Mobile broadband for the masses:

Regulatory levers to make it happen

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Sören Buttkereit
Luis Enriquez
Ferry Grijpink
Suraj Moraje
Wim Torfs
Tanja Vaheri-Delmulle

McKinsey&Company

About the authors

Sören Buttkereit is a Strategy Expert in McKinsey's Munich office.

Luis Enriquez is a Partner in McKinsey's Brussels office.

Ferry Grijpink is an Associate Principal in McKinsey's Amsterdam office.

Suraj Moraje is a Partner in McKinsey's Johannesburg office.

Wim Torfs is an Associate Principal in McKinsey's Dubai office.

Tanja Vaheri-Delmulle is a Senior Research Analyst at McKinsey's Benelux Knowledge Center.

Summary

As the long-awaited promise of mobile broadband finally comes within reach, a new role for the technology is emerging that takes a step beyond company balance sheets and business strategies. Bringing broadband penetration levels in emerging markets to today's Western European levels could potentially add USD 300-420 billion in GDP and generate 10-14 million jobs. Mobile broadband is uniquely positioned to stimulate economic growth and welfare in areas that lack adequate fixed-line broadband infrastructures. However, to assume this role the industry needs not only smart business models but also a supportive regulatory regime – particularly in poor and rural areas. Without this regulatory support, countries risk being left behind in their communications infrastructure and economic development.

Operators and regulators both need to take action to make mobile broadband a reality in emerging markets. While other articles by these authors have explained the need for operator action, this paper will discuss how well-tailored regulation could achieve mobile broadband penetration on a large scale.

Broadband can have extensive benefits for emerging markets

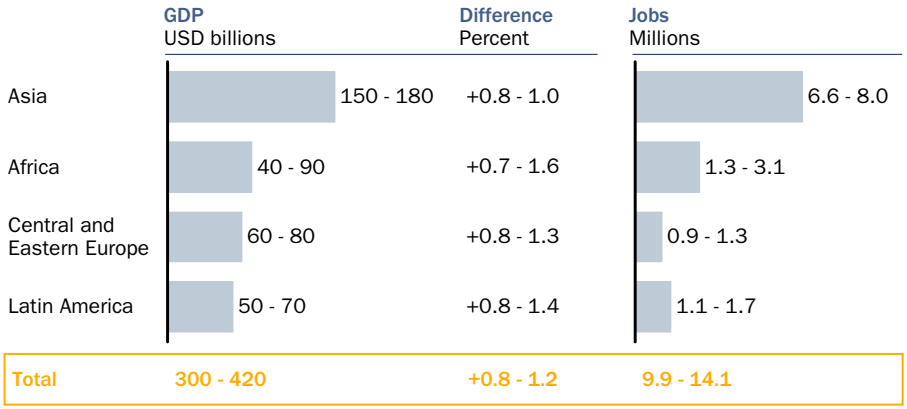
We estimate that bringing mobile broadband penetration in developing economies to today's level in Western Europe could produce enormous economic benefits, potentially increasing the gross domestic product (GDP) by USD 300–420 billion and creating over 10–14 million jobs (Exhibit 1). Beyond this, and perhaps more importantly, we believe that broadband could have a significant impact on overall societal welfare as it helps boost human capital, improve healthcare and create new income opportunities in the poorest and remotest parts of the world.

EXHIBIT 1

Potential economic impact of increased broadband penetration

ABSOLUTE AND RELATIVE INCREASE IN EACH REGION*

TOP-DOWN ESTIMATES



* Assumptions: Mobile broadband reaches present levels of fixed broadband penetration of Western Europe today (54%); 10% broadband increase leads to 0.5% increase in GDP; employment elasticity of 0.5%

Source: McKinsey

A positive correlation exists between a country's readiness in terms of information and communication technologies (ICT) readiness and its economic competitiveness. Broadband plays an important role in this equation, an assertion supported by numerous studies that show its effects on the economies of developed and emerging markets alike. While the studies vary in their estimates of broadband's impact on growth (to some degree a result of different methodological approaches), the consensus seems to be that a 10 percent increase in broadband's household penetration delivers a boost to a country's GDP that ranges from 0.1 percent to 1.4 percent.

This growth takes place through different mechanisms (Exhibit 2). First, there is clearly some *immediate value* created by the investments in broadband themselves. South Korea is a good example of this, with its nationwide rollout of subsidized broadband. The country also introduced a number of ICT projects to increase consumer interest in broadband usage, establishing 8,600 IT information centers to educate consumers; providing e-Learning programs such as ICT training at schools; and introducing e-Government and e-Health programs (e.g., offering live operations that medical students can view remotely). As a result of these and other initiatives, South Korea dramatically surpasses the Asian-Pacific region on all indicators regarding the economic contribution of ICT and broadband.

EXHIBIT 2

Effects of higher broadband penetration

NOT EXHAUSTIVE

		Explanation	Examples
Direct effects (ICT industry)	**Immediate value creation**	GDP contribution from direct investments in network	South Korea
	Multiplier effects	Impact of broadband investment on suppliers of equipment, content, etc.	Japan
Indirect effects (other industries)	**Foreign direct investments**	Foreign direct investments as a result of good ICT infrastructure	Argentina
	Productivity increases	More efficient business processes because of connectivity	Zambia
	Human capital formation	Increase in knowledge and skills as well as improved services through broadband	Bangladesh, Malawi, Rwanda,

Source: McKinsey

Second, broadband has a *multiplier effect* within the industry. In Japan, the rapidly rolled-out and now well-established 3G network has had a significant positive impact on upstream and downstream businesses and on neighboring industries that analysts expect to continue. Between 2008 and 2012, for example, applications such as mobile music downloads, mobile games, and mobile television – already at a comparatively high level of usage in Japan today – are forecast to grow at 6–9 percent annually.

Third, higher *foreign direct investment* (FDI) levels represent another way broadband fuels economic growth. Argentina's good infrastructure and fast-growing ICT cluster, for example, have been among the factors attracting investments from global players in industries that critically rely on the exchange of large amounts of data, such as Intel, Motorola, Oracle and Google.

Fourth, broadband – like ICT in general – has a positive impact on *productivity*, and this effect is not limited to high-tech companies and high-skilled labor. For example, the Manobi Development Foundation in Senegal today allows 40,000 farmers to use mobile data services to link to their larger customers and sell directly, tripling their average revenue. Similarly, hundreds of small-boat fishermen in Senegal already use mobile phones and the same platform to select the best ports for unloading their catches each morning, increasing sales by 30 percent. This system also includes GPRS-based SOS messages, which have saved many lives. Likewise, UNICEF's Ethiopia RapidSMS system monitors supplies to feeding centers, coordinates food distribution, and sends alert messages. Each of these applications could be even more powerful if their users had access to larger bandwidths through mobile broadband. Agricultural producers could, for instance, monitor prices or stocks in real time; citizens could save time and travel by accessing e-Government applications for administrative tasks; and civic organizations in developing countries could increase their reach through social network applications.

Fifth, and finally, we believe that broadband has significant societal implications that could over time outweigh plain economics, especially for developing nations. In essence, broadband can help to develop *human capital*, which can take the form of improved healthcare or better access to information and education. For example, Click Diagnostics is experimenting with providing cell phones equipped with macro-lens cameras and software to healthcare workers in South Asia and elsewhere, enabling them to take close-up images of a patient's eye or skin conditions. They then send photos and audio files via the network to regional doctors, who diagnose and reply within 24 hours.

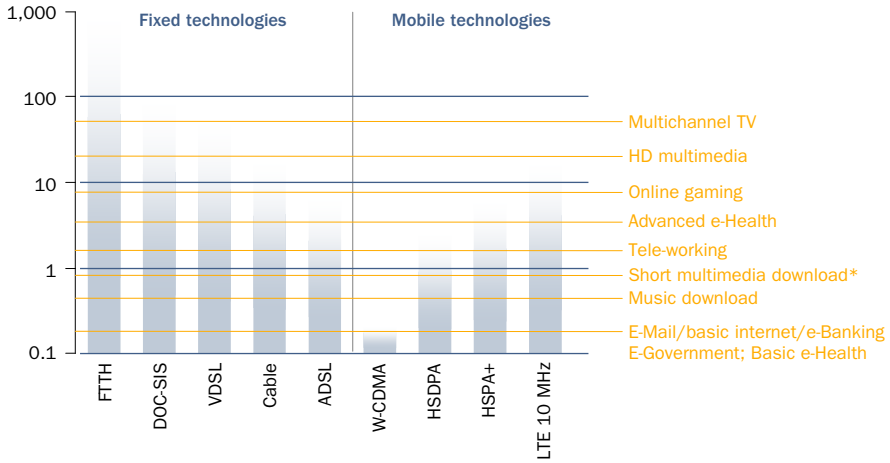
Mobile broadband can be economical to achieve broader service

While mobile broadband will not reach the connection speeds of all fixed-line service in the foreseeable future, it will be sufficient for the most important applications. Indeed, only the transfer of high-definition multi-media content will remain out of reach for mobile technology for the time being (Exhibit 3). The economics of mobile broadband, however, make it the most cost-effective solution for large areas in the developing world and capable of reaching up to 2 billion more users than wire line access.

EXHIBIT 3

Connection speeds of technologies and required for applications
Mbps (logarithmic scale)

INDICATIVE



* MPEG4 decryption
Source: OECD; analysis; equipment vendors; McKinsey analysis

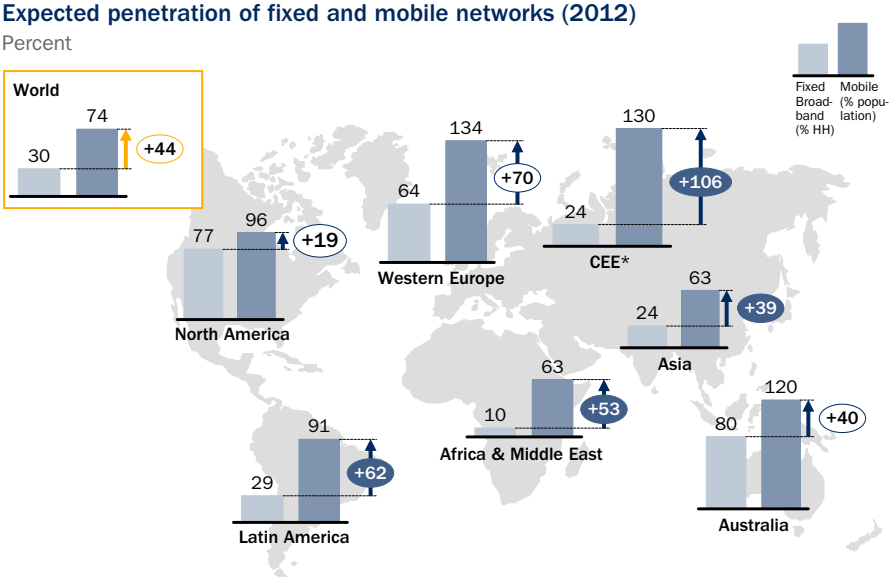
Fixed-line access service faces a number of barriers that will likely prevent significant new build-outs in developing countries, especially in areas where the required bandwidth is relatively low. For instance, many emerging markets have *poor existing copper infrastructure* to begin with, with an inherently inefficient structure (long loops, multiple joints). Frequently, the infrastructure faces deterioration due to *copper theft*. Additional roll-out can be cumbersome and expensive – not only does it require *physical digging* and the resolution of *right-of-way issues;* in lower-density areas it also needs a large field force for maintenance. On the demand side, *unreliable electricity services* can limit personal computer usage, thus reducing the consumer's ability to access fixed-line broadband.

Mobile networks, on the other hand, are forecast to achieve significant penetration levels in developing/emerging economies in the relatively near future (Exhibit 4). By 2012, for example, Central and Eastern Europe should achieve a penetration rate of 130 percent (i.e., multiple accounts per capita), Latin America should exceed 90 percent and Asia and Africa/Middle East should both reach nearly 65 percent.

EXHIBIT 4

Expected penetration of fixed and mobile networks (2012)

Percent



* Central and Eastern Europe

Source: Pyramid Research, Q3 2008; WCIS

Furthermore, mobile networks enjoy *scale and technology advantages*. In sparsely populated areas with lower bandwidth requirements, the economics tend to work better than those of fixed-line networks. As a later section of this paper will illustrate, the use of lower-band spectrum can greatly contribute to this cost advantage. *Greater spectrum availability* (e.g., through the "digital dividend") promises even more network capacity as 3G spectrum licensing spreads globally. Also, the costs for mobile networks and handsets continue to drop as scale increases. The industry had 2.2 billion subscribers in 2005 compared to 3.9 billion today, and the cost for a handset has dropped from USD 100 several years ago to less than USD 25 today. These trends tend to resemble the *Moore's Law*-driven paradigm of exponential growth in price per performance.

The magnitude of these effects will also depend on the degree of *standardization* that will take hold in the sphere of mobile broadband. Converging around standards will help operators, equipment manufacturers and regulators reap the full benefits of scale on a global level.

Because of these and other advantages, mobile broadband will be the only affordable solution for many rural areas of emerging markets that need only moderate per-user throughput. Both Saudi-Arabia and South Africa demonstrate the ability of mobile broadband to overtake fixed-line coverage rapidly. Saudi-Arabia, for example, had no mobile broadband but 57,000 fixed broadband subscribers in 2004. By 2008, the number of mobile subscribers had reached more than 3 million, eclipsing fixed broadband by over 2.5 times.

However, the success of mobile broadband in developing and emerging economies is by no means automatic. The economics are challenging, and both operators and regulators need to work hard to make it a success. The variable cost per megabyte still substantially exceeds that found in fixed networks, so margins per megabyte are typically lower than on voice, and operators around the world continue to innovate to develop value-creating businesses. In our view, operators have several options to optimize mobile broadband economics:

Smart pricing: While most operators have sophisticated voice pricing schemes that maximize the value from both marginal and high-end users, many price their data services using flat-rate tariffs and thus miss the marginal user segment while promoting heavy data use. In poorer countries, this leaves broadband out of reach for a large share of the population. Meanwhile, the examples above show that even lower-income groups can greatly benefit from mobile broadband and would be willing to pay a certain amount without expecting huge bandwidth or large data volumes.

Behavior shaping: Operators should design offers that shape the behavior of subscribers toward favored usage patterns. For example, they can move traffic outside of peak hours by lowering off-peak hour charges, in particular for non-business customers, or by promoting “light” bandwidth applications. Also, they can promote the use of handsets that feature successful applications and are adequate for the network capacity.

Device strategy: It seems likely that in developing economies the majority of mobile internet access will be from an internet-enabled handset and not from a plugged-in personal computer. Therefore, the industry needs to seek ways to bring down the price of handheld internet-enabled devices to affordable levels. For manufacturers, it opens an opportunity to capture the huge market for broadband-enabled ultra-low cost handsets (ULCHs).

Optimized network upgrade: Many new network options (e.g., HSPA+, LTE, or 700 MHz and 2.6 GHz spectrum) will become available in the coming years, and making the right trade-off decisions among technologies and spectrum bands can impact an operator's cost-to-serve by 40 to 50 percent. These decisions are highly operator-specific because they depend on factors like the current installed base, the number of base stations, customer profiles and frequency holdings.

We have discussed these challenges for operators and potential solutions in separate articles.[1]The rest of this paper will focus instead on how regulators could leverage the tools available to themselves to drive mobile broadband adoption.

[1] McKinsey O&T Recall 1: The rocky road to 4G, McKinsey O&T Recall 1: Building a Sustainable Wireless Carrier Business Model.

Mobile broadband economics are sensitive to the regulatory framework

The business case for mobile broadband is influenced by a range of resources and factors often governed by regulatory decisions (Exhibit 5). These regulatory decisions often require understanding and balancing trade-offs, e.g. between imposing coverage obligations and lowering costs to the industry. In our model of an archetypical developing country, a supportive regulatory regime produces a monthly per-subscriber cost for mobile broadband service that is up to 75 percent lower than that under the "base case" regime.

EXHIBIT 5

Impact of various regulatory levers on cost to serve for mobile broadband

SIMULATION RESULTS

Driver	From	To	Impact on cost to serve per subscriber* Percent
Spectrum availability	2.1 GHz	700 MHz	-40 - 50
Infrastructure/ spectrum sharing	No site/spectrum sharing allowed	Active site and spectrum sharing encouraged	-35 - 40
Coverage obligations	High coverage requirements	No coverage requirements	-25 - 35
Industry structure	5 players	3 players	-20 - 30
Spectrum/ license fees	Higher fee levels (USD 2.20 per MHz per population)	No fees	-15 - 30**

Total impact of up to 75% reduction in cost to serve

* Individual effects if implemented stand-alone – combined effect is less than sum of individual effects
** Highly dependent on time of payment and cost of capital applied
Source: McKinsey

Exhibit 5 shows the ranges for the impact of each tool, or lever, available to regulators. It is important to keep in mind that the actual effects in a particular market depend on the specific circumstances in that market (for example, industry structure, topology, population density), so the figures should be seen as indicative.

Spectrum availability, for example, drives the investment levels for mobile broadband coverage in two ways. First, the type of spectrum assigned determines the price and maximum reach of base stations and therefore the investment levels

needed to cover a certain area. Second, the amount of spectrum bandwidth allocated to a player sets the maximum capacity per base station.

Likewise, the introduction of *infrastructure sharing* can help operators reduce their capital expenditures, with the impact often strongest in rural and low-population-density areas.

Another key driver are an operator's mandated *coverage obligations* – overly extensive obligations will increase investment levels, leading to higher per-subscriber costs and higher market price levels. But without obligations, operators might be tempted to "cherry pick" areas. Consequently, regulators need to balance their desire to provide service across the country against the need to provide a sustainable business environment for operators.

The *industry structure* also plays a role, since a large number of competitors leads to lower market shares per player and can therefore increase investments per customer, making the rollout of mobile broadband in poor and low-density areas unattractive. So, the apparent benefits of higher competition with respect to prices, service levels or innovation have to be balanced with the need to establish operators with a sufficiently large customer base and capacity to invest.

Finally, *spectrum and licensing pricing decisions* affect the rollout of mobile broadband. High fees reduce the amount of resources operators can invest in infrastructure deployment, thereby sometimes limiting a company's ability to offer more affordable price levels.

Regulatory policy can make a difference

The economics laid out earlier suggest that regulators can influence the rate of development and adoption of mobile broadband. To promote significant mobile broadband penetration in poor and rural areas, policy makers could consider introducing a combination of enablers that will allow the industry to improve the economics to a level that could trigger higher penetration (Exhibit 6).

EXHIBIT 6

Potential options for policy makers to facilitate mobile broadband growth

NOT EXHAUSTIVE

Spectrum availability	• Make low-band spectrum available to reduce base station cost • Ensure allocation of sufficient contiguous spectrum (10 - 12 MHz) • Monitor and manage usage to optimize allocation • Guarantee neutrality of technology to ensure innovation
Infrastructure/ spectrum sharing	• Promote infrastructure sharing (tower/backhaul) to reduce network cost • Allow spectrum sharing/national data roaming to increase efficiency and reduce operational costs
Coverage obligations	• Provide incentives for roll out (e.g., regulatory concessions) • Encourage public-private partnership or grant separate licenses in rural areas to drive coverage • Provide public funding for remote areas to achieve sufficient coverage
Industry structure	• Ensure an economically viable number of players in the market • Allow industry consolidation if not market-distorting
Spectrum/license fees	• Charge cost-based spectrum/license fees to ensure affordability • Consider awarding licenses based on coverage, not financial criteria

Source: McKinsey

Spectrum availability: Low-band spectrum can drastically reduce the capital expenditures operators have to make for base stations, especially in rural areas, due to the greater coverage that lower spectrum provides. Compared to the 2.1 GHz spectrum, the use of the 700 MHz spectrum can decrease the required number of base stations by up to 65 percent while also improving the quality of indoor coverage. In the US, for example, the 700 MHz spectrum was made available last year. In Finland and Australia, the regulator has allowed operators to refarm the similarly advantageous 900 MHz spectrum from 2G to 3G use, enabling the fast spread of HSPA in rural and suburban areas. Other supportive activities include ensuring the allocation of sufficient contiguous spectrum (especially important as operators migrate to LTE, where contiguous spectrum significantly improves spectral efficiency), establishing ways to

monitor and manage spectrum usage, and guaranteeing technology neutrality to ensure innovation (although this, of course, needs balancing against the desire to standardize).

Infrastructure & spectrum sharing: Policy makers could consider, and perhaps even promote, infrastructure sharing among operators in selected areas. This is already a reality in India, where operators share 30 to 40 percent of all cell towers through passive infrastructure companies that multiple operators jointly own, maintain and expand as needed. Spectrum sharing can even enhance this effect. In Spain, Orange and Vodafone share 3G networks in rural towns, while T-Mobile and Hutchison began to share a nationwide 3G network in 2008 in the UK. Along the same lines, regulators could promote national data roaming to increase efficiency and reduce operating costs. In this case, a single operator maintains the entire network, which multiple operators then utilize via roaming agreements. Austria has a modified version of this arrangement, with Hutchison users roaming on Telecom Austria's 2G network when outside their coverage areas.

Roll-out obligation/incentives: Countries can create roll-out incentives in the form of regulatory concessions or other enticements. Japan, for example, awarded 3G licenses to major players at no cost, but the process achieved world-class coverage and services. Governments can also provide public funding, awarding subsidies to operators that achieve specific broadband coverage and quality of service (QoS) goals. India, for example, provided subsidies to operators rolling out mobile services in 11,000 sites that covered 50 million people in rural areas. Some countries encourage public/private partnerships to serve rural areas or confer monopoly status and favorable conditions on market players in rural locations. South Africa, for instance, gives special "Under-Serviced Area Licenses" that offer favorable terms to operators willing to enter specific rural areas. In light of the benefits of broadband for other public policy areas such as health or education, these programs might even be co-financed from other public governmental departments.

Industry structure: A larger number of operators does not always create incentives for higher penetration. India, for example, which has eight mobile operators in urban areas, has a mobile penetration rate of less than 30 percent. In contrast, Pakistan and the Philippines – with comparable income levels – boast

penetration rates of 55 percent and nearly 75 percent, respectively, despite having fewer operators. Regulation can play a role in fine-tuning the industry structure, so than an economically viable number of operators participates in the market.

License and spectrum costs: Our analysis shows that license fees can dramatically increase the ARPU operators require to break even. In one scenario that compared breakeven rates for a rural area with no license fees versus fees set at European levels, operators would require an ARPU nearly 40 percent higher under the elevated fee structure. The fees also have an impact on an enterprise's economic value, reducing it by almost 35 percent under the above scenario. Therefore, when setting their licensing and spectrum fees, regulators should consider the effect on the industry regarding the funds available for investments and the required price level to remain profitable. Regulators should evaluate multiple options for licence fees such as charging nominal fees in exchange for coverage commitments, or discounting fees if certain penetration or coverage targets are met.

* * *

Developing and emerging countries have clear tools and regulatory levers available to foster mobile broadband penetration, and, in the process, providing their citizens with value that far exceeds the mobile industry's own GDP contribution. While operators need to drive business model innovations to achieve high penetration rates and reach the population in poorer or rural areas, public managers are also called upon to step beyond the regulatory status quo, evaluate regulatory options, and provide a regulatory framework that supports mobile broadband – to the benefit of all.

Parc Einstein
Rue du Bosquet 19A
B-1348 Louvain-la-Neuve
www.mckinsey.com

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