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Connecting the world

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Ten mechanisms for global inclusion

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Contacts

Delhi

Ashish Sharma
Partner, PwC India
+91-124-499-8700
sharma.ashish
@strategyand.pwc.com

Doha

Bahjat El-Darwiche
Partner, Strategy& Middle East Ltd.
+974-44026-777
bahjat.eldarwiche
@strategyand.ae.pwc.com

Jakarta

Abhijit Navalekar
Partner, Strategy& Middle East Ltd.
+62-21-521-3885
abhijit.navalekar
@strategyand.ae.pwc.com

Paris

Mohssen Toumi
Partner, PwC France
+33-1-44-34-31-31
mohssen.toumi
@strategyand.fr.pwc.com

São Paulo

Ivan de Souza
Partner, PwC Brazil
+55-11-5501-6368
ivan.de.souza
@strategyand.br.pwc.com

Seattle

Mathias Herzog
Principal, PwC US
+1-206-398-3000
mathias.herzog
@strategyand.us.pwc.com

Shanghai

Sarah Butler
Partner, PwC China
+8621-2327-9800
sarah.butler
@strategyand.cn.pwc.com

About the Strategy& Digital Prosperity Project

The Strategy& Digital Prosperity Project brings together leading experts to provide thought leadership at the intersection of technology and economics. The project has developed measures of digitization and digital maturity to better inform policymakers and business leaders on how to use digitization to further economic and social progress.

The members of the project are: Bahjat El-Darwiche, Mathias Herzog, Rawia Abdel Samad, Jad El Mir, and Roshni Goel. Milind Singh was part of the project when he was with Strategy&.

Bahjat El-Darwiche is a partner with Strategy&, part of the PwC network, in Doha. He is the leader of the communications, media, and technology practice in the Middle East. He provides advice to policymakers and regulators in the areas of sector policy, regulatory management, sector development, socioeconomic impact, and public–private partnerships. He advises telecom and technology players on business development and strategic investments, corporate strategy, digitization, governance, operating models, and restructuring.

Mathias Herzog is a leader in the digital services practice and primarily focuses on technology, media, and retail sectors for Strategy&. Based in Seattle, he is a principal with PwC U.S. He advises clients on the shift from physical to digital and works with organizations to define digital and multichannel growth strategies. He has led strategy and transformation initiatives in North America, Europe, and Asia.

Milind Singh is the CEO and co-founder of Dosh, the first online platform that allows individuals to trade their credit scores. He was previously a principal with Strategy& and a member of the communications, media, and technology practice in the Middle East. He worked with policymakers, regulators, and operators across emerging markets, helping them navigate change and maximize their returns from digitization.

Rawia Abdel Samad is the director of the Ideation Center, the leading think tank for Strategy& in the Middle East. She was previously a manager with Strategy& in Beirut and a member of the communications, media, and technology practice in the Middle East. She has extensive experience in ICT policies, sector strategies, and impact assessment.

Jad El Mir is a manager with Strategy& in Dubai and a member of the communications, media, and technology practice in the Middle East. He works on strategy, business development, and transformation for communications, media, and technology clients. He focuses on customer-facing strategies, large-scale business transformations, and operating models. He has also formulated market-entry strategies, along with business and financial plans.

Roshni Goel is a strategist with over four years of experience working for clients in the telecommunications and high-tech sectors for Strategy&. Based in San Francisco, she is a manager with PwC U.S. Her expertise includes customer analytics, digital marketing, and product management.

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Executive summary

The Internet is one of the most transformational technological innovations in human history, similar to the invention of movable type, the electric motor, radio, or television. Yet today, only an estimated 2.9 billion people — 40 percent of the world's population — are online and connected to the digital economy. The Internet's truly revolutionary potential will be unleashed only when the remaining 60 percent are also connected. This will create millions of new jobs, develop vast new markets, and lift millions out of poverty. However, achieving universal access in a timely manner is looking increasingly difficult as Internet growth has slowed down in the past four years. This paper seeks to understand the challenges and identify mechanisms that can accelerate Internet growth and drive universal inclusion.

Internet access is enabled by three critical, interdependent markets, and structural challenges within them have caused the recent slowdown in Internet growth:

- The Connectivity Market — which seeks to provide affordable and reliable access
- The Content Market — which seeks to create relevant "use cases," reasons for people to go online
- The Retail Market — which acts as the sales and service arm for the Internet industry and helps people to discover the Internet

In this report, we identify 10 mechanisms — promising ideas, approaches, and technological and business-model innovations — that will address the structural challenges in these markets and generate faster Internet growth.

In the Connectivity Market, for example, data prices need to fall by around 90 percent, on average, to make the Internet universally affordable. However, this is challenging given that margins on data are already negative in many developing countries. Reducing data prices while increasing capacity to deal with ever-increasing data demand requires the Connectivity Market to use three mechanisms. The first is to modernize its technology base. The second is to rethink content

distribution. The third is to create more national and international data infrastructure, such as Internet exchange points (IxPs) and data centers.

The first mechanism, modernizing the technology base, is needed because the mobile industry in developing countries relies overwhelmingly on second-generation (2G) networks to carry data. In India, for example, around 70 percent of connections are on 2G networks. However, 2G is a two-decades-old technology that is slower than modern technologies such as Wi-Fi, third generation (3G), or fourth-generation Long Term Evolution (4G/LTE). Also, 2G is only one-fifth as efficient at carrying data. Yet, 2G occupies over 60 percent of spectrum resources available in developing countries. However, it is not profitable for operators to carry data along such networks given the low prices. Replacing 2G with 3G, or 4G/LTE, can bring about a 60 to 70 percent reduction in the cost to serve per megabyte (MB) and can make it profitable for operators to transmit this data. This mechanism alone can make the Internet more affordable for close to 2 billion more people.[1]

Still, replacing 2G is not enough. For this reason, it is critical to build decentralized content distribution networks, the second mechanism for inclusion. This is because developing countries lack the high-speed Wi-Fi networks that allow people to consume video-rich content. For example, average U.K. consumer usage on Wi-Fi is three times higher than usage on cellular networks.[2] In developing countries, such Wi-Fi networks do not exist, in particular because of the difficulty of transmitting this data between end-users and data distribution points such as nodes (known as backhauling). Instead, decentralized content distribution networks can distribute pre-provisioned content offline through a series of high-speed networks (e.g., Wi-Fi) that provide end-users with coverage and capacity. This mechanism will enhance affordability for a further 300 million people.

The third mechanism is to provide developing countries with more efficient and more nationally based IxPs and access to international Internet infrastructure. These provide the backbone of the Internet and enable data to be exchanged nationally and regionally. Without such infrastructure, a typical data packet in Africa has to travel eight to 10 times further before it is received by a content server than a similar data packet in the U.S. More IxPs and content delivery networks will provide end-users with a better, more affordable experience that could bring the Internet to another 170 million people.[3]

The Content Market needs to create more content that is local and based on utility services, but is struggling to find sustainable monetization models for such services. The failures of the Content Market need to be seen in light of increased bandwidth and consumption driven by the above-mentioned developments in the Connectivity Market. The unconnected will consume the content categories that the currently connected prefer, such as entertainment, search, and communication, if they have more affordable, high-speed Internet access.

There are three Content Market mechanisms that will attract more people online: providing more educational content, making it possible to obtain social services online, and promoting economic opportunity. These three mechanisms together can create an incentive for a further 200 million to go online.[4]

Education is one of the most important consumer purchases in developing countries. It is also an important reason to go online because so many traditional education outlets struggle to provide quality and reliability.

Targeted e-government services that allow people in remote or rural areas to undertake critical economic activities, such as land record management, will be another important reason for them to go online. Such e-government services are the only way that many of these people can access public services.

The final Content Market mechanism is economic opportunity. People will go online if there is content that boosts their productivity and expands the market that they can sell to.

The Retail Market needs to increase awareness of the Internet, while also supporting people coming online for the first time. However, it is struggling to develop beyond a product-selling mind-set.

There are three Retail Market mechanisms that can bring more people online by reducing the cost and risk of discovery: consultative selling channels, brand- or subscriber-subsidized access, and simpler value propositions. A further mechanism, innovative technology, will be required to allow the people who are most difficult to reach on earth, the last half-billion, to go online.

The first of these mechanisms, consultative selling channels, allows people to experience the Internet for the first time and creates awareness among the unconnected of the Internet's features and benefits. Learning centers are an important form of consultative selling. Learning centers can make people technology-literate through shared devices and pooled access. Consultative selling channels can bring another 200 million online.[5]

The second mechanism in the Retail Market is free or low-cost discovery of the Internet through brand- or subscriber-subsidized access. Brand-subsidized trials or subscriber-subsidized access allow people to experience and discover the Internet for free for a short duration. Introduced globally, such mechanisms could enable 500 million people to discover the Internet.[6] The third Retail Market mechanism is to offer simplified value propositions, like bundled access and content plans or "pay-per-app" plans. These can provide clarity to new users on the benefits of the Internet. They also make the distribution of Internet services easier in most markets.

The final mechanism for universal inclusion will be disruptive technologies that bring the hardest to reach online, the so-called last half-billion. These are people living in remote places without modern transportation, electrical, or retail infrastructure. Making these people Internet users will demand new paradigms of technology and business.

If governments, Internet providers, telecom operators, communities, and other stakeholders implement these new approaches, then we can connect the poorest of the world's population to the Internet and the modern economy. The result will be an Internet that looks very different from the one we see today in developed countries. It will rely far more on mobile devices in terms of data consumption, and will be more efficient at data transmission. It will be far more focused on education, social services, and income generation. It will also be more multilingual. The result will be growth, employment, and improved incomes for the 60 percent of the world's population whose ingenuity and industriousness is currently thwarted by their lack of connection to the Internet.

The case for universal access

The Internet is a powerful tool for development that provides benefits to individuals, communities, and countries alike.

Take the case of Matthew, a farmer in the city of Kasama, in northern Zambia. When Airtel and Facebook launched the Internet.org mobile app in the country, Matthew leveraged it to interact with experts and obtain feedback from them on the best ways to run chicken farms. He also used it to connect with potential buyers. As a result, his output has increased five-fold since he went online.[7] Cases like Matthew's are not unique nor are they found only in developing countries. The broader economic impact of the Internet was clear even during the recent global slump. In 2011, a year of relatively slow growth, digitization increased global output by an estimated US$193 billion and created over 6 million jobs.[8]

Transformative as the Internet is to individual lives and societies, it also creates new economic opportunities and disruptive companies. Take the example of the growth in China's e-commerce. In 2009, Alibaba adopted "Singles Day" as a much-hyped occasion for online discounting and shopping. In China, "Singles Day" is the November 11 (11/11) holiday on which young people exchange gifts and celebrate. On November 11, 2009, the first digital Singles Day, 29 percent of China's population was online; the company sold just $8.2 million of goods on its Tmall business-to-consumer platform. On Singles Day 2014, by which time 50 percent of the Chinese population was online, Alibaba's platforms sold more than $9 billion of goods in 24 hours — a 1,000-fold increase in five years. As a result, Alibaba's Singles Day sales in 2014 eclipsed the total combined online sales on all U.S. websites of the top five American online shopping days in 2014.[9]

The expansion of Internet activity in other developing countries could stimulate economic expansion, job growth, and poverty reduction on an unprecedented scale. To do so, we must broaden Internet access and deepen the level of engagement of those who are at best nominally connected. Based on an econometric analysis of 120 countries, we believe that achieving universal Internet penetration could expand world output by $6.7 trillion. For China and India this would mean combined incremental GDP growth by 2020 of over $2 trillion dollars. In addition, global inclusion could bring 7 percent of the world's

Transformative as the Internet is to individual lives and societies, it also creates new economic opportunities and disruptive companies.

population above absolute poverty levels — in effect providing 500 million of the world's poorest people new opportunities to grow and engage with the world (*see Exhibit 1*).

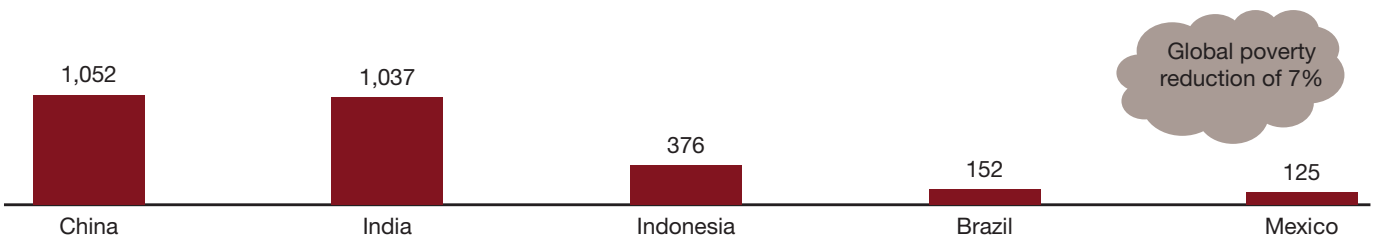
Of course, as more people from developing countries go online, the nature of the Internet itself will start to change. By 2020, if the mechanisms recommended in this report are implemented globally, there could be five Internet users online in developing countries for every user in developed countries — compared with the current ratio of two to one.[10] Thus, to achieve universal access in the next five years, the Internet will have to adapt to the consumption patterns of people in developing countries. The process of linguistic adaptation is already under way. It will be accompanied by marked cultural and economic alterations in the character of the Internet.

The different complexion of the Internet will also affect the corporate sphere. At the end of 1995, the market capitalization of the top 15 public Internet companies was $16.7 billion and all were from developed countries. By May 2015, when at best only 40 percent of the world was using the Internet, the valuation was $2.4 trillion. Eleven of the 15 in May 2015 were from the U.S. and the rest from China.[11] In the future, new companies will emerge in developing countries to provide new and locally relevant content and services. These companies will help to bring many of the unconnected online and will more effectively engage those whose Internet usage is often sporadic. The result will be the creation of several hundred billion dollars of additional value for shareholders and others, along with many new technology jobs in developing countries.

Exhibit 1

Universal Internet access would add substantially to GDP in major developing countries by 2020

Additional Cumulative GDP Growth from Achieving 100% Internet Penetration
(In US$ Billions [2014 dollars], Selected Countries, 2015–2020)



Note: Data based on a multivariate analysis conducted using a classic production function, with Internet penetration as a variable. Dataset across 120 countries for six years.

Source: The World Bank, World Development Indicators; Strategy& analysis

The barriers slowing Internet growth

In the developed world it is easy to imagine that we are entering an era of ubiquitous Internet access and universal usage. However, in the developing world the picture is less encouraging. Indeed, the global rate of Internet growth is slowing down. The percentage increase in the number of new Internet subscribers was in single digits in 2013 and 2014 for the first time, according to data from the International Telecommunication Union (ITU).[12] Some 4.3 billion people today, most of whom live in the world's poorest countries, are still not online.[13] Many hundreds of millions remain entirely unaware of the Internet and what it can do for them. Another worrying fact is that many of those already online are barely benefitting from the Internet. Many of today's 2.9 billion Internet users go online only occasionally. Some go online only once per year. For example, in South Africa 36 percent of those with online access use the Internet only weekly or less frequently.[14]

Viewed from an end-user perspective, three main barriers are slowing down Internet growth: affordability, infrastructure, and relevance. *Affordability* relates to cost. We use the Broadband Commission's definition of affordability: when the cost of basic broadband services is less than 5 percent of average monthly income.[15] *Infrastructure* is about being able to use proffered services. Although much of the world is covered by mobile telephony, data speeds are often too slow. *Relevance* is about content and the use cases that will attract people to discover, engage with, and habitually use the Internet.

Although much of the world is covered by mobile telephony, data speeds are often too slow.

The Internet.org report "State of Connectivity: 2014" assessed the quantum of challenges across each barrier, identifying affordability to be a key barrier across markets. The severity of the affordability problem depends on what assumptions we make for data consumption. The report assessed affordability based on average data usage of between 100 MB and 250 MB per person each month.[16]

However, for two reasons, we have used 500 MB per person per month in this report as the targeted usage level for developing countries. First, we assume that data consumption patterns in developing countries are likely to rise gradually toward the level of developed countries. In 2014, average data consumption in developed countries on mobile networks

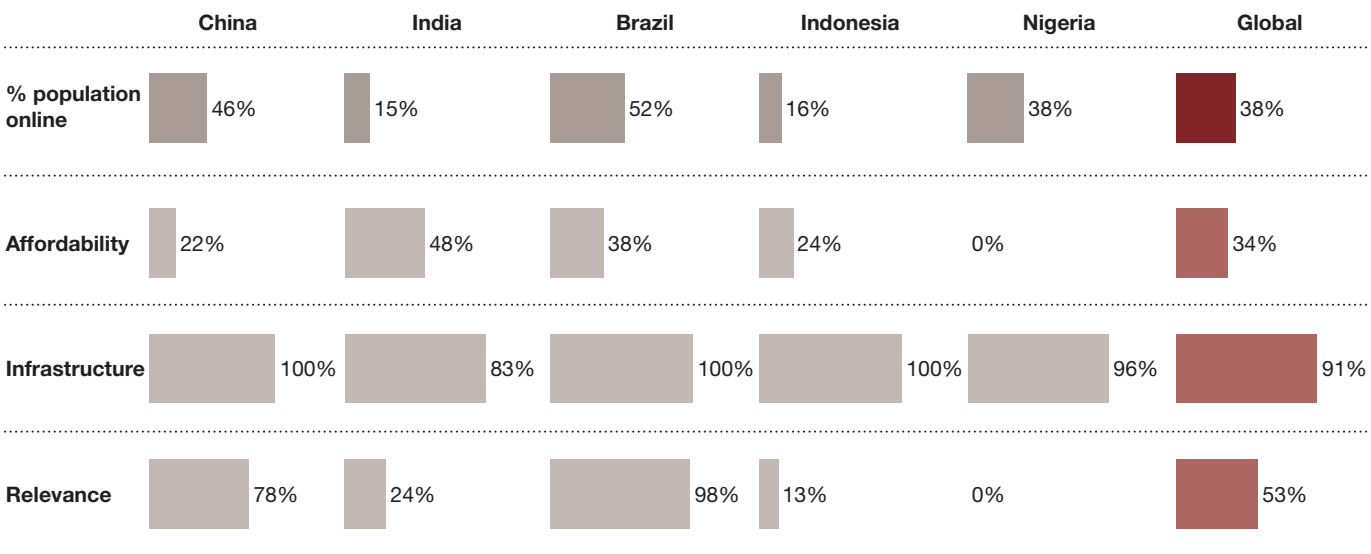
alone was around 630 MB per month and increasing.[17] Even this represents only a fraction of total Internet usage, because at least two-thirds of the total data consumed typically flows through Wi-Fi networks. The average user in a developed country consumes close to 2 GB per month of data.[18] Second, our 500 MB per month figure is based on a consumption analysis of a reasonable level of Internet usage (*see Appendix*).

We calculate that only 34 percent of the world would be able to afford the Internet at current prices with 500 MB per month of data consumption.[19] This level of data usage would make the Internet affordable to only 48 percent of India's population, 22 percent of China's population, and less than 1 percent of Nigeria's population (*see Exhibit 2*).

Exhibit 2

Affordability is the main barrier to Internet adoption when data consumption is 500 MB per month

% Population Able to Go Online because of the Following Factors, 2013



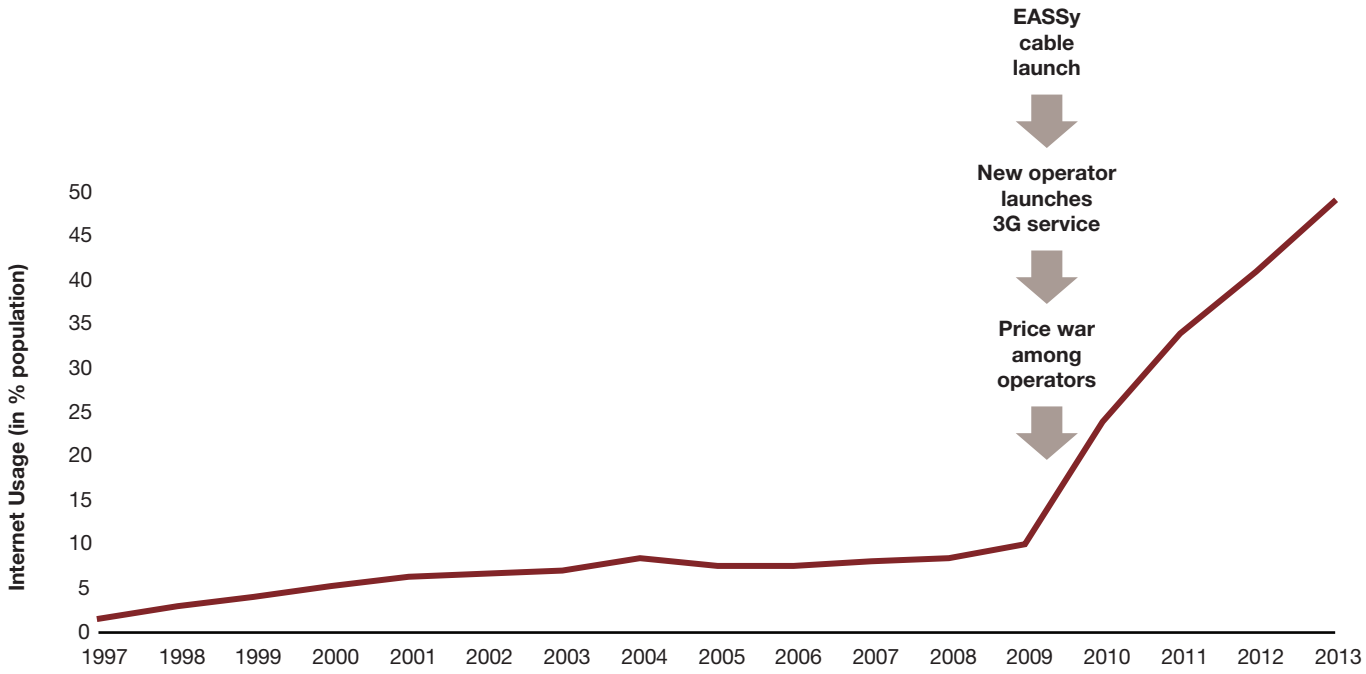
Note: In this exhibit, Affordability is defined as the percentage of the population for whom a 500 MB plan costs 5% or less of their monthly income; Availability is based on volume of content available on Wikipedia in local languages based on the population's primary languages, which for India and Nigeria excludes English; Accessibility is based on the World Economic Forum's GITR 2014 mobile network coverage rate.

Source: World Economic Forum; Strategy & analysis

Although all the barriers are substantial, affordability is probably the single most important of the three. Based on an analysis of 120 countries, we found that a significant reduction in prices was a common factor in all cases of very fast uptake of Internet services. South Africa provides an excellent example of how lower prices drive more Internet usage and how accessibility plays a supporting role. The country saw a sharp increase in the growth of Internet usage in 2010 after an aggressive price war among local providers, the introduction of 3G, and improved international connectivity. The launch of a major piece of international infrastructure, the Eastern Africa Submarine Cable System (EASSy), made accessibility easier and significantly reduced international bandwidth prices (*see Exhibit 3*).

Exhibit 3
South Africa shows that lower prices get people online

Internet Usage, Changes in Infrastructure, and Service Provision in South Africa



Source: The World Bank, World Development Indicators; Strategy& analysis

The three critical markets

These barriers to universal Internet access result from deficiencies in three broadly defined markets that are the foundation of the Internet: connectivity, content, and retail.

The Connectivity Market provides affordable, high-quality access to end-users. The Content Market creates relevant use cases that produce an incentive for people to come online. The Retail Market serves two purposes. First, it makes Internet products and services more available to people by selling connectivity vouchers, devices, and services. Second, it promotes awareness of the Internet and its benefits.

Connectivity

The market for connectivity, which provides an affordable, high-quality connection to the end-user, is largely served by telecom operators, Internet service providers (both wireline and wireless), satellite companies, and cable TV companies.

For global digital inclusion, the Connectivity Market needs to deliver in two areas: The first is to extend quality access to those not currently covered by high-capacity networks. This requires addressing some 50 percent of the world's population that lives outside the coverage area of a 3G network. 2G networks provide an extremely poor user experience for those going online as the typically realized speeds are less than 50 Kbps. In addition, investment will be required to improve the capacity and quality of data networks so that they can support new users consuming up to 500 MB a month. This roughly equates to a five-fold increase in network assets in markets such as India, which currently have low penetration and Internet usage rates.[20]

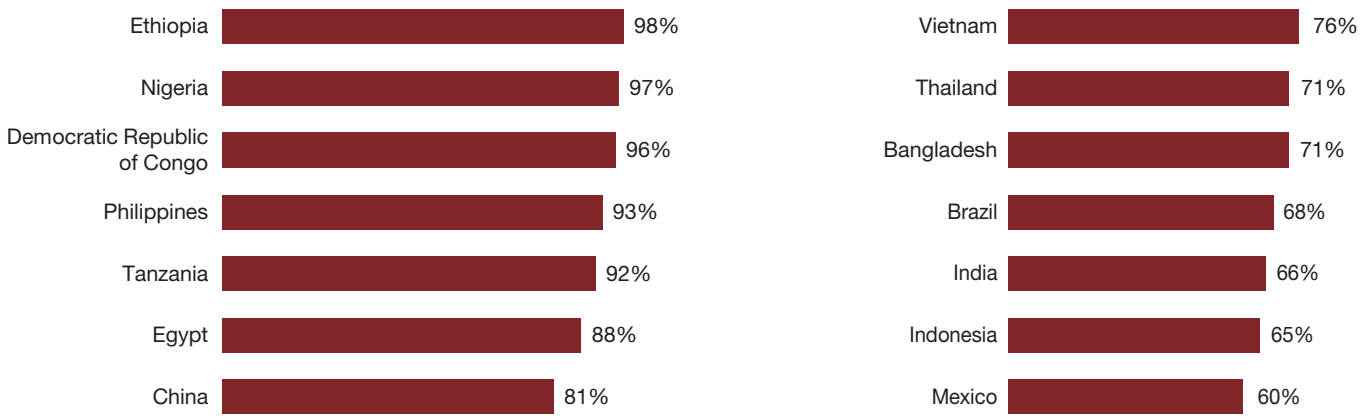
The second — and more important — area where the Connectivity Market needs to deliver is to reduce the average price of getting online. Prices need to drop by close to 70 percent of today's average retail price for 80 percent of the world's population (*see Exhibit 4*).

Barriers to universal Internet access result from deficiencies in three broadly defined markets that are the foundation of the Internet: connectivity, content, and retail.

Exhibit 4

Internet plan prices need to be slashed to achieve widespread affordability

Price Reduction Needed for the Internet to Be Affordable for 80% of the Population



Note: Assumes cost is less than 5% of gross monthly income, prepaid price in purchasing power parity US$ for 500 MB.

Source: Gallup; Google broadband pricing database; ITU; The World Bank, World Development Indicators; Strategy& analysis

Clearly there is a tension between the need to invest in network assets and the need to cut prices. This applies particularly to telecom operators seeking to monetize growing data volumes to earn sufficient returns on their investments. The challenge of balancing investment against profitability is particularly acute in developing countries. Operators in most of these markets already charge very low prices and have negative margins on data, which makes it difficult for them to cut prices further (*see Exhibit 5*).

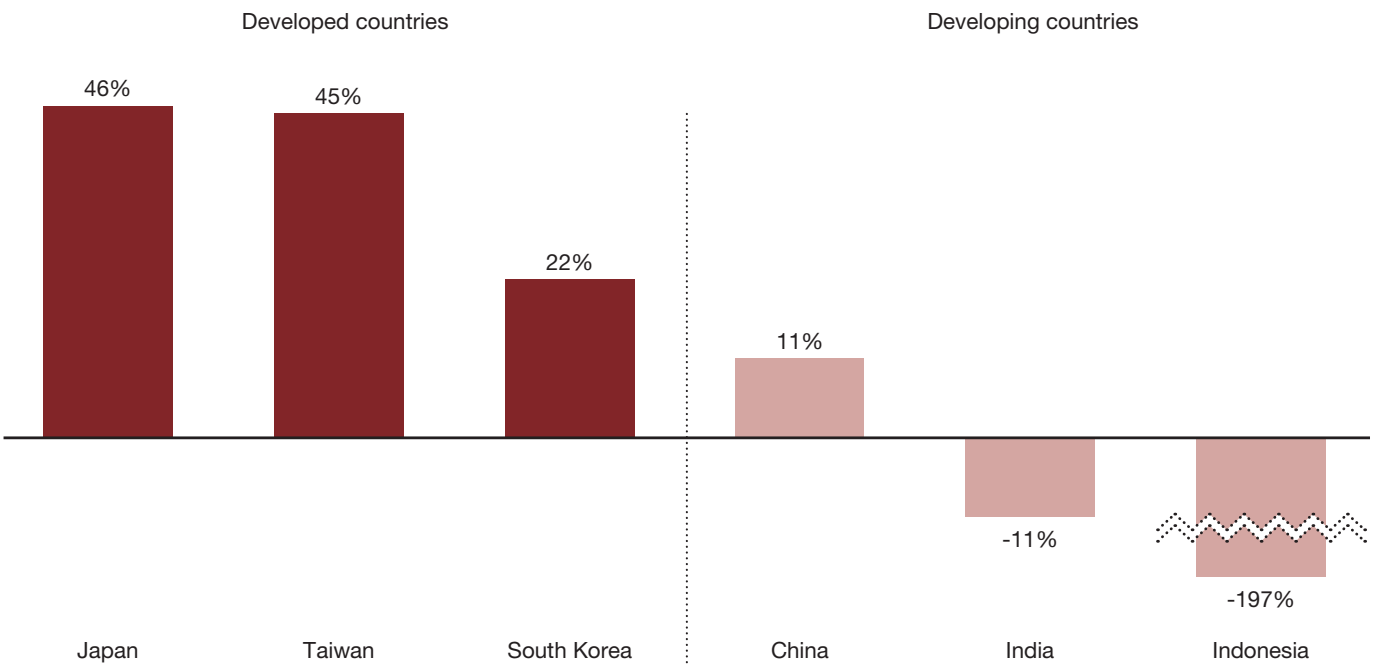
Content

The market for content, which creates reasons for people to go online, includes many global players with strong market positions, such as Facebook (social media), WhatsApp (communications), Google (search and email), Yahoo and Outlook (email), YouTube (entertainment), and Amazon (e-commerce).

Exhibit 5

Developing country telecom operators often have negative margins on their data sales

Implied Data Margins (Based on Current Pricing, 5-Year Capital Expenditure per Base Transceiver Station)



Source: JP Morgan analysis

However, the market for content is complex and fragmented. It is composed of numerous sub-markets including entertainment, information, utilities, business services, sharing platforms, and communications. Some of these sub-markets, such as sharing platforms and communications, are well-served by global companies. However, other content categories are significantly underdeveloped (*see Exhibit 6*).

Exhibit 6

The developing world has substantial gaps in entertainment, information, and business services content

Category	Proxy	Developing	Developed
Entertainment	Number of YouTube views per capita[1]	33	267
Information	Number of online newspapers per million population	1.9	12.0
Utilities	Government online service index	0.37	0.72
Business services	Internet retail share of total retailing	0.7%	4.3%
Sharing platforms	Facebook penetration of population	18%	41%

[1] From the inception of the channels until October 2014

Source: Entertainment: Socialbakers; Information: onlinenewspapers.com; Utilities: UN - eGovernment Survey 2014; Business services: Euromonitor (2013); Sharing platforms: Internet World Stats, 2012; Strategy& analysis

Content creators will have to address the more basic needs of the poorest consumers in developing countries to give these potential users reasons to pay for content. These needs are mostly about education, public services, and income enhancement. At present, many of these people have no incentive to pay for consuming entertainment or communication services online. However, according to a recent Vodafone report, farmers in India have improved their incomes by 5 to 15 percent by using online information services, which demonstrates that economic opportunity content is effective.[21] Similarly, consumers in developing countries tend to spend more of their income on education than those in developed countries, which is another important reason to go online.

To reach these poorest consumers, however, content creators need to overcome two main challenges: uncertain monetization models and a lack of popular awareness about the Internet. The main monetization obstacle is that digital advertising markets in developing countries are in their infancy.

Patient investors, with support from governments and organizations seeking social impact, need to provide support at the initial stages of content development to help monetize content creation. One means of overcoming the discoverability problem is to create platforms that widen the reach of content developers and that bundle precisely the services that are of the greatest utility to the poorest people.

Retail

The Retail Market is an important tool for driving awareness and supporting people as they become Internet users. Currently, telecom operators typically have large direct or indirect retail networks that sell vouchers for connectivity services in the poorest consumer markets. These retailers, however, typically have limited awareness of the Internet themselves, and lack the ability to help people get online for the first time. Such a product-centered approach does not work for consumers who have income of less than $4 per day on a purchasing power parity basis (often referred to as those at “the bottom of the pyramid”).

Research shows that these poorest consumers do not readily adopt new products. Rather, they look for assistance from a trusted source before they try new goods or services. As a result, retailers eager to reach these customers will need to use selling techniques that enable them to show someone how to get online. Moreover, they will have to articulate the compelling benefits and use cases that the Internet provides.

Ten mechanisms for energizing the connectivity, content, and retail markets

We have identified promising ideas, approaches, and technological and business-model innovations in each of these markets; in all, 10 mechanisms that can be applied to bring about universal Internet adoption. These mechanisms should significantly accelerate Internet adoption, bringing billions more people online. We recognize that there will remain a significant population of hard-to-reach individuals (likely the last half-billion), which will require new disruptive approaches to bring them online (*see "Mechanism 10: Disrupting for the last half-billion," page 37*).

Connectivity mechanisms: modernization, decentralization, and localization

There are three mechanisms for overcoming the clash between providing services at low enough rates to make the Internet more affordable, accessible, and available and monetizing data profitably: modernizing networks, decentralizing content distribution, and building more national and international Internet infrastructure.

Mechanism 1: Modernize networks

Network deployment, operations, and upgrades continue to be a significant part of the overall cost base for any connectivity provider. For licensed telecom players, these costs could be even higher given the need to secure expensive spectrum resources from governments. A typical licensed mobile operator spends between 40 to 50 percent of its overall costs on network infrastructure and spectrum resources. Some 60 to 70 percent of these network infrastructure costs arise from the so-called last mile of the network, which interacts with the end-user. For a licensed mobile player, the biggest determinants of last-mile costs are the radio technology and the spectrum bands.

From a policymaker's perspective, a successful transition to improved access technology means having a coordinated policy involving operators and the device industry. Such a policy involves managing a broad coalition of stakeholders, informing and educating the public, and implementing the changeover in a reasonable time frame.

In terms of the cost to serve, one way to make access technology cheaper is to reallocate the existing spectrum to more efficient technologies. At present, 2G, a two-decades-old technology designed for voice, has the largest share of spectrum in the world. Although 2G is very profitable for providing voice calls, the same does not apply to data (*see Exhibit 7*). This is because connectivity providers have very limited bandwidth that they can monetize. In addition, 2G throughput pales in comparison to newer technologies like 3G and 4G/LTE. The end-user experience is not good enough to support a meaningful Internet experience that would allow a user to engage in e-commerce, learning, or economic opportunity. Despite these shortcomings, 2G continues to take the lion's share of scarce spectrum assets globally (*see Exhibit 8*).

Exhibit 7
Extending 2G to serve data is not profitable

2G Voice and Data in Indian Villages

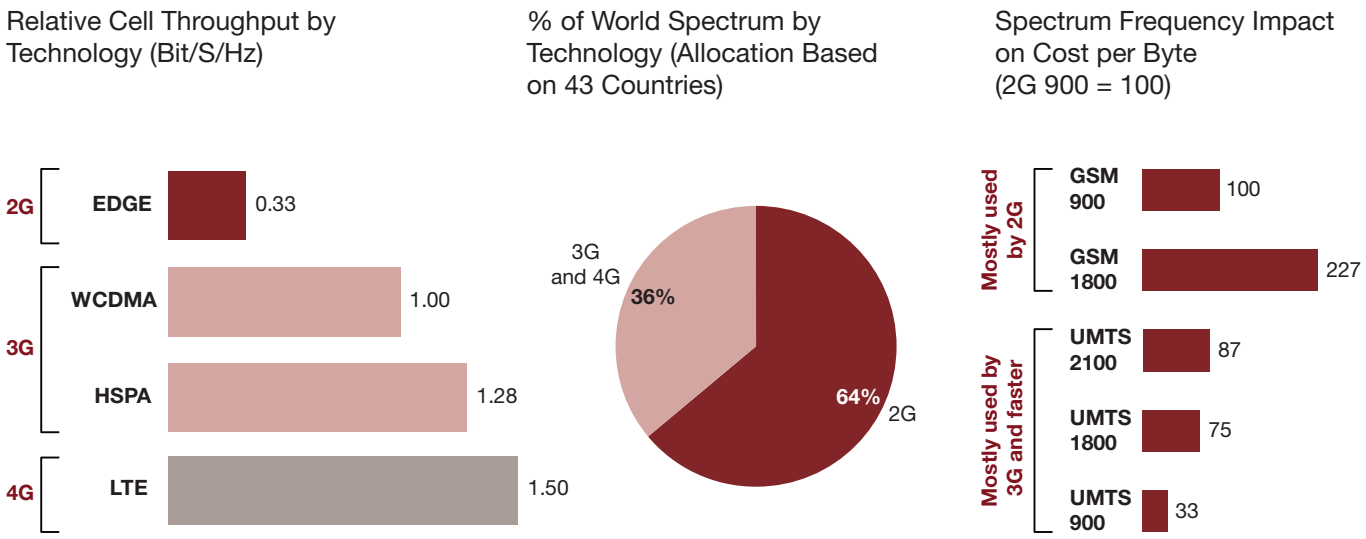
	2G Voice	2G Data
Monthly cost per site	Rs. 80,000	Rs. 80,000
Pricing[1]	Rs. 0.427 per min	Rs. 0.325 per MB
Revenue potential	Rs. 1.1 million	Rs. 66,800 (not profitable)
Number of subscribers with average consumption needed to break even	480	>1,000 (not profitable)

[1] Bharti ARPMB = 0.325 (2Q FY13); Bharti Voice ARPM = 0.427 (2Q FY13).

Source: Bharti Airtel annual reports; Strategy& analysis

Exhibit 8

2G technologies have the least throughput but occupy the most spectrum, the Internet's scarcest resource



Source: spectrummonitoring.com; Strategy& analysis

Upgrading from 2G to 3G or 4G/LTE and leveraging existing spectrum bands dedicated to 2G (especially 900 Mhz) has the potential to reduce costs by 60 percent. It will make data pricing sustainable and potentially cut data prices in multiple markets. The challenge is to do this in a cost-effective manner, given the significant investment associated with undertaking such an upgrade. This mechanism will have the most impact as it can bring some 2 billion people online.

This is already starting to happen in developed countries such as Australia, the U.K., and the U.S. Some operators are switching off their 2G coverage completely to better use scarce spectrum resources, such as AT&T in the U.S. and Telstra in Australia. True Corporation in Thailand is repurposing one frequency for 3G that was previously used for 2G, thereby shifting subscribers to a faster speed. Similarly, Vivacom Bulgaria was able rapidly to cover 99 percent of the population with 3G by deploying the technology on an existing frequency that had previously been allocated to 2G. Vodafone Romania was able to provide Internet access to 90 percent of that country's population through the same method.

A number of factors are slowing the move away from 2G. One reason is that some policymakers still mandate specific usage for spectrum bands, making it difficult for operators to change how they use them. Another reason is that in several developing countries, there are too many players using too few 2G bands to be able to provide meaningful amounts of data throughput. A third reason is that operators are reluctant to be the first mover, given the large installed base of 2G devices that they might lose if they upgrade their networks to 3G.

Of course there are benefits to operators as well from a 2G shift. Deploying data networks on lower spectrum bands (e.g., 900 Mhz as opposed to 2100 Mhz), for example, is cheaper given wider coverage and better indoor penetration for lower frequencies. In addition, an improved data experience reduces churn on developing operators' networks and better positions them to deal with rapidly growing data consumption.

A multi-stakeholder approach could be the way forward. Government support to enable the move away from 2G handsets to more data-ready handsets is critical. The policy environment needs to enable operators to alter how they use the spectrum. In addition, operators need tax and other incentives to invest in 3G upgrades. This is because considerable capital expenditure will be incurred to replace already depreciated 2G networks. Third, supporting non-licensed connectivity players like wireless service providers creates the right competitive environment to accelerate the replacement of old technologies. These are typically smaller and more nimble and willing to take risks. In developed markets, alternate service providers such as cable companies are creating the pressure for modernization. These firms are often small or non-existent in developing countries.

Mechanism 2: Decentralize content distribution
Modernizing the last-mile data technologies reduces the overall cost structure for operators and creates better data experiences for end-users. However, it also creates a backhauling challenge in many developing countries. Backhauling is when end-user traffic is aggregated at the service node and then transferred to a high capacity "core" network that then carries it to its desired destination.

In developed markets, backhauling is enabled by high bandwidth fiber networks or occasionally wireless backhaul networks. In most developing countries, these networks cannot provide enough backhauls. This is because their capacity was designed to carry limited amounts of voice traffic and not high-bandwidth, low-latency data traffic.

In addition, as end-user demand for data increases, operators' costs will increase exponentially unless they can find means to put the traffic through other delivery mechanisms, such as large-scale offloading onto Wi-Fi networks.

One way to deal with the lack of adequate backhaul networks is decentralized content models. These can create a vital mechanism to make the Internet affordable for another 300 million people.

Even in developed countries, consumer behavior suggests a more nomadic rather than truly mobile consumption of the Internet. Heavy consumption such as "binge watching" occurs when people are stationary, whether at home or the office, and through Wi-Fi. In a decentralized model, by contrast, developing country users will be able to download entertainment and education at discrete times and consume a fair portion of their content offline and on the move. What this means is that they will not be tied to data networks that strain under the pressure of high demand and low capacity. This actually makes the Internet more mobile.

Decentralized solutions could alleviate pressure on the always scarce spectrum by routing data through other delivery methods. These distribute content through retail procurement points, such as Wi-Fi hotspots that act as content repositories. These procurement points connect only periodically to a central server through satellite or high-speed data connections to update or refresh content. However, they broadcast continually to local users through Wi-Fi. Users can thereby access the content they need from the hotspot whenever they want without clogging the distribution system. Such an approach creates opportunities for content creators and distributors to design for people to search and download while online and then to consume offline.

Decentralized solutions could alleviate pressure on the always scarce spectrum by routing data through other delivery methods.

Developed country experience shows that Wi-Fi is an efficient technology for off-loading data from the spectrum. It improves access in a cost-effective manner and provides users with a good-quality customer experience. Wi-Fi reduces the need for operators to build network capacity continuously and to have high-speed connectivity available throughout their network.

Already, YouTube is experimenting in India with similar methods. People can download videos into a YouTube app on their devices when they are connected to a Wi-Fi network. They can later watch the video offline, thereby preventing bandwidth-hungry videos from using streaming data connections.[22]

New business models can also increase content distribution, take advantage of lower price capacity from operators, and provide cheaper and faster Internet connections for users. For example, SoloView, a device manufacturer in Nigeria, is using an approach that bridges markets for connectivity and retail. The company launched a platform called ContentHotspot, supplied by KIORA, which offers over 1,000 hours of local and international content, including news and movies.[23] Users access the content in a KIORA Content Zone, a Wi-Fi hotspot, thereby avoiding the consumption of valuable 3G bandwidth. Full-length movies can be downloaded in two to three minutes, and they expire automatically after 48 hours.[24]

Governments can also play a role by expanding their existing Wi-Fi hotspot initiatives. For example, México Conectado (Mexico Online), an initiative of the Mexican federal government, aims to provide Internet access at 250,000 public sites by 2018, a substantial increase on the roughly 65,000 locations currently connected through Wi-Fi hotspots.[25] These public places include parks, schools, health and community centers, municipalities, and libraries.[26]

Mechanism 3: Build more national and international Internet infrastructure

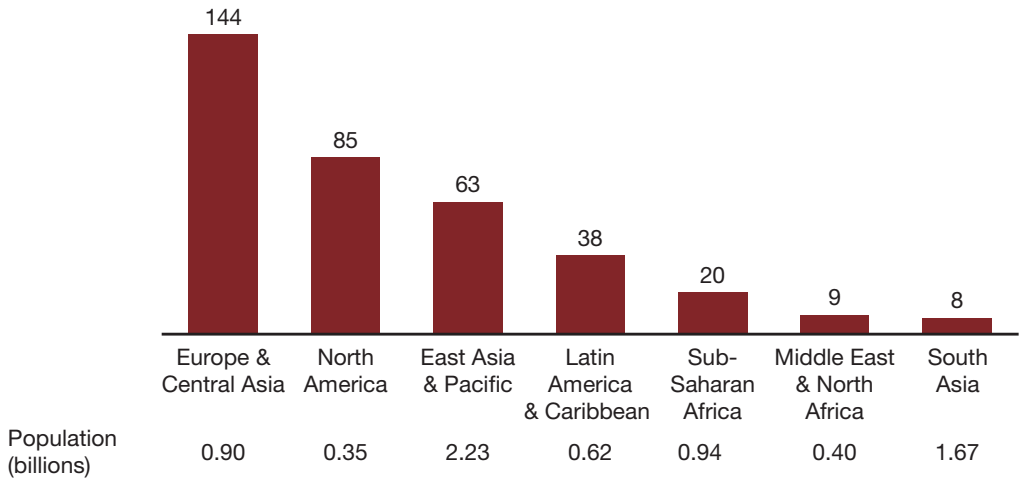
The third way to enhance the connectivity market is to build more international and national Internet infrastructure with data centers and IxPs. These speed up data transmission and improve its quality. There are currently 134 IxPs in developed countries, compared with 77 in the developing world.[27] We calculate that this lack of IxPs in the developing world means that a typical data packet in Africa has to travel eight to 10 times further before it reaches a content server than a similar data packet in the U.S. This extra travel creates a poor user experience. The developing world requires over 200 more IxPs to reach the same level of IxPs per million users as the developed world. More national IxPs and content delivery networks will reduce the need for extra local infrastructure such as content servers, thereby providing end-users with a better, more affordable experience. Building more national infrastructure so that developed and developing countries are on a similar footing can bring the Internet to another 170 million people by the end of 2020.[28]

A typical data packet in Africa has to travel eight to 10 times further before it reaches a content server than a similar data packet in the U.S.

Improved international infrastructure, which connects multiple countries to the Internet more efficiently, increases capacity and reduces costs per user, which means improved affordability and accessibility. Indeed, there is an established correlation between international Internet bandwidth per capita and Internet penetration. For example, the entry into service of two IxPs, the EASSy and SEACOM Africa submarine fiber optic cables, provided East Africa with 13.4 terabits of data per second. As a result, the price of fixed broadband in Kenya decreased from 261 percent of monthly gross national income per capita in 2008 to 60 percent in 2010. The same cost ratio fell in Mozambique from 312 percent to 60 percent, and in Tanzania from 174 percent to 50 percent. Although the costs of fixed broadband remain above the affordability level of 5 percent, these are impressive reductions.

A virtuous circle is thus created as faster connectivity leads to an acceleration in Internet adoption, which in turn allows people to create more locally hosted content and services. For example, the growth of residential Internet in the Argentine province of Neuquén, where the first provincial IxP was established in May 2011, has comfortably outstripped the national average.[29] Across the world, more IxPs mean more people online (*see Exhibit 9*).

Exhibit 9
More IxPs mean more people can go online



Source: ITU; Packet Clearing House; The World Bank, World Development Indicators

Content mechanisms: education, social services, and economic opportunity

As the Connectivity Market improves and the unconnected are offered a higher-speed, more-affordable Internet, they will adopt many of the preferences of users in developed countries. Their adoption rate of platforms such as communication, entertainment, search, sharing, and video will resemble those of users in developed countries. In general, however, the new content will need to be about edification along with gratification. Mechanisms that provide three additional content categories will play a critical role in attracting more people online — education, social services, and economic opportunity. These three mechanisms together can create an incentive for a further 200 million to go online.[30]

An important consideration in building this new content will be to address the critical challenges confronting existing sectors such as education, public services, health, and income generation. All of them are limited by being in bricks and mortar, limitations that the Internet can help them to overcome. At the same time, content that provides economic opportunity will bring more people in the developing world online. Such content will make the Internet more available and, as the volume of content grows and becomes economically self-sustaining, it will also become more affordable. Although health is a critical reason to go online in many developing countries, it will remain a low-frequency use case if it is not supplemented by actual physical delivery of services. This constraint does not apply to education, e-government services, and income generation.

Mechanism 4: Fulfill the need for education materials and services
Content producers can help people in developing countries by providing them with the education materials and services that they need. Online content is attractive as traditional materials and services can be expensive and unreliable. For example, in developing countries the quality of teaching is often variable and teacher absenteeism is frequent.[31] Consumers in developing countries are also willing to pay for education materials and services. According to a 2013 Credit Suisse consumer survey, consumers in India and China spent 15 percent of their incomes on education for their children.[32] A more recent Credit Suisse study reported growing purchases of online education in the largest developing countries; with 16 percent of Chinese, 10 percent of Brazilian, and 7 percent of Indian respondents having taken Internet courses in 2014.[33]

One means of creating content is for education authorities to move essential materials online. Textbooks can be prohibitively expensive. Poor families sometimes use out-of-date versions to avoid paying for the most recent editions. Education agencies and content providers can ensure that even the poorest families have access to the latest material at affordable prices by digitizing textbooks and other materials. They can make the material available through shared access devices at schools or through subsidized devices.

Another method is to offer simple-to-use supplemental education tools such as online parent-teacher interaction, preparation materials for national examinations, and language courses. Amazon, for example, has recently signed a contract with the Brazilian Ministry of Education to work with the National Education Development Fund to digitize and distribute textbooks to schools across Brazil. The initiative has already begun to digitize more than 200 textbooks and distribute them to hundreds of thousands of Brazilian educators through Amazon's Whispercast e-book sharing tool.[34]

Content producers can help people in developing countries by providing them with the education materials and services that they need.

Mechanism 5: Improve social services offerings
Government services in most developing countries tend to be stretched, due to the lack of resources and the significant infrastructure challenges of delivering services to remote areas. Visits to government offices can be expensive and time-consuming. Given these problems, digital government services have emerged as a key use case in developing countries. In India, for example, more than 130,000 villages are covered through the Indian government's Common Services Centres Scheme. These centers provide government services such as identity documents, business services such as mobile plan top-ups, financial services, education services, and weather and soil information for farmers.[35] In some of these villages, access to government services is the only form of Internet available to most customers.

Expanding e-government services, especially social services, is an important motivator for people to go online that governments should promote aggressively. E-government services tend to reduce transaction costs in terms of time, money, and hassle compared to their physical counterparts. Examples of such services are the smart cards that now allow Egyptians to receive bread subsidies.[36]

In addition, government moves to create digital identity services and infrastructure offer further incentives for people to get online. One example is the Estonian government's creation of a unique digital identity for each citizen. These identities are now embedded in mobile SIM cards, and since inception had been used more than 376 million times by mid-September 2015.[37]

Mechanism 6: Provide economic opportunity
Beyond education and government services, content can prove a powerful means of attracting people to the Internet if it can enable or enhance income generation. Indeed, the Internet in developing countries can be a powerful economic tool for individuals and small companies. For such approaches to succeed, however, they must move away from existing methods, which tend to provide static information. They should instead be improved and made more widely available by significantly boosting quality and timeliness, and by enabling people to participate in a wider range of markets.

Esoko, a Mauritius-headquartered company that enables African farmers to monitor markets and obtain better prices for their produce, is one such example. The company also allows other stakeholders — such as non-governmental organizations (NGOs), development finance institutions, and governments — to profile and survey farmers so that they can establish a better understanding of market players. The farmers, in turn, can register directly to receive localized information. Esoko operates models that provide services to NGOs, governments, and mobile operators.

Amardesh Eshop in Bangladesh is a startup that provides both more information and larger markets to small producers. Amardesh Eshop acts as an electronic marketplace that connects rural producers and urban buyers. Farmers, handicraft makers, and entrepreneurs are able to sell a wide variety of products, including vegetables, fish, spices, clothing, and arts. Amardesh Eshop arranges delivery and payment.

Retail mechanisms: consultative selling, discovery, and the value proposition

There are three main mechanisms to enhance the power of the Retail Market to connect more people: building more consultative distribution channels such as learning centers, reducing discovery costs, and simplifying the value proposition. These mechanisms will overcome the Retail Market's fragmentation and tendency to sell products rather than engage Internet users. They will promote awareness of the Internet and its benefits, while supporting those who are learning the basics about the Internet and who in many cases are encountering it for the first time.

The fact that most of the unconnected are extremely poor and live in rural areas complicates matters. It is very difficult to get the attention of those at the bottom of the pyramid and to convey to them clear and compelling reasons to go online. The poorest tend to buy goods and services from distribution networks that sell multiple products, from telephone plans to pots and pans. Or the distribution systems belong to telecom operators whose goal is to sell their products and services to those who are already aware of ICT and the Internet.

Mechanism 7: Build more consultative distribution channels
Consultative marketing is one of the most effective ways of overcoming the wariness of the poorest about the Internet. This approach allows those who are nervous about paying for a new service to seek advice and education. It provides them with the validation and trusted external input they generally seek before buying any new goods or services. Such consultative, or "high-touch," marketing models have been critical for success in selling goods and services to consumers at the bottom of the pyramid. The most famous high-touch example, which began over a century ago in the U.S., is the Avon representative. In many cases these marketing approaches use agents to go to customers rather than having the customers come to them. This technique has been very effective for the financial services and consumer goods industries. High-touch marketing raises awareness about offerings, educates and trains customers, and reduces transaction costs. Consultative sales channels could bring another 200 million online.[38]

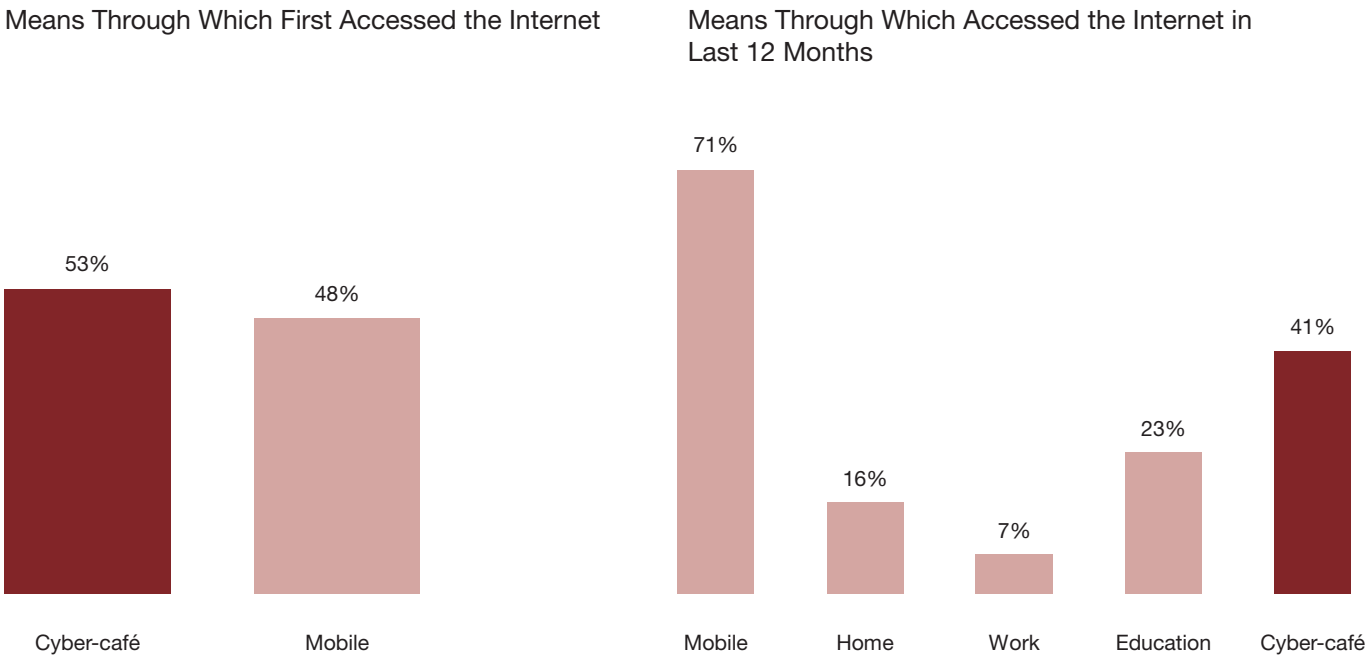
In many places, the local community can provide the assurance and support for those connecting for the first time. Moreover, the community can also provide people with a reason to go online. One large-scale consultative marketing program is Hindustan Unilever's Project *Shakti* ("empowerment"). This rural distribution initiative employs over 65,000 entrepreneurs selling products in more than 165,000 villages to more than 4 million households.[39] The Project *Shakt*i approach could be copied and scaled up to connect people to the Internet.

In some cases, consultative selling and new content overlap. In India, the delivery of e-government services is outsourced in rural areas to village entrepreneurs, who receive a service fee from the government. These village entrepreneurs act as high-touch distributors of the Internet, provide an outlet for e-government services, and bring people online.[40]

Learning centers are an additional consultative sales channel at the community level. In many developing countries, for example, cyber-cafés allow people to discover the Internet and act as learning centers (*see Exhibit 10*). They act as schools for digital literacy, enlightening the unconnected about the Internet and its benefits. They host shared devices and provide pooled access. The costs associated with these centers can be made more bearable if they are set up and managed by community entrepreneurs. These local businesspeople can be supported by governments, brands, or NGOs. The technological aspects can be simplified by providing standardized packages of equipment, software, and connectivity that are easy to install and support, in effect "community learning in a box."

Exhibit 10

Cyber-cafés as learning centers play an important role in allowing people to discover the Internet in Ghana, Kenya, and Zambia



Source: Research ICT Africa – South Africa Survey

A successful example is the rural knowledge centers in Sri Lanka run by village-level entrepreneurs known as Nenasalas. These are multi-stakeholder initiatives enabled by government, the community, and private companies. Nenasalas have found widespread acceptance in communities. A 2010 survey highlighted that 88 percent of community members believe that the Nenasalas improve the state of ICT in their society, and 90 percent believe they have positively contributed to their livelihoods.[41]

Mechanism 8: Reduce discovery costs
Many of those at the bottom of the pyramid cannot afford basic Internet services. They do not have the time to learn about the Internet and cannot see what benefits paying for these services can provide. To overcome these problems, stakeholders should seek ways of lowering these costs through brand alliances or subsidies. Introduced globally, such mechanisms could enable 500 million people to discover the Internet.[42]

The most plausible approach is for brand tie-ups with consumer packaged goods manufacturers and financial or health organizations. These brands and organizations are already actively promoting their products in rural areas where the poorest live. Such enterprises are often interested in corporate social responsibility programming that will enrich their customers. For example, Hindustan Unilever created a free radio-on-demand service, Kan Khajura Tesan, for villages in India that are "media dark" (where traditional media have little coverage). From a marketing and brand awareness perspective, Kan Khajura Tesan has been a tremendous success and has won awards.[43] It has over 41 million subscribers and is India's most rapidly growing media outlet.[44] The villagers gained access to news and entertainment, both important reasons to go online. They are also now more closely connected with the rest of India.

Mechanism 9: Simplify the value proposition
Operators and other providers need to combine reasons to go online with lower access costs to attract the poorest to the Internet. The current value proposition separates these elements, which makes going online both costly and risky. People have to buy access first and then find a use case. There is no reason for the poorest to commit a tranche of their income up front to go online without knowing whether they will find services that appeal to them.

Furthermore, the way in which operators charge for data access can baffle consumers. People understand the charges for a three-minute telephone call. By contrast, the charge for 1 MB of data is less understandable given that consuming it can last five minutes (e.g., browsing low-bandwidth-enabled websites) or 30 seconds (e.g., watching live streaming video).

Some operators are attempting to bundle content with access packages that redefine the value proposition.

Some operators are attempting to bundle content with access packages that redefine the value proposition. Airtel India's Rupee One store offers short videos, music, and photos with no extra charge for bandwidth.[45] The cost is one rupee per download. Such an approach also uses bandwidth more efficiently, and is known as a "sachet model" because people consume little packets of data, in much the same way that they buy small, affordable packets of shampoo or soap. The store has successfully helped over 5 million people discover the Internet, giving them a reason to go online and a clear value proposition for doing so.[46]

Another method is to associate the price paid with the value of the content experience. This breaks the link with raw data consumption. For example, the Finnish technology provider Pryte (acquired in 2014 by Facebook) allows people to pay by app usage rather than by the megabyte. People without a data subscription pay to access an app without having to sign an expensive long-term contract.[47] Such an approach is easy to understand and cost-effective for users who need only essential apps. Operators can install a "pay-per-app" platform on all new devices to allow more users to benefit from this mechanism.

Mechanism 10: Disrupting for the last half-billion
An additional mechanism will be disruptive technology for the last half-billion people who live in areas without modern transportation, electrical, or distribution infrastructure. The last half-billion will be last to experience the benefits of the Internet. Connecting these people requires new technological and business-model paradigms. Connectivity for these markets will most likely be provided by a combination of non-terrestrial technologies and ground-based networks. Proposals include unmanned aerial vehicles that connect to a ground terminal, which then distributes Internet connectivity to end-users at a much lower cost and higher quality than is viable for current terrestrial-based networks.

The market for content in this segment will likely be high in user-generated and rich-media content, because language and literacy will be a challenge. Retail markets as we know them are less likely to play a role in this segment, but we may see approaches like the village entrepreneur programs launched by Unilever's Project *Shakti* and others to deliver products and services to end-users.

Although the primary focus for these innovations may be to reach the last unconnected half-billion, those who are already connected will also benefit. Technological breakthroughs for the last half-billion will be used to improve the quality and efficiency of connectivity for those who already have access to the Internet.

Building the Internet of the future

The Internet of the future will differ in meaningful ways from the Internet of the past. The changes that will connect billions of the poorest to the Internet will also reshape it. As we surmount the market barriers that are slowing the global expansion of the Internet, people will connect, engage, and communicate in different ways. Moreover, as the global center of economic activity shifts to the South and to the East, so too will the norms that govern Internet usage.

Streaming live video on mobile devices through expensive, fast data networks will give way to access through distributed networks that connect to fast data pipes only periodically. As more and more new users find the Internet and discover its benefits, they will be accustomed to offline consumption of content. They may well consider the decentralized model of delivering content, rather than constant high-speed connection, to be the norm.

We will also see a shift toward content, value, and economic activity from developing countries. Affordable connectivity, relevant content creation, and enhanced distribution channels will lead to the creation of billions of Web pages in dozens of languages whose current online presence is minimal. The new users will be less motivated by the desire for entertainment and diversion than they will by a desire for information and services that educate, boost their productivity, and enable the functioning of micro-enterprises. There will be a growth in e-commerce that sources from, and sells to, the bottom of the pyramid. Although entertainment will remain important, it will acquire a different character as more and more regionally and locally generated material appears online.

Universal Internet access is one of the fundamental challenges of our time. The economic and social benefits will transform lives and communities across the developing world. The most important change, however, may well be a new global sense of community. Today, 40 percent of the world's population can communicate and interact online. Tomorrow, if the drive to provide genuinely global access succeeds, the Internet will truly be a world wide web.

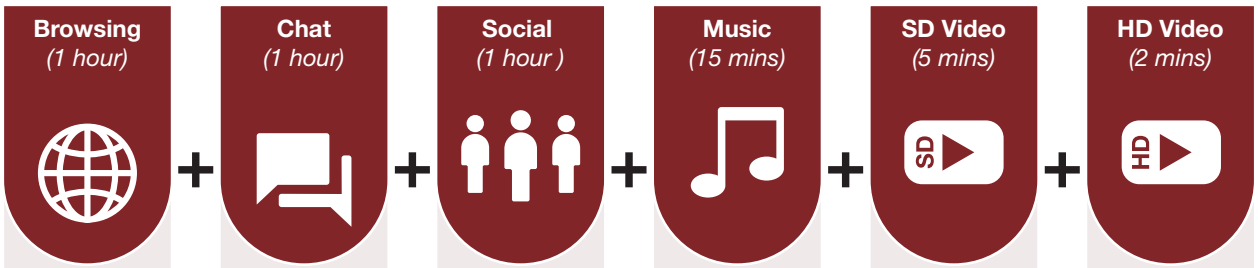
Appendix

Our estimate of the targeted usage level for developing countries is based on one or two online sessions per week, composed of a mix of browsing, audio, and video. We have used the example of India, where Internet usage is growing but many are disengaged and many more remain unconnected (*see Exhibit 11*).

Exhibit 11

In India, monthly and weekly usage patterns are affordable until users access music and video daily

Affordability by % of Population According to Incremental Data Consumption



	Browsing (1 hour)	Chat (1 hour)	Social (1 hour)	Music (15 mins)	SD Video (5 mins)	HD Video (2 mins)
Once a month	~100%	~100%	~100%	~100%	~100%	~70%
Once a week	~100%	~100%	~100%	~100%	~70%	~10%
Daily	~100%	~100%	~70%	~40%	~2%	<1%

Note: Affordability is maximized by optimizing price plan based on data allowance and days of plan validity. For example, using a total of 40 MB many times over one month is more costly than using 45 MB in one session in a month. Data consumption is assumed as follows: browsing 1 hour = 2 MB, chat 1 hour = 0.3 MB, social media 1 hour = 2.5 MB, music 15 minutes = 15 MB, Standard Definition video 5 minutes = 25 MB, High Definition video 2 minutes = 240 MB.

Source: Airtel; Gallup; Google; ITU; Verizon; Strategy& analysis

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