Broadband Everywhere

Media Implications of Internet Access for the Next Three Billion

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Introduction

In February 2018, a rocket launched by Elon Musk's company, SpaceX, placed a Spanish radar satellite named Paz into orbit. While the launch itself was uneventful, there were two significant stowaways on board: a pair of small prototype communications satellites, Microsat-2a and Microsat-2b.[1] SpaceX plans to use information from these prototypes to build Starlink, a network of communications satellites intended to provide broadband services across the planet.

There are currently about 800 functioning communications satellites in orbit, providing services across the globe.[2] SpaceX has permission from the FCC to launch 11,943 Starlink satellites in the next few years, and the constellation is scheduled to be completed by 2025.[3]

In the 25 years since the World Wide Web appeared with the launch of the Mosaic browser, about half the population of the planet has gained access to the internet. In the next three to five years the other half will be gaining access.

Starlink is just one of several large projects involving a new generation of communications satellites that will provide broadband services across the planet over the next few years. Other non-satellite technologies, such as high-altitude balloons and solar-powered drones, are being developed by Google, Facebook, Airbus, and other major players. These will also help extend broadband to parts of the planet currently unreached by the internet.

In the 25 years since the World Wide Web appeared with the launch of the Mosaic browser, about half the population of the planet has gained access to the internet. In the next three to five years the other half will be gaining access. That second half of the planet's population, notably, is the "poor half", with most of the three billion or so future internet consumers currently living on less $2.50 per day.

The impact of internet extension in developing countries will be profound. Broadband will bring many services that have thus-far been unavailable to a major segment of the world's population, including information access, distance education, online banking, health services, and government programs. It will also, of course, bring many challenges, including fraud, misinformation, and hate speech.

With respect to media, the impact on the next three billion will be especially significant. In developed countries the internet has completely transformed the media landscape. In the remote, rural areas of developing countries soon to be reached by broadband, there often is no media landscape to transform. Broadband will introduce true third-party media for the first time to billions of people over a few short years.

The extension of broadband into developing countries represents a dramatic opportunity for global media organizations. This includes commercial media, but also government news sources, development agencies, humanitarian groups, and other organizations active in poor and rural areas. Never in history have so many new users been introduced to media in such a short period of time. And as is the case with any powerful technology, the expansion of broadband will bring many opportunities and numerous perils for new media audiences.

In this paper, I describe the current state of broadband and media, including where the boundaries currently lie for global media. I discuss some of the most consequential new technologies that will be responsible for a rapid expansion of broadband in the coming years, and I review the potential timelines these new technologies may follow. I consider the major implications for broadband expansion, based in part on experience in developing countries which are recently online. Finally, I propose a number of recommendations for media organizations that are intended to better prepare them for new markets.

Broadband is coming to the other half of the planet. Media organizations that recognize the speed and reach of this expansion will enjoy major new and positive opportunities.

Current Status of Broadband Coverage

Although there are numerous ways to define and measure broadband availability, most research efforts conclude that about half the planet now has reliable, affordable access to broadband. The other half soon will.

What Is Broadband?

The term "broadband" typically refers to an internet connection that is always on with high data connection speed. Anyone with broadband has persistent access to the internet. (In this paper I also periodically use "bandwidth" and "connectivity" to mean persistent access to the internet.)

In developed countries broadband access comes as a mix of wired connections to computers and wireless connections through WiFi, and fast cellular networks. The internet is accessed through laptops, tablets and smartphones.

In developing countries, broadband access is primarily wireless, accessed through cellular networks via smartphones.

Different organizations use different data connection speeds in defining broadband. The FCC, for example, defines broadband as exceeding speeds of 25 mbs downstream and 3 mbs upstream. The ITU, UN and others use lower benchmarks. The definitions matter when reporting on broadband extension across the planet, although any persistent internet connection – even if halting – represents a major step forward for communities coming online.

According to the UN's State of Broadband 2018 report,[4] 49.2% of the world's population would be online by the end of 2018 with reliable, affordable broadband access. Regions obviously vary greatly: Europe is 80% online, Africa only 22%.

Other studies provide similar findings. The World Economic Forum, working with the International Telecommunications Union (ITU), states in its working pa-

per "Connecting the Unconnected"[5] that 47% of the world's population is online (meaning about 3.9 billion people are still offline).

A number of complementary studies provide more granular analyses of the status and trends of online connectivity.

The impact of internet extension in developing countries will be profound, since broadband will bring many previously unavailable services, such as information access, distance education, online banking, health services, and government programs. It will also, of course, bring many challenges, including fraud, misinformation, and hate speech.

Tufts University, in cooperation with MasterCard, has developed a Digital Evolution Index (DEI)[6], which ranks countries based on their progress in digital development. The DEI includes 60 countries evaluated across more than 100 different indicators. In its main ranking, the DEI compares overall digital development to recent digital progress in order to see which countries are innovating and improving most quickly.

The 2017 DEI report identifies a number of "break out" developing countries that are showing great progress in connectivity, including China, Bolivia, and Kenya. It also identifies some "watch out" developing countries where progress is halting, including Egypt, Pakistan and Peru. In other words, as global connectivity increases, it races forward in some regions and progresses only fitfully in others.

A separate organization tracking global connectivity is Huawei, the Chinese networking company. Huawei releases an annual Global Connectivity Index (GCI),[7] which looks at 40 indicators for 50 countries. The countries in the index represent 78% of the global population and 90% of global GDP.

The 2017 GCI report notes that while the metrics are climbing globally overall, there is wide divergence. Countries in the index tend to cluster into three groups: Frontrunners (average per capita GDP $50,000); Adopters (per capita GDP $15,000); and Starters (per capita GDP $3,000). Progress across these groups varies widely.

It is important to note that while these analyses refer to broadband access, mostly through smartphones, a far higher percentage of global population already has access to voice networks through simple feature phones.

There are currently about seven billion cell phones on the planet, about the same number as humans on the planet (although penetration obviously varies greatly — from 240 phones per 100 people in Hong Kong to less than 10 in many regions of Africa). According to a recent Facebook study of 75 countries, 94% of the overall population had access to 2G networks (which are sufficient for voice and texting), while only 76% had access to 3G (data) networks or better — and many of those networks are still very expensive to use.[8]

The fact that most of the planet has access to simple cell phones is significant, however, because once people have basic phones it is often a natural progression to start moving into more capable smartphones. This transition, which about half the planet is now going through, is a true game changer. Simple phones are convenient for calling, but smartphones, which provide full access to online information and services, represent a major opportunity for those now coming online.

Current Challenges to Expanding Broadband Access

The biggest challenge currently confronting the expansion of global broadband is that most of the regions not yet covered are rural and poor. It is often prohibitively expensive to lay fiber optic cable (or any cable) in rural regions. Cell tower coverage is less expensive to provide, but it requires a critical mass of paying customers to make the economics viable. Cell towers are generally placed several miles apart, or closer. The fixed cost of cellular infrastructure limits the regions that cellular networks can serve.

To complicate things further, the next generation of cellular technology, called 5G, is optimized for rich countries and cities. It allows for a huge number of high-speed connections (in anticipation of the "Internet of Things" — where everything is hooked to the internet), but it is very expensive to deploy. So, while current cellular infrastructure is expanding, it faces both economic and technical obstacles and will likely never reach all areas of the planet.

There are other current hurdles to internet adoption. Those obstacles, as outlined by the International Telecommunications Union in "Connecting the Unconnected," include:

- **Power:** Many of the poorest people on the planet don't have electricity, a prerequisite for internet access;
- **Cost:** 57% of the world's population can't afford internet access as offered;
- **Education:** Only 44% of the world's population has a secondary education or higher — a clear predictor of internet usage;
- **Relevance:** Many people in the poorest countries don't see the relevance of online services (and may grow to be actively opposed to the internet).

In summary, internet access is expanding, but it faces headwinds.

Approaches to Expanding Broadband

Expansion of Cellular Services

Despite economic challenges, cellular coverage providing broadband access continues to expand, particularly in certain regions. The most dramatic current example is in India, where the world's largest extension of cellular coverage is taking place.

The Indian telecommunications firm Jio is radically disrupting cell phone markets in the country through heavy investments in infrastructure and by providing data and cell phone services that are almost free.

As the story goes, a few years ago a Yale college student was home visiting her father during a school break and complained about the low-quality internet in their house.[9]

The college student's father, Mukesh Ambani, is chairman of Reliance Industries, a petrochemical consortium in India, and the country's richest person. As he tells it, his daughter's complaints, as well as his country's poor internet infrastructure overall, inspired him to launch Jio and promptly spend $35 billion building out a high-speed 4G cellular network across India. Jio built 200,000 new cell towers and laid 150,000 miles of fiber optic cable in about two years.

In 2016, Jio opened the network to consumers, offering free phone calls, free texting, and six months of free data, after which data charges were about one-fourth industry average. Usage skyrocketed, both in terms of subscribers, now over 200 million, and data usage, which is now the highest in the world for any telecommunications company.[10]

In 2017, Jio introduced the "JioPhone", a hybrid feature phone / smartphone that takes advantage of 4G data speeds. Among other features the phone comes preloaded with 500 streaming TV channels and music in 17 languages. The phone is essentially free: it requires only a $23 deposit, which is reimbursed with the return of the phone.

Josh Woodward, Group Product Manager of Google, who has led teams building new web services in India, says that thanks to Jio and the JioPhone, "hundreds of millions of users are now going to come online faster than all the models projected."[11]

At the moment, there are 800 million Indians who still don't have access to the internet – but they will soon. Recently Mukesh Ambani claimed his network was still only at 20% capacity. He said, "we are determined to connect everyone and everything, everywhere."[12]

Expansion of Fiber Optic

Cellular networks typically connect users in the "last mile," but the backbone of broadband connectivity is fiber optic cable. And like cellular coverage, the expansion of fiber optic cable is steadily moving forward in developing countries.

Fiber optic cable proliferated throughout the developed world at the end of the 20th century. The first transatlantic fiber optic cable, called TAT-8 (for "Transatlantic cable #8"), was constructed in 1988. A rapid extension of cables of higher capacity followed.

Progress has been slower for developing countries. In Africa, for example, the first fiber optic connection only arrived in 2000 with the SEA-ME-WE3 cable, which stretches from Germany, through the Red Sea, to India, Southeast Asia, and Australia. That cable connected to Egypt and Djibouti.

Meaningful connections to Africa didn't appear for another decade. Since 2010, however, every year has seen logarithmic growth in capacity. Current capacity to

all of the countries of East Africa is approximately 24 terabits per second (Tbs) over multiple cables, a figure soon expected to grow to nearly 90 Tbs due to the completion of a major new cable (DARE). West Africa's capacity is approximately 45 terabits per second, a figure soon to expand to nearly 200 terabits per second due to the completion of three new major cables (SAIL, SACS, EllaLink).[13]

New cables not only introduce capacity, they also introduce redundancy. Undersea cables are periodically damaged unintentionally, such as during the commercial shipping incident that caused an outage in all of Somalia in 2017.[14] With a new web of connections, outages will be less prolonged and severe.

At the same time that undersea cables are proliferating, hundreds of projects are underway to lay cable across the continent itself.

Liquid Telecom, which operates the largest fiber network across Africa, has laid over 50,000 km of cable.[15] In 2017 Google laid about 1,000 km of cable in Uganda, and it is currently laying 1,000 km more in Ghana.[16] Facebook plans to add nearly 1000 km of cable in Uganda.

With added capacity comes added competition — and lower prices. Nic Rudnick, the chief executive of Liquid Telecom, estimates that the price of moving a megabit of data from London to Lagos has dropped over several years from $600 to $2.00.[17]

Expansion of Internet Exchange Points

Fiber optic isn't the only technology expanding quickly in Africa and other developing regions. There are many other technologies playing consequential roles behind the scenes.

One such technology, viewed as critical by network engineers, is the proliferation of Internet Exchange Points (IXPs) in developing countries. An IXP serves as a country-level or regional gateway between different networks, obviating the need to send traffic to distant regions or countries in order to be routed correctly. In other words, IXPs provide local shortcuts for internet traffic, which greatly lowers cost and latency.

According to the UN's State of Broadband 2017 report[18]:

> *According to Packet Clearing House, 24 more countries established a new IXP over the twelve months between mid-2016 and mid-2017 (of which eleven were African). By mid-2017, 119 ITU Member States now have IXPs, compared with 76 ITU Member States which do not. The total number of IXPs in ITU Member States globally is 471."*

The African countries that recently added IXPs were Benin, Botswana, Burkina Faso, Côte d'Ivoire, Rep. of Congo, Madagascar, Malawi, Mozambique, Rwanda, Sudan and Zimbabwe. This increases the total number of African countries with IXPs to 29. The EU has 145 IXPs. The US / Canada have 84. Step by step developing countries are narrowing the gap.

New Broadband Technologies: Stratospheric Balloons

Despite progress with cellular coverage, fiber optic penetration, and other supporting technologies such as IXPs, the poorest and most remote regions are still years away from broadband access using traditional technologies. For this reason, a number of major efforts are underway to research, develop and deploy new complementary technologies.

For example, Google has been investigating the use of high-altitude balloons as a way to provide broadband coverage, and it is beginning to roll out services in Africa. The Google initiative, called Loon[19] (short for "balloon"), uses balloons launched into the stratosphere — about 18 kilometers up — to form an aerial wireless network that provides coverage similar to cell towers. The oblong balloons, filled with helium, are about 50 feet across and 40 feet high. They are made of a translucent, silver material and carry, dangling about 80 feet below, a payload of communications equipment, solar panels, and batteries.

The promise of the Loon project is to provide significantly cheaper cell coverage: A single balloon can deliver the same coverage as many dozens of cell towers. With this technology, poor or low-density populations across the planet can now become economically viable markets for telecommunications firms.

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Initially, Loon had assumed the balloons would simply ride the major wind currents eastward, resulting in a "necklace" of balloons circumnavigating the planet. However, with experience, and with wind mapping and forecasts provided by the National Oceanic and Atmospheric Administration (NOAA) and other international agencies, Loon discovered it can find winds in appropriate directions to navigate to any destination (or stay more or less stationary) just by adjusting the elevation of a balloon. The balloons have an inner envelope filled with helium and an outer envelope that ingests or expels air as ballast. (The Loon staff has named the fan unit that manages this air exchange "Franz," after the Saturday Night Live character, because it wants to "pump you up.")[20]

The company now manages navigation and placement of the balloons through complex data analysis and artificial intelligence technologies, requiring relatively few balloons to provide extensive coverage.

The initiative, active since 2008, has tested balloons on six continents, logging over 26 million kilometers around the world. Many balloons stay aloft for over 100 days; the record is nearly 200 days.

In 2017, Loon provided more than 200,000 Puerto Ricans with free cellular services following widespread outages on the island after Hurricane Maria.[21] Earlier that same year, Loon provided emergency cellular coverage in Peru following a disastrous flood.

Now Loon has signed its first commercial client, Telkom Kenya, to provide 4G internet access to rural parts of the country that are currently without broadband.[22] Loon expects the network to launch in 2019 and is currently navigating technical and regulatory details with Telkom Kenya, the Government of Kenya,

and international bodies. Once Loon is operational, users in Kenya probably won't be aware of it. They'll simply see a signal on their cell phones from Telkom Kenya, and they'll access calling and data services as they would anywhere else in the country that has traditional cell tower coverage. Most people will probably never even see the balloons, which look like tiny silver specks when they are flying in the stratosphere.

If Loon is successful in Kenya, there are many other telecom companies around the globe in line to be logical future partners.

New Broadband Technologies: Stratospheric Drones

Other companies are tackling the broadband challenge with different technologies. Facebook, for example, shares Google's goal of connecting the next three billion users and has experimented with giant solar-powered drones to provide bandwidth to rural and remote regions around the world. The drones, part of Facebook's "Project Aquila", fly at 60,000 feet (about the same as Loon balloons) and are designed to be aloft for months at a time.

The vision for Aquila had been to have a fleet of Facebook drones communicating among themselves by laser as well as with ground stations. In June 2018, however, Facebook announced it will stop manufacturing drones and leverage the aircraft development of aerospace firms now entering the space.[23]

Airbus, for example, recently set a new flight-endurance record of 26 days with its solar-powered drone called Zephyr S.[24] The drone charges its batteries by day, flying at an altitude of about 60,000 feet. At night, batteries power two small electric motors as the drone makes a slow descent to about 50,000 feet. By day the drone climbs back to 60,000 feet. Airbus will soon be launching a larger drone, called Zephyr T, used for bigger payloads than previously possible, including communications equipment to provide broadband to remote regions.

New Broadband Technologies: Low Earth Orbit Satellites

The technology that is likely to revolutionize broadband extension into rural areas in the most comprehensive way is satellite, specifically a new generation of small, low earth orbit (LEO) satellites currently being developed and deployed by a number of companies.

Like other forms of technology, satellites are getting faster, smaller, and more powerful. At the same time, launch capabilities are getting much less expensive.

These significant developments open up new opportunities. What if instead of placing a few dozen really large, expensive satellites into geosynchronous orbit, we could place thousands of small satellites in orbits very close to earth?

Quick Primer on Satellites

- There currently are about 1,700 operational satellites in orbit. This includes satellites dedicated to communications, earth observation, navigation, space science, research, and other topics.

- About 800 satellites in orbit today are for communications.

- Communications satellites are often placed into geosynchronous orbit, about 36,000 kilometers above the equator. At this altitude a satellite orbits the earth in 24 hours, appearing to remain stationary over one point. That greatly simplifies communications, because antennas can continuously point at one spot in the sky.

- Geosynchronous communications satellites are very expensive to design, build, test, launch, and deploy, costing, in some cases, over one billion dollars. Time from design to deployment can be many years. The satellites can be as large as a small bus.

- Because geosynchronous communications satellites are so far away, a signal takes over half a second to get there and back — an eternity in today's hyperconnected world.

A number of companies are sprinting in that direction. The most consequential — because of reputation, technical prowess, and launch capabilities — is SpaceX.

SpaceX plans for its new Starlink constellation to include nearly 12,000 satellites. These satellites will operate close to earth — generally within about 1000 km in altitude. Prototype satellites are already in orbit, with operational satellite launches set to begin in 2019 and roll out over about five years. Limited service would be available globally in 2020 or 2021 from the initial 800 satellites. The FCC license received by SpaceX requires that half of the satellite constellation be launched within six years and the rest within three years after that.[25]

Low earth orbit satellites can be much smaller and offer internet latency periods of 25-35 milliseconds, equal to or better than many cable and DSL systems. Because Starlink satellites will be much closer to earth, the coverage area of any given satellite will be relatively small — a circle with about a 1000 km radius — requiring a large number of satellites in the network. The service will principally serve individuals and small businesses who employ a laptop-sized user antenna. SpaceX is promising "fiber speeds."

SpaceX plans to launch the full complement of nearly 12,000 satellites by 2025. Internal SpaceX documents estimate that in 2025 its launch business might represent $5 billion in annual revenue, while global communications services might represent $30 billion in annual revenue (based on 40 million subscribers). The global launch business is much smaller than the global telecommunications business — by more than an order of magnitude — so SpaceX is motivated to expand into

telecommunications as a lucrative, adjacent market.[26]

Gwynne Shotwell, president of SpaceX, commented after the initial launch of the prototype satellites:

> *Although we still have much to do with this complex undertaking, this is an important step toward SpaceX building a next-generation satellite network that can link the globe with reliable and affordable broadband service, especially reaching those who are not yet connected.*[31]

SpaceX isn't alone in the race to satellite-based broadband — or even leading it. OneWeb, which received FCC permission before SpaceX, plans to launch 648 LEO satellites and have initial service available to Alaska beginning in 2019. LeoSat has plans for 108 satellites. Iridium has deployed most of its 66 next-generation satellites (with the help of SpaceX launches). The $3 billion Iridium upgrade, replacing a legacy system of 66 satellites, will be complete in 2018.

The technology that is likely to revolutionize broadband extension into rural areas in the most comprehensive way is satellite, specifically a new generation of small, low earth orbit (LEO) satellites currently being developed and deployed by a number of companies.

One firm has already implemented satellite broadband using a small and growing network of medium earth orbit (MEO) satellites. O3b Networks (now part of SES) currently maintains 16 satellites at an altitude of 8,000 km, which is about one fourth the distance of geosynchronous competitors. Additional satellites are scheduled to be launched in 2019.

The O3b network provides backhaul services to mobile providers as 4G subscribers grow, according to company estimates, from 1.6 to 3.8 billion by 2020. The network also serves multiple niche markets, such as emergency response and cruise ships. The name "O3b", by the way, stands for "other three billion" — a reference to those on the planet currently without broadband.

Viasat, a satellite communications firm that has been providing services for years (with current satellite technology that by terrestrial standards is slow and expensive) claims it will be the first firm offering true global broadband access. Viasat is launching three high-capacity geosynchronous satellites between 2019 and 2021, each with the network capacity, according to the company, comparable to the total of "the approximately 400 commercial communications satellites in space today."[27]

China, not to be left out, also has announced plans to launch an internet satellite network. The Chinese government's Hongyun Project plans to launch 300 satellites into low earth orbit starting in 2018, with the network operational in 2022 and complete by 2025.[28] A private Chinese technology firm, LinkSure Network, has also announced plans for a constellation of 272 satellites with aspirations to provide free wifi to regions currently without coverage.[29]

Finally, a lot of eyes are watching Facebook to see what its next moves are around satellite communications. Facebook has been interested in satellite technology for years, although its first satellite, designed to support broadband in rural Africa, unfortunately blew up on a SpaceX launchpad in August 2016.

Now, Facebook has reportedly registered a new subsidiary to build LEO satellites.[30] The subsidiary, called PointView Tech, plans to launch a demonstration satellite in 2019 to investigate using the E-band spectrum for communications. E-band promises much higher data connection speeds than those planned by rivals, but it needs to overcome some challenges, including absorption by rain and other particles. E-band has also been used by the Facebook Aquila drones, so the company has experience with the technology.

Potential Timelines for Expanded Broadband Coverage

When will developing countries have high-quality, affordable access to the internet?

The UN Broadband Commission has a target of 75% global coverage by 2025, although this figure assumes very little progress in Africa — only 35% coverage, a figure the satellite companies may dispute — by that date.

The UN Sustainable Development Goals (SDG) have more ambitious (if vague) targets for internet access, calling to "significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020."[32]

While internet access is increasing steadily through traditional cellular networks, it is hard to be certain how quickly new technologies will gain traction. The companies promising access through balloon, drone, and (especially) satellite have ambitious timelines suggesting that most of the planet will have reasonably priced access in the next five years. Their ambitions are, as of yet, untested.

It is also important to appreciate that in a region without current access, the process of gaining connectivity will rely heavily on "first adopters" that can afford more expensive initial services. Government offices, NGOs, health clinics, universities, tourist destinations, journalists, business executives — these are the entities that typically adopt access quickly when it becomes available. Even if few people in a community can afford internet access immediately, the fact that some in the community can afford access is in itself a significant step in bringing services to a broader population.

It is reasonable to predict that in the next few years most of the planet will have some access to reliable, if somewhat expensive, broadband. Dropping costs will then promote access to the remaining unconnected populations over the next several years through smartphones and other devices.

In summary, it is reasonable to predict that in the next few years most of the planet will have some access to reliable, if somewhat expensive, broadband. Dropping costs will then promote access to the remaining unconnected populations over the next several years through smartphones and other devices.

Implications of Expanded Broadband

Unique Characteristics of New Media Markets

Media markets in the developing country regions that will soon be getting internet access are qualitatively different than media markets in developed countries.

First, and most significant, many regions currently without broadband are also currently without any significant media market. Poor communities across the globe may have intermittent access to radio. They may have sporadic exposure to television. Print publications are generally limited or non-existent. By and large, the only consistent source of information for billions of people living in poor and rural areas is word of mouth. As hard as it is for those of us who live in media-saturated societies to remember, much of the planet is media-free.

Second, the people in poor and rural areas that will soon get internet access generally have limited education. In sub-Saharan Africa, for example, only 40% of youth between ages of 15-17 are in school.[33] In many poor regions around the planet, most people are illiterate, most are innumerate, and many speak a regional language which may or may not have a written form.

Third, new users likely have little or no exposure to technology. More than a billion people around the planet don't even have electricity, much less technologies that require power.

Finally, in many poor and rural areas, studies show that users presented with new technologies place high trust in the information they receive. If the news is from a third party such as Google or Facebook, it must be true.[34] There is scant experience with local media. The profession of "journalist" typically doesn't exist. People haven't been raised as cautious media consumers because historically there has been no media to consume.

The following table summarizes the major differences between established media markets and emerging media markets:

	Established Media Markets	Emerging Media Markets
Media saturation	*High*	*Low or non-existent*
Media exposure	*High*	*Low or non-existent*
Consumer education	*Mid or high*	*Low*
Literacy	*High*	*Mid or low*
Fluency in "major" language	*High*	*Mid or low*
Familiarity with technology	*High*	*Low*
Trust in technology	*Mid or low*	*High*

Media Opportunities of Broadband Expansion

Despite significant challenges, imminent broadband expansion to three billion new consumers represents an enormous opportunity for media organizations.

To state the obvious, this is the largest, fastest expansion of media markets in world history. Billions of new users will soon have internet connectivity. That fact alone should force every major media organization, as well as governments, development agencies, non-profits, and others interested in the developing world, to plan ahead.

The new markets are also in most cases qualitatively unique, allowing media to organizations to approach them as a clean slate. Innovative ideas for media coverage will be crucial.

Because many new markets have been bereft of professional media in the past, media companies have an enormous opportunity to foster positive change. Media will be entering previously information-free zones. By reporting on topics like health, education, government services, business approaches, and individual rights, media organizations have an unprecedented opportunity to inform, educate and empower. Media organizations also have the opportunity to define and develop a healthy media ecosystem.

Media Challenges of Broadband Expansion

Media organizations seeking to expand into new markets also face significant obstacles. Communities may have no history with professional media. Users have limited education. Familiarity with new technologies is scant. Trust of new information is often unreasonably high. The full list of obstacles is daunting.

There are two specific challenges, however, that will confront every media organization expanding in developing countries.

First, as is the case in developed countries, media companies need to develop effective business models. This is a complex topic, but suffice it to say that given that new markets are mostly poor and rural, media business models will need to be especially low cost and possibly rely on hybrid financing with a mix of both commercial and philanthropic support.

Second, and related, is that in new media markets, major internet companies quickly dominate the landscape, particularly Facebook. New smartphone users often don't understand the internet, but they do understand Facebook. They have been discussing issues in groups their entire lives, and they see Facebook as an extension of that natural tendency. Also, in many places, Facebook is offered for free, so adoption is rapid. Once entrenched, Facebook often monopolizes the media environment by providing information embedded within Facebook itself or by serving as the gatekeeper to third-party news sources. In so doing, it dominates the ad market and starves other news sources of revenue, often putting them out of business. In many markets, consumers don't even know that there are other online

services or resources outside of Facebook. For example, research in 2015 indicated that 65% of Nigerians, 61% of Indonesians, and 58% of Indians agreed with the statement "Facebook is the internet." (Only 5% of Americans agreed.)[35] Facebook also owns WhatsApp, the messaging service that is dominant in many developing countries, as well as Instagram, the photo sharing service which also has a major profile. Because of Facebook's dominance in new markets, every media organization considering expansion in developing countries needs to factor in Facebook's likely control.

Implications for Media Companies

If a media organization is interested in new markets in developing countries and in reaching the three billion new consumers coming online in the near future, how should it best prepare for broadband expansion?

10 Recommendations for Media Companies

1. Anticipate Broadband Expansion:

The first recommendation is straightforward: acknowledge and anticipate that a major expansion of broadband is underway and is happening quickly.

Not many years ago organizations heard "the internet is coming" and debated whether to launch a website. Now, for many of those same organizations, their website effectively is their organization.

A few years ago, Mark Zuckerberg said that "mobile is coming", and that Facebook would focus on "mobile first". Now, Americans check their phones 12 billion times a day. Ninety-five percent of Facebook's global users access the service by smartphone.[36]

Today, broadband expansion is coming. What does that imply for your media organization?

2. Simplify:

Most consumers gaining broadband access in coming years have limited education, limited familiarity with media, and limited exposure to technology. To be effective, media organizations need to produce content that is clear and simple. This has always been a mandate for journalists. Broadband expansion makes the mandate especially important.

3. Teach Media Literacy:

Because new users will not have had extensive exposure to media in the past, media organizations have an opportunity and responsibility to teach media literacy skills. Orientation of new users can address different sources of information, describe how stories are compiled, provide transparency around points of view, and offer guidance on how to identify fake news.

Facebook Training on Fake News

Facebook offers many resources to users on how to effectively use the platform. For example, a Facebook service called Blueprint provides over 80 free online courses, eligible for certification, with instruction on better use of business services offered by Facebook.[37]

Facebook also works to reach those not on the platform. Prior to the Mexican presidential election in July 2018, Facebook took out full-page ads in many Mexican newspapers instructing citizens about how to recognize fake news.[38] The list of 10 tips included "doubt the headline", "check the source", and "carefully observe the URL". The instructional materials concluded with the aspiration that "together we can limit the diffusion of fake news."

4. Localize:

Over three billion people speak one of the top five languages in the world (Mandarin, Spanish, English, Arabic, Hindi). Historically, media organizations could get away with providing news in major languages only.

The billions of people now coming online speak around 7,000 languages. Media organizations will be effective in these new markets only by localizing their content in terms of language and culture.

5. Use Video and Audio:

Since most new users in many regions will not be literate, video and audio are the principal modes of media communications. Short videos and podcasts optimized for smartphones are most effective.

The corollary to this is that print journalism in most new environments will be meaningless. Nearly everything needs to shift to video and audio.

Media for the Rohingya

Since being forcibly expelled from Myanmar, 1.2 million Rohingya are living in a sprawling refugee camp in southern Bangladesh. The camp has limited broadband, poor radio reception, and no print publications -- but it has one popular media channel that helps keep the population informed. R Vision is a daily Rohingya-language video news broadcast, distributed through YouTube, that targets Rohingya in the camp as well as the Rohingya diaspora living in neighboring countries.[39]

Initially little was known about R Vision -- it appeared on YouTube and quickly became popular. Even senior Bangladeshi authorities responsible for the camps knew nothing about its origin. Now it is understood as a broadcast professionally produced in discreet offices in Malaysia by members of the Rohingya community there. They manage a team of about 25 journalists working in the camp. The R Vision founders anticipated that a timely, language-specific, culturally appropriate daily video would become popular. At this point the YouTube channel has over 125,000 subscribers and many tens of thousands of daily views. It is the main source of news and information for the Rohingya.

6. Train Journalists:

Media organizations expanding into new regions will discover that since there has been no journalism previously, there are no journalists. Media organizations need to anticipate that the staff they need for operations will require training. They also will need to help governments and communities understand that journalism as a profession is something to be valued and protected.

7. Support Local Media:

Local communities are best served if they have access to locally-produced, trusted, useful information. In the digital age, with communities confronting Facebook and other global media giants, local media organizations are more important than ever.

United for News

United for News is a coalition of 15 international organizations with the shared goal of supporting local media in developing countries.[40] United for News programs include helping local media organizations transition to digital environments, assisting in the creation and distribution of trusted, quality content, and efforts to increase the positive impact of quality content for citizens, communities and governments.

One program priority for 2018 is the development of a new advertising program which allows global brands to funnel ad dollars directly to the most responsible local media organizations in a community. A second program priority seeks to increase the role of women in local media. United for News sees three billion people soon coming online, and is trying to lay the groundwork for sustainable local media.

8. Plan for Facebook:

Facebook typically dominates new media markets. It is uncertain if that will always be the case, but for the time being, every media organization working in developing media markets needs to have a Facebook strategy. This will require both deciding what information users will access through Facebook, and planning for which resources should be provided outside of Facebook. Because of Facebook's advertising dominance, the plan also needs to consider business strategies for direct ad sales or hybrid business models involving other revenue streams.

9. Build Systems for Trust:

New media consumers often trust everything they see online. This is good for media organizations in that they gain credibility quickly. It is also bad for media organizations since they immediately are competing with rumor and fake news.

New media markets need the services of a credible local organization to highlight accurate information and debunk falsehoods online. Members of the community need to play a close role in helping build systems for trust.

Google News Initiative

Google has launched a new program in India called the Training Network to teach 8,000 Indian journalists to identify and combat fake news.[42] The initiative, conducted in coordination with several international news and data organizations, will begin by training 200 journalists in a five-day boot camp and certification program. Those trainers will then lead further trainings across India.

Among other skills, journalists will learn to use the services of several Indian fact-checking services, including First Draft, Storyful, AltNews, BoomLive, Factchecker.in and DataLeads. Programs will be conducted in English, Hindi, Tamil, Telugu, Bengali, Marathi and Kannada.

10. Anticipate Problems, Particularly Hate Speech:
It is important that media organizations react quickly to problems as they occur, such as fake news, rumors, or fraud. It is even more important for media organizations to anticipate hate speech. Armed with smartphones and new communications capabilities, communities will find historical animosities greatly amplified online. This can lead to violence or, in the case of Myanmar and the Rohingya, facilitate genocide. Media organizations have an important role to play in predicting and addressing hate speech online.

Preparing for Future Technologies: Virtual Assistants

The next billion or so consumers coming online will do so through smartphones. The billion after that, however, will very likely be introduced to the internet through smart speakers. Amazon, Apple, Microsoft and Google have major "virtual assistant" initiatives (Alexa, Siri, Cortana, and Google Assistant respectively) that are making significant inroads in developing countries.

Smart speakers have major limitations in providing internet access since they rely just on voice. But they have a number of significant advantages over smartphones and computers, particularly in developing countries. Because they rely on spoken commands, they are simple to use. They don't require the user to be literate. They are facile with many languages. They are also cheap: it is reasonable to imagine that someday smart speakers will be given away for free.

As one example of the extension of smart speakers in developing countries, Amazon has been investing heavily in the Indian version of Alexa in order to promote adoption across India. Alexa is now adept in Hinglish (the Hindi + English dialect popular across much of the country). In addition to mastering accent and vocabulary, Alexa has learned about Indian holidays, Biryani recipes, funny Cricket jokes and Bollywood plot lines. Developers have added 10,000 "skills" to Alexa's repertoire that are appropriate for the Indian market. Alexa also speaks other dialects, including Hindi, Kannada, Tamil, Telugu and Malayalam. Alexa must be doing

something right: globally, she received over one million proposals for marriage last year.[41]

Smart speakers have significant implications for media companies. To be effective, content needs to be audio, language appropriate, in formats that virtual assistants can manage, and searchable. This requires new journalistic approaches as well as facility with current technical skills and approaches.

Preparing for Future Technologies: Automation

Automated journalism, in which machine algorithms employ natural language generation and data analysis to write news stories, is proliferating in developed countries. For a number of reasons, it is likely to be a major platform in developing countries.

In developed countries, machines already write and publish stories on sports, financial markets, and even natural disasters. (The LA Times has a "Quakebot" that automatically drafts stories about earthquakes within minutes of a tremor.[43])

In developing countries, automated journalism is likely to be even more prevalent. Because many new markets will be poor and rural, journalism needs to be inexpensive. Social media, an environment that facilitates automated journalism, often dominates.

Developing country media markets are often exceptionally heterogeneous in terms of language, region and culture, providing advantages to automated systems.

Media organizations seeking to expand in new markets need to acknowledge and embrace the potential of automated journalism as a major component of the media landscape.

Conclusion

Expansion of the internet to three billion more consumers in the next few years represents both a profound opportunity and a major challenge to global media organizations. The media environment for the "other half" of the planet is qualitatively unique. Media organizations that recognize the differences, see the opportunities, and prepare for the challenges will enjoy unprecedented growth in reach and impact.

The planet is currently undergoing the largest expansion of media in global history. If this expansion is recognized and prepared for, it can serve as a major catalyst for good.

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Endnotes

1 Ralph, Eric. "SpaceX's Starlink High-Speed Internet Satellites Alive and Well in Orbit." TESLARATI.com, 29 May 2018, www.teslarati.com/spacex-first-starlink-internet-satellites-go-live-in-orbit/.

2 "How Many Satellites Are Orbiting the Earth in 2018?" Pixalytics Ltd, 28 Mar. 2018, https://www.pixalytics.com/sats-orbiting-the-earth-2018/.

3 Russell, Kendall. "SpaceX Testifies: First Prototype Satellite Coming This Year." Satellite, 2 Nov. 2017, www.satellitetoday.com//telecom/2017/11/02/spacex-testifies-first-prototype-satellite-coming-year/.

4 "The State of Broadband 2018: Broadband Catalyzing Sustainable Development." Broadband Commission for Sustainable Development, www.broadbandcommission.org/publications/Pages/SOB-2018.aspx.

5 "Connecting the Unconnected: Working Together to Achieve Connect 2020 Agenda Targets." International Telecommunications Union, https://broadbandcommission.org/Documents/ITU_discussion-paper_Davos2017.pdf

6 "Digital Planet 2017." Culturing Media, sites.tufts.edu/digitalplanet/dei17/.

7 "GCI 2018: Tap into New Growth with Intelligent Connectivity." Huawei, www.huawei.com/minisite/gci/en/.

8 Le Maistre, Ray. "Africa Still Trailing in Internet Access, Finds ITU Report." Connecting Africa, 20 Sept. 2017, http://www.connectingafrica.com/author.asp?section_id=530&doc_id=736509

9 Purnell, Newley. "Two Years Ago, India Lacked Fast, Cheap Internet-One Billionaire Changed All That." The Wall Street Journal, 5 Sept. 2018, https://www.wsj.com/articles/two-years-ago-india-lacked-fast-cheap-internetone-billionaire-changed-all-that-1536159916.

10 "The World's Largest Data Network Based on Mobile Data Consumption." Jio 4G LTE Network - Experience High Speed 4G Mobile Internet, www.jio.com/.

11 Purnell, Newley. "Two Years Ago, India Lacked Fast, Cheap Internet-One Billionaire Changed All That." The Wall Street Journal, 5 Sept. 2018, https://www.wsj.com/articles/two-years-ago-india-lacked-fast-cheap-internetone-billionaire-changed-all-that-1536159916.

12 Ambani, Mukesh, speech at Reliance Industries shareholder meeting, 5 July, 2018; reprinted in Economic Times of India, 5 July, 2018, https://economictimes.indiatimes.com/markets/stocks/news/full-text-what-mukesh-ambani-said-at-agm/articleshow/64867000.cms

13 African Undersea Cables. https://manypossibilities.net/african-undersea-cables/

14 "Somalia Hit by Internet Outage after Fibre Optic Cables Are Cut by Ship." Africanews, 28 June 2017, www.africanews.com/2017/06/29/somalia-hit-by-internet-outage-after-fibre-optic-cables-are-cut-by-ship/.

15 Liquid Telecom - Network Map, www.liquidtelecom.com/about-us/network-map.html.

16 "Google Is Laying Fibre Optic Cable in Africa to Ease Access to the Internet." BusinessLIVE, Business Day, www.businesslive.co.za/bd/companies/2017-03-15-google-is-laying-fibre-optic-cable-in-africa-to-ease-access-to-the-internet/.

17 "Beefing up Mobile-Phone and Internet Penetration in Africa." The Economist, 9 Nov. 2017, www.economist.com/special-report/2017/11/09/beefing-up-mobile-phone-and-internet-penetration-in-africa.

18 "The State of Broadband 2017: Broadband Catalyzing Sustainable Development." Boradband Commission for Sustainable Development, https://broadbandcommission.org/publications/Pages/SOB-2017.aspx.

19 https://loon.co/

20 Davies, Alex. "Loon's Internet-Slinging Balloons Are Headed to Work Over Kenya." Wired Magazine, 19 July 2018, www.wired.com/story/loon-internet-balloons-kenya-google-alphabet-x/.

21 Westgarth, Alastair. "Turning on Project Loon in Puerto Rico." Loon Blog, Medium, 20 Oct. 2017, medium.com/loon-for-all/turning-on-project-loon-in-puerto-rico-f3aa41ad2d7f.

22 Mattise, Nathan. "Project Loon Signs Its First Deal for Internet-Delivering Balloons-in Kenya." Ars Technica, 19 July 2018, arstechnica.com/gadgets/2018/07/project-loon-signs-its-first-deal-for-internet-delivering-balloons-in-kenya/.

23 "High Altitude Connectivity: The next Chapter." Facebook Code, 27 June 2018, code.fb.com/connectivity/high-altitude-connectivity-the-next-chapter.

24 "Zephyr." Airbus, www.airbus.com/defence/uav/zephyr.html

25 "FCC Authorizes SpaceX to Provide Broadband Satellite Services." Federal Communications Commission, 24 Oct. 2018, www.fcc.gov/document/fcc-authorizes-spacex-provide-broadband-satellite-services.

26 Winkler, Rolfe, and Andy Pasztor. "Exclusive Peek at SpaceX Data Shows Loss in 2015, Heavy Expectations for Nascent Internet Service." The Wall Street Journal, 13 Jan. 2017, www.wsj.com/articles/exclusive-peek-at-spacex-data-shows-loss-in-2015-heavy-expectations-for-nascent-internet-service-1484316455.

27 "Inspired to Connect the World." Viasat, viasat.com/.

28 "The SpaceX Starlink Program 'China Edition' is coming." Science and Technology Daily, http://www.stdaily.com/zhuanti01/hangkong/2018-03/05/content_643752.shtml

29 Cheng, Kelsey. "Chinese Tech Firm Unveils the First Satellite in Its Ambitious Plan to Provide Free Worldwide Wi-Fi." Daily Mail Online, 29 Nov. 2018, www.dailymail.co.uk/news/article-6442441/Chinese-tech-firm-unveils-satellite-ambitious-plan-provide-free-worldwide-Wi-Fi.html.

30 Magan, Veronica. "Could Facebook Be Building Its Own Satellite?" Via Satellite, 3 May 2018, www.satellitetoday.com/telecom/2018/05/03/could-facebook-be-building-its-own-satellite/.

31 Fung, Brian. "SpaceX Gets OK to Launch High-Speed Satellite Internet Service." The Mercury News, 30 Mar. 2018, www.mercurynews.com/2018/03/29/

spacex-gets-ok-to-launch-high-speed-satellite-internet-service/.

32 "Sustainable Development Goals." United Nations, www.un.org/sustainabledevelopment/sustainable-development-goals/.

33 "263 Million Children and Youth Are Out of School." UNESCO UIS, 27 Apr. 2017, uis.unesco.org/en/news/263-million-children-and-youth-are-out-school.

34 Digital Planet, sites.tufts.edu/digitalplanet/dei17/.

35 Mirani, Leo. "Millions of Facebook Users Have No Idea They're Using the Internet." Quartz, 6 July 2016, qz.com/333313/milliions-of-facebook-users-have-no-idea-theyre-using-the-internet/.

36 "Facebook Users Reach by Device 2018." Statista, www.statista.com/statistics/377808/distribution-of-facebook-users-by-device/.

37 "Facebook & Instagram Free Online Marketing Courses." Facebook & Instagram Free Online Marketing Courses | Facebook Blueprint, https://www.facebook.com/business/learn/courses.

38 McKay, Tom. "Facebook Is Running Ads in Mexican Newspapers Warning About Fake News." Gizmodo, 21 Mar. 2018, gizmodo.com/facebook-is-running-ads-in-mexican-newspapers-warning-a-1823941676.

39 "R Vision, a Digital News Outlet by and for Rohingya People, Aims to Shed Light on Crisis." Nieman Lab, www.niemanlab.org/2018/04/r-vision-a-digital-news-outlet-by-and-for-rohingya-people-aims-to-shed-light-on-crisis/.

40 United For News, www.unitedfornews.org/.

41 Phonearena. "Alexa Received over 1 Million Marriage Proposals Last Year, but Turned Them All Down." Technology Breaking News, 11 Oct. 2018, www.technologybreakingnews.com/2018/10/alexa-received-over-1-million-marriage-proposals-last-year-but-turned-them-all-down/.

42 "Introducing the Google News Initiative India Training Network." Official Google India Blog, 19 June 2018, india.googleblog.com/2018/06/introducing-google-news-initiative.html.

43 Oremus, Will. "The First News Report on the L.A. Earthquake