8 Openness in Telecommunications Reform and Practice: The Case of Open Access Broadband Networks, Public Wi-Fi, and Zero-Rating

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Introduction

Open access has had a positive effect on all things digital, including broadband. However, there is limited empirical research on its application as policy in developing countries or its impact or effectiveness in such contexts. Many of the assumptions underlying the theories and practices of *open* reflect conditions of abundance and freedom that are characteristic of mature, competitive economies and democracies of the Global North (see, e.g., Benkler 2013, vii–ix). As such, open access strategies cannot be applied uncritically to developing countries where the local context may not be conducive for success. There is also limited research on the potential of leveraging private and public resources through open systems to deliver public goods such as broadband, where states may not have the capacity to do so on their own.

This chapter seeks to contribute to a better understanding of open access regulation as a policy instrument in the context of developing countries. Building on the notion of private provisioning of social and public goods (Hirschman 1958), the argument presented in this chapter is that where there are no resources or institutional endowments for the state to provide social and public goods, the only way of doing so (in this case ensuring digital inclusion) may be accomplished by leveraging private resources. Drawing on Frischmann (2005, 2012), this chapter also makes the case for recognizing the often-ignored demand-side value of infrastructure, especially in the case of redressing digital inequality and citizens being unable to pay for services essential to their economic and social participation in modern society (see also Gillwald 2016).

The theories discussed in this chapter are used to create a framework to conceptualize and examine various types of open access in developing countries: (1) the mandatory open access regulatory regimes that emerged with the liberalization of markets and the regulation of former monopolies, in the interests of enabling the interoperability of networks and access to wholesale networks and facilities by service providers; (2) the

mandatory and voluntary competitive models that have evolved with new broadband networks required to meet the demand for data with the popularization of the Internet; and (3) the resource management form of open access found in the theory and practice of the commons. In some cases, the latter is a subset of the governance framework described in the first point. This is true, for example, in the unlicensed spectrum set aside for public use that is examined here in the case of free public Wi-Fi as a state intervention to meet the communications needs of its citizens. What can be seen as a commercial variant of this service is also examined here: private operators zero-rate products or services by allocating bandwidth for open use in order to attract customers by providing free access to a product or service.

The chapter proceeds as follows. First, it discusses the evolution of open access regulation. It then extends this conceptualization by discussing the three approaches outlined previously: mandatory open access, voluntary open access, and commons-based approaches. It then assesses the outcomes and policy implications of these approaches. Finally, the chapter concludes by highlighting the need for context-specific considerations of open access applications, particularly when the use of these strategies in the Global South could disrupt existing systems without offering better access conditions or enhancing developmental outcomes.

Evolution of Open Access Regulation in Telecommunications

Despite its common usage in infrastructure regulation, there is no single, formal definition of *open access* in telecommunications policy and regulation. However, there is some consensus around open access principles in policy and regulation.[1] Common tenets include nondiscrimination and price transparency, wherein nondiscrimination is defined as equal access to networks and wholesale services;[2] and price transparency, meaning that prices are displayed to the public and customers understand how prices, based on actual costs, have been set.

The rationale for adopting open access regulation in telecommunications is to enhance overall consumer welfare, through both access and price, by improving both market competition and the efficiency of the telecommunications network. In the policy context of universal service, open access theoretically overcomes the problems associated with the high sunk costs required in infrastructure industries that make the duplication of certain network elements uneconomical.

Open access has long been a favored instrument of regulators to guarantee seamless access for consumers to competing networks and services, which nowadays include the Internet. The core principle of open access regulation is nondiscriminatory access to

communication-enabling efficiencies, which would create surpluses for investment in network extension. Krämer and Schnurr (2014, 5), on the basis of this broad consensus, define open access in relation to infrastructure as follows:

> Open Access regulation refers to the mandated or voluntary provision of access to an upstream resource which must be based on the principle of non-discrimination. The concept may apply to publicly or privately owned access providers that are vertically separated, integrated, or represent a cooperative of multiple entities. Open Access regulation usually refers to the network layer, but may also be applied to other layers of the telecommunications value chain.

A growing body of evidence from more mature regulated markets indicates that the adoption of mandatory open access network strategies may come at the expense of investment and innovation (e.g., Bauer and Bohlin 2008). These trade-offs need to be assessed not only by means of the kind of static efficiency and instrumental competition models that are typically used to regulate the telecommunications sector, but also through dynamic efficiency models more suited to the rapidly changing and fluid Internet environment.

Open access regimes exist, then, to address the interrelated problems of (1) inflated prices, (2) reduced consumption of services as a result, and (3) insufficient investment and innovation. The first two contexts can best be understood in terms of static economic effects (i.e., at a given point in time). The dynamic economic effects associated with the third, innovation and investment, are the most difficult to solve with an open access regime (Gillwald, Odufuwa, Rademan, and Esselaar 2016b).[3]

As we have moved from a regulated telecommunications environment to that of the unregulated Internet, notions of *open* as regulated and unregulated access have collided. This is illustrated by the contested terrain of net neutrality, which has evolved with changes in technology and markets, as well as the propensity to regulate them over time. *Net neutrality* means many things to many people, but, at its core, it is about open access and control. An unwavering principle for proponents of *the free and open Internet* type of net neutrality is demonstrably a fluid concept in regulation, depending on definitions of the Internet as content or carrier.[4] The net neutrality debate has its roots in telecommunications regulation, particularly in the context of the US common carrier rules and in liberalizing markets to ensure interconnection with incumbent or dominant players. It also emerged with the popularization of the Internet and the shift in focus to informational resources.

In the net neutrality discourse, the argument has been around retaining the end-to-end architecture that has characterized the free and open Internet and is regarded as neutral; this arguably places limitations on the quality of services and product innovation. The argument put forward by operators and service providers, on the other hand,

is for a shift to intelligent network design capable of allocating access to the infrastructure based on the identity of users. The former favors realizing the social value of the Internet, while the latter privileges private value (Goldsmith and Wu 2006).

Most recently, net neutrality has found expression in the zero-rating debate, and the calls by advocacy groups for zero-rating to be banned for fostering discrimination among providers of online content and content applications in ways that may skew incentives for subscribers (i.e., users may choose to access the free services of identified partners instead of the services of competitors). As discussed further later in this chapter, the issue of net neutrality has arisen starkly in the Global South over the zero-rating of Internet services, particularly the offer of free access to social networking platforms (e.g., Facebook's Free Basics, formerly Internet.org). Net neutrality proponents argue that such zero-rated services create *walled gardens* that limit access to and use of the free and open Internet. Many advocates have called for Free Basics to be regulated, and even banned. Some have been successful, the highest profile case being that of India.

Yet, from a pricing point of view, the concept of zero-rating has underpinned the expansion of the free and open Internet; in regulation, it has referred to the relationship between the network providers or Internet service providers (ISPs), depending on who is providing the service to the customers (and in mobile broadband markets, such roles are increasingly conflated), and content providers, who are prevented from charging fees for access to their customer base. As pointed out by Lee and Wu (2009, 63), since its inception in academia in the 1980s to its mass popularity in the 1990s and beyond, the Internet has maintained a pricing structure that is unique among information networks: "users and content providers typically pay ISPs access fees—fixed fees to get on the Internet at all—and usage fees—variable fees paid based on time or bandwidth usage; however, there have not generally been any additional charges for one user of the network to reach another user or content provider, reflected in the concept of the peering (free exchange) rather than paid interconnection, associated with traffic exchange in telecommunications networks."

As the balance of profitability shifted from the network providers and ISPs to the platforms and over-the-top[5] (OTT) applications (e.g., Skype and WhatsApp), especially ones that replaced high-cost local and international voice calls, telecommunications operators began calling for regulatory intervention that would enable them to charge certain users of the Internet, such as, notably, large application or content providers, additional fees to reach their subscribers, and enable forms of revenue sharing. Research by the European Telecommunications Network Operators' Association (ETNO 2012), for example, discusses ETNO's efforts to have regulations on revenue-sharing with OTT services adopted at the World Conference on International Telecommunications.

As Brett Frischmann (2005) recognizes, however, things are not as straightforward as they might appear. Prevention of quality of service discriminates in favor of various applications in the end-to-end architecture debate on net neutrality grounds. Additionally, by extension, it safeguards the commons, which favors data applications, at the expense of time-sensitive applications such as voice and video. The latter are being pushed generally by private and, particularly, giant companies requiring intelligent networks to manage network profitably and are viewed as being not net neutral in these generally polarized debates. But such arguments treat the generation of private value and social value as mutually exclusive. This chapter demonstrates the importance of creating incentives for private investments to deliver social value in countries where public resources do not exist.

Frischmann (2005) further argues that shifting to a quality of service regime where use is determined solely by private property owners that are able to offer such services (including arguably significant social value in the ability to offer greater cybersecurity) also is clearly not net neutral. He highlights the prioritization of innovation in the arguments that are made for optimal Internet design. Private property owners, on the one hand, argue strongly for incentives for innovation in private allocative models that are responsive to market demands. The counterarguments to this are made by those who advocate for the extension of the commons precisely to enable innovation (Lessig 2001). Frischmann (2005, 1008–1016) points out that innovation and competition in upstream and downstream markets, where the debate invariably lands in liberalized markets, is an important part of the policy debate. He notes, however, that "the Internet supports a substantially wider range of socially valuable downstream activities that are neither innovative nor commercial," have public or nonmarket value, and require equal policy consideration. He concludes, after a lengthy analysis of the arguments of Wu (the main proponent of net neutrality to safeguard a free and open Internet) and Lessig (the main proponent of the innovation commons), that while a theoretically neutral system has significant benefits, true neutrality is not attainable.

Besides the questionable attainability of net neutrality, the debate around neutrality and zero-rating is generally based on assumptions of universal access, or at least widespread access and quality of service thresholds that do not even pertain to the developing countries where such regulatory principles are now being instrumentally adopted.

The zero-rated approach to access contrasts with the typical private provision of the Internet at regulated or unregulated data tariffs. However, free services are not new. The major social platforms, including Facebook and Twitter, are free to users, with a business model based on two-sided markets where marketers and advertisers pay high prices to exploit user data (Bauer 2014; Economides and Tåg 2012). There are few, if

any, open goods that are free of cost or nonproprietary in all stages of provision. Thus, as Spence and Smith point out (see chapter 7 of this volume), while free services offered by private companies may be surprising, private companies have long developed innovative ways to use open practices to generate revenue streams and to capture value in other areas of the business, or, in the sum of it, by deploying such strategies.

Conceptualizing Open Access

While the rationale for the monopoly provisioning of communications infrastructure in the form of public utilities was based on demand-side value associated with public goods, as markets became liberalized and the delivery of public services shifted to the private sector, the focus of regulation shifted to the supply-side value associated with private goods, and the extraction of rents. Yet, these were not ordinary private goods; they were public goods delivered by the private sector, and thus they required regulation to ensure that they were delivered affordably (Hirshmann 1958). In both the analysis of these problems and the proposed solutions, "complex motivational structures and … diverse private-for-profit, governmental, and community institutional arrangements that operate at multiple scales to generate productive and innovative, as well as destructive and perverse outcomes (North 1990 and 2005)" (Ostrom 2009, 408), need to be taken into account.

Historically, debates about resource management have been polarized into market versus state control of resources. Markets are narrowly seen as closed or proprietorial, while state ownership is potentially more public and open, although if monopolies are the providers, this is not necessarily the case. Advocates of open access frequently call for the creation or protection of the commons as an alternative to state control. This is, generally, a rejection of the management of resources, even if regulated, through market relations that are associated with private control. However, as pointed out by Frischmann (2005, 1), this "prescriptive call" arising from the revisiting of the commons is underdeveloped both from an economic perspective and in terms of the level required for policy implementation; meanwhile, on the private control side, there is a robust economic theory supporting the market mechanism with minimal government regulation that informs the approach to best practice infrastructure reform, and there is little theoretical support for the implementation of infrastructure commons (Frischmann 2005, 2–5).

Drawing on Ostrom's theory of common pool resources (Ostrom 2009), Frischmann (2005, 2012) presents an economics-based case for why some classes of key resources need to be managed in an accessible manner. Conventional economic analyses of infrastructure

focus primarily on the supply-side value of infrastructure and the profit imperative in network investment and regulation, but Frischmann (2012) explores demand-side considerations to analyze how infrastructure resources generate value for consumers.

Three key insights emerge from this demand-side, value creation–focused analysis. The first, as also found in other infrastructure theories, is that infrastructure resources are fundamental and generate value when used as inputs into a wide range of productive processes. The second highlights that the outputs of infrastructure industries are generally public and nonmarket goods that create positive multipliers in both the economy and society. The third is that "managing infrastructure resources in an openly accessible manner may be socially desirable when it facilitates these downstream activities" (Frischmann 2005, 918).

Frischmann (2005), building on traditional economic concepts used in welfare analyses of infrastructure resources and the societal demand for such resources, puts forward a new theory of infrastructure. He notes that despite the extensive role of private and commercial delivery of information infrastructure, with the increased positive externalities derived from information infrastructure, the role of the state as coordinator and regulator in ensuring its provision and management is still required to ensure widespread access by citizens and the overall distribution of social gains (Frischmann 2005, 919–921).

The following section provides an empirical examination of different open access models, including mandatory-, voluntary-, and commons-based approaches to access regulation of competitive networks, open access broadband networks, free public Wi-Fi, and zero-rated services. The types of open access presented here, and shown in figure 8.1, are all intended to enable or enhance Internet access in developing-country contexts. The analysis of the cases and the conclusions presented thereafter highlight both the need to find new ways of addressing digital inequality and the dangers of static and instrumental regulation.

Cases: Mandatory Open Access, Voluntary Open Access, and Variations on the Commons

Mandatory Open Access Regimes

The first case looks at the application of open access to the mandatory regulation of more traditional telecommunications networks within the context of supply-side valuation associated with economic and competition regulation. Because markets were liberalized and competitors to public monopolies entered the market, open access regulation was mandatorily applied to ensure access to the remaining natural monopoly

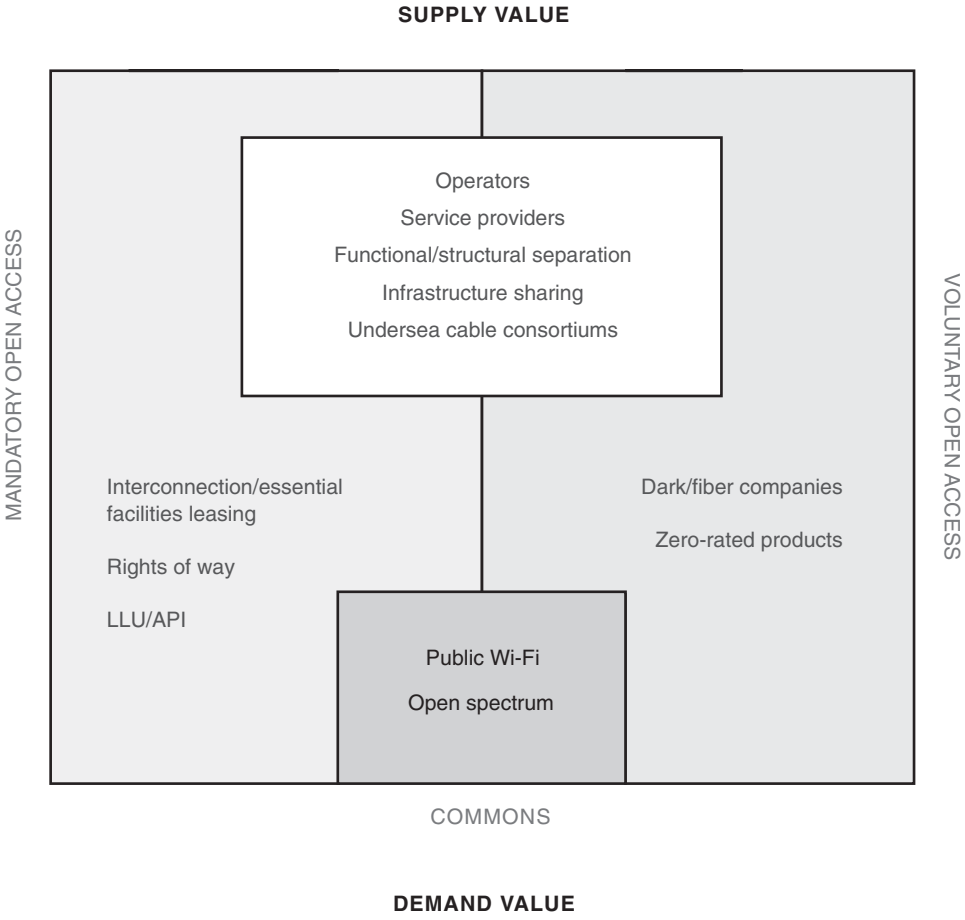

Figure 8.1
Depiction of various mandatory and voluntary open access forms.
Source: Author.

elements of backbone networks and fixed access network infrastructure. Open access regulation helps to ensure the seamless connection of customers on different networks by mandating the nondiscriminatory interconnection of networks. Facilities are thus available to connect other network operators, especially those that might otherwise have formed bottlenecks, including the wholesale segments of the market (backhaul[6] and the access network) where few suppliers exist and markets naturally tend toward oligopoly or monopoly.[7] This has led to the creation of open access regimes that compel dominant operators to provide access to rival operators to enhance competition.

Europe's open access regulation introduced competition into various monopoly elements of the market by mandating access at multiple layers of the network. This can be implemented through the separation and opening up of network elements, particularly the *last mile* or *access networks*, which have been the most uneconomical to duplicate from a fixed-line perspective. Unbundling of the local loop[8] has been a requirement of European and American regulators to enable competitive access to the last mile. At the backbone level, fair access to networks built with public investments as public utilities prior to any privatization has been accomplished through the structural separation of the network and the services, which are then offered independently to customers.

Local Loop Unbundling One way of implementing open access on traditional copper access networks has been through local loop unbundling (LLU). The rationale here is to foster competition and reduce telecommunications costs by eliminating the duplication of large investments required for last-mile infrastructure. South Africa, as one of the only markets in sub-Saharan Africa with any significant copper networks, has long had LLU on the reform agenda. This is in line with claims made by dominant epistemic communities within the Organisation for Economic Co-operation and Development (OECD), International Telecommunications Union (ITU), and World Bank a decade ago to the effect that LLU was a best practice scenario. The stated argument was that it would enable telecommunications providers to innovate and differentiate their product offerings, promote competition in the provision of broadband services, offer opportunities for innovation to drive product and price differentiation, speed up national economic growth, and even increase competitiveness in the global market and create employment opportunities. With the identification of a second network operator by the South African government after none had met the public policy–determined criteria to be licensed by the regulator, an environment more conducive to new entrants had to be established.[9] Prevarication on the issue continued for years as a result of the conflict of interest of the government in South Africa. This conflict resulted because the government was responsible for market reform of a sector in which the state held a significant share of the incumbent operator, Telkom (Gillwald 2005), thereby preventing the second network operator from benefiting from market reform of the previous monopoly market.

The public process proceeded at a snail's pace. This was because the regulator, the Independent Communications Authority of South Africa (ICASA), was facing its own internal leadership crisis. It was also pursuing other urgent activities with more powerful interests (e.g., spectrum) than the second network operator. Despite the publication by the regulator of a findings document identifying four options for unbundling, including an easily implementable bitstream option, ICASA never published any

regulations from that round of hearings. This was widely perceived as being a result of the obstructionism by the incumbent, Telkom (Ellipsis 2011).

As all elements of mobile networks are considered replicable (other than termination, which is inherently monopolistic), open access to mobile networks through an enabling application programming interface (API) or API access has not yet been considered mandatory. However, given the dominance of mobile operators in developing-country markets, this is being reviewed in the context of mandatory infrastructure sharing.[10]

Functional and Structural Separation Market restructuring through functional and even structural separation is a more drastic form of intervention to deal with incumbency or dominance in the market. Essentially, this restructures the market by separating out vertically integrated operations and compelling them to treat their downstream operations in the same way that they treat their competitors. With the network and services separated structurally, the network is often transformed into an open access, carrier of carriers network that can offer services only under the separated sister company. In South Africa, Telkom, which had been partially privatized in 1996, was required by the Competition Commission to functionally separate its activities as part of the remedies imposed after it was found guilty of anticompetitive practices in 2013. This separation did not restructure the market, but it did give effect to the policy and regulatory framework that required the incumbent to operate its wholesale and retail activities independently enough from each other to allow operators and service providers to compete fairly. Following several proposed turnaround strategies, including complete privatization and renationalization, and in the face of growing competition and price undercutting from new fiber companies, Telkom voluntarily undertook to separate structurally under the mantle of the national broadband champion (Padayachee interview, 2016). Given the voluntary nature of this restructuring exercise, the effects on the market may not be as dramatic as mandatory separation; but the effect on bandwidth prices in the market has been positive, and Telkom's own balance sheet has improved consistently throughout the early days of this transition despite the harsh economic climate in South Africa (Telkom 2016, 2017).

Outcomes of various forms of mandatory open access regulation are mixed and are context specific, and comparative data is limited. However, there is evidence that while such initiatives might have resulted in short-term positive consumer gains, they can negatively affect investment and innovation (Bauer and Bohlin 2008). In most African jurisdictions with barely any fixed local loops to unbundle, the focus has been instead on extending wireless networks. Since it is more economically feasible to invest in competitive wireless access networks, there has been little effort to require dominant players to provide access to competitors, despite the fact that outside the main urban

centers, there is often only one operator network, or possibly two, available to consumers, with very little choice. As yet, very limited attention has been paid to mandating API access to mobile networks, which would have a similar effect to unbundling the fixed local loop. Rather, the focus of policymakers and regulators has been on mandating national roaming by new entrants on incumbent mobile networks. Without very extensive fiber networks in most African countries, open access, state-owned broadband networks have been set up in several countries (e.g., Botswana, South Africa, Tanzania, and Uganda).

National Open Access Broadband Networks (Carriers of Carriers) Competition at the infrastructure level is not viable in many developing economies (indeed, it is not in many developed ones as well). Also, given the high cost of rolling out broadband, states have instead opted to deploy a single national fiber backbone open to all service providers on a nondiscriminatory price basis as a way of enhancing network expansion and access. Australia is one country that has led the way in this regard. Consolidating use on a single backbone enables economies of scale and cost reductions that translate into lower access prices for service providers. Competition then takes place at the service rather than at the network level. This could still foster the efficiencies usually associated with competition and contribute to consumer welfare through bypassing the high input costs for service providers arising from the duplication of facilities or networks.[11] State-owned broadband companies have had anticompetitive effects by either squeezing out private-sector investment (e.g., in Tanzania), or by governments requiring the public sector (often the single biggest collective user in many countries) to exclusively use the state-owned broadband services (e.g., in Uganda) (Lumu 2015).

Mandatory open access broadband networks, especially in developing countries where there is already significant private-sector investment, have not been successful. The high sunk cost associated with the rollout of fixed networks is difficult to replicate profitably. Without conscientious efforts to enable competition, the ability to challenge the market dominance of incumbents is limited. The case of South Africa illustrates these challenges.

The fiber-optic networks of the public rail network (Transnet) and the power utility (Eskom) were set aside for the creation of a second network operator at the end of Telkom's exclusivity in 2003. However, as the second operator was about to be licensed to Neotel in 2006, and broadband was starting to take off, the Department of Public Enterprises withdrew the mandatory setting-aside of holdings so that the transport communication network could create a new, state-owned, open access broadband company, Broadband Infraco (BBI). Since this decision happened without public consultation and cut across the emerging competitive convergence policy, the process was delayed.

Licensed for the provision of wholesale services, BBI became operational in 2009 (see Gillwald 2007 for a detailed case) following additional delays related to the determination of the type of services that the entity would be entitled to offer. BBI has since invested in national and international backbone communications networks and is one of the main investors in the West Africa Cable System (WACS).[12] However, state coordination has been weak and arguably lacking sufficient investment in BBI to deploy even the roughly 12,000 kilometers of backbone planned (not a great distance for a national backbone for a country the size of South Africa). The decision to create an open access network failed to consider the market dominance of the incumbent, which now has over 50,000 kilometers of unduplicated fiber and over 75,000 kilometers in all. Furthermore, international bandwidth capacity in the country had already increased significantly in terms of quality and pricing by then (Gillwald 2007; Nkhereanye interview, 2016).

Initially, there was some concern that BBI would squeeze out private-sector investment. However, having fallen victim to the lack of coordination between the Department of Public Enterprises and the Department of Communications, which was responsible for allocating BBI's license, BBI could no longer represent the interest of its target clients, the network operators, that in 2009 went on to cobuild an alternative national infrastructure network, while in the process undermining the viability of the BBI business model.[13]

Nigeria announced a similar open access model in 2012, but the process has been delayed. So far, there has not been an intervention in wholesale markets, and market regulation based on a comprehensive study is long overdue (see the Nigeria case in Gillwald et al. 2016a).

National Open Access Wireless Networks Within infrastructure industry policy and regulation, the creation or enforcement of open access wireless networks has been identified as a mechanism to reduce infrastructure that is not economical to duplicate, and also as a remedy for monopoly. Open access networks have been tried in Kenya and Mexico to counter the extreme dominance of incumbents (above 80 percent of market share), and where such primary markets for achieving universal service were deemed uncompetitive. In these cases, the implementation of open access often takes the form of a consortium-owned mobile network. Here, spectrum is to be shared by any operator or service provider who wishes to offer wireless services on the designated spectrum. In Kenya, the dominant network operator Safaricom backed out of the deal before the proposed network became operational resulting in the collapse of the consortium. In the case of Mexico (discussed next), only the digital dividend spectrum has been set aside for this experiment (Gillwald et al. 2016a).

In Mexico, which is the only remaining country pursuing open access wireless, there is considerable concern about the risks emerging from the constitutional obligations to

continue with the process in the face of growing evidence that it might not ultimately fulfill its mandate. A state company, Red Compartida, has been established to hold the spectrum licenses in an attempt to mitigate the risk of failure (Borjón Figueroa interview, 2016). In the meantime, other regulatory reforms in Mexico, which enabled the introduction of classical asymmetrical remedies for the market in which operators were exercising significant market power and distorting market outcomes, were implemented during the six years that it took to finally set up the open access wireless consortium (Labardini interview, 2016), reducing the dominance of the dominant operators to around 60 percent (from 80 percent).

South Africa's Integrated ICT White Paper (RSA 2016) proposes the introduction of an exclusive wireless network, not limited to the digital dividend spectrum, as proposed by Mexico and Kenya, but rather extending across the entire high-demand spectrum that is currently unassigned (2.6 GHz and the 700 MHz digital dividend spectrum). It also proposes the incorporation of other mobile spectrums when the operators' 15-year licenses expire so that the full spectrum is held in the open access wireless network (RSA 2016). As discussed previously, the extreme complexities of such proposals require a sophisticated understanding of the mobile market.

Although the white paper provides no insight into the business plan or ownership structure of the wireless open access network (WOAN), a consortium of the kind embarked on for the successful, voluntary, and partially open access undersea cable company consortia (WACS, Seacom, and Eassy) has been suggested as a model. The business model for the construction and maintenance of a single end-to-end cable with a 25-year life span, however, cannot be readily applied to a common carrier model in the dynamic and fast-changing mobile wireless market, where operators' control of the spectrum determines the competitive advantage.

International expert inputs into the consultative process for SA Connect, the national broadband plan, which was unpublished but publicly available at the time, contended that at least one of the bigger mobile operators needs to be inside the network for it to enjoy economies of scale and scope. Consultants appointed by the National Treasury of the Republic of South Africa to establish the viability of the WOAN also cautioned against its establishment (Bedi and Schumann 2013). To work, the model requires incentives to make the investment in the open access network more attractive to the mobile operators than investing and controlling their own networks. In another scenario, if operators are unable to access any of the additional long-term evolution (LTE) spectrum necessary for the cost-effective development of their businesses (as has been the case in South Africa), then there is no need for them to invest in their own networks. Instead, they can simply access wholesale networks at regulated open access prices.

There are at least two problems: first, capital for the open access network has to come from somewhere, fast; and second, the history of the public open access broadband company does not bode well. With some pressure from government, but also given the promise of low-cost access to BBI (the new state-owned company), the dominant mobile operators, MTN Group Limited (MTN) and Vodacom, opted not to build out fiber networks once the incumbent's exclusivity period expired, and they were permitted to do so. However, the delays to the licensing process, and subsequently the operationalization of the license and the clear undercapitalization of it for national champion purposes, drove MTN, Vodacom, and the second network operator, Neotel, to build their own intercity transmission network. Because the government again is trying to cut across the policy framework (flawed as it may be, it nevertheless is the result of a consultative process to force an exclusive wireless network), it appears that no lessons have been learned from its own recent history.

The proposed open access wholesale wireless network in South Africa could result in negative unintended consequences, particularly the inhibition of the current extremely high level of private investment in mobile network extension and upgrades. The opportunity costs of this to the country, already lagging on 4G[14] deployment, are potentially enormous and include negative impacts on economic growth and employment, which would take years to correct.

State efforts to intervene in the successful mobile market with mandatory open access wireless networks for the high-demand spectrum in South Africa may be counterproductive if the goal is to meet development objectives. Furthermore, there is anxiety about whether there is the institutional capacity and sophistication to oversee the complexity of creating a viable, single, open access network. After all, the absence of state coordination in relation to the spectrum has plagued far simpler processes. The WOAN may well fail for the same reasons that complex auctions, as an alternative to open access and other models, may also fail. The lack of success of any auction in Africa is cited by open access advocates (Song interview, 2017; Rey-Moreno interview, 2017) to argue against the multilateral best practice orthodoxy on spectrum assignment of auctions.

There are a couple of rejoinders to this position. There are few ways, other than auctions, of valuing and assigning spectrum set aside for commercial use competitively and in ways that will ensure optimal efficiency in the use of the spectrum (including regulated spectrum trading to enable the correction of any auction outcome errors). For example, the South African Treasury is regarded as a highly effective government department, and the high standing of the financial sector in South Africa and the long view taken on the economy is attributed to them. The Treasury already provides technical assistance to most departments through its Government Technical Assistance

Committee (GTAC). Within policy and regulatory confines that would contain fiscal interests in maximizing the pricing of the spectrum, the department could assist the regulator with the technical dimensions of the auction and the management of any external consultants who are brought in. This could be implemented far more quickly than an exclusive open access network, which is bound to face multiple rounds of legal review before the network could even be established and become operational. The release of the high-demand spectrum has already been delayed by six years.

The best case scenario if legal hoops were navigated, using the Mexican model as some measure, even with some lessons learned, is probably a minimum of five years. That would already place South Africa ten years behind early adopters of LTE in the allocated and cost-effective bands (although operators have refarmed alternative, less-cost-effective spectrum that they hold currently to make it available for LTE). All operators are offering such services in the major centers. With the urgent release of high-demand spectrum, and with all the previously mentioned caveats for making available unlicensed and open access spectrum, regulators should be focusing on creating incentives for infrastructure sharing, channeling complementary investments, and moving to an industry-coordinating role by enabling voluntary models that allow the participants to assume the risk associated with high sunk-cost infrastructure investments.

Voluntary Open Access Networks

Voluntary Open Access International Backbone Networks (Commercial Models) An example of successful voluntary open access in Africa is the provisioning of undersea international bandwidth by Seacom (and arguably WACS as well). Seacom broke the monopoly that SAT-3 (South Atlantic 3 submarine cable) had on Africa operating as a closed club consortium consisting of incumbents. The commercial logic of Seacom, and to some degree the shared infrastructure consortium that operates WACS, is similar to that of the commercial, open access, dark fiber national transmission networks (described next), and some have argued that that should be the form of the wireless open access network in South Africa.

Voluntary Open Access Fiber Networks (Commercial) With the opening of backbone competition, commercially operated, voluntary, open access networks operate in the South African market in complementary ways with existing broadband network investments and OTT platforms and applications. Commercial companies that operate voluntary open access models have managed to optimize their traffic flows and maximize their return on investments in as short a period as possible, allowing them to refinance the next phase of network rollout and contribute to the cost of network extension.

Open access companies such as Dark Fibre Africa (DFA) and FibreCo created competitive alternatives to Telkom on main intercity routes (MyBroadband 2014). This competitive pressure in the national data transmission market compelled Telkom to review its strategy in the market and adopt an open access model, undergoing a voluntary structural separation of its wholesale and retail divisions, as already mentioned. This has largely been welcomed, although it has not entirely eradicated the lingering skepticism of the incumbent's competitors and clients represented by the industry association that brought the initial anticompetitive case against Telkom. A voluntary regime could be reversed at any time, and there is still a view among some stakeholders that, given that Telkom is the dominant backhaul provider, oversight of the open access regime by the regulator is still necessary (Cull interview, 2016; Cohen interview, 2016; Nkereanye interview, 2016).

This open competitive environment results in the duplication of networks, certainly in the metro areas where competition can be easily sustained. However, there is also extensive evidence of complementary investments by different tiers and types of operators, and procurement or sharing of infrastructure for primary and redundancy use for national coverage (Hussein interview, 2016).

As the acting director general of the then-Department of Telecommunications and Postal Services (DTPS) in South Africa[15] indicated, commercial fiber "has been one of the most phenomenal developments in the sector, a game changer that demonstrated that open access networks are viable, unlike what the traditional operators have argued" (Mjwara interview, 2016).

The success of voluntary, open access, commercial fiber networks demonstrates that delivery of social goods through supply-side value can be enabled through demand-side valuation of those services and the creation of incentives for operators, such as the government anchor tenancy identified in the South African national broadband policy, SA Connect. It was the success of this voluntary open access model that led SA Connect to propose that instead of building another state-owned network for the public sector, as was being suggested in government circles but for which there was no state funding, that the extensive private networks be provided with the incentives to extend their nearby networks to underserved areas. The proposal was to aggregate public-sector demand and smart procure services from existing providers at cost-effective prices. In this way, incentives such as government anchor tenancies through demand aggregation in underserved areas could foster broadband investment in areas that would otherwise be uneconomical to service.

Despite this potential of leveraging private investment to furnish public-sector broadband services as proposed in SA Connect, little to no progress has been made since 2013 in this regard. The lack of capacity within the ministry to coordinate the plan across government departments is the main stumbling block.

Variants of the Commons

Free Public Wi-Fi—Bring Your Own Device The use of universal service funds to reach underserved communities and to provide access to the Internet was locked into fixed-lined models for a long time, and today it remains largely focused on subsidizing network extension and the aggregation of demand through computer-based telecenters. However, with the advent of mobile broadband and smart devices, the price and skill barriers that the computer-based Internet access created were essentially removed. This undermined the logic of access aggregation of this kind. Mobile devices can now offer adequate user experiences, with web browsing, email access, messaging, and an increasing variety of applications for using the Internet without having to travel to single points of presence.

While increased Internet penetration (with its widening coverage), mobile technology upgrades to 3G (and now LTE), and the relative affordability of smart devices have combined to increase mobile data uptake, the majority of people in the Global South still lack access (see www.afteraccess.net). Limited coverage and slow data speeds outside the major centers, together with the relatively high cost of services, exclude the poor and inhibit the optimal use of mobile data by most users (Rey-Moreno 2013; Stork, Calandro, and Gillwald 2013). Yet in only a few countries have universal service funds or agencies made this transition to supporting user access.

Nevertheless, in some countries, such as Rwanda and South Africa, metropolitan governments are offering free public Wi-Fi (FPW) as part of their strategy to provide citizens with connectivity to access government services and the Internet more widely. Given the widespread use of Internet-enabled phones with sufficient computer power and adequate screen sizes for meaningful use (even among lower-income groups), FPW is a promising solution. FPW sponsored by a local authority is popular in many major Asian and North American cities; and the South African broadband plan, SA Connect, requires that all public buildings be connected to broadband and that, whenever these connections occur, they include a FPW hot spot. But provinces and cities in South Africa are moving even more swiftly by actively investing in both central business districts and underserviced areas, rolling out FPW. The traction with citizens has been overwhelming.

There are various models of public Wi-Fi in South Africa, but the two largest initiatives, in Gauteng and the Western Cape provinces, respectively, implemented assessable initiatives by 2016. These are the wealthiest provinces in the country and are highly urbanized (Gauteng almost entirely). There are projects in the four largest metropolitan areas: Tshwane (formerly Pretoria); Johannesburg and Ekurhuleni (in Gauteng); and Cape Town (in the Western Cape).

FPW projects typically emanate from authorities that already have broadband development strategies and plans in place, as is the case in both Gauteng and the Western Cape. Most FPW plans are linked to initiatives to interconnect government buildings via fiber networks. FPW projects tend either to piggyback on these fiber deployments (Western Cape, Ekurhuleni, Johannesburg, and, to some extent, eThekwini in KwaZulu-Natal province), or to benefit from existing municipal fiber (Tshwane and Cape Town) (Geerdts et al. 2016).

Of all the projects, the state-funded Tshwane Free Wi-Fi, Project Isizwe, is the most advanced in terms of scale and impact. The project began in 2013 and is based on two investment justifications: first, broadband, as a basic right for every citizen, should be offered across the country, fully funded by government; and, second, increased broadband penetration will drive economic growth, increase commercial and financial activity that will expand the tax base, and altogether will exceed the city's initial investment. On this basis, public Wi-Fi should be furnished for free (Geerdts and Gillwald 2017).

The results, in terms of network deployment, have been impressive. The content portal and program launched to generate local video illustrate the potential for Wi-Fi and broadband to enhance employment opportunities, improve health and education, and connect government to citizens. In line with the national broadband plan, SA Connect, the focus has been on connecting educational institutions.

In the longer term, Project Isizwe expects that input pricing will reduce to the point where free Wi-Fi is no longer considered a significant expense. Until then, the model is entirely dependent on substantial public funding, which has been large for a relatively small-scale, low-cost, public Wi-Fi network, at around $75,000 a month (Geerdts and Gillwald 2017).

The model for the Western Cape is more complex. The province and city take a holistic view of promoting broadband on multiple fronts. One of the foundations of this model is to stimulate private-sector investment in broadband by improving market information (RIA 2016) to help investors understand the costs, by creating demand (with government as an anchor tenant), and by reducing the capital outlay requirements (by paying for part of the infrastructure). At the provincial level, the government is implementing a fiber/Wi-Fi contract to connect government buildings and selected Wi-Fi sites. What was intended to be a public-private open access network was scuttled by the national State IT Agency (SITA), which asserted its prerogative to undertake a regular competitive tender under its auspices. As a result, a privately operated, closed network was created, with premiums significantly above those offered by the public open access network initially proposed.[16] The winning proposal allowed the second

Table 8.1
Comparison of Tshwane Free Wi-Fi and Western Cape Broadband Initiative (WCBBI).

	Tshwane Free Wi-Fi	Western Cape Broadband Initiative (WCBBI)/CoCT	Development outcomes
Production	Closed	Public-private community interplays: multiple players, but not open	Tshwane sustainability dependent on state-funded project; single service provider; closed system
Distribution	Closed	Multiple players/models	Tshwane fastest deployment
Consumption	Open/free	Open/free Paid (premium services)	Tshwane: free, more users, consistent quality and capacity WCBBI: mixed free/pay models, building sustainability with public backbone/private Wi-Fi model

Source: Alison Gillwald, using Smith and Seward's (2017) open access conceptual framework.

network operator, Neotel, to deliver services to government, as the anchor tenant, via both fiber and Wi-Fi, but also to exploit the private-sector market (Geerdts et al. 2016).

On the other hand, the City of Cape Town (CoCT) is encouraging private investment by reducing the upfront capital outlay required. The CoCT provides connectivity from a central point to remote locations while also supporting access points (APs). The ISP only has to offer data connectivity. This model is more expensive to implement than the Tshwane model, but includes the private sector and fosters innovation and competition. See comparisons in table 8.1.

What this natural experiment demonstrates is that various models of public Wi-Fi can be justified on the basis of the demand-side value of the network, as the Tshwane municipality has done to justify the substantial subsidy that it provides to offer limited free access to the Internet. Although the supply-side value of public Wi-Fi has been more difficult to institute across the world, the Western Cape government has attempted to support the private provisioning of public goods by enabling access to low-cost bandwidth and providing start-up subsidies, but, ultimately, it intends them to become self-sustaining and economically viable. See comparisons in table 8.1.

Free, Limited Access and Use: Zero-Rating Services *Zero-rating* has been defined as tariff plans that enable mobile (wireless) customers to download and upload online content without incurring data usage charges or having their usage counted against

data usage limits (Eisenach 2015). In developing countries, zero-rating allows mobile subscribers to access certain or preselected online content for free (i.e., without having the associated data usage counted against their usage allowances under wireless service plans). Zero-rating practices, therefore, are considered a violation of the net neutrality principle by some regulators. In India, this led to the mobilization of civil society to produce a million-signature campaign, which subsequently led to the banning of Free Basics and other zero-rated products by the Indian regulator, Telecom Regulatory Authority of India (TRAI). Most African countries, which tend to follow European Union (EU) regulatory trends rather than those in the United States, have been slow to develop positions on net neutrality, with the EU itself only adopting net neutrality rules late in 2015. The EU rules enshrine the principle of net neutrality in law: no blocking or throttling of online content, applications, and services. Under these rules, efforts to prohibit ISPs from blocking, throttling, and discrimination with regard to Internet traffic are largely focused on the quality of the service and treatment of traffic.

Services that are typically zero-rated by providers in developing countries include the world's biggest web properties, such as Google, Facebook, and Twitter, as well as messaging services such as WhatsApp, KakaoTalk, and WeChat that can reduce the high cost of communicating through phone calls and short message service (SMS)/text messages. See the comparisons in table 8.2.

Table 8.2
Zero-rating models for different platforms.

Platform/offering	Who subsidizes consumer?	Content
Free Basics	Does not pay carriers to zero-rate access and does not receive payments from carriers	Facebook Zero + mix of public-interest websites, including government, nongovernmental organizations (NGOs), and businesses (e.g., Smartbusiness, Girl Effects, and BBC News)
Wikipedia Zero	Does not pay carriers to zero-rate access to the Wikimedia sites and does not receive payments from carriers	Access to the regular mobile version of Wikipedia and other Wikimedia sites, in all languages
Mozilla Equal Rating	Low cost + unlimited talk + text + 500 MB of data for six months/watch ads to access other sites	All content equally available

Source: Gillwald et al. (2016a).

Assessment of Outcomes and Policy Implications

Mandatory Open Access Regulation and Broadband Networks

The empirical assessment of the cases demonstrates how the long history of mandatory open access regulation, derived from both regulation in the EU and multilateral agency reform programs as a way to enable market entry and manage market dominance and anticompetitive practices, has not transformed easily into fixed broadband network extension in South Africa and Nigeria, an open access wireless network extension in Kenya, or, as yet, South Africa (e.g., Gillwald et al. 2017).

All the national open access broadband cases highlight the institutional constraints on implementation, with the failure to implement since 2012, the planned wholesale open access national broadband network as cornerstones of national public policy. Inadequate funding and insufficient institutional and regulatory capacity to create a level playing field for the new entrants and investors, especially in upstream segments, explain this failure. See the comparisons in table 8.3.

State-Owned Open Access Wholesale Broadband Companies The introduction of open access wholesale networks in countries with very low per-capita incomes or small population sizes, such as Tanzania and Botswana, in countries where the duplication of competitive networks may not be feasible, and in countries unable to attract competitive private investments may have resulted in the extension of broadband networks across the country. As shown, however, this does not necessarily mean that such networks meet national objectives of digital inclusion, either because of the unavailability of access networks or consumers' inability to afford the Internet-enabled devices needed to access them.

The cases of state-initiated, open access, wholesale networks examined here demonstrate that the more sophisticated mandatory open access arrangements requiring institutional expertise to control or manage resources are limited or entirely absent in many developing countries. Even in more dynamic markets, such as Kenya, Nigeria, and South Africa, where state-owned entities needed to compete with or attract private operators, they have largely failed. In South Africa, the national broadband company never really thrived due to undercapitalization and inability to compete in the dynamic and fast-growing voluntary open access market. In Kenya and Nigeria, state-owned wireless and regional wholesale broadband networks proposed in those countries' national development plans were never even implemented.

Early efforts to intervene in the successful mobile market with early mandatory open access wireless networks for high demand spectrum in Kenya and South Africa have faced similar institutional constraints, perhaps even more so than in the case

Table 8.3
Comparison of mandatory and voluntary open access.

Purpose	Open access	Outcomes (combined private and social value)
Dominant/public operators required to provide interconnection with other operators or provide facilities to downstream competitors or be the "common carrier" to all service providers in order to reduce wholesale prices for facilities and services.	MANDATORY: Open access regulation, including termination (monopoly) rate regulation, to ensure interoperability of networks, and seamless interconnection of customers, serving to drive down prices for users. Wholesale regulation of dominant markets. Essential facilities regulation to ensure access to network elements, enhance competition, and level the playing field so that service providers can compete in vertically integrated operations.	Resource-intensive access regulation, but if effectively done, enables competition, enhances efficiency of resource allocation, reduces wholesale prices, and enhances consumer welfare. Reduces access price/data prices for users to access services/internet. The basis of intervention is supply-side value (cost-based/profitability studies), but social benefits ensue.
	VOLUNTARY open access fiber network investment has complemented incumbent high-speed backbone networks, stimulating competition in the market and driving down wholesale prices. With the correct incentives, such as aggregating demand and offering government anchor tenancies, providers could be induced to go to underserved areas.	No regulatory transaction costs; avoid unnecessary duplication of services; commercial imperative likely to produce the most efficient outcomes, with associated cost saving and price reductions (reduce regulatory scrutiny). Private-value driven, but public and social value is derived.
Ensure a fair and competitive environment and access for downstream competitors to vertically integrated incumbent networks.	MANDATORY unbundling/structural and functional separation of networks from services or LLU of incumbent access networks in an open access wholesale network and separate services company (functional separation as behavioral remedy to anticompetitive practices (e.g., South Africa: Competition Commission, Telkom).	Creates a fair, regulated environment for downstream competitors, access to facilities and competition in fixed access network. Public good imperatives, but private value considerations.
Seeks to create trusted environment for downstream competitors (clients) by removing anticompetitive incentives in incumbent.	VOLUNTARY functional or structural separation (South Africa: Telkom) of services from open access wholesale networks.	Introduces more competitive pricing to attract clients (who are also service competitors), more profitable, more investment in network extension. Services with a similar cost base compete on quality-enhancing consumer choice.
Common carrier network/fiber extension to reduce duplication of investments in infrastructure to enable affordable access.	MANDATORY: National open access wholesale broadband company (not competing with downstream players' services). Aggregated demand into a low-cost national provider, usually state owned, and sometimes a monopoly provider.	State-owned open access carrier network in South Africa failed to extend access or reduce prices; Nigeria appears not to have the institutional capacity to get proposed regional infrastructure companies under way.

Table 8.3 (continued)

Purpose	Open access	Outcomes (combined private and social value)
	VOLUNTARY: Commercial open access models providing complementary investment have resulted in considerable network extension and driven down wholesale prices.	Potential to leverage private investments (supply-side value) for public goods (demand-side value), such as anchor tenancies offered by the state to connect remote public buildings such as schools, clinics, and police stations.
Intended to deal with extreme dominance in mobile markets, by either excluding dominant players from the low-cost open access network (Mexico) or compelling them in through exclusive spectrum holding by the network to lower barriers to entry for new entrants by providing low-cost, high-demand spectrum.	MANDATORY: Open access wireless network to operate as a wireless common carrier network, offering smaller players access to the spectrum.	No successful examples yet to draw from, and it is not clear how the proposed model in South Africa will overcome the problems faced in Kenya and Mexico around risk management, investment incentives, and institutional capacity to implement and oversee. Mobile markets with high levels of concentration or dominance. Effectively asymmetrical access regulation can reduce prices and spur take-up more rapidly and with less risk than the exclusive open access networks being proposed.
	VOLUNTARY: Mobile virtual network operators generally gain access to the market through late entrant network (API) wishing to complement revenues through roaming agreements.	Increasing competition in the market and driving down prices.
To enable or enhance broadband access to public services or to complement commercial access for price sensitive users.	Public Wi-Fi exploits spectrum commons for unlicensed low-power use. FPW provided by government recognizes demand-side value of broadband connectivity for citizens by enabling free access, either through government subsidies or public–private interplays. Various free commercial offerings tied to commercial dimensions of either telecom or other businesses attracting clientele or collecting information on their behavior.	In most African contexts, where even cost-based broadband is not affordable to many, this enables social and economic inclusion (though not necessarily equality).
Zero-rating, intended to attract new and price-sensitive users onto mobile networks by offering limited access to social networking products for free.	Zero-rated bandwidth provides open access to limited content of popular social networking platforms.	Private value for mobile operators who attract customers to their networks, who go on to become paying customers for full services or other products. Demand-side value in the provisioning of primary or complementary access and use to users.

of fixed broadband, where there was not much competition at the time of the initial interventions. Open access initiatives in the extremely successful mobile sector, where billions of dollars are being invested in broadband network extension while access prices are coming down, may turn out to be counterproductive in terms of meeting development objectives.

The voluntary open access undersea cable company consortia (WACS, Seacom, and Eassy) successfully broke the dominance of the club consortia of incumbent operators that monopolized the provisioning of international bandwidth, the high cost of which has prevented Internet proliferation in Africa for decades. A similar consortium model applied in the dynamic mobile market will require clear incentives to make the investment in open access networks more attractive than operators investing in and controlling their own networks. In all the countries assessed in the case studies, the dominant mobile operators are also the largest investors in broadband rollout. If they are permitted to access the high demand spectrum while continuing to operate their own networks, then any competitive open access network will most likely be marginalized. On the other hand, if mobile operators are not permitted to access the desired spectrum in an attempt to compel them to use the WOANs, then there is no need for them to invest in the latter, as they can simply access wholesale networks at regulated open access prices instead of investing in a shared pool. This is the impasse faced in South Africa.

Additionally, anxiety persists about the existence of the institutional capacity and sophistication necessary to oversee the complexity of creating a viable single, open access network. The absence of state coordination in relation to broadband, first with the state-owned company, BBI, and then in relation to spectrum, is evidence of the institutional risks associated with the management of complex processes. The decade-long digital television migration debacle in South Africa, which has now been overtaken by global events, together with the six-year ministerial delay in issuing a policy directive on the release of high-demand spectrum, which has now resulted in a legal standoff between the Ministry of Telecommunications and Postal Services and the regulator, provide evidence of both the complexity and risk of this undertaking. The traditional asymmetries of information between operators, regulators, and the ministry that have plagued far simpler processes, such as licensing hearings or the successful completion of market reviews, are unlikely to be overcome in the short run.

In the context of limited capacity and resources, alternative approaches that leverage private capital and skills, lower regulatory risk, and use the large public-sector demand for broadband as an incentive for investment by the private sector are required. The unintended consequences and potential policy and regulatory failure in Mexico,

Kenya, and Rwanda, all with far less competitive and far more concentrated markets than South Africa, should be taken as a caution to policymakers. Without the institutional capacity and sophistication to oversee the complexity of creating a viable, single, open access network, more stringent enforcement of competition in the market to deal with dominance through well-established practices of asymmetrical economic regulation may be more feasible, as the case of Mexico demonstrates.

Finally, the high levels of risk associated with the likely protracted legal battles that would ensue from an exclusive open access network, as proposed in South Africa, would delay the release of high-demand spectrum, at considerable cost to the economy.

Voluntary Open Access Fiber Networks The commercial companies in South Africa that operate voluntary open access models to optimize their traffic flows and maximize their short-term return on investments so that they can refinance the next phase of network rollout are contributing to network extension in a cost-effective manner. Although this results in the duplication of networks, this is certainly the case in metropolitan areas, where competition can be easily sustained, and there is also ample evidence of complementary geographic investments by different tiers and types of operators. Moreover, procurement or sharing of infrastructure for primary and redundant use for national coverage is taking place.

New Ways of Extending the Commons

Accepting that large numbers of Africans will not be able to afford to be optimally online, even if markets were effectively regulated and prices were cost based, deploying spectrum to create and extend the commons (i.e., the unlicensed spectrum) would be a key enabler. Extending commercially available public Wi-Fi from elite urban areas, possibly through deploying poorly utilized universal service funds or other public resources to all public spaces, offers a viable way of increasing the intensity of use in urban areas and enhancing network effects that would contribute to more inclusive digital development.

This chapter argues for an innovative policymaking approach that understands the need for a new interplay between state and market. It looks at novel models of access, service delivery, investment, and risk that leverage private and community knowhow, low-cost technology innovations, and complementary access solutions such as FPW.

There is a need for even greater regulatory agility and insight to manage tensions between the various policy objectives of competitive efficiency, innovation, and consumer welfare, as well as the safeguarding of the public and social value of the Internet through the extension of spectrum commons (i.e., an unlicensed and social use spectrum). In developed and developing countries alike, most of the spectrum is largely

unused outside main metropolitan areas. In the sharing economy of the Internet era, we are already seeing voluntary infrastructure sharing by operators. These types of approaches need to be embraced by governments from a critical resources management perspective. Enabling secondary spectrum use would enable new dynamic spectrum sharing, which operates at a fraction of the cost of the Global System for Mobile Communications (GSM) network (originally known as Groupe Spécial Mobile) to be deployed on new business models in the largely unused spectrum in rural areas. Such an approach could instantly provide low-cost, high-quality bandwidth.

With the long-term evolution of fifth generation (5G) under way, African governments need to ensure that the potential of this technology, which operates within a spectrum-sharing environment with data offloads to proprietorial and open public Wi-Fi, is harnessed for public purposes, not just for niche commercial applications.

Similarly, one of the main arguments in favor of zero-rating is that it brings down the cost of access to and use of information in developing countries. A user of Wikipedia Zero, for example, has unlimited, no-cost access to everything in the online encyclopedia. Furthermore, providing free access to popular content and services is preferable, from an access to information perspective, to restricted access or no access at all. Such free access may drive the demand for general-purpose, mobile Internet access that can stimulate demand and fund investment in infrastructure. If the unverified data provided by Facebook can be used as an indication, it may be that zero-rated services provide, to some extent, a gateway to the Internet. Facebook claims that 50 percent of Internet.org/Free Basics users move on to use some paid data service within a month of using the free service for the first time (Internet.org 2015[17] quoted in Futter and Gillwald 2015).

Traditionally, the net neutrality argument has been applied to ensuring equivalent quality of service to everyone who accesses the Internet by preventing positive pricing discrimination. The main problem with the net neutrality argument for banning zero-rated products, however, is that it prioritizes the principle of net neutrality over other public interest principles of universality and equality (of access, not quality) (Gillwald et al. 2016a). Applying net neutrality to zero-rating through negative pricing discrimination affects not the technical quality of the Internet, but the entry to and use of it. In African countries, where affordable access is the main factor inhibiting Internet take-up, and where even cost based prices may be unaffordable to many, zero-rated services may provide access to the Internet that otherwise would not be at all possible.

The critique of zero-rating on the grounds of breaching net neutrality in the mobile prepaid environment also tends to conflate different competitive outcomes for different players and elements, which, if found to have anticompetitive outcomes, may

require different policy and regulatory remedies to address them at the level at which they occur, rather than through blanket bans or restrictions.

RIA's detailed pricing of products across the African markets also confirms that zero-rating is one of multiple short term market strategies to grow market share by late market entrants. If most users do not buy data at some point, it will not make sense as a business strategy for mobile network operators to continue to discount their data use of this platform (Gillwald et al. 2016a).

With regard to the mobile market, which is the market providing access to the majority of Internet users in Africa, zero-rating of products by late entrant operators in fact may be competition enhancing; and regulators should refrain from regulating it, so long as it does not establish or entrench anticompetitive practices or long-term dominance in a market. While it can be argued that zero-rating enhances the dominance of the platform that is being supported (e.g., Free Basics) and channels users to it, it should be noted that social networking in general, and Facebook in particular (whether it is zero-rated or not), is driving Internet take-up.

Conclusions

The cases of open access discussed in this chapter highlight the need for a case-by-case, context-specific consideration of open access applications. In highly resource-constrained environments, those resources that are available must be optimized to deliver on the social good promised by broadband and digital economy policies.

While open access policies and strategies have again become part of the best practice telecommunications reform templates to deal with absence or bottlenecks in broadband networks,[18] and the principle of openness underpins the public Internet, the uncritical use of open access strategies in developing countries operating under conditions of scarcity and constraint can end up disrupting existing systems without offering more favorable access conditions or enhancing planned developmental outcomes. Network competition is still seen as producing the best outcomes regarding public policy objectives in more developed economies; but the duplication of infrastructure and the fragmentation of demand typical in such cases are not feasible in most developing markets, or even in some more mature ones (Gillwald et al. 2016b). Where states are weak and lack the institutional capacity to enable or enforce open access, the instrumental application of open access solutions may have unintended consequences or promote elite outcomes that can end up exacerbating current bottlenecks or digital exclusion.

In much of the literature on open access and in the advocacy that accompanies its implementation, the value attached to the infrastructure tends to be siloed according

to the delivery mechanism. Yet the information infrastructure underpinning our modern economy and society is now a mixed commercial, public, and social infrastructure. In practice, communications resource management has become far more complex than ever, with value being delivered through various hybrid regulated and unregulated models. Communications infrastructure is no longer simply a national communications system, manageable through national policy or regulation. Policy, regulation, and practice develop in response to technology developments in global markets, and increasingly through global governance, although they play out at the national and local levels. We see public and private networks delivering market goods with social value (productive use in downstream activities) and using nonmarket and public goods to transact and produce private goods, as people move from simply being users or producers to being both within the new forms of content development and provision in the platform economy. While the current practices largely undervalue public and social value, as this is classically understood in public goods or the commons, considerable social and public value is offered by private infrastructure investments driven by profit imperatives. This is particularly so in places where, without private provisioning, there was not, or would not be, much delivery of communications infrastructure at all.

Policymakers and regulators need to gear themselves up to the complex adaptive systems that have developed globally; regulators should be focusing on enabling and creating incentives to ensure that the underlying network necessary to support the high-value informational infrastructure is affordably available. This will require reducing cost drivers in developing markets through the regulation of infrastructure sharing through incentives and enabling rights of way regimes, as well as enforcing limitations on fruitless duplications in trenching and masts. Instead of adopting instrumental static regulation of competition derived from telecommunications regulation, regulators need to see how they can be channeling complementary investments and moving toward an industry-coordinating role by enabling voluntary models that allow the participants to assume the risk associated with high-sunk-cost infrastructure investments and open innovation.

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Chair, Ariel Futter, Fola Odufuwa, Kweku Korateng, and John Walabengu. For more information, see http://www.researrchictafrica.net.

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Notes

1. OECD (2013), the ITU (2011), the New Partnership for Africa's Development (NEPAD 2010), the Body of European Regulators of Electronic Communications (BEREC 2011), and the European Commission (2011) have generally accepted a set of open access principles, but no common definition.

2. Nondiscrimination does not exclude volume discounts or other market segmentation tools, so long as they are available to all customers (i.e., customers would qualify, provided that they meet transparent volume requirements) (Gillwald et al. 2016b).

3. Within this regulatory framework, *openness* is not equated with *free*. Concepts of free (as in no cost to users) emerged in regulatory theory more with regard to regulation to deal with market failure and the need for subsidized access to services found in universal service regulation. In practical terms, free or subsidized services were realized through obligations on operators to contribute to universal service funds or to cover certain percentages of the population, or the provisioning of telecenters and, more recently, the provisioning of free public Wi-Fi.

4. The shifting and contentious position of the US Federal Communications Commission (FCC) in its latest regulations, called "Restoring Internet Freedom Order," which took effect on June 11, 2018, has outraged net neutrality proponents. It claims to provide "a framework for protecting an open Internet while paving the way for better, faster, and cheaper Internet access for consumers." It overturns former "unnecessary, heavy-handed regulations that were developed way back in 1934 with strong consumer protections, increased transparency, and common-sense rules that will promote investment and broadband deployment" (FCC n.d.).

5. OTT services and platforms are those that are delivered over the Internet, typically by broadband.

6. According to the Wikipedia "Backhaul (Telecommunications)" entry, "[T]he backhaul portion of the network comprises the intermediate links between the core network, or backbone network, and the small subnetworks at the 'edge' of the entire hierarchical network. … Visualizing the entire hierarchical network as a human skeleton, the core network would represent the spine, the backhaul links would be the limbs, the edge networks would be the hands and feet, and the individual links within those edge networks would be the fingers and toes" (Wikipedia 2018a).

7. The initial telecommunications reforms in the mid-1990s, which helped establish an independent regulatory authority and the liberalization of markets, introduced the first transparent access regime through interconnection and facilities leasing guidelines in compliance with General Agreement on Trade in Services (GATS) agreement on basic telecommunications.

8. According to the Wikipedia "Local-Loop Unbundling" entry, "Local loop unbundling … is the regulatory process of allowing multiple *telecommunications* operators to use connections from the telephone exchange to the *customer*'s premises" (Wikipedia 2018b).

9. In 2007, the Honorable Minister Ivy Matsepe-Casaburri, the minister of communications, appointed an LLU Committee, which in May of that year issued a report called *Local Loop Unbundling: A Way Forward for South Africa*.

10. Passive sharing is most common and occurring voluntarily as operators manage their costs with the transition to data. However, mandatory requirements on mobile operators to offer virtual private networks or access point name access to ISPs, in a way similar to bitstream on fixed lines, is emerging in some African countries.

11. See Williams (2010) for an example of the World Bank's philosophy of competition, where network competition is not feasible.

12. The West Africa Cable System (WACS) is a high-capacity, fiber-optic, underwater cable that links South Africa and western Africa to Europe via the United Kingdom.

13. It was clear by the time of the diagnostic report undertaken in 2011 for the National Development Plan that BBI was perceived as having failed. The company was undercapitalized and unable to compete with the low-cost, commercial open access companies that had emerged to fill the vacuum left by the incumbent Telkom's failure to embrace emerging broadband technologies. BBI had a single client, Neotel, and was unable to service its own network; in addition, Neotel had not built out its own intercity transmission network with the mobile operators Vodacom and MTN (Cohen, then the chief corporate services officer of Neotel, interview 2016).

14. *4G* refers to the fourth generation of the GSM technology standards developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for the second-generation (2G) digital cellular networks used by mobile phones, first deployed in Finland in July 1991, to the 5G currently being deployed in mature markets. As of 2014, it has become the default global standard for mobile communications, with over 90 percent market share, operating in over 219 countries and territories. For more information, see https://www.gsma.com/futurenetworks/faq/gsm/.

15. The DTPS was merged into the Department: Communications and Digital Technologies (DCDT) in June 2019.

16. The author served on the Western Cape Broadband Initiative advisory group between 2012 and 2014 to review the public-private delivery plan.

17. See https://info.internet.org/en/blog/2015/11/19/internet-org-myths-and-facts/.

18. Although initially there was resistance by African governments, largely as a result of pressure from their telecommunications incumbents, at the policy level, open access found currency through its extensive promotion by infoDev, a World Bank organization, a decade ago. This had a significant impact on telecom reform policy and practice. Open access regulation in areas such as interconnection (and, later, local loop unbundling) was emulated from the European

Commission by many African regulators. Also, infoDev described open access as being "about creating competition in all layers of the IP network, allowing a wide variety of physical networks and applications to interact in an open architecture" (Spintrack 2005, 8).

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