
- providing advice to the ACMA and former Minister for Communications on spectrum allocation limits.

The *Measures to address regional mobile issues* paper is available [here](#).

ACCC submission to the House of Representatives Inquiry into the deployment, adoption and application of 5G in Australia (2019)

In the ACCC's submission to the Inquiry into the deployment, adoption and application of 5G in Australia the ACCC noted that the ACCC's approach to the mobiles sector has been to promote competition and support the dynamism of the sector.

The ACCC noted that as 5G rolls out, the need to densify networks may lead to calls for network sharing.

While infrastructure sharing can bring significant cost savings and efficiencies for operators, it can also raise competition issues such as risk of collusion, reduced or distorted incentives for investment in shared infrastructure.

ACCC submission to the Regional Telecommunications Independent Review Committee Inquiry 2021 (the Hartsuyker Inquiry)

The RTIRC report on the 2021 Regional Telecommunications Review made a number of findings about mobile networks and services in regional, rural, remote and peri-urban Australia. It highlighted the continuing importance of mobile services including their use during natural disasters.

The Hartsuyker Inquiry recommended, amongst other things, that preference is given to government funded mobile infrastructure providing shared network access. This included a particular focus on the design of the Mobile Black Spot Program towards neutral host solutions and innovative funding models to encourage participation. This aligns with suggestions the ACCC made in its submission¹ to the review including how co-contribution

¹ The ACCC submission to the RTIRC review is available at: <https://www.infrastructure.gov.au/have-your-say/2021-regional-telecommunications-review>

programs could be better designed to promote increased coverage and promote the efficient use of infrastructure.

The report considered ways of improving mobile coverage and competition such as shared network access. It also considered the conditions under which MNOs gain access to the necessary inputs from the owners of tower infrastructure. It recommended that the government continue to support the provision of new mobile coverage with investments that address coverage, capacity and competition issues and consider funding vehicles which leverage private sector co-investment (recommendation 2).

The ACCC's submission to the 2021 RTIRC Inquiry noted that achieving better connectivity in regional Australia requires significant ongoing investment in infrastructure. However, the commercial incentives for investing in regional Australia, particularly in areas of low population and undeveloped geographical areas, remain challenging.

For MNOs, the competitive advantage derived from having the largest population coverage has provided an incentive for investment in regional areas. Many consumers, particularly those in regional areas, place value on having wide coverage. However, commercial incentives to extend coverage or improve depth of coverage become increasingly marginal in more regional and remote areas. There are also limited incentives outside government subsidisation to improve either reliability or depth of coverage in many areas as the costs of doing so will likely far outweigh the potential returns from that investment.

The ACCC noted that the costs of building networks, both fixed and mobile, are high in rural, regional and remote areas and returns are generally low. This means that the commercial case for extending networks in sparsely populated areas is generally a difficult one to make absent some form of government subsidy.

Due to the low returns from building network infrastructure in sparsely populated regional and rural areas, the commercial incentives to roll out network infrastructure in these areas are typically lower than in metropolitan areas. Consequently, co-contribution funding is likely to be a key driver for MNOs when considering expanding mobile coverage. As a result, local, state and federal governments have developed co-contribution programs from time to time to provide subsidies to network operators to roll out infrastructure in these areas. Co-contribution programs, like the federal government's Mobile Black Spot Program, provide incentives to invest in areas where there is either inadequate or no mobile coverage.

The Mobile Black Spot Program has provided funding to build over 1,270 new base stations across Australia under the first 5 rounds and Round 5A, and has committed further funding for Round 6.²

The early rounds of the Mobile Black Spot Program provided for co-location on funded sites as a means to attract MNOs, other than the funding recipient, to provide services on the funded sites. However, the extent to which the MNOs actually co-locate on Mobile Black Spot Program funded sites has been limited. The ACCC's analysis from the Mobile Infrastructure Reports shows that, as at January 2022, only 9 per cent of active mobile sites funded under the Mobile Black Spot Program have more than one MNO operating on them.³

This means that while the Mobile Black Spot Program has delivered improved mobile coverage in many regional and remote communities, those improvements are largely only

² See the Department of Infrastructure, Transport, Regional Development and Communications' (DITRDC) website at <https://www.communications.gov.au/what-we-do/phone/mobile-services-and-coverage/mobile-black-spot-program>.

³ Data from the MNOs' reports in accordance with the ACCC's Infrastructure Record Keeping Rules and published in the ACCC's Mobile Infrastructure Report 2022.

accessible by the subscribers of the successful applicant's network, rather than available for all end-users.

The ACCC considers the experience with earlier rounds of the Mobile Black Spot Program suggests that a co-location framework for co-contribution programs is unlikely to be sufficient, on its own, to promote competitive outcomes or maximise choice of providers for regional communities.

The ACCC noted that co-contribution programs could potentially seek to promote competition by adopting other models to co-location such as:

- a neutral host model, where funding is awarded to a non-MNO infrastructure provider who can then provide wholesale services to all MNOs. The neutral host should be provided with incentives to collaborate with as many MNOs as possible. The ACCC notes that Round 5A of the Mobile Black Spot Program awarded funding to Field Solutions Group (FSG) to trial this model.
- an active sharing model, where at least two MNOs collaborate and jointly apply for funding on the basis that they will share both passive and active infrastructure being deployed under the co-contribution program, perhaps through a joint venture.

The ACCC noted that, in New Zealand, the Rural Connectivity Group (RCG) is a joint venture of the three mobile operators to build sites under the Rural Broadband Initiative and the New Zealand Mobile Black Spot Fund. Sites are acquired, built and operated independently by the RCG and are actively shared by the operators.⁴

In Australia, there are indications that co-contribution programs at both federal and state levels are increasingly considering the neutral host and the active sharing model as a means to improve mobile coverage in regional areas. For example, the NSW state government is currently trialling various co-contribution funding and infrastructure deployment models.

ACCC Mobile Infrastructure Report (2022)

Australia has a difficult geography. A large proportion of the population (81.4%) lives in a relatively small land area (50,000 sq km) in the metropolitan cities and major regional centres. Conversely, a small proportion of the population (0.7%) lives across a very large land area (1,000,000 sq km) in remote areas of Australia. In addition, regional Australia accounts for around 17.4% of the total population and covers approximately 1,500,000 sq km (see Table 1 in **Attachment A**)

In the metropolitan areas, population density has driven investment and network rollout by all three MNOs. In general coverage is good, however, there remain pockets in peri-urban areas where coverage is claimed to be poor. In regional areas, while a substantial portion of the population has mobile coverage in the more densely populated areas, there remain many areas where coverage is poor or not available. In regional and remote areas, investment has been confined to areas where commercial returns are likely to be greatest. These are generally the larger population centres and more densely populated areas. In other areas, ongoing investment is likely to rely on co-investment by governments and local councils.

To improve transparency in mobile infrastructure assets and coverage, the ACCC publishes data provided by the MNOs on their mobile infrastructure in its annual Mobile Infrastructure Reports. The reports are intended to:

⁴ See the RCG website at: <https://www.thercg.co.nz/>.

- provide transparency on how the MNOs' networks are changing over time
- allow for more scrutiny of these changes in specific geographic areas, and
- provide accountability over investment claims made by the MNOs, particularly in specific geographic areas.

The *ACCC Mobile Infrastructure Report 2022* found that:

- Telstra continues to have the most mobile sites with significant dominance in regional and remote areas. It also found that Telstra has a significant first mover advantage in 5G.
- Growth in 3G and 4G network deployment in regional and remote areas has generally slowed since 2019. This appears to be due to change in focus from the MNOs to 5G roll out predominately in major cities. This trend is in line with the findings of the 2021 report.
- Co-contribution programs, like the Mobile Black Spot Program, continue to provide incentives to invest in areas where there is either inadequate or no mobile coverage.
- The design of these programs could be improved in order to provide broader benefits to consumers.
- Varying levels of co-location existing across the MNOs with declining rates of co-location as you move into less populous regional and remote areas.
- Co-location reduces the cost of network deployment. This enhances the ability of MNOs to expand mobile infrastructure to improve the breadth or depth of their coverage.

Mobile site analysis

A mobile site hosts radio (active) equipment that uses radiofrequency spectrum to provide connectivity to mobile devices. With the use of backhaul, they connect end users to their service provider's core network for voice and data connectivity.

A mobile site exists in various forms including on a mobile tower, on top of commercial or residential buildings and structures such as light poles. They may also be inside buildings. This is collectively referred to as passive infrastructure. Passive infrastructure may have been built by an MNO or a third party such as a specialist infrastructure company.

An MNO may deploy their equipment on the same passive infrastructure as another MNO(s), this is known as co-location. Co-location is one way to reduce the cost of site deployment. Reducing the cost of site deployment enhances the ability of MNOs to expand mobile infrastructure to improve the breadth or depth of their coverage, thereby promoting delivery of competing downstream services.

The number of mobile sites an MNO has active equipment deployed on provides an indication of the overall scale of their network. MNOs add and remove sites from their network over time. An MNO may decommission a site because it has added equipment to a new mobile site nearby which provides the same or more depth and/or breadth of coverage. A mobile site can also have several technologies installed on it at once.

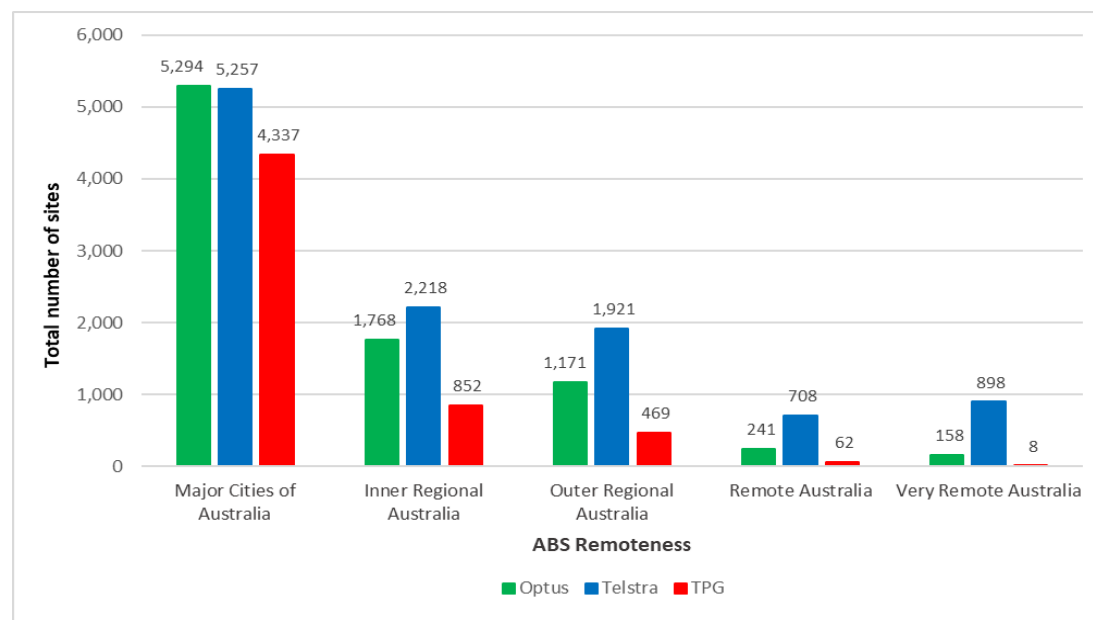
Table 1 below shows the number of mobile sites by MNO between 2018 and 2022. As at 31 January 2022, Telstra had the most mobile sites (11,002) followed by Optus (8,632) and TPG (5,728).

Table 1: Total number of sites by MNO and ABS Remoteness Area – Major Cities of Australia vs Outside Major Cities of Australia – 2018 to 2022

	2018	2019	2020	2021	2022
Major Cities of Australia					
Optus	4,691	4,758	4,874	5,037	5,294
Telstra	4,736	4,800	5,059	5,166	5,257
TPG	4,207	4,268	4,306	4,503	4,337
Outside Major Cities of Australia					
Optus	2,644	2,954	3,106	3,201	3,338
Telstra	4,693	5,172	5,392	5,600	5,745
TPG	1,215	1,340	1,369	1,389	1,391
Total					
Optus	7,335	7,712	7,980	8,238	8,632
Telstra	9,429	9,972	10,451	10,766	11,002
TPG	5,422	5,608	5,675	5,892	5,728

Source: ACCC Mobile Infrastructure Report 2022

Figure 1: Number of sites by MNO and ABS Remoteness Area – 2022



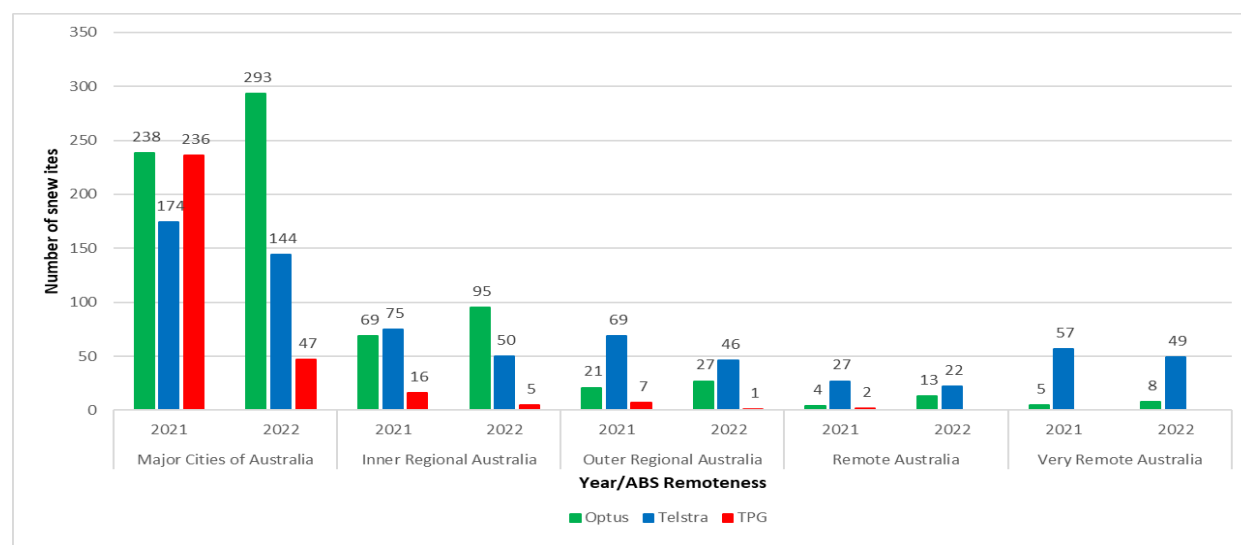
Source: ACCC Mobile Infrastructure Report 2022

Figure 1 above shows a breakdown of MNO sites by ABS Remoteness Areas for 2022. It shows that in Major Cities Telstra and Optus have a similar number of sites. However, outside of Major Cities⁵ Telstra has significantly more sites than the other MNOs.

Between 2021 and 2022, the MNOs collectively added a total of 800 new sites across their three networks. A majority of these new sites were deployed in Major Cities, where Optus deployed the largest number of new sites (293), followed by Telstra (144). TPG added the fewest new sites in Major Cities (47).

Over the same period, Figure 2 below shows the MNOs deployed a much lower number of new sites in regional and remote areas compared to Major Cities. Outside the Major Cities, Telstra added slightly more new sites (167) than Optus (143) and significantly more than TPG (6).

Figure 2: Number of new sites by MNO and ABS Remoteness Area – 2020 to 2022



Source: ACCC Mobile Infrastructure Report 2022

Co-location and the divestment of tower sites by MNOs

It is important to note that tower sites often host the equipment of multiple MNOs. As such the number of sites is much lower than the number of sites where active equipment is located. Over the last year, the MNOs have divested t significant portions of their telecommunications tower assets into new tower entities (while maintaining various levels of ownership). This has resulted in significant and ongoing structural changes in the telecommunications tower industry.

Amplitel (51% owned by Telstra) has around 8,000 tower sites. Indara Digital Infrastructure (18% owned by Singtel, the parent entity of Optus) has around 4,300 tower sites. In addition, Waveconn recently acquired around 1,400 TPG tower sites and structures (see Table 2 in **Attachment A**).

⁵ Outside of Major Cities means the sum of Inner Regional, Outer Regional, Remote and Very Remote Remoteness Areas.

Spectrum

MNOs use a range of radiofrequency spectrum bands for the purpose of providing mobile services. Radiofrequency spectrum can be used across a variety of technologies including 3G, 4G and 5G and can also be repurposed or re-farmed over time to support a different technology. The availability of spectrum is essential for the development of new sites and coverage areas.

Generally, spectrum is classified into three categories – low band, mid-band and high band. Each band has different propagation characteristics which serve a different main purpose (capacity and/or coverage) in the MNOs' networks. Table 2 below shows the different characteristics of spectrum bands.

Table 2: Characteristics of spectrum bands

Spectrum band	Purpose	Key characteristic	Site density
Low (Less than 1 GHz)	Mainly provides coverage with some capacity	Transmits information over greater distances and through obstacles such as buildings more easily than higher frequencies. This means it is ideal for providing mobile services in sparsely populated regional/remote areas.	Allows for the deployment of a smaller number of sites, as a given site provides coverage over a greater geographical area.
Mid (1-6 GHz)	Mainly provides capacity with some coverage, supplements low band	Transmits information over shorter distances than that of low band spectrum. It is likely to have a larger amount of spectrum available than in the low band, and hence a higher capacity, which makes it very useful in more populated and congested areas.	An MNO may need to build more sites when using this spectrum compared to low-band, to cover areas of the same size.
High (Greater than 6 GHz)	Mainly provides capacity	The distances information can travel is very short range (mainly line of site) and less than both low band and mid-band spectrum. Provides significant capacity making it ideal for use in high traffic areas.	An MNO will need to build more sites when using this spectrum compared to low-band and mid band to cover areas of the same size.

Source: ACCC Mobile Infrastructure Report 2022

3. Co-investment and infrastructure sharing

Infrastructure sharing amongst mobile telecommunications operators in Australia is not new. In general, mobile network sharing can be characterised as passive or active sharing. Passive sharing involves the sharing of passive elements of network infrastructure, such as masts and sites. Active sharing involves active elements such as the radio access network

(including the base station, antenna, nodes, feeders), spectrum, transmission and core networks.

There have been numerous arrangements for the sharing of both spectrum and infrastructure (towers, backhaul etc). Most of this sharing has been within the passive network although active network sharing is becoming more prevalent globally. Infrastructure sharing is also present in the form of commercial roaming agreements (for example, TPG has a roaming agreement with Optus in certain areas).⁶

Passive infrastructure sharing is where MNOs share non-electronic infrastructure at a tower site such as land, power and other physical elements. This form can be further classified into site sharing, where MNOs share the physical sites of base stations. In addition, MNOs can also share backhaul links from shared sites to an operator's core network. Passive infrastructure sharing is relatively simple because the network's active equipment remains separated.

Active infrastructure sharing involves sharing of electronic components of the network including the radio access network (antennas, transceivers, base station controllers). It is also common for MNOs to share backhaul transmission equipment or services and core network elements (servers etc) under this model. This form of sharing is known as multi-operator radio access network (MORAN), where MNOs share radio access networks and dedicated spectrum is used by each sharing operator.

Another network sharing arrangement is where MNOs combine active and passive sharing under a multi-operator core network (MOCN) approach. MNOs typically share multiple elements including the radio access network, spectrum and the core network (at least parts of the core). The ACCC notes a number of trials and commercial arrangements for infrastructure sharing are under consideration, particularly through state and federal government funded programs and initiatives.⁷

Infrastructure sharing can allow greater efficiencies or economies of scale to be pursued, resulting in lower costs. However, this is often balanced against the competitive advantage derived from having the greatest mobile coverage to attract customers and revenue. The benefits of lower costs are often pursued in less densely populated areas where it is less economic to extend mobile coverage.

Future co-investment models will have to consider the impact of recent divestments by MNOs of significant proportions of their tower assets to private entities. Not only will co-investment models have to take into account new commercial models of tower ownership, but they will also have to consider how to reconcile funding from separate entities with interests in either the passive or active infrastructure, or both.

4. Co-investment models

High costs associated with building telecommunications infrastructure in underserved geographical areas, commensurate with low revenues from sparsely populated areas, complicate the commercial case for expanding networks in regional and remote Australia. In response, government programs have aimed to incentivise infrastructure expansion through co-investment with MNOs.

⁶ <https://www.zdnet.com/article/vodafone-australia-and-tpg-merger-everything-you-need-to-know/>

⁷ For example, see [NSW Mobile Coverage Project](#) and [Connecting Victoria](#)

As noted in the 2021 Regional Telecommunications Review, these programs have increasingly struggled to expand mobile coverage and capacity into increasingly remote areas in recent years.⁸ Poor economics are increasing the Australian government's co-investment share, as is evident between Round 1 and 5A of the Mobile Black Spot Program. In Round 1, the government's \$110 million subsidy yielded \$275 million in co-investments.⁹ In contrast, Rounds 5 and 5A were undersubscribed, with \$36.8 million of the \$80 million initially allocated being utilised.¹⁰

Telstra is the main historical recipient of Mobile Black Spot Program funding, which has entrenched its incumbent competitive advantage over other MNOs in remote markets.¹¹ Lack of competition is problematic because it limits access to those users of alternative networks.

Despite these challenges, government subsidisation remains one of the limited incentives available to improve coverage, capacity and competition in regional and remote areas. Without these programs, the costs of extending mobile coverage into increasingly marginal areas would likely outstrip any potential return on investment.

Table 3 and Table 4 in **Attachment A** show the number of co-located sites both as a percentage of total sites by MNO and ABS Remoteness Area in the period from 2020 to 2022 and by total number of sites by MNO combination (as reported in the ACCC's Mobile Infrastructure Report). The number of new co-funded site varies each year depending on program dates and build completion. Table 5 in **Attachment A** shows the number of new co-funded sites by MNO and ABS Remoteness Area in the period from 2020 to 2022

As the ACCC has consistently expressed, leveraging these programs as a means of both enhancing coverage and competition in marginal areas will improve consumer outcomes for all end users, not just subscribers of one network. Government co-contribution programs should have clear objectives to expand coverage, promote competition and maximise choice of providers.

The ACCC has previously suggested that the low co-location rates characterised by earlier Mobile Black Spot Program rounds indicates that a co-location framework for co-investment programs is unlikely to sufficiently enhance competitive outcomes in marginal areas. Rather, co-investment programs could potentially leverage enhanced competition by considering the infrastructure sharing models detailed below. Co-investment criteria, such as those that may be set under the Mobile Black Spots Program, may need to consider new, or substantially different, models where current funding programs are no longer attracting or influencing investment in regional mobile infrastructure by the MNOs.

Neutral host models

Neutral host models allow multiple MNOs to share a third-party's mobile network equipment on a tower. Each MNO gains equitable access to the tower site and shares the infrastructure rental cost. This reduces the high costs associated with building telecommunications infrastructure in undeveloped geographical areas by eliminating the requirement for each MNO to build or share passive tower infrastructure and deploy, manage and maintain their own networks.

⁸ RTIRC 2021 p.7

⁹ RTIRC 2021, p.44

¹⁰ RTIRC 2021, p.44

¹¹ RTIRC 2021, p.45

For example, under Round 5A of the Mobile Black Spot Program, Field Solutions Group (FSG) was awarded a total of \$7.75 million to trial its neutral host mobile delivery model. The infrastructure model will allow all Australian MNOs, including Telstra, Optus and TPG, to share FSG's mobile network infrastructure. The aim of this model is to:

- extend network coverage into increasingly marginal regional and remote areas,
- improve competition and consumer choice, and
- improve Mobile Black Spot Program funding efficiency.

Active sharing models

Active sharing models involve the sharing of active elements in the radio access network such as antennas, transmission and spectrum. This model involves at least two MNOs collaborating and jointly applying for funding on the basis that they will share passive and active infrastructure, often through a joint venture. Similar to neutral host models, the model allows MNOs to reduce infrastructure deployment costs.

Open access network models

The purpose of 'open' radio access networks is to develop a set of common radio access network standards that is open, as opposed to proprietary, and interoperable between network operators. Open radio access networks enable service providers to use components from a variety of vendors. The open radio access network is made possible by a set of industry-wide standards that telecommunications suppliers adhere to when producing related equipment. The interfaces between components in an open radio access network are interoperable. This open access system is emerging as an alternative to the traditional vendor system which locks-in networks to proprietary systems.

Open radio access networks seek to lower costs by reducing the price of network equipment (see the O-RAN Alliance¹²) potentially making them more suitable for deployment in areas where the traditional business case for deployment is more marginal.

In Australia, co-investment programs are increasingly considering neutral host and active sharing models. Open radio access network models appear less developed. The ACCC supports this development as these models will likely enhance competition and support more efficient deployment of infrastructure.

5. Single carrier versus multi-carrier mobile infrastructure models

The ACCC considers there are both advantages and disadvantages in the single carrier and multi-carrier models, and that both may have application dependant on the geographic location or region to be deployed. Choice will largely be determined on a case-by-case basis, particularly in regional areas.

Single carrier models

In general, single carrier models prioritise their network builds based on coverage and expected commercial returns. As such, they are likely to avoid low density areas where they cannot obtain a sufficient return on investment. However, they will likely extend coverage to

¹² <https://www.o-ran.org/>

non-urban areas where they expect their urban and rural customers to visit (like tourist places, camping areas) even if these are relatively low-density areas.

MNOs are also likely to extend coverage when they perceive there is a competitive advantage to be obtained by doing so. In this way, MNOs use their non-urban coverage as a differentiator to sell their services in the urban areas.

Small operators face greater hurdles to establish the business case for extending their coverage outside urban areas, and so may seek roaming agreements with a major MNO. The ACCC notes that some low-cost solutions such as repeaters and relays can extend the coverage from a base station to an extent.

There are a number of advantages to single carrier models. These include that the single carrier model:

- allows for a specific mobile network coverage design that is in accordance with the MNO's commercial objectives and network planning.
- can result in faster network enhancements in the radio access network (at least for a short period) through deploying feature upgrades before the competitors. A single carrier model may also improve coverage quality. This may become a product differentiator if various operators have different performance objectives.
- are likely to encourage private investment to provide competing coverage and foster infrastructure deployment competition. In addition, it may also foster competition on the supplier side, although in Australia this is limited as almost all major operators are now using either Ericsson or Nokia equipment.
- there may be more vendor options in the near future with the emergence of O-RAN and small vendors.
- urban deployment may be easier because of greater synergy with their urban equipment needs.
- may provide better diversity in networks in emergency situations.

There may also be some disadvantages from the single carrier model including:

- difficulty in getting suitable sites. This can limit coverage for some operators if another operator has already taken the best site.
- any extension of mobile coverage is generally only available to the specific operator unless roaming arrangements are in place.
- in non-urban areas, there is likely to be significantly higher investment required for both deployment of, and maintaining, the network.
- MNOs like to extend coverage in a continuous fashion from their existing coverage footprint (to ensure continuity). A single carrier model may result in coverage holes in a geographic area.

Multi-carrier infrastructure models

Multi carrier models can potentially allow coverage extension in otherwise non-profitable rural and regional areas. Usually, multi-carrier models include either passive sharing (where an operator shares passive infrastructure such as mast, tower, equipment shelters) or active

sharing which include antenna, base station equipment and backhaul). Roaming agreements are also a form of multi-carrier active sharing.

Generally, site costs (including land, power and site access) are often the most expensive part in the total infrastructure costs, particularly in rural areas. Infrastructure costs can be provided by one major operator and shared, or the parties can form a joint company to deploy the infrastructure and share costs.

A reciprocal model can also be implemented where coverage areas can be sub-divided, and each operator assigned some of these sub-divisions where they deploy the network. The operator then can have access to each other's networks.

There are a number of advantages to multi-carrier models. These include that the multi-carrier model may enable:

- cost reductions can be available in both the fixed costs and variable cost components. Lower costs can translate into lower consumer prices.
- improvements to the quality of service experienced by consumers, including a faster roll-out of new mobile technologies, better network quality overall for all (from better location) and better coverage.
- fixed cost reduction can incentivise the MNOs to invest further to deploy faster or wider resulting in more coverage.
- positive carbon and environmental effects by reducing overall energy consumption and visual impact on landscapes.
- potential more efficient use of spectrum if spectrum is shared.
- positive customer benefits from wider choice, including more choice in MVNO providers.
- reduced barriers to entry by smaller players thus potentially providing more choice to the customer.
- allow operators to combine resources, and use their spectrum assets more efficiently, through a more effective network planning and deployment that maximizes network coverage and capacity.

There are a number of disadvantages to multi-carrier models. These include that the multi-carrier model:

- removes infrastructure-based competition in radio access networks.
- coverage design principles can vary between operators as the performance objectives could vary. This may result in a minimalist design which can affect brand advantage for some operators.
- may result in lower service differentiation and could also reduce incentives to invest. This can potentially reduce the incentives to compete or to invest in improving coverage and network quality.
- passive infrastructure may not always be feasible or may require further investment to make the site ready for multiple operators. Tower height may not be suitable for some operation and replacement tower may be required.
- sharing can also increase complexity - due to the need for technical coordination between operators - and may slow down decision making and the roll-out of new sites or upgrading to new technologies.

- can reduce network resilience. If the shared network fails, no one gets the service. There is no opportunity to provide roaming to other networks.
- there may be less incentive to upgrade to new technology (for example, 5G) or to build new infrastructure for the new technology.

Examples of co-investment programs

Stage 1 Mobile Coverage Program - NSW

NSW's Mobile Coverage Project (MCP) has been allocated \$300 million from the Regional Digital Connectivity program to promote active sharing partnerships between the Department of Regional NSW (DRNSW) and Australian MNOs. Active sharing partnerships will involve market participants forming a partnership with government to design active sharing solutions. Stage 1 funding has been awarded to Field Solutions Group (FSG) and BAI Communications Australia (BAI).

FSG was selected to lead the NSW Neutral Host Infrastructure Pilot. FSG will collaborate with the NSW Government to design and deploy a multi-operator core network (MOCN) to be shared between MNOs. MOCN involves a network operator—in this case FSG—hosting and providing access to a single radio access network to other MNOs. Telstra, Optus, TPG Telecom and Pivotal will access the shared network.

Similarly, BAI was selected to partner with DRNSW to design and deliver an Open Radio Access Network (ORAN). ORAN is an emerging 4G and 5G base station interoperability software technology that supports MORAN and MOCN network sharing arrangements. BAI will work with Optus to deliver ORAN to all MNOs.

Peri-Urban Mobile Program

The Australian Government's Peri-Urban Mobile Program (PUMP) provided grant funding to MNOs and MNIPs to improve mobile phone reception in peri-urban and regional city fringe areas that are prone to bushfires.

The objective of the program is to provide grant funding to MNOs and Mobile Network Infrastructure Providers (MNIPs) to improve mobile phone reception in peri-urban fringe areas that are at threat of bushfire. The intended outcome of the program is to fund deployment of new mobile phone infrastructure that will provide improved quality of service to mobile telecommunications users in peri-urban fringe areas, to assist during times of emergency.

The Department of Infrastructure, Transport, Regional Development and Communications strongly encouraged applicants to seek third-party co-contributions from State, Territory or Local governments, local communities and/or other third parties, and requested that parties note co-contributions in their grant applications.

New Zealand's Rural Connectivity Group

The Rural Connectivity Group (RCG) is using funding from the New Zealand government's Rural Broadband Initiative Phase 2 and the NZ Mobile Black Spot Fund as well as contributions from New Zealand MNOs Spark, Vodafone and 2degrees to build a 4G mobile network in areas with poor broadband coverage and areas of no mobile coverage. The RCG network uses 4G Multi-Operator Core Network (MOCN) technology where all three NZ

mobile networks use the same radio spectrum and infrastructure including the pole, antenna, power and backhaul.

This co-investment policy favours network sharing as the preferred approach to addressing coverage challenges in marginal areas. The New Zealand MNOs have developed a joint venture arrangement which uses co-investment to independently acquire, build and operate infrastructure, which is shared actively between the three MNOs.¹³

The aim of the funding is to improve:

- the amount of spectrum capacity available to consumers,
- service quality near mobile sites,
- costs for both MNOs and the government
- consumer choice, and
- competition.

Some limitations of this type of active sharing policy model have included:

- potential network congestion in populated areas
- MNOs experiencing difficulty when negotiating costs of infrastructure upgrades, particularly when MNO requirements differ, and
- tension as to where new infrastructure should be deployed.

¹³ See the RCG website at: <https://www.thercg.co.nz/>.

Attachment A

Table 1: Mobile population and coverage area

	Cumulative proportion of total population covered by mobile	Estimated total area covered (sq km)
Metropolitan	81.4%	50,000
Regional	98.8%	1,500,000
Remote	99.5%	1,000,000

Source: ACCC estimate from publicly available data

Table 2: Number of towers by mobile network infrastructure provider

	Number of tower sites
Amplitel	8,000
Indara	4,300
Waveconn	1,400

Source: ACCC estimate from publicly available data

Table 3: Co-located sites as percentage (%) of total sites by MNO and ABS Remoteness Area - 2020 to 2022

	2020	2021	2022
Major Cities of Australia			
Optus	84.9	83.4	80.3
Telstra	46.0	46.2	46.4
TPG	92.2	89.1	92.9
Inner Regional Australia			
Optus	63.4	62.5	60.9
Telstra	35.5	35.3	35.8
TPG	85.3	85.4	85.4
Outer Regional Australia			
Optus	52.9	52.9	52.4
Telstra	26.1	25.9	25.6
TPG	75.7	75.3	75.7
Remote Australia			
Optus	40.9	41.2	41.1
Telstra	11.8	11.7	11.9
TPG	61.7	62.9	64.5
Very Remote Australia			
Optus	26.7	25.8	27.8
Telstra	4.7	4.4	4.8

TPG	62.5	62.5	62.5
Total			
Optus	73.7	72.7	70.5
Telstra	35.1	34.9	35.0
TPG	89.5	87.2	90.0

Source: ACCC Mobile Infrastructure Report 2022

Table 4: Total number of sites by MNO co-location combination – 2020 to 2022

	2020	2021	2022
Optus & Telstra	1,028	1,070	1,137
Optus ONLY	2,095	2,252	2,548
Telstra ONLY	6,787	7,005	7,149
TPG & Optus	2,441	2,446	2,440
TPG & Telstra	220	221	209
TPG ONLY	598	755	572
TPG, Optus & Telstra	2,416	2,470	2,507

Source: ACCC Mobile Infrastructure Report 2022

Table 5: Number of new sites that are co-funded by MNO and ABS Remoteness Area – 2020 to 2022

	2021	2022
Major Cities of Australia		
Optus	0	4
Telstra	3	3
Inner Regional Australia		
Optus	11	29
Telstra	38	19
Outer Regional Australia		
Optus	3	12
Telstra	46	23
Remote Australia		
Optus	1	8
Telstra	13	7
Very Remote Australia		
Optus	3	7
Telstra	15	15
Total		
Optus	18	60
Telstra	115	67

Source: ACCC Mobile Infrastructure Report 2022