

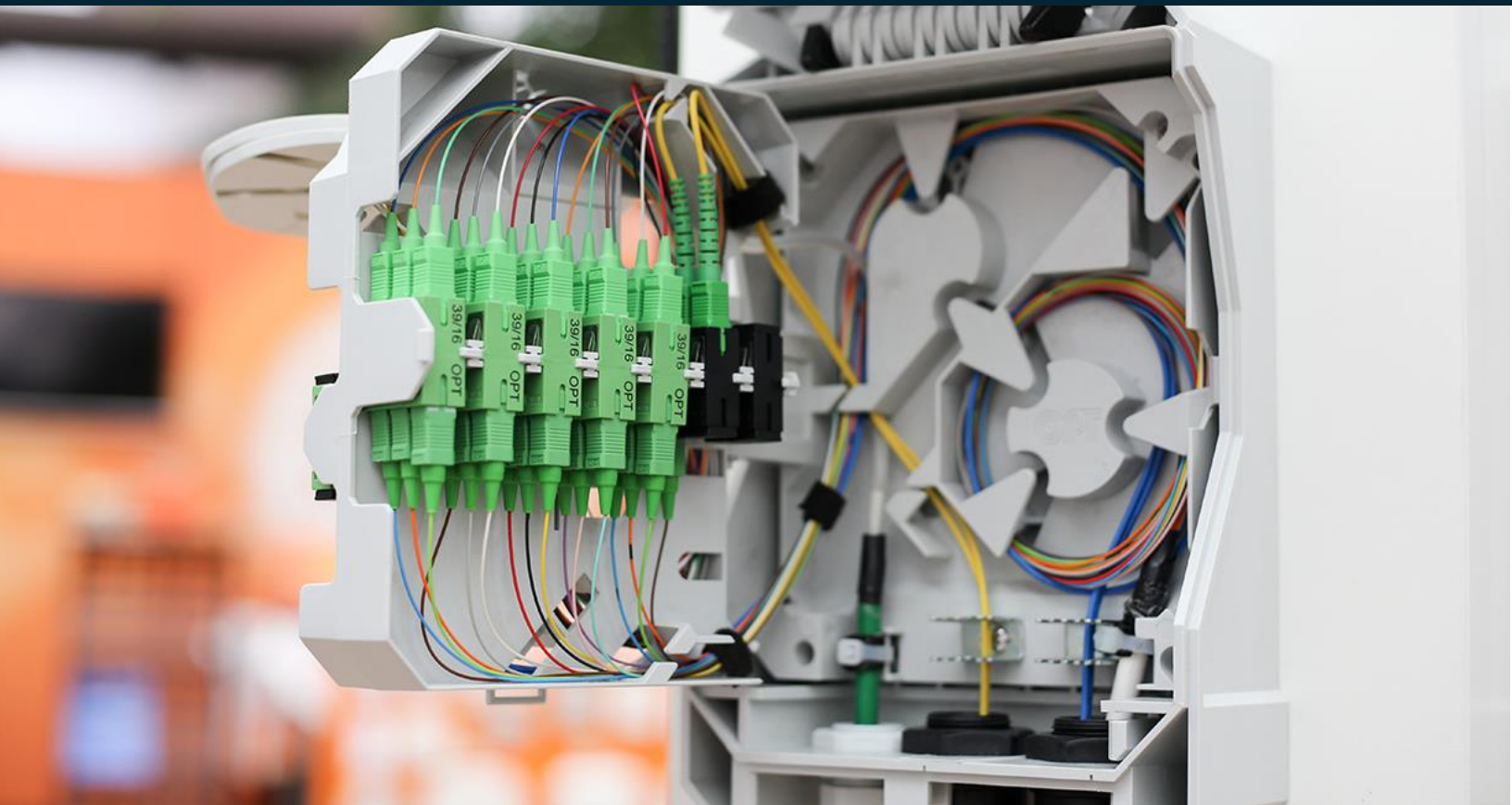


RESEARCH TO ACTION LAB

Lessons from Superfast Cymru for Broadband Access in the United States

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The COVID-19 pandemic has underscored both the importance and the vulnerability of many of our country's support systems. As we move toward recovery, we can strengthen policies and programs so they better support an inclusive economy and ensure equitable access to services and opportunities. This moment offers us the chance to learn from other countries and to explore how solutions they have undertaken might be applied or adapted to our circumstances.

The Urban Institute, supported by a grant from the Robert Wood Johnson Foundation, set out to study how innovative policies and programs from abroad could inform state and local efforts in the US to advance an inclusive recovery from the COVID-19 pandemic. To share what we learned, we produced five briefs, each profiling an approach from abroad that addresses a different policy priority: child care, broadband access, local economic development, parks and public space, and housing stability and affordability. A sixth brief describes the project's methodological approach. Resources from the full project are available at <https://urbn.is/lessons>.

High-speed broadband has become the connective tissue between the individual and all facets of society: educational, professional, social, and civic. The COVID-19 pandemic has only cemented this reality as schools, businesses, and governments have shifted online. Yet 24 million Americans lack access to baseline broadband with download speeds of 25 Megabits per second (Mbps). For millions more, broadband is unaffordable or inadequate (FCC 2018). Bridging this connectivity gap is essential to an inclusive and equitable recovery from the pandemic, but political and technical barriers mean that new and innovative policy solutions are necessary to do so. Considering that the US lags behind peer countries in broadband access and ranks 131st out of 206 countries in internet affordability,¹ we conducted a worldwide landscape scan of connectivity innovations to better understand how other countries have provided broadband access. We identified Superfast Cymru as a program that could inform US policymakers seeking to close access gaps.

Superfast Cymru, designed by the Welsh government and implemented with funding and program goals set by the British government, over five years connected hundreds of thousands of households across Wales to high-speed broadband. Through our research and interviews with 10 US- and UK-based broadband experts, we identified several of its innovative features. Acknowledging the different regulatory environments in the United States and the United Kingdom, we find that policymakers seeking to expand broadband access in the US can consider the following four policy innovations that emerged from Superfast Cymru:

1. Building open-access broadband infrastructure to expand competition among service providers and to ensure ample consumer choice
2. Including revenue-sharing provisions in contracts to reinvest any excess subsidy above expected profits back into broadband-access expansion
3. Pairing investments in infrastructure with parallel investments encouraging broadband adoption, such as outreach to businesses, which can advance economic development
4. Deploying rigorous speed testing and verification to ensure that promised speeds and geographic distribution targets are met

These policy innovations would need to be modified for a US context, but the US could pursue a model similar to Superfast Cymru in which the federal government establishes broadband speed and coverage targets then provides funding to states and local governments while granting them autonomy to pursue the approach that best addresses their specific challenges—including whether and how to adapt these policy innovations.

The High-Speed Broadband Gap in the United States

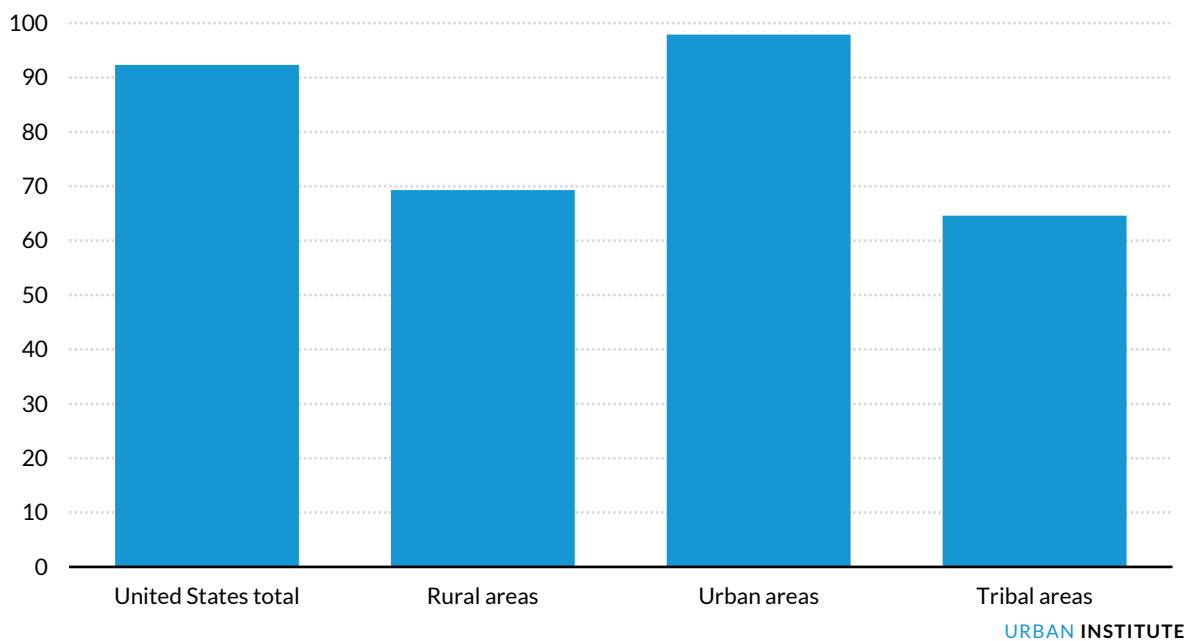
As digital technology has become increasingly integrated into all aspects of life—both before and increasingly during the COVID-19 pandemic—access to high-quality, reliable broadband is essential for full participation in society. But persistent barriers in access, affordability, and adoption have kept broadband out of reach for far too many Americans. The Federal Communications Commission (FCC) estimated in 2018 that 24 million Americans did not have access to baseline broadband speeds of at least 25 Mbps for downloads and 3 Mbps for uploads. These Americans disproportionately live in rural areas, where the FCC estimates about 31 percent of rural residents and about 36 percent of rural Tribal land residents cannot access baseline broadband speeds (figure 1).² For activities that require higher broadband speeds, such as virtual schooling or telemedicine, even more inequity will emerge among rural residents: only 23 percent have access to broadband at speeds of 50 Mbps or higher (Beede and Neville 2013).

These challenges exist in urban areas as well, albeit for different reasons. Although 98 percent of urban residents have access to baseline broadband access (Beede and Neville 2013), “digital redlining” practices by internet service providers (ISPs) have left many low-income households and communities of color without high-quality broadband (Callahan 2017; Turner 2016). Digital redlining, as defined by the Robert Wood Johnson Foundation, refers to “when major network providers systematically exclude low-income neighborhoods from broadband service—deploying only substandard, low-speed home internet.”³

FIGURE 1

Deployment of Fixed Terrestrial 25 Mbps/3 Mbps Broadband Services in the United States

Share of United States population



Source: Federal Communications Commission (FCC), “2018 Broadband Deployment Report” (Washington, DC: FCC, 2018), <https://www.fcc.gov/reports-research/reports/broadband-progress-reports/2018-broadband-deployment-report>.

Note: “25 Mbps/3 Mbps” refers to the FCC-defined baseline broadband speed of at least 25 Megabits per second (Mbps) for downloads and 3 Mbps for uploads.

Even where quality broadband internet is accessible, service remains unaffordable for many Americans. The average monthly cost of broadband in the US is \$60, nearly twice as much as in France and the UK.⁴ The Pew Research Center found that only 56 percent of survey respondents with household incomes below \$30,000 reported having broadband internet at home compared with 95 percent with household incomes above \$100,000.⁵ This disparity disproportionately affects communities of color, who tend to have fewer choices for ISPs or lack affordable options even when controlling for income.⁶ A key driver of broadband unaffordability in the US⁷ has been decades of

deregulation that significantly reduced competition among service providers.⁸ Nearly 80 percent of Americans have only one or two options for providers of fixed broadband service, as measured at cable broadband speeds of 100 Mbps/10 Mbps (download/upload) (Sallet 2020).

During the COVID-19 pandemic, schools, public services, and health care have relied increasingly on high-speed broadband access.⁹ Education at all levels has had to adapt to remote learning, exacerbating disparities between students who have the capabilities for online instruction at home and those who do not.¹⁰ Government agencies responded similarly to the COVID-19 pandemic by delivering public services, providing information, and engaging community residents online. Although digitized government may expand access to services, it also underscores the need for ubiquitous broadband access to enable civic participation (Brown, Ezike, and Stern 2020). Hospitals and physicians have moved toward telehealth alternatives, switching as many as 75 to 80 percent of in-person visits to virtual visits.¹¹ Although many public programs have provided emergency broadband during the pandemic, long-term solutions to expand access are desperately needed (Brown, Ezike, and Stern 2020).

Program Innovation from Abroad: Superfast Cymru

In 2012, the Welsh government launched Next Generation Broadband Wales, known publicly as Superfast Cymru, to provide broadband access at superfast speeds (30 Mbps) to at least 95 percent of underserved households and businesses (Baker and Hutton 2021). Implemented between 2013 and 2018, Superfast Cymru was part of the UK-wide Superfast Broadband program established in 2010 to close gaps in broadband access (UK Department for Digital, Culture, Media, and Sport 2018).¹²

Although the Superfast Broadband program was overseen by Broadband Delivery UK, a UK government department that contributed funding and helped outline program goals and evaluation metrics, the Welsh government independently designed and managed Superfast Cymru (Baker and Hutton 2021). That program design and implementation, which included several innovative features, could provide an adaptable model for US policymakers seeking to bridge broadband gaps.

Program Background and Context

In accordance with a 2009 European Union directive to provide universal minimum service at an affordable cost,¹³ the UK established a universal service commitment to set a minimum service target of 2 Mbps broadband at an affordable cost.¹⁴ Later, through the Digital Economy Act 2017, the UK established the Universal Service Obligation that granted all citizens a legal right to a minimum broadband service speed of 10 Mbps by 2020.

But the commitment to expanding broadband access and adoption in the UK goes beyond the legal requirements set out by the universal service obligation. Indeed, multiple experts identified investments in universally accessible high-speed broadband as critical to creating a modern, prosperous UK. For Superfast Cymru, the Welsh government saw investment in broadband as investment in the economic development of Wales. One expert noted in our interview that expanding broadband infrastructure would be critical to “leveling up” economic opportunity and productivity in rural communities.

Before Superfast Cymru, roughly 40 percent of homes and businesses in Wales could access superfast broadband.¹⁵ In 2013, research from Ofcom, the UK government’s independent industry regulator for communication services, highlighted the significant digital divide between Wales and the rest of the UK and between urban and rural areas within Wales (table 1).

TABLE 1
Availability of Superfast Broadband (30 Mbps) in the UK, 2013
Percentage of households

	All	Urban	Semiurban	Rural
UK	67.9	86.0	67.0	21.2
England	70.9	86.7	70.5	19.1
Northern Ireland	96.0	98.4	97.1	92.4
Scotland	47.6	72.3	48.3	6.3
Wales	39.8	90.1	33.8	6.6

Source: Ofcom, *The Availability of Communications Services in the UK* (London: Ofcom, 2013), https://www.ofcom.org.uk/_data/assets/pdf_file/0021/53382/economic-geography.pdf.

Innovative Features of Superfast Cymru’s Design and Implementation

A 2011 analysis of market data indicated that over half of all premises in Wales, would not have access to superfast broadband by 2015 (Miller and Greenwood 2019). This prompted the Welsh government to develop Superfast Cymru to connect the identified premises to superfast broadband. After competitive bidding, the government contracted the British Telecom subsidiary Openreach to deliver superfast broadband to a targeted intervention area comprising 767,000 homes and businesses, setting the superfast speed standard at 30 Mbps. According to one interview subject, Superfast Cymru set its standard higher than the 24 Mbps common at the time to encourage Openreach to use fiber-optic cable technology. Many experts consider fiber to be uniquely “future proof” for its ability to scale with growing demand.¹⁶

Openreach used a mix of fiber-to-the-premises (FTTP) architecture, delivering fiber-optic cable directly into a home or business (with 100 Mbps speeds) and fiber-to-the-cabinet (FTTC) architecture,

which delivers fiber to a network access point near a home or business (with 30 Mbps speeds). Some have criticized the choice to primarily use FTTC, as it will have to be replaced with the faster and higher-capacity FTTP to keep pace with growing demand.¹⁷ But the UK experts we interviewed were unanimous that this was the right choice during project implementation for quickly expanding broadband to rural areas that lacked any service.¹⁸

The contract also governed targeting of services through a postcode cap, which stipulated that Openreach could only receive payment for a certain number of premises within each Welsh postcode area. As a result, Openreach had to build broadband infrastructure across a wide area, rather than focus delivery on densely populated areas, to reach contractual targets (Miller and Greenwood 2019). One interview subject indicated that specifying difficult-to-reach postcodes as priority areas was fundamental to ensuring these areas were serviced.

Superfast Cymru's program design also included four innovative provisions that could inform or be adapted to a similar initiative in the US:

1. Building open-access broadband infrastructure to expand competition among service providers and to ensure ample consumer choice
2. Including revenue-sharing provisions in contracts to reinvest any excess subsidy above expected profits into broadband-access expansion
3. Pairing investments in infrastructure with parallel investments encouraging broadband adoption, such as outreach to businesses, which can advance economic development
4. Deploying rigorous speed testing and verification to ensure that promised speeds and geographic distribution targets are met

BUILDING SHARED (OPEN-ACCESS) INFRASTRUCTURE

Openreach was required by contract to build an open-access network,¹⁹ meaning Openreach would operate the network, and hardware and other ISPs could purchase access at wholesale prices to provide direct retail service. Several respondents noted that by investing in an open-access infrastructure, Superfast Cymru bolstered retail competition by enabling multiple ISPs to provide service using the underlying network without each ISP having to incur the often prohibitive costs of building its own.²⁰

INCLUDING REVENUE-SHARING PROVISIONS

The Superfast Cymru contract between the Welsh government and Openreach included revenue-sharing ("gainshare" in the UK) provisions to facilitate reinvestments into Welsh communities as required by EU regulations governing state aid. Gainshare provisions in the Superfast Cymru contract were intended to protect the government from providing a larger subsidy than needed. Without

knowing exact costs or adoption in the targeted areas, the Welsh government could not be sure how profitable the program would be at the procurement stage. With the gainshare mechanism, the Welsh government would not oversubsidize the rollout. When the broadband adoption exceeded projections and generated surplus revenue, the Welsh government was able to reinvest the money in additional broadband-access projects. The Welsh government projects being able to reinvest between £30 million and £50 million by 2023, depending on the level of adoption (James 2016).

PAIRING INFRASTRUCTURE INVESTMENTS WITH CONSUMER TAKE-UP EFFORTS

Part of Superfast Cymru that several individuals described as crucial to its success was the paired investment approach that encouraged businesses and individual residents to subscribe to broadband service at the same time the infrastructure was being built. Interviewees also noted that the efforts to stimulate broadband demand combined with the gainshare provision allowed for a virtuous cycle: increased take-up led to increased gainshare revenues, which led to increased investment and further increased take-up.

The Welsh government hoped that demand stimulation would encourage small businesses to use the new broadband services and improve the productivity and prosperity of the Welsh economy. But the government also aimed several marketing and awareness campaigns at individual residents; the government initiative Digital Communities Wales helped build computer literacy among digitally excluded individuals.²¹ Notable components of the campaign included several targeted initiatives:

- Superfast Business Wales provided free training and tailored one-on-one support to help small and medium enterprises improve their business by effectively using broadband and digital technologies.²²
- The Welsh government allocated £12.5 million to raise awareness that broadband service was being built and to generate demand once available (National Assembly 2017). One expert noted that targeted marketing materials, especially when delivered by mail, considerably increased the rate of take-up.
- The government created a dedicated business advisory group to engage directly with the broader Welsh business community, help tailor support services, and offer advice to meet take-up needs. The advisory group comprised volunteers across the spectrum of invested stakeholders, including members of the Federation of Small Businesses, small ISPs, Openreach, large institutional businesses, local authority representatives, and others.²³
- The Welsh Economy Research Unit of Cardiff University collected data and conducted other research on the take-up and impacts of superfast broadband. Output included the annual Digital Maturity survey, quantitative economic impact research, and 50 case studies on the impacts of broadband on individual businesses and industry sectors in Wales (WERU 2020a, b).

DEPLOYING SPEED VERIFICATION TESTS

With the rollout of broadband to new homes and businesses, the Welsh government independently examined a random sample of broadband endpoints each month to verify that the infrastructure quality and broadband speeds matched the program's claims for the area. The Welsh government also checked Openreach's data to verify whether each serviced location was in the intervention area and not a duplicate claim, did not exceed the postcode cap, and had complete data (Miller and Greenwood 2019). Payment to Openreach was only made after broadband speeds were verified. Although this verification was time and labor intensive, it ensured the Welsh government received the expected value for its money.²⁴

Translation of Superfast Cymru to the US

Key differences in the division of power, the administrative and regulatory landscape, and equity considerations between the US and Wales and the UK could limit the applicability of Superfast Cymru to the US context. In particular, the regulatory framework governing the UK's telecommunications industry differs greatly from that in the US,²⁵ including the presence of a legal requirement to ensure universal access to all telecommunication services, including broadband, at an affordable price in the UK and the absence of such requirements in the US. The US could navigate these differences through a similar model to Superfast Cymru, in which the federal government establishes broadband speed and coverage targets and provides funding to states and local governments while giving them the autonomy to pursue the approach that best addresses their specific broadband-access challenges.

Devolution and Superfast Cymru

Although the UK and the US share similarities in the division of power between the national government and other regional and local government entities, the shape and legal basis for American federalism and British devolution (the division of powers between the UK and Wales, Northern Ireland, and Scotland) are different, and in neither case are those divisions uniform. In the US, federal and state laws can preempt local government powers, including the ability to expand broadband access.²⁶ Legislation in 18 states already restricts city or county municipal broadband.²⁷ In the UK, each devolved government was formed and given authority by a separate act of the British Parliament, leaving the Northern Irish, Scottish, and Welsh governments with different levels of autonomy and local control.²⁸

Though broadband and telecom policy is a "reserved power" of the central UK government, the design and delivery of superfast programs were left to local bodies, including each of the three devolved governments and various English counties, to ensure the infrastructure projects and

programs addressed local challenges and needs. Broadband Delivery UK worked with all subnational authorities to ensure the local projects met UK-wide policy goals and provide funding support.²⁹

The US could pursue a similar model, in which the federal government establishes broadband speed and coverage targets³⁰ and provides funding to states and local governments while giving them the autonomy to pursue the approach that best addresses their specific broadband-access challenges. The Biden administration has introduced several promising funding windows, including approximately \$338 billion of flexible funding in the American Rescue Plan that could be used toward broadband access and an additional \$3.2 billion in the Emergency Broadband Benefit program to make broadband more affordable (Tomer and George 2021). The inclusion of broadband in the proposed American Jobs Plan could also provide a significant funding window for state and local governments.³¹ The federal government can also support local governments by raising federal broadband speed standards³² and removing legal barriers that constrain local policy options.³³

Superfast Cymru offers US policymakers an example of balancing local autonomy and regional consistency. Wales took a regional approach, enlisting one company to create the infrastructure grid, which allowed for consistent service delivery and technology. In other parts of the UK, such as England, the Superfast program had local constituency-level projects. One expert we interviewed critiqued England's approach, saying it contributed to a patchy and inconsistent network relative to Wales's, but another noted that the regional approach of Superfast Cymru advantaged large incumbents in the bidding process. US officials will need to weigh these trade-offs when designing broadband programs.

Administrative and Regulatory Differences between the US and the UK

Ofcom has legal powers to impose corrective regulations when an industry does not have effective competition. To ensure effective retail competition via open-access networks, Ofcom has used this power to regulate British Telecom and Openreach as the dominant broadband and infrastructure providers.³⁴ This framework and culture of industry regulation in the UK is unlikely to transfer to the US, but one UK interviewee stressed that creating similar open-access infrastructure requirements, especially for providers with large market power, will help ensure both infrastructure competition and retail competition in the broadband market.

Funding for Superfast Cymru came from three public sources, the Welsh government, the European Union Regional Development Fund, and Building Digital UK. Private cofunding was also contributed by Openreach. As a condition of public funding, the Welsh government's contract with Openreach was subject to EU and UK state-aid regulations, which necessitated that Superfast Cymru minimize the

amount of aid and market distortion, leading to the gainshare provision and the open-access infrastructure requirement (Broadband Delivery UK 2011).

In the US, gainshare provisions are not commonly included in public procurement programs. Protecting a project from oversubsidy by building in revenue sharing from the outset is a novel approach worth exploring but may be difficult to replicate unless included in the initial funding mechanism, as it was for Superfast Cymru. Also, the US has no similar legal requirements to promote open-access networks or to increase market competition. Several US localities have adopted open-access broadband models even without these legal directives (box 1), and many advocates have called for the US federal government to adopt similar regulations, such as requiring open-access wholesale and requiring ISPs to serve all households within their service area to eliminate digital redlining.³⁵

Equity in Superfast Cymru

When translating Superfast Cymru to the US, policymakers should consider how to best address inequities in broadband access. Superfast Cymru focused primarily on closing the digital divide between rural and urban areas, using the postcode cap to force Openreach to build in hard-to-reach areas. But multiple interview subjects pointed out that even with the postcode cap, Openreach started rollout by focusing on denser, easier-to-build areas before moving to harder-to-reach areas. Although this approach may be efficient and effective at building support, US policymakers using a similar geographic targeting scheme could consider whether another approach may be more equitable for the specific case.

Lack of access to quality broadband is only one driver of the digital divide in the United States, especially in rural areas and urban areas that have been neglected through digital redlining. For many low-income households in the US, broadband is accessible but unaffordable. These households make up the majority of those disconnected, particularly in communities of color.³⁶ To better consider racial equity and affordability, policymakers can adapt the best practices of Superfast Cymru to programs to improve broadband access in areas affected by digital redlining and unaffordability. Investing in targeted “gap networks” to bring low-cost or free access to low-income neighborhoods with low connectivity could be one solution.³⁷

BOX 1

Open-Access Broadband Models in the United States

Localities across the United States have successfully expanded internet affordability and access through open-access models. In Virginia, the Mid-Atlantic Broadband Communities Corporation (MBC) was established in 2004 as an open-access middle-mile fiber network to reduce the cost of providing

last-mile service in rural Virginia. Today, MBC connects 32 counties, and 45 service providers use MBC to deliver last-mile service. MBC estimates it has generated \$2.1 billion in investments to the area.^a

Westminster, Maryland, city government established a public-private partnership with service provider Ting, in which the city built and owns the last-mile fiber network and Ting operates the network with an initial period of exclusivity, transitioning to an open-access model.^b The network currently serves 6,000 residents and moved to expand beyond the town's boundaries in October 2020.^c

Multiple US interviewees praised UTOPIA Fiber as a promising model for last-mile open-access broadband in the US. Servicing 16 municipalities and counting across Utah and Idaho, UTOPIA Fiber began in 2004 to provide 100 Mbps broadband service for every home and business in each member city, tailoring an approach for each community.^d UTOPIA Fiber has facilitated the choice of up to 14 competitive ISPs for the communities it serves. To guarantee sufficient revenue, UTOPIA Fiber forecasts demand based on presubscriptions and enters a new city only after a subscription threshold is met. By operating over multiple cities, UTOPIA Fiber is well positioned to spread its operating costs and overhead.

^a Jordan Arnold and Jonathan Sallet, *If We Build It, Will They Come? Lessons from Open-Access, Middle-Mile Networks* (Evanston, IL: Benton Institute for Broadband and Society, 2020).

^b Patrick Lucey and Christopher Mitchell, *Successful Strategies for Broadband Public-Private Partnerships* (Minneapolis: Institute for Local Self-Reliance, 2016).

^c Kristen Griffith, "Westminster to Extend Fiber Internet beyond City Limits," *Baltimore Sun*, October 20, 2020, <https://www.baltimoresun.com/maryland/carroll/news/cc-westminster-fiber-optic-network-20201022-f5o3eoeprcctn2hfk3uvr4rse-story.html>.

^d In Idaho Falls, Idaho, UTOPIA Fiber has a consulting role, whereas in West Point, Utah, UTOPIA Fiber is involved in financing, building, and operations. UTOPIA's role in expanding broadband access is particularly salient in Morgan, Utah, where one incumbent ISP had left town and the other was known for unreliable service. Drew Clark, "UTOPIA Fiber: A Model Open-Access Network," *Broadband Communities*, November 2019, <https://www.bbcmag.com/community-broadband/utopia-fiber-a-model-open-access-network>; "Open Access—UTOPIA," ILSR, <https://ilsr.org/rule/2398-2/>; Joanne Hovis, Jim Baller, David Talbot, and Cat Blake, *Public Infrastructure/Private Service: A Shared-Risk Partnership Model for 21st Century Broadband Infrastructure* (Evanston, IL: Benton Institute for Broadband and Society, 2020).

Lessons for US Policymakers

Superfast Cymru offers multiple valuable lessons that US policymakers can adapt to expand broadband access: (1) invest in open-access infrastructure, (2) focus on demand generation and infrastructure provision in parallel, and (3) ensure value for money. However, many of the experts interviewed said that equitably expanding broadband access will not be a one-size-fits-all approach, and local actors are best positioned to know what approach will meet their community's needs.

Invest in Open-Access Infrastructure

Investing in open-access broadband infrastructure through Superfast Cymru strengthened retail service competition in Wales, something sorely lacking in many parts of the US. Multiple interviewees emphasized that the UK approach of mandating structural separation between the infrastructure owner/provider and service provider would be critical to achieving a competitive market in the US.

But investing in open-access infrastructure may not create robust competition unless regulation is sufficient to ensure a level playing field among new and existing providers. Indeed, some respondents expressed concerns that the lack of regulation in the US to impose open-access requirements on existing providers could hinder a new market entrant in competing with existing providers while complying with open-access infrastructure requirements in government contracts.³⁸ As a result, all but large incumbents may be deterred from bidding for such contracts. Although the Superfast Cymru contract was awarded through an open procurement, multiple interviewees referenced limited competition for Openreach, perhaps because of the project scale and contract requirements. State and local actors that consider including open-access requirements should weigh these trade-offs to determine whether requiring open access is the right approach in their specific case.

Focus on Demand Generation and Infrastructure Provision in Parallel

Across nearly all our interviews with UK experts, demand generation was highlighted as a key driver in the take-up of superfast broadband and its positive economic effects. US experts agreed that a parallel approach would be beneficial in the US. Local outreach via trusted intermediaries proved key to securing take-up, with experts describing investment in message testing and community engagement as critical to overcoming a lack of awareness and understanding of the new Superfast service.

Replicating Superfast Cymru's approach to small business support could offer the US significant benefits for local economic development. Our interviewees said that engaging nongovernmental actors in broadband efforts, in both implementing the Superfast Business Wales program and serving on the business advisory group, was essential to securing trust and participation from local businesses. In addition, collaborating with the Welsh Economic Development Unit to collect data helped the business advisory group understand where barriers persisted and tailor their support as needs evolved. Although efforts to generate demand for Superfast Cymru focused primarily on business, US officials could think about how to adapt the lessons learned to support broadband adoption by households.

Ensure Value for Money

The Superfast Cymru speed verification program is a useful model for ensuring value for money in public broadband investments. According to one expert, while the auditing process is inherently time consuming and burdensome, speed verification effectively maintained broadband quality and reliability. Another interviewee noted that such speed tests could be used as a metric for evaluating future contract bids.³⁹ Finally, one interviewee recommended that speed test capabilities be built into hardware to yield hourly data on network performance.

Superfast Cymru's gainshare provisions also incentivized stakeholders to expand broadband beyond traditional markets while protecting Welsh government spending and reinvesting excess subsidies in broadband development. Gainshare generated significant revenue for the Welsh government, as several interviewees noted, although in later iterations suppliers adapted their profit forecasts to this system and revenue decreased. Several respondents noted that few providers bid for the Superfast Cymru program because EU funding and the Welsh government mandated significant compliance requirements. When translating gainshare to the US context, a more complex and riskier contract could similarly deter newcomers and reinforce anticompetitive challenges. Gainshare mechanisms could be considered for the benefit of the community and local governments, but with added thought on outcomes.

Suggested Modifications for the United States

Although Superfast Cymru pursued a strategy of mixed FTTC and FTTP in 2013, many US broadband experts have argued that an FTTP strategy is the best, most future-proof approach to broadband expansion in the US today.⁴⁰ The experts did acknowledge that the time and cost associated with FTTP require stopgap solutions for communities that will not be serviced in the first phases of a project. One such approach would be starting with an FTTC rollout paired with wireless service to provide access in the short term and then building toward FTTP in the long term. In rural Renville and Sibley counties in Minnesota, for example, RS Fiber (named for the counties served) first constructed a fiber ring that connected 11 towers to provide high-quality wireless service as the FTTP network was implemented (Carlson and Mitchell 2016). Policymakers could also follow Superfast Cymru's approach of subsidizing community-led efforts to upgrade existing broadband infrastructure through vouchers while the larger network is constructed.⁴¹ One UK expert emphasized that US policymakers pursuing this approach will need to carefully communicate the differences between the stopgap hybrid approach and the ultimate full-fiber model, as consumer confusion harmed take-up of the new FTTP implementations in Wales.

Superfast Cymru offers a compelling model for expanding broadband access, but it is certainly not the only effective model. Other approaches such as municipal broadband, rural cooperatives, and gap networks will undoubtedly be part of the solution to closing broadband-access gaps in the US. And these efforts should be paired with programs to improve affordability that address inequities in broadband adoption.

In addition to Superfast Cymru's more centralized approach, the Welsh government is also pursuing a community-driven strategy to address persistent broadband-access gaps through the Local

Broadband Fund. One expert noted that this “bottom-up” approach would not have been possible at the outset of Superfast Cymru, given limited and uneven broadband capacity among local authorities. Recognizing that robust local capacity is essential to identifying the best broadband approach and effectively implementing it, many experts have called for the Biden administration’s funding to support local broadband capacity investments.⁴² As local policymakers take lessons learned from Superfast Cymru, we expect that they will adapt approaches, including those we highlight, to fit their specific context and needs.

Notes

- ¹ “The Price of Fixed-Line Broadband in 211 Countries,” Cable.co.uk, accessed August 24, 2021, <https://www.cable.co.uk/broadband/pricing/worldwide-comparison/>.
- ² The FCC defines census blocks as rural based upon the designation used in the 2010 Census. The term “rural” encompasses all population, housing, and territory not included within an urban area (see 2011 Census Bureau Notice, 76 Fed. Reg. 53039, July 15, 2011). The FCC’s assessment of Tribal lands is conducted by examining the census blocks the Census Bureau identified as federally recognized Tribal lands for the 2010 Census (FCC 2018).
- ³ Robert Wood Johnson Foundation (@RWJF), “What’s digital redlining? It’s when major network providers systematically exclude low-income neighborhoods from broadband service—deploying only substandard, low-speed home internet. In Cleveland, many areas that face digital redlining also experience deep poverty.” Twitter, 2:51 p.m., April 29, 2020, <https://twitter.com/rwjf/status/1255600609874632711?lang=en>.
- ⁴ Nilay Patel, “Why Is American Internet Access So Much More Expensive Than the Rest of the World?,” *Vergecast* (podcast), November 3, 2019, <https://www.theverge.com/2019/11/13/20959216/thomas-philippon-economist-interview-internet-access-vergecast>.
- ⁵ Emily A. Vogels, “Digital Divide Persists Even as Americans with Lower Incomes Make Gains in Tech Adoption,” Pew Research Center blog, June 22, 2021, <https://www.pewresearch.org/fact-tank/2021/06/22/digital-divide-persists-even-as-americans-with-lower-incomes-make-gains-in-tech-adoption/>.
- ⁶ Turner (2016) reports the following rates of home internet service by race and ethnicity in 2015: 72 percent of American Indian/Alaska Natives, 70 percent of Hispanics, 68 percent of Blacks, 68 percent of Native Hawaiian/Pacific Islanders, 81 percent of whites, and 83 percent of Asians.
- ⁷ In a survey conducted by the Berkman Klein Center, 33 percent of nonsubscribers cited cost of service as the primary barrier for internet adoption (Talbot, Hessekiel, and Kehl 2018).
- ⁸ In the early years of the internet, dial-up had an open-access model and consumers had more than a dozen ISPs to choose from. With the Telecommunications Act of 1996 and subsequent regulatory changes in 2002, the industry was deregulated. Municipalities entered into agreements with providers that could supply internet access to everyone in their jurisdictions and established incumbents with preferential financing and low bank interest rates, in the same manner that telephone companies had developed monopoly status for telephone lines. An ISP’s influence in a locality now prevents competition in the market, which would have otherwise incentivized more affordable service, upgrades to existing network, and expansion to further consumers.
- ⁹ A 2020 article in the *American Journal of Public Health* argues that broadband access is a social determinant of health, as internet access facilitates access to our health care system, economic stability, education, food, community, and the physical environment (Benda and Ancker 2020).

- ¹⁰ Emily Tate, “COVID-19 Has Widened the ‘Homework Gap’ into a Full-Fledged Learning Gap,” *Edsurge*, June 6, 2020, <https://www.edsurge.com/news/2020-06-16-covid-19-has-widened-the-homework-gap-into-a-full-fledged-learning-gap>.
- ¹¹ Jessica Denson, “Broadband Access, Telehealth, and the Challenge of Delivering the COVID-19 Vaccine,” *Connected Nation* (podcast), March 24, 2021, <https://connectednation.org/podcast/>.
- ¹² One interview subject noted that Superfast Cymru was planned by the Welsh government starting in 2010 and then integrated into the broader Superfast UK program, which was created after the origination of Superfast Cymru.
- ¹³ Legal requirements for minimum broadband provision have been discussed in the UK at least as early as 2008 when Switzerland, Spain, and Finland became some of the first European countries to establish “universal service obligations,” which require the government to provide a minimum service at an affordable cost, as defined by each country. Since 2008, several EU and OECD countries have adopted various forms of universal service obligations, though definitions vary considerably across countries (Davies 2016).
- ¹⁴ The Universal Service Commitment was a nonbinding precursor to the UK’s subsequent Universal Service Obligation. Universal service obligations are based on the principle that all citizens should be provided, or have access to, a range of basic services that are required to participate fully in society. The USO for broadband in the UK creates a legal right for citizens to request access (Hutton 2020).
- ¹⁵ “Shaping Europe’s Digital Future: Next Generation Broadband Wales—‘Superfast Cymru,’” European Commission, accessed August 24, 2021, <https://ec.europa.eu/digital-single-market/en/node/88520>.
- ¹⁶ See Hovis and coauthors (2020, 8) for a discussion of the capacity, reliability, and scalability advantages of fiber-optic technology relative to other wired and wireless broadband approaches.
- ¹⁷ Phase 2 of Superfast Cymru will extend FTTP to 39,000 premises by June 2022. This will be followed by the UK government’s Project Gigabit, which aims to extend 1 Gbps speeds to 85 percent of UK premises by 2025. Mark Jackson, “Welsh Government Publish New Digital Strategy for Wales,” *ISPreview*, March 23, 2021, <https://www.ispreview.co.uk/index.php/2021/03/welsh-government-publish-new-digital-strategy-for-wales.html>.
- ¹⁸ Some experts interviewed noted that FTTP was a new technology in the UK at the time, and that Superfast Cymru was a leader across UK nations in its use of rural FTTP that greatly improved how Openreach used the technology. A 2019 evaluation of Superfast Cymru found that FTTP coverage of rural premises was 16 percent, the highest proportion across the UK nations (Miller and Greenwood 2019). One respondent noted that Openreach had to redo some early FTTP implementation with more reliable technology to meet promised speeds.
- ¹⁹ The EU state aid requirements underpinning the Welsh government’s Superfast Cymru contract required that the service provider build an open-access broadband network. British Telecom had also been required to provide wholesale access to its network following the Ofcom Telecommunications Strategic Review in 2005.
- ²⁰ The Superfast Cymru network is a wholesale “lit fiber” open-access network. Some experts we interviewed stressed that lit fiber open access is necessary to reduce barriers to entry relative to “dark fiber” open access. In a “dark fiber” approach, the service provider is responsible for activating (or “lighting”) the fiber and providing services, whereas in a lit fiber approach, the infrastructure provider also provides the network electronics required to activate the fiber and deliver services from the service provider to the subscriber (Hovis et al. 2020).
- ²¹ Digital Communities Wales includes a “training of trainers” model in which individuals and organization staff are trained as volunteer “digital champions,” who are then equipped to offer free, tailored digital inclusion training. “Digital Inclusion Training,” Digital Communities Wales, accessed August 24, 2021, <https://www.digitalcommunities.gov.wales/digital-inclusion-training/>.
- ²² “Digital Support for Welsh Businesses,” Business Wales, accessed August 24, 2021, <https://businesswales.gov.wales/superfastbusinesswales/>.

- ²³ The full Business Advisory Group can be found on the Business Wales website: “The Advisory Group,” Business Wales, accessed July 20, 2021, <https://businesswales.gov.wales/superfastbusinesswales/information-hub/advisory-group>.
- ²⁴ “Shaping Europe’s Digital Future,” European Commission.
- ²⁵ Overarching regulations in the UK today stem from the Communications Act 2003, which has been amended and reauthorized several times since the original legislation. The most recent changes were passed in 2019 to decouple regulatory coordination with the Body of European Regulators for Electronic Communications after Brexit. Alexander Brown and Peter Broadhurst, “In Brief: Telecoms Regulation in United Kingdom,” *Lexology*, August 5, 2020, <https://www.lexology.com/library/detail.aspx?g=052ebad9-d503-4a22-9c70-2e9652be9428>.
- ²⁶ For example, the landscape of powers at local city and county levels in each US state depends greatly on whether the state is organized under home rule or Dillon’s rule. The power of cities and counties to legislate on particular issues can also vary greatly, depending on whether the state legislature has passed laws preempting local action on an issue.
- ²⁷ Tyler Cooper, “Municipal Broadband Is Restricted in 18 States across the US in 2021,” *Broadband Now*, May 3, 2021, <https://broadbandnow.com/report/municipal-broadband-roadblocks/>.
- ²⁸ For example, the Government of Wales Act, originally passed in 1998, established the National Assembly for Wales and granted it legislative powers. The act was last revised, expanded, and reaffirmed in 2017, conferring additional powers enabling the Welsh government to borrow up to £1 billion to support capital investments, as well as to collect supplementary income taxes under the newly established Welsh Revenue Authority. These developments show that devolved authority is more flexible and changeable than the US separation of powers.
- ²⁹ This administrative arrangement, in which a power is reserved for the central government but the administrative responsibility may be handed off to a devolved government, is not uncommon. Indeed, the UK Department for Digital, Culture, Media, and Sport and the Welsh Assembly Government created a concordat of cooperation on “all matters arising from DCMS’s responsibilities which impact directly or indirectly on the responsibilities of the Assembly Government and vice versa” (2018, 3).
- ³⁰ In the UK setting speed targets and thresholds for levels of service has been important for targeting subsequent rounds of government funding and setting goals for programs to help areas reach the next tier of broadband. Targets include Superfast (30 Mbps), Ultrafast (300 Mbps), and Gigabit (1,000 Mbps).
- ³¹ “FACT SHEET: The American Jobs Plan,” White House, accessed August 24, 2021, <https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/31/fact-sheet-the-american-jobs-plan/>.
- ³² A wide coalition of organizations recently called on the federal government to change its definition of baseline broadband access from the current 25/3 Mbps standard to a higher target that reflects today’s broadband needs. Ernesto Falcon, “A Wide, Diverse Coalition Agrees on What Congress Needs to Do about Our Broadband,” *Deeplinks* (blog), Electronic Frontier Foundation, June 29, 2021, <https://www.eff.org/deeplinks/2021/06/wide-diverse-coalition-agrees-what-congress-needs-do-about-our-broadband>.
- ³³ The federal government can expand the policy options available to local governments by preempting the state legislation that restricts municipal broadband and by overturning FCC regulations limiting cities’ ability to generate revenues from 5G small-cell deployments. John B. Horrigan and Jorge Schement, “Competition Won’t Solve the Digital Divide—Communities Will,” *The Hill*, June 24, 2021, <https://thehill.com/opinion/technology/560101-competition-wont-solve-the-digital-divide-communities-will?rl=1>; FCC, “Carr Announces Next 5G Order in Indiana Statehouse Speech,” news release, September 4, 2018, <https://docs.fcc.gov/public/attachments/DOC-353927A1.pdf>; Marguerite Reardon, “FCC Limits Fees Cities Can Charge for 5G Deployment,” *Cnet*, September 26, 2018, <https://www.cnet.com/news/fcc-limits-fees-for-5g-deployment/>.
- ³⁴ Corrective regulations are mechanisms for when a network operator or service provider is deemed to have “significant market power,” that is, when a network operator or service provider is in position to act independently of its competitors and consumers or end users. For example, in 2005 Ofcom required a functional separation between the network operation division (Openreach) and the retail service business of the UK’s

dominant ISP, British Telecom, to enhance broadband and telecommunications competition. While this separation helped facilitate retail service competition, criticisms were levelled at British Telecom for abusing their Openreach monopoly, underinvesting in the UK's broadband infrastructure, and charging high prices. Ofcom intervened again in 2017, requiring a full legal separation of the businesses. In 2019, after a further market review, Ofcom determined Openreach had retained significant market power and did not face sufficient competition in broadband infrastructure provision, resulting in new requirements to allow all telecom providers to access Openreach's network of physical infrastructure, including underground ducts and telegraph poles. For more information, see Ofcom (2005, 2016, 2018); Ofcom, "BT Agrees to Legal Separation of Openreach," media release, March 10, 2017, <https://www.ofcom.org.uk/about-ofcom/latest/media/media-releases/2017/bt-agrees-to-legal-separation-of-openreach>; and Openreach (2019).

- ³⁵ Ernesto Falcon, "Local Franchising, Big Cities, and Fiber Broadband," *Deeplinks* (blog), Electronic Frontier Foundation, March 30, 2021, <https://www.eff.org/deeplinks/2021/03/local-franchising-big-cities-and-fiber-broadband>.
- ³⁶ Vogels, "Digital Divide Persists"; Jabari Simama, "It's 2020. Why Is the Digital Divide Still with Us?," *Governing*, February 28, 2020, <https://www.governing.com/now/its-2020-why-is-the-digital-divide-still-with-us.html>.
- ³⁷ Amy Huffman, "NDIA Submits Comments to Treasury Recommending ARPA Funds Support Gap Networks," *Digital Inclusion News* (blog), NDIA, June 2, 2021, <https://www.digitalinclusion.org/blog/2021/06/02/ndia-submits-comments-to-treasury-recommending-arpa-funds-support-gap-networks/>.
- ³⁸ One interview subject noted that many of the larger-scale open-access networks, such as those in New Zealand and Wales, did not face incumbent competition, which may not be the case in the US.
- ³⁹ Following the FCC's 2020 reverse auction on the Rural Digital Opportunity Fund, many have called for the FCC to incorporate the results of verification procedures and due diligence in future bidding (Rivkin-Fish 2021). This is one component of the lengthy efforts by policymakers and advocates to improve transparency and accountability, including legislation introduced in March 2021 to create a "broadband nutrition label." "OTI Applauds Bill to Create a 'Broadband Nutrition Label,'" *New America*, press release, March 5, 2021, <https://www.newamerica.org/oti/press-releases/oti-applauds-bill-to-create-a-broadband-nutrition-label/>.
- ⁴⁰ Hovis and coauthors note that FTTP is "superior to all other broadband technologies," including even the best theoretical wireless technologies, which themselves rely on fiber infrastructure for backhaul (2020, 8). They argue that only fiber technology offers the bandwidth capacity and durability to be "future proof" and should be used in public investments in broadband.
- ⁴¹ The superfast voucher approach, which continues today as Gigabit vouchers under Project Gigabit, allows individuals and businesses in a community not scheduled to be served by an active infrastructure project to hire a supplier to upgrade infrastructure. This voucher program offers a limited subsidy per household and business that will not cover the full cost of installing a new network connection but does encourage communities to pool demand and share the costs of installation. If broadband is a community or business priority, the voucher program ensures a path to receiving service more quickly.
- ⁴² Tomer and George (2021); John Horrigan and Jorge Schement, "Competition Won't Solve the Digital Divide—Communities Will," *The Hill*, June 24, 2021, <https://thehill.com/opinion/technology/560101-competition-wont-solve-the-digital-divide-communities-will?rl=1>.

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