APPENDIX B

Chapter 7: “Policies for Mobile Broadband,” *from Maximizing Mobile*.

Chapter 7

Policies for Mobile Broadband

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This final chapter looks to the future and provides policy recommendations for expanding the range and uptake of mobile applications for development. In practical terms, that means looking at the shift toward mobile broadband networks. Broadband has a positive impact on growth and development (Qiang and Xu forthcoming). Mobile broadband, in particular, is expected to show an even higher positive effect on economic growth, especially in developing countries. Thus, mobile broadband development and diffusion across the economy is a subject of policy action. Unlike other information and communication technology (ICT) services, such as fixed-line voice telephony, broadband (including mobile broadband) behaves as an ecosystem where the supply and demand sides interact and mutually reinforce each other. Hence, both aspects of the ecosystem—supply and demand—need to be addressed by policy initiatives (Kelly and Rossotto 2011). Supply-side policies aim at promoting and enabling the expansion of mobile broadband networks; demand-side policies seek to increase adoption of mobile broadband services. Policy recommendations for both supply and demand are addressed below.

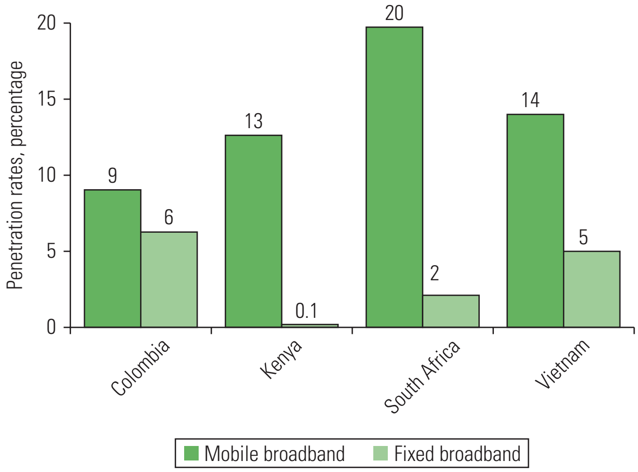
The mobile broadband opportunity and developing countries

As discussed in chapter 1, broadband has an important effect on economic growth and development. Numerous studies have found a positive relationship between broadband penetration and economic growth, particularly in developing countries (Qiang and Rossotto 2009, 45; Friedrich et al. 2009, 4; Katz et al. 2010, 2; Digits 2011). One of the transmission channels of this growth is linked to the transformational effect of broadband throughout the sectors of the economy, raising productivity and efficiency (Kelly and Rossotto 2011). Mobile broadband has been found to have a higher impact on GDP growth than fixed broadband, through the reduction of inefficiencies (Thomson et al. 2011).

Mobile telephony has already demonstrated that networks that use spectrum, such as mobile networks, are often the most efficient infrastructure for expanding ICT services worldwide, especially in developing countries, which generally suffer from a shortage of fixed infrastructure (see Statistical Appendix). Such is the case for broadband, which is now growing faster in developing countries than in developed ones, with a compound average growth rate of over 200 percent since 2009. In some countries, such as Colombia, Kenya, South Africa, and Vietnam, mobile broadband is already the main platform for broadband access, having surpassed fixed broadband by over 10 times in the two African countries and almost 3 times in Vietnam (figure 7.1).

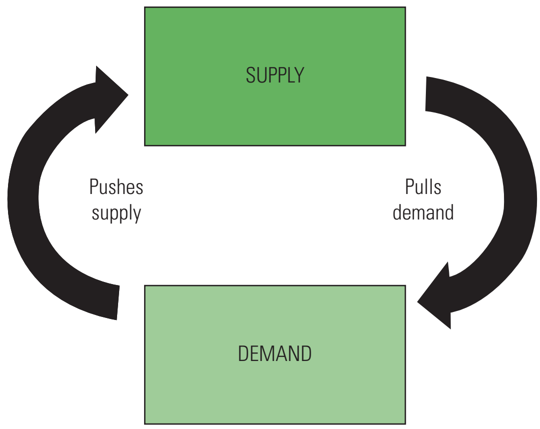
Even so, the broadband gap between developing and developed countries is increasing.[1] Whereas around half of mobile connections provide broadband access in

Figure 7.1 Broadband subscriptions in selected countries per platform (mobile vs. fixed)



Sources: TeleGeography Inc. database, March 2011, and World Bank database for population data,
Note: Data are for the third quarter, 2011, for Colombia, Kenya, and South Africa; second quarter, 2011, for Vietnam.

Figure 7.2 Broadband as an ecosystem where supply and demand factors interact with each other



Source: World Bank.

developed countries, in developing countries this percentage is below 10 percent. The different pace of mobile broadband adoption has many causes, one of which has been more aggressive policies in developed countries to enable and foster the implementation of mobile broadband technologies. As shown by examples in Chile, Germany, Sweden, and the United States, to name but a few, policies that foster mobile broadband allow for its faster and wider diffusion.

Policy recommendations for facilitating mobile broadband diffusion

To understand how policy-making can promote and enable broadband, it is useful to understand the various elements that influence broadband diffusion. By contrast with other ICT services, such as voice, broadband works as an ecosystem, where the supply and demand sides interact and reinforce each other (Kelly and Rossotto 2011, 25). Thus, broadband diffusion not only requires the supply of access through network coverage expansion, but also the development and availability of demand-side enablers, such as affordable smart devices and content and applications that respond to user needs (figure 7.2).

With this framework in mind, policies to support and enable broadband diffusion through mobile networks can be categorized as either supply-side or demand-side policies.

Supply-side policies

Supply-side policies aim to expand mobile broadband networks by addressing the bottlenecks and market failures that constrain network expansion and by providing incentives for wider mobile broadband coverage. Bottlenecks and market failures differ among countries, and policy-makers and regulators should assess their specific market conditions, prioritizing those policies that are relevant to their domestic bottlenecks and market failures. However, two main bottlenecks are relatively common worldwide: insufficient availability of spectrum, and inadequate backbone networks.

The following policy recommendations focus on these common bottlenecks, as well as on incentives for expanding the coverage of mobile broadband networks.

Ensure sufficient availability of quality spectrum to deploy cost-effective mobile broadband networks. Availability of spectrum may become a bottleneck to the development of mobile broadband networks for various reasons. First, to facilitate rapid deployment of these networks, operators need spectrum that is technically adapted to the most cost-efficient mobile broadband technologies. Technologies are designed to be more efficient in specific spectrum bands. International harmonization provides the benefits of economies of scale for network equipment. As a result some bands are much more commercially attractive than others. If spectrum is not offered for the bands where the most cost-efficient technologies work, operators have to opt for other less efficient options, which can result in more limited investments or no investments at all.

Second, operators need spectrum in the bands that are most effective for deploying mobile broadband technologies. For instance, a fourth-generation broadband mobile technology such as Long-Term Evolution (LTE) can operate in multiple frequency bands, but the lower bands (such as 700 and 800 megahertz, or MHz) can be more cost-effective, allowing for both wider coverage from fewer radio base stations (an important consideration for rural area deployments) and higher powers to support building penetration (an important consideration in urban areas). Using optimal frequency bands can also assist with the high availability of network equipment and lower prices resulting from global economies of scale. Continuing with the previous example, deployments of LTE networks driven by U.S. and European operators have generally been more successful in the 700 and 800 MHz bands. That has resulted in more affordable network equipment in these two bands.

Third, blocks of spectrum must be sufficiently large to allow cost-efficient provision of mobile broadband, with multiple operators. LTE, for example, allows operations with different-sized blocks of spectrum (from 1.4 to 20 MHz); the size of the spectrum blocks and the pairing of frequencies determines the maximum broadband speed and the cost of deploying mobile broadband networks based on this technology. Because data traffic and bandwidth are growing rapidly, operators may need larger blocks of spectrum to cope with demand and avoid congestion, particularly in urban areas. Use of Wi-Fi networks to offload mobile broadband traffic from cellular networks can also help to offset congestion pressures over these networks. However, these complementary networks will not be able to solve the growing congestion problem by themselves. Although forecast to almost double, Wi-Fi offload traffic is expected to handle only around 20 percent of total mobile broadband data by 2016 (CISCO 2012).

To minimize bottlenecks in the availability of spectrum, policy-makers and regulators should assess spectrum needs and available cost-efficient technologies and release to the market spectrum of suitable and sufficient quality for these technologies. In some case, policy-makers and regulators may need to refarm spectrum (the practice of making spectrum available by moving existing users or organizing band use more efficiently) and reassign legacy users with less valuable uses or less efficient technologies to other bands. Permitting spectrum trading among operators also allows for spectrum refarming for more efficient uses through private sector–led transactions. The digital switchover (the process whereby analog television has been superseded by digital television) has allowed spectrum managers worldwide to liberate spectrum for other uses, particularly mobile broadband. That in turn has allowed policy-makers worldwide to institute spectrum refarming. In the United States, the 700 MHz band, where LTE networks are currently being deployed, was released as a result of the digital switchover. Similarly, in Europe, countries such as Sweden and Germany have taken advantage of the digital switchover to release spectrum in the 800 MHz band for their LTE networks.

Eliminate technological or service restrictions on spectrum. The availability of spectrum is not the only issue. Technical or technological restrictions or mandated uses that require the spectrum to be used for other services could still act as a bar to mobile broadband technologies. Eliminating such restrictions, and making spectrum technologically neutral, allows operators to choose the most efficient technology to deploy on broadband services. Market mechanisms for spectrum allocation, such as auctions or secondary trading, should help to ensure that available spectrum is used efficiently. This is valid not only for current mobile broadband technologies, such as WiMAX, HSPA, or LTE, but also for other technologies that may be developed in the future. Applying the principle of technological neutrality is as relevant for new spectrum being released as for spectrum that has already been allocated, particularly second- and third-generation (2G, 3G) band spectrum. Operators can thus leverage existing network deployments in the 2G- and 3G-bands, such as GSM (Global System for Mobile communications), and Wideband CDMA (Code Division Multiple Access), by turning over part or all of the spectrum they already use for these services to advanced mobile broadband technologies (in-band migration).

This practice has been successfully applied for 3G technologies within the 2G bands in many countries, particularly in Latin America where operators could launch 3G services before 3G licenses where awarded or in bands initially awarded for 2G services. In Mexico operators launched 3G services in 2007 and 2008 using both CDMA and Universal Mobile Telecommunications System (UMTS) technologies, well before 3G spectrum licenses were awarded in 2009. In Brazil operators started launching CDMA-3G services in 2004, before 3G licenses were awarded. In addition, the regulator allowed the use of 2G-awarded spectrum for 3G services as 3G spectrum licenses were awarded in 2007.[2] Allowing the use of existing spectrum for any technology-neutral use (given that these technologies do not result in harmful interferences) also enables operators to follow a phased and scalable approach to transition from 2G/3G technologies to 4G technologies (such as LTE).

Focus on expansion of network coverage rather than on spectrum proceeds. High up-front spectrum costs may limit the capital available for operators to invest in coverage beyond the most affluent areas (EC 2002; Delian 2001; Bauer 2002). There are several methods for awarding spectrum rights, the most common ones being auctions, beauty contests, and hybrid methods of these two. Although auctions are generally considered more efficient than beauty contests, auction designs aimed at increasing up-front revenues for the government do not achieve the highest social welfare benefits (Hazlett and Munoz 2008, 2010). Indeed, auctions that extract high rents from operators may result in delays of investments or in concentration of network coverage in urban and high-income areas, while rural and low-income areas are not served (Patrick 2001). The results of the 3G auctions in Europe, where high proceeds were achieved, but 3G network deployment was delayed for several years and a number of licenses were returned, showed that high up-front costs may result in low or delayed investment (Gruber 2006). To encourage coverage in underserved areas, some governments, such as Chile (box 7.1), Germany (Brugger and Oliver 2010; Wireless Intelligence 2011), and Sweden,[3] have introduced hybrid methods adding specific coverage obligations to mobile broadband spectrum licenses to cover underserved areas, or "white spots."

Require transparency in traffic management and safeguard competition. Demand for mobile broadband is growing exponentially. Mobile data traffic, spurred by mobile broadband growth, is expected to grow more than 26 times in five years (figure 7.3; CISCO 2012). The expansion of data-hungry devices, such as smartphones and tablets, are already resulting in exponential increases of traffic in some countries (see figure 1.5).

Unlike fixed broadband technologies that can make use of the almost unlimited capacity of fiber optics to cope with growing data traffic, mobile broadband networks must work with finite allocations of spectrum. Mobile operators rely on optimization of networks and traffic management to increase efficiency, at least in the short term.[4] However, operators may also use optimization and traffic management techniques to hinder competition through data caps and by blocking or "throttling" access to applications. For instance, mobile network operators may limit the bandwidth available to those applications that threaten to deprive them of revenue, such as Skype used as a substitute for voice calls. To avoid such practices, regulators have been imposing limits on traffic prioritization while permitting optimization of mobile broadband networks, within the network neutrality concept.

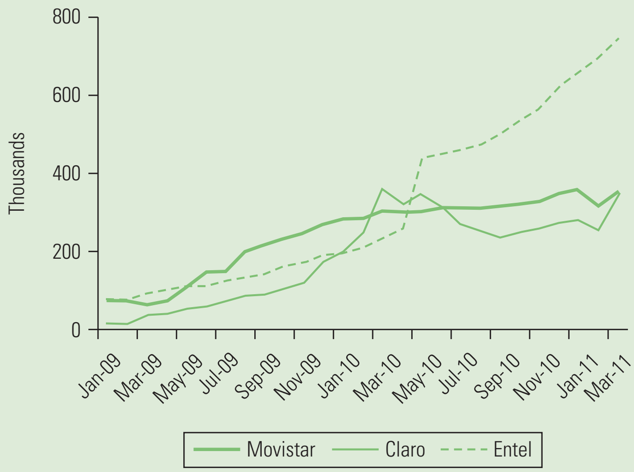
Network neutrality generally refers to the notion that an Internet Service Provider (ISP) should treat all traffic equally, including any content, application, or service (Atkinson and Weiser 2006). Based on this principle of nondiscrimination, a growing number of jurisdictions have adopted regulations that range from barring ISPs from managing internet traffic in a way that discriminates among content providers to permitting "best efforts" to deliver content on equal terms. These regulations have generally not been applied to mobile networks, however. In some cases, the justification for the exemption has been to allow mobile broadband networks to develop. Some governments are now beginning to regulate certain practices, for example by requiring full access to certain applications (such as Voice over IP services, like Skype).[5] It is also useful to promote transparency on the part of operators to explain how they are applying traffic management.

Limit spectrum hoarding that could distort competitive conditions in the market. Making spectrum available to the market is critical for developing mobile broadband, but this spectrum also must be used efficiently. Operators should use their spectrum allocations to provide services and not to distort the market or impede other providers from entering the market. To avoid these pernicious effects, governments have introduced limitations in awarding spectrum, such as

Box 7.1 Using reverse auctions to match spectrum allocations with coverage obligations in Chile

In Chile, the government provided spectrum in multiple bands for mobile broadband in underserved rural areas. Chile offered subsidies through a reverse auction (resulting in a government subsidy of more than $100 million) to develop mobile broadband in around 1,500 municipalities in rural areas, where no broadband service was available. Extending coverage to these areas could mean that 90 percent of Chile's population would have broadband coverage. Minimum service conditions for broadband access (such as a 1 Mbit/sdownlink) and a ceiling on prices was established. The winner of the auction, Entel Movil, started deploying mobile broadband in these areas in September 2010.[a] The large expansion of mobile broadband services in the country, has permitted Entel Movil to achieve the largest share of mobile broadband connections in the country, surpassing its other two main competitors (figure 7.1.1).

Box figure 7.1.1 Mobile broadband subscriptions per operator in Chile

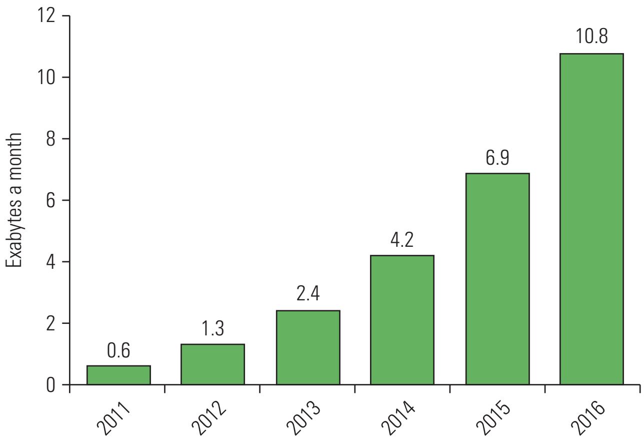


Source: Subtel.

a. Subsecretaria de Telecomunicaciones, Chile. 2010. Proyecto Bicentenario: "Red de Internet rural: Todo Chile comunicado."
http://www.subtel.gob.cl/prontus_subtel/site/artic/20100819/asocfile/20100819103226/ppt_bicentenario_fdt_red_internet_rural.pdf; Entel, Todo Chile Comunicado. http://personas.entelpcs.cl/PortalPersonas/appmanager/entelpcs/personas?_nfpb

spectrum caps in specific bands (see above) or sunset clauses in case the spectrum is not brought into timely use by a certain date. However, governments should be wary of imposing spectrum caps that are too stringent and might impede operators' ability to react to market demand. Broadband data traffic demand is expected to require increasing amounts of spectrum, especially in urban areas (Rysavy Research 2010). For this reason, it is advisable for governments to be flexible in using spectrum caps and monitor the market needs and competitive conditions as they evolve. If competition conditions are not in danger, regulators and policy-makers would be better off monitoring market conditions rather than establishing spectrum caps. Mobile broadband demand can grow very quickly as more and more applications are developed and handsets prices are reduced (see below). In this scenario, caps that are too stringent may result in underdevelopment of mobile broadband services, lower speeds, or limited quality of service.

Figure 7.3 **Mobile data traffic by 2016, CISCO forecast**



Source: CISCO 2012.
Note: The compound annual growth rate between 2011 and 2016 is projected to be 78 percent.

Foster the development of national broadband backbone networks. In contrast to voice mobile networks, mobile broadband networks require high bandwidth backbones to support the delivery of broadband to end users. To support rising volumes of mobile broadband traffic, the backbone networks of the mobile platform must be upgraded to fiber. Governments can support the development of backbone networks by enacting infrastructure sharing policies, allowing mobile operators to make rational build or lease decisions, streamlining procedures to obtain rights of ways (by issuing national rights of way, for example), and adopting other specific policies. In addition, governments can foster the development of backbone networks by coordinating with the private sector, providing seed capital for the development of backbone networks, and enabling public-private partnership (PPP) schemes. However, governments must be careful to avoid market distortions when intervening in the infrastructure market.

In addition, governments can also encourage the opening to broadband operators of fiber infrastructure deployed by other utilities, such as electricity, roads, or water. Many utilities have already deployed fiber networks for internal operational purposes, and their surplus capacity can be utilized for broadband development. Indeed, this surplus fiber capacity can serve to build or complement mobile broadband backbone networks (Arthur D. Little 2010).

Foster infrastructure and spectrum sharing. Policies that encourage infrastructure sharing allow operators to develop common networks, share costs, and hence lower investment requirements, all of which can result in lower prices for users.[6] In Kenya, instead of auctioning LTE-band spectrum to separate operators, the government is planning to implement a PPP model with a sole network with LTE-band spectrum available on an open-access basis. The possible risk is that by creating an effective monopoly, deployment may be slow and inefficient. On the other hand, by requiring companies to share a common infrastructure, the aim is to reduce duplicate investment and minimize competition distortion (Msimang 2011).

Demand-side policies

Demand-side policies aim at expanding adoption of broadband services by addressing the barriers to adoption and fostering the development of broadband-based services and applications and thereby promoting user demand. As with supply, local market conditions affect the effectiveness of demand-side policies, and policy-makers and regulators should take good note of those conditions. Two main barriers to entry are relatively common among developing countries, namely, the availability and affordability of broadband-enabled devices and service. In addition, the development of services and applications that address local market needs has proven to be a critical driver of demand for broadband services, because such services can improve their value proposition for businesses and consumers.

Ensure the availability and affordability of broadband-enabled devices. As mobile broadband has expanded globally, the reach of broadband-enabled devices, such as handsets and tablets, has increased, and their price has fallen. As penetration continues in developing countries, manufacturers are targeting these markets by providing low- and ultra-low-cost devices and designs tailored to these markets' needs. The global market for handsets has seen a continual reduction in prices even as performance increases. Mobile broadband handsets, or smartphones, have fallen in price from more than $300 in 2005 to less than $100 in 2011 for low-end models (IBM 2011; Kalavakunta 2007). Devices costing under $16 are forecast by 2015 (Scottsdale 2011).

However, barriers such as taxes, import restrictions, and duties may prevent consumers from benefiting from best global market prices (Katz et al. 2011). Direct sales taxes affect all legitimate handsets on sale within a country, and their level should be assessed carefully by policy-makers to avoid limiting broader access or spurring a profusion of “gray market” devices. Import restrictions and duties apply only to imported devices, but given that equipment manufacturing has become a global industry, virtually all devices are imported to some extent. The combination of sales taxes and import duties may increase prices to unaffordable levels for most of the population. For instance, in Bangladesh handsets are subject to a 12 percent import duty and an additional sales tax of 15 percent (Boakye et al 2010).

Subsidization of handsets by the mobile voice industry has made them affordable but has kept service prices high. As a result, a few countries, such as Finland, have made the practice illegal.[7] In the case of mobile broadband, though, high-end devices that make use of more efficient networks (such as LTE) may actually reduce unit prices for data. So, policy-makers should be prepared to show evidence of market distortion effects before imposing bans on subsidizing broadband-ready devices.

Finally, some countries have promoted domestic development of cheap handsets. For instance, India has fostered the development of cheap tablets coupled with a program of subsidies for the education sector, making tablets for education available for $35, less than 3 percent of that country’s annual gross national income (GNI) per capita.[8] Not all countries have the manufacturing base, low labor costs, and large domestic market size of India, however, so policy-makers need to evaluate carefully the potential for success of these kinds of policies in their local markets. Without import protection, it is difficult to compete on cost and quality with the global market.

Enable increasing affordability of broadband services. Along with the cost of the handsets themselves, service costs may deter access to broadband. Mobile operators have generally been successful at reducing the total cost of ownership for mobile phones, in best practice cases to below $5 a month for a basket of services.[9] Prepaid offerings have been the most successful marketing strategy to increase the affordability of mobile services. In fact, prepaid service has been an important driver of mobile telephony in developing countries; for example, more than 80 percent of all users in Africa, Asia Pacific, and Latin America in the third quarter of 2011 bought prepaid service (Wireless Intelligence 2011).

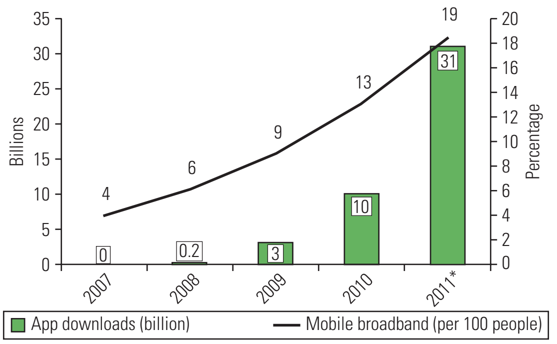
A similar strategy is being applied to mobile broadband. Operators provide prepaid packages and other tailored services for mobile broadband services, such as offering a USB (universal serial bus) “dongle”[10] with a certain amount of data that can be used on laptops or PCs over cellular networks. For instance, in the Arab Republic of Egypt mobile operators are offering prepaid traffic-based mobile broadband access starting at $8, less than 4 percent of the monthly GNI per capita.[11] In Colombia operators offer prepaid mobile broadband for different prices based on duration and service access, ranging from $0.5 a day for chat or email access only to $25 a month for full broadband access, less than 6 percent of monthly GNI per capita at the highest offering.[12] Policy-makers and regulators should enable these practices and avoid distorting the market unnecessarily. Imposing a high level of taxes (particularly direct taxes) on mobile broadband service may reduce their affordability and deter adoption (Katz et al. 2011).

As the mobile voice market proved, competition among service providers is also a critical driver of price reductions and innovative offerings that increase affordability (Rossotto et al. 1999). Policy-makers and regulators should safeguard competitive conditions in the market and, when needed, increase competition (by reducing barriers to entry to the market, for example, or increasing the number of licenses).

Enable the development of broadband applications and content. Applications and content are drivers of broadband demand. Broadband in itself does not provide much value directly to business and consumers. It is the applications and content that can be accessed through broadband that consumers want. Mobile broadband has made this link even more evident. Adoption of mobile broadband services is closely followed by applications growth for this service (figure 7.4).

Mobile applications are easier to use than earlier web-based applications and allow additional features, such as geo-location of services, unique to mobile services. Coupled with social networks, applications are now the main demand drivers for mobile broadband. But most mobile broadband applications and services are developed in and for developed countries. For instance, the vast majority of downloads for the Android platform have occurred in the United States, followed by the Republic of Korea, Japan, and other developed countries (Empson 2011).

Figure 7.4 Mobile applications as a driver of mobile broadband demand



Source: Adapted from Apple, Google, and Wireless Intelligence.
Note: * Estimate.

To foster local demand for mobile broadband applications and content, policy-makers actively promote local capacity for development and customization. Policy-makers can develop policies to provide the right enabling environment for this industry and to actively foster its development through the creation of a mobile broadband innovation ecosystem. Co-creation platforms linking educational institutions and industry as well as technology hubs and crowdsourcing strategies are some of the tools for creating such an ecosystem. In addition, policy-makers can encourage government agencies to develop mGovernment applications (see chapter 6) and content for mobile broadband (through open data policies, for example), as well as acting as a consumer for sectoral applications (in education or health, for instance), in order to create a critical mass for the development of local applications and content.

Conclusions

Fostering mobile broadband diffusion in developing countries requires appropriate policy actions to enable and encourage both components of the mobile broadband ecosystem—supply and demand. Policy-makers should evaluate local conditions before applying specific policies, screening for bottlenecks or market failures on each of side of the ecosystem. The most common bottlenecks and market failures on the supply side are spectrum and backbone networks. On the demand side, limited availability of affordable broadband-enabled devices and services, as well as the lack of local applications and content, are the main bottlenecks and market failures. The policy recommendations described in this chapter provide guidance on how to address these common barriers.

This report has shown the potential of mobile applications to transform different sectors of the economy while benefiting the livelihoods and lifestyles of citizens and communities. Mobile broadband is an important element in that process, because it will offer the tools, from smartphones to services, that enable that transformation to take place: from access to apps.

Notes

1. http://www.itu.int/ITU-D/ict/statistics/.
2. Telegeography Inc., Globalcomms database, 2012.
3. Telecoms.com, 2010, "Sweden to Auction 800 MHz Spectrum in February" (December), http://www.telecoms.com/23770/sweden-to-auction-800mhz-spectrum-in-february-2011/; IT World, 2010, "Spectrum for Rural 4G Auctioned Off in Sweden" (March), http://www.itworld.com/mobile-amp-wireless/139121/spectrum-rural-4g-auctioned-sweden; Economist Intelligence Unit, 2011, "Germany/Sweden Telecoms: Fixing Mobile Broadband" (June), http://viewswire.eiu.com/index.asp?layout=ib3Article&pubtypeid=1162462501&article_id=1838266568&rf=0.
4. Mobile network optimization and self-organizing networks are expected to grow over 84 percent from 2010 to 2015 as LTE networks are deployed worldwide. See TotalTelecom (December 2011–January 2012), http://www.totaltele.com/.
5. For instance, the United Sates has limited the application of network neutrality principles to wireless operators. However, the government prohibits operators from blocking certain websites and applications. In France, network neutrality rules apply to all broadband operators (including wireless), although the regulator can still apply less stringent rules for traffic management for mobile operators based on objective reasons. In the Netherlands the Parliament passed a law forbidding mobile operators from blocking applications, particularly VoIP and text messaging. See http://www.iptelephonyusa.net/internet-protocol/2846-dutch-pass-law-to-ensure-open-internet-access.
6. Telecoms.com, 2009, "Tele2, Telenor to Build Swedish LTE Network" (April), http://www.telecoms.com/10423/tele2-telenor-to-build-swedish-lte-network/; Telegeography, 2011, "Telia and Telenor Share Danish Networks" (June), http://www.telegeography.com/products/commsupdate/articles/

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7. "Market Analysis of Mobile Handset Subsidies," http://www.netlab.tkk.fi/tutkimus/lead/leaddocs/Daoud_Haemmaeinen_slides.pdf.
8. "India's Aakasha Tablet Soon to Be Free for Students" (February 2012), http://androidcommunity.com/indias-aakash-tablet-soon-to-be-free-for-students-20120208/.
9. Nokia and LIRNEasia conduct an annual survey of the total cost of ownership (TCO) of mobile, covering user prices for voice, SMS and data, a SIM card, taxes, and local handset costs in 50 countries. In the June 2011 study, Sri Lanka came out the cheapest, at $2.91 a month; 10 other countries had a TCO under $5 a month, excluding data. By contrast, in Morocco the same basket of services provided in Sri Lanka would cost $52.14; see: http://lirneasia.net/2011/06/nokia-annual-tco-total-cost-of-ownership-results-show-bangladesh-and-sri-lanka-as-cheapest/.
10. A "dongle" or data card is a piece of hardware that plugs into a PC, tablet, or other computing device to permit it to use mobile data services. Similar to Wi-Fi cards that proliferated in the early 2000s, the market for such devices is likely to disappear once the hardware is increasingly built into the device itself.
11. See Vodafone Egypt's offering: http://www.vodafone.com.eg/vodafoneportalWeb/en/P604978041288690285509.
12. See Movistar's prepaid offering: http://www.movistar.co/Personas/Internet_Movil/Planes/Internet_prepago/internet_para_telefonos/.

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