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Internet for All: The Barriers and the Solutions

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Abstract

Can internet, reduce poverty? A few recent studies have shown that Information and Communication Technologies (ICT) can act as a facilitator in reducing poverty. Nearly 90% of the global population has access to mobile phones, and about one half of them have access to basic internet services through the mobile phones. Many governments in the developing world and some major IT companies have ambitious goals to connect the entire population to the internet. A recent McKinsey report found that over 4 billion people, are not connected to the internet. The paper examines the barriers to achieve universal connectivity. Among other things, illiteracy, lack of local language content and affordability are found to be the major hurdles in adopting the internet by the poor who form the bulk of the unconnected population. The paper concludes with some suggestions and policy guidelines to the governments and the industry, to expand internet connectivity to all.

Classification: Technology and Economic Development

Keywords: Digital Divide, Poverty, Internet Adoption, Bottom of the Pyramid, Mobile Phones, Public Policy, Public and Private Partnerships

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1. Introduction

Of the four billion poor people at the Bottom of the Pyramid (BoP) nearly fifty percent or two billion have access to mobile phones (Sprague, 2014). Several studies explored the use and impact of ICTs (mobile phones) among the poor people. Some of the issues examined were, why the poor use the phones, how much of their income they spend to use the services, what is the impact on incomes, and poverty levels. For example, a three year study in Peru found that the household income of a group of internet-users increased by 19% on average when compared to a similar group of Peruvian families without internet access (De Los Ríos, 2010). Similarly, a comparative study of two villages in Kenya found a reduction in poverty levels in the village provided with free mobile & internet access over a period of five months. Many countries do not consider access to mobile phones and ICT as one of the tools to reduce poverty and as such, mobile phones are not included in the portfolio of items provided to the poor at free or subsidized cost. There are other anecdotal examples and studies showing the positive impacts of ICT use on poverty levels. If access to ICT plays a significant role in reducing poverty, may be the governments in developing countries should consider providing free or subsidized access to ICT services to poor households. The paper examines whether it is worthwhile for the governments in developing countries to take a proactive role to help the poor by providing access to the internet to all the people in their countries.

The first part of the paper examines the importance of the internet, its adoption through mobile phones, and its impacts. The second part provides a review of the current research on the use and impacts of ICT on poverty. The third section reviews the barriers to the adoption of the internet, and profiles the "unconnected or offline" population. The next section analyzes implications and feasibility of achieving the ambitious goal of "Internet for All". A framework on the access and effective use of ICT for different needs is presented. The final part of the paper suggests a plan of action for the governments and the industry to expand the internet access and enable the billions of unconnected people to participate in the knowledge society.

2. Importance of the Internet and the Access through Mobile Phones

The use of information and communication technologies (ICT) has been exploding globally.

While an array of computer and communication products & services are part of the ICT, the internet has become the dominant component of the ICT. From a small collection of users in 1990, the user base of internet has grown to 2.7 billion people in 2013 (World Bank, 2013). Internet access either through a mobile network, wireless access point, or fixed broad-band connection, provides individuals a gateway to the online world that is expanding every day. The major driving forces for this growth are: expansion of mobile network coverage, increasing adoption of mobile-internet, urbanization, shrinking prices for devices and data plans, a growing middle class, and increasing usefulness of internet for both the individuals, businesses, and other organizations. At the current rate, one billion more people are expected to join the internet population by 2017. In most of the countries the internet has become a powerful economic engine. It transformed the way that governments, individuals, businesses, and organizations connect, engage and access the information needed. The internet has spawned many innovative business models, has given rise to many new industries, and accelerated innovation in both products and services. Many research studies have shown a direct link between internet adoption and economic growth in several countries across the globe (Czemich, 2009).

More people are using mobile connections to access the internet than the traditional fixed line connections using desktop / laptop computers. Across the world, 2G, 3G, and 4G networks are used for mobile communications and to access the internet. 2G networks can support voice communications, text messaging, and low data speeds of up to 9.6 kilobits per second (kbps). In practice, it is not possible to use 2G networks, for many internet applications on a reliable basis. 3G networks can deliver speeds of up to 2 megabits per second (mbps) are suitable for most of the internet applications including multimedia services.4G networks can offer speeds of up to 10 mbps. As per Ericsson reports, 2G services are available for 85% of the world population, and about 60% of the population is covered by 3G services in 2012 (Ericsson, 2014). Many developing countries are still in the early stages of deploying 3G networks. In 2013, while there were 6.8 billion mobile phones in the world, the number of unique subscribers were only 3.4 billion. On an average each unique subscriber to a mobile network uses two mobile phones. The number of mobile internet connections have also increased to 2.3 billion in 2013 (GSMA, 2014). Developing countries account for 75% of the mobile connections and 55% mobile internet connections in 2013.

The proliferation of mobile internet connections in developing countries can be attributed to the lack of fixed-line infrastructure as well as the high cost of personal computers and other devices. Mobile internet connections exceed the broadband connections by a ratio of three to one (ITU, 2013). However, mobile accounts for only a small portion of total internet traffic. Cisco estimates that by 2018, Internet traffic via fixed-broadband connections will account for 39 percent of the total, compared with 12 percent on mobile and 49 percent on Wi-Fi.(Cisco, 2013).

The internet has significant impact on several segments of the society, as outlined below:

Individuals and Society: The internet has a profound impact on individuals and society. Anyone with an internet connection has access to vast amounts of information and services. It has become a tool to mobilize resources, raising awareness about issues and coordinating social movements. The internet has become an important social media tool in political campaigns. It has become a critical tool in mobilizing aid for people affected by natural disasters like the Haiti earthquake in 2010. More and more governments especially in developing countries are adopting e-government services (tax filing, direct payments, file status, etc.). Now citizens, and consumers can access the documents much more easily than before. In many developing countries, social media accounts for top the online activity. Social media is used to communicate with friends and relatives both at home and abroad. In India for example, 75% of the internet users use social media like “what’s up”, frequently. The online educational content has increased dramatically in recent years. Several reputed universities and consortiums are offering online courses at no cost to the students. Many people in developing countries are taking advantage of these online courses. Analysts forecast that global revenues from online learning will reach USD 51 billion by 2016 (Ambient, 2013).The internet is also used as an entertainment service. Many users watch videos, listen to music, read and comment on newspaper and magazine articles, participate in blogs and discussion groups.

Consumers: Internet has provided numerous direct and indirect benefits to the consumers in developed countries where internet penetration rates are high. Some of these benefits through e-commerce include: access to greater array of goods, products and services (variety), cost savings due to the ability to compare prices through search engines, it is estimated that the online prices are about 10% lower than off line prices (Manyika, 2011); The internet also provides the technical infrastructure for the "sharing economy", thereby improving asset utilization, resulting in cost savings for all. Because of online advertising, internet users are benefiting indirectly through free e-mail, search engines, social networks, research sources, product reviews, etc. Consumers also benefit through time savings, as they can shop online without leaving their homes or offices. With increasing internet penetration especially through mobile connections, the consumers in developing countries are also likely to receive the benefits of e-commerce in the future.

Businesses: Internet has become an important tool to manage global operations, enter new markets around the globe, and source any inputs from any global location where it makes economic sense. Internet also has reduced the barriers to entry for many small businesses. The internet enables many IT companies to offer same level of services with very little upfront costs to all sizes of companies. Internet has spawned several innovative business models, and several new businesses have been created because of the internet. It has become a game changer in many industries like entertainment, media, and others.

National and global economy: The McKinsey Global Institute (MGI) estimates that in 2010, the Internet accounted for USD 1,672 billion of the global economy, or an average 2.9 percent of total GDP (McKinsey, 2012). Research by the World Bank in 2009 found that for every 10 percentage points increase in high speed Internet connections in developing countries, there is an increase of 1.3 percentage points in economic growth (World Bank, 2009). McKinsey estimates that the internet could transform sectors from agriculture to retail to health care and account for up to USD 300 billion of Africa's annual GDP by 2025 (McKinsey, 2013).

3. Impacts of ICT on Poverty

This section explores the existing research on the impacts of ICT on the poor especially in developing countries.

Some of the poorest people in developing and marginalized communities have been spending a significant portion of their meagre incomes to use mobile phones and to go online. Today, in the developing world mobile phones dominate all other ICT devices in usage. From their phone handsets, a growing number of people in low-income households browse the internet, send email, text, tweet, keep in touch using Facebook, listen to radio, send mobile money, or live chat. Mobile phone is the first accessible ICT for people in many rural communities in the world. The International Development Research Center, in Ottawa, Canada has recently published two books (Elder, 2013, and Adera, 2014) detailing the research on how ICT affects the lives and livelihoods of the poor in the developing countries and its impacts on poverty alleviation.

The first book (Elder, 2013) is based on the household surveys undertaken by research networks active in 38 developing countries, in Asia, Africa, and South America. The researchers found that cost is the biggest obstacle to use mobile phones, and access the internet. However, the cost has not prevented the poor from purchasing phone time. The poor people among the cell phone users in Africa spent a significant portion of their household income on connectivity, as high as 27% for Kenyans. The flexibility to buy small amounts of pre-paid time has enabled large number of poor people in Africa and Asia to access the cell phones and the internet. The high taxes in South America, constrained the use of cell phones by the poor people. A typical broad band plan in South America, costs 66% more than the average cost in a developed country. The survey found that the poor buy the phone services mainly for social calls and to use it in potential emergencies, For businesses, saving time and money on transportation was the biggest benefit of using the cell phones. Growing number of potential customers accessing the internet had provided a great help to the self-employed and small business owners. More poor people with no bank accounts found "mobile money" more convenient and beneficial. There was some anecdotal evidence of relationship between "ICT Access" and "reduced poverty" among the very poor. For example, over a period of three years the incomes of a group of Peruvians with internet access, had increased by 19% when compared with a similar group of Peruvians without internet access. Similarly, in a comparative study of two villages in Tanzania over a period of five months, the village with mobile internet access had experienced reduction in poverty in all the seven measures, whereas the other village with no access to internet experienced reduction in only two measures of poverty.

The research study details several examples of benefits of access to ICT, in the areas of healthcare, education, businesses, mobile money, phone related jobs including self-employment, new business opportunities, price alerts and other information to farmers, search for information, etc.

The second book (Adera, 2014) based on the field studies in four African countries also provides several examples exploring the relationship between ICT access and poverty. Kathleen Diga (2013), one of the researchers pointed out, "In poor settings, social relationships are intrinsically linked to economic issues; people usually get jobs or loans from family and friends." Those with access to ICT will improve their social relationships resulting in better socio economic relationships.

Researchers undertook a longitudinal study of 1,600 East African households between 2007 and 2010, that showed a link between ICT access and a rise in income levels among the very poor (May). They found that the very poor with access to ICTs were able to spend US$21 more a month than those without access. The gains added 0.5% to annual household income and narrowed the gap between the low income and high income households. People at the bottom of the income pyramid who lacked access to ICTs did not experience any change in their income levels. The study also found that the income increased further for those with one more year of education or additional skills or training in entrepreneurship.

There were also other studies that explored the relationship between ICT and economic growth:

- Using data from 28 developing countries, Sridhar and Sridhar (Sridhar, 2007) found that an increase in the number of phones, both fixed-line and mobile, has a positive impact on national economic output.
- Waverman et al. (Waverman, 2005) showed that, in a typical developing country, an extra 10 mobile phones per 100 people results in 0.6% growth in per capita GDP. This is double the expected impact in a developed country.
- Looking at 113 countries over 20 years, the International Food Policy Research Institute (Torero and Von Braun, 2006) found that a 1% increase in telecommunications penetration led to a 0.03% increase in GDP.
- A World Bank (World Bank, 2010) study in Kenya calculated that ICTs were responsible for roughly a quarter of Kenya's GDP growth during the first decade of the 21st century.

These research studies provide some qualitative and quantitative evidence that ICTs play a positive role in poverty alleviation and the poor can benefit from access to ICT services. It should also be noted that ICT cannot be a sole solution to reduce poverty, but it should be a part of the portfolio of tools to reduce poverty.

4. Barriers to Internet Adoption

From the foregoing review, it is clear that the internet has the potential to improve the lives & livelihoods of individuals including the poor people, drive the growth of businesses, accelerate the economic development, and lift the people out of poverty. A recent report from the McKinsey and Company called "Offline and Falling Behind" (Sprague, 2014), estimated that there were 4.4 billion off line individuals worldwide in 2013. The report states “Those who can not go online increasingly suffer from diminished opportunities for economic attainment, class and social mobility, education, and other areas related to quality of life. As the internet becomes more ubiquitous, the costs of digital divide will mount leaving substantial portions of the global population at a disadvantage that may be permanent. The voices of the off line population (over 60% of the world population) can't be heard until they are connected. The rest of the world will be missing their ideas and contributions. The world can't achieve meaningful economic and social progress until all segments of the population participate, contribute and work together as a global community. Internet provides an unique opportunity to bring all the groups of people, rich & poor, young & old, rural & urban, educated & un-educated, to come together and make a contribution to make the world a better place to live”. It is therefore essential to make the internet accessible and useful to all the people.

The McKinsey report (Sprague, 2014) analyzed the demographic characteristics of the "offline" population, and examined the barriers they face in adopting the internet. The McKinsey analysts created an "Internet Barriers Index" based on the four categories of barriers identified. Nearly 75% of the offline population live in 20 countries. When compared to online population, they are disproportionately rural, low income, elderly, illiterate and female.

	Rural	Low Income	Elderly (>55 Yrs.)	Illiterate	Female
Offline	64%	50%	18%	28%	52%
Online	24%	0%**	7%	0%**	42%

** All the online population is assumed to be in higher income (above poverty line) group and literate in one of the ten internet languages.

Source: The World Bank as reported in the McKinsey Report (Sprague, 2014)

Table 1 shows the four barriers to internet use and adoption as identified in the McKinsey report.

Table 1: The Four Categories of Barriers (faced by Non-Internet Users)

Incentives	Low income and Affordability	User Capability	Infrastructure
No compelling reason to go online. No awareness of internet/ relevant use cases. No local or localized content or Services. **Causes** High costs of developing localized content and service provider costs. Low awareness or interest from brands. Lack of trusted payment systems and security.	Low income, low consumer purchasing power. Total cost of ownership of device. Cost of data plan. Taxes and fees. **Causes** National economic environment. High device manufacturing costs, and business model limits. High network operator costs. High taxes, fees. Unfavorable market structure.	Lack of digital and language literacy. **Causes** Under resourced educational system.	Lack of mobile internet coverage or network access. Lack of adjacent infrastructure like grid electricity. **Causes** Limited access to international bandwidth. Under - developed national core network. Limited spectrum availability. Ineffective national ICT strategy on broad band. Under resourced infra- structure development.

Source: McKinsey Report

These four categories of barriers to internet adoption among the offline population can't be considered in isolation. The McKinsey analysts found systematic correlation between the four categories and also with the internet penetration rates. This implies that the countries with low internet penetration rates, tend to have multi-dimensional bottlenecks in increasing internet adoption.

Further, it means that meaningfully addressing these barriers require coordination across the participants in the internet ecosystem.

McKinsey report classified 25 countries into five groups based on the Internet Barrier Index.

Group 1, High barriers across the board: Bangladesh, Ethiopia, Nigeria, Pakistan, and Tanzania. Home to 550 million offline individuals. The offline population in this group is predominantly young, live in rural areas, and have low literacy rates. Internet penetration rate 15%.

Group 2, Medium to High Barriers: Egypt, India, Indonesia, the Philippines, and Thailand. Offline population 1.4 billion (India over 1 billion).Greatest challenges in the categories of incentives and infrastructure. Internet penetration rate: 19%.

Group 3, Medium Barriers: China, Sri Lanka, and Vietnam. 800 million offline individuals. Most of the offline population lives in rural areas. Challenging barrier to internet adoption is incentives. Internet penetration rate: 45%.

Group 4, Medium Barriers: Colombia, Mexico, Brazil, South Africa, and Turkey. Offline population just under 260 million.Predominantly urban, literate, and low income. Challenges low income, and affordability. Internet penetration rate: 49%.

Group 5, Low Barriers: Germany, Italy, Japan, Korea, Russia, and United States. Offline population: 180 million people. Offline population disproportionately low income and female. Internet penetration rate: 79%

Out of the nearly 4.3 billion offline population, India accounts for nearly 25% of them. The major barriers faced by India are lack of infrastructure, and lack of incentives to use the internet. Many offline users believe that the internet is not useful to them and it is meant for educated and rich people.

5. Internet for All?

Many governments have recognized the role of internet access in enabling economic activity and social developments and have set out ambitious plans to promote investment in internet access, such as the National Broadband Plan in the US and the Digital Agenda in Europe, and capitalize on this opportunity Recently, many leaders both in the industry and politics have started talking about providing internet access to all the citizens of the world.

On October 16, 2014 the online edition of Hindustan Times reported (Chauhan, 2014), that the Prime Minister of India, will greet the nation on the New Year eve with a message "that in 2015 the government will aim to connect entire country on a digital platform either through broadband or mobile phones." Earlier in August 2014, in his Independence Day speech the Prime Minister had emphasized on “Digital India” as key to transform the country and bring in transparency in governance. Through Digital India, the government aims to bring all public services on a common digital platform and create knowledge empowered society. The main goal of The Digital India Mission is to link every village in India with a broadband connection.

In August 2013, Mark Zuckerberg, the founding CEO of Facebook, started an organization called Internet.org with a team of technology companies (like Ericsson, MediaTek, Nokia, Opera, Qualcomm and Samsung) with a goal to make internet access available to the 5 billion people in the world who don't have it and provide them the same opportunities to everyone the connected world has today.

Deloitte (Deloitte, 2014) estimates that extending internet access in developing economies to the level seen in developed countries can raise living standards and incomes by up to $600 per person a year, thus lifting 160 million people out of extreme poverty in the developing countries The economic activity resulting from extending the internet access to all the people could generate $2.2 trillion in additional GDP, a 72% increase in the GDP growth rate, and more than 140 million new jobs.

While the goal of providing internet access to everyone in the world appears to be very ambitious, there is a broad consensus that expanding the internet access to a large number of people in the developing countries will help their economies and likely bring millions of people out of poverty. However there needs to be some understanding of the meaning of "internet access". As defined in many of the studies "internet access", means "connecting to" and "using" the internet. Access should not be considered as just making it available to the users, the "users" should be able to use it. Many of the "barriers" discussed apply to both the "availability" of the internet and also to the "use" of the internet.

5.1 Internet Availability

Internet can be made available in several forms as described below.

1. *Basic Mobile Phones*: These phones operate in 2G networks. Mostly used for incoming and outgoing voice calls and messages. Some telecom operators embed them with some built-in applications. For example, Facebook has a built in application to access Facebook on some mobile phones offered by few telecom operators in a few countries. On average the number of mobile phones in use amount to nearly 90% of the population. For example, there are over a billion cell phones in use in India. The use of these basic phones is not considered as "internet access".
2. *Basic Mobile Phones with Data access*: These phones operate within 2.5G and 2.75G networks. They offer capacity to handle limited digital data in addition to the voice. These phones can be used for SMS messages, e-mails with light data loads, and web browsing with no graphics, audio and video. The band width is the major constraint, these devices are useful to access applications with narrow band width requirements. While over 60% of the population is covered by these networks, less than a third of them use them to access the Internet or e-mails. Most popular use (among those with data plans) is for messaging.
3. *Mobile Phones/ Smart Phones*: These phones operate under 3G/ 4G (LTE) networks. Many of these phones have several additional features for multi-media application, with high end cameras. These phones are capable of using many sophisticated internet applications, voice synthesizing, bio-metric applications, and thousands of other applications. While nearly 6o% of the population is estimated to be covered by these networks, effective coverage amounts to only about 30% of the global population. 4G LTE coverage is very sparse in developing countries. These devices are relatively expensive and the users have to subscribe to data plans from cellular operators. They can also operate under Wi-Fi networks without paying for the cellular band width. While these smart phones are good for internet applications, they can't be a substitute for personal computers (desktops, or laptops).

4. They are not usually good for creating content like reports, analyzing spread sheets, creating web pages, databases, and so on.
5. *Personal Computers (Desktops / Laptops, Tablets)*: These devices can be connected to the internet, either through fixed cables (telephone, cable networks, fiber optic cable), or wireless (Cellular, Wi-max, Wi-Fi, Satellite, etc.). They can be used to perform all types of computer, communications, and internet applications. The can be used extensively to create and operate e-commerce web sites, to create and offer online courses, and any other creative content in arts, music, books, movies, etc. Off late, the use of these devices has been decreasing, especially in developing countries. In many developing countries people are leap frogging to internet capable phones and foregoing the use of personal computers. In developing countries the penetration of personal computers is around 25%.

5.2 User Capability (Literacy)

In addition to the "availability" of internet the actual "use" is the other component of the "access" to the internet. As discussed earlier, the main barriers to the actual use of internet in the developing countries are the capabilities of the user, the affordability, and the need. Even if the internet is made available to all the areas in the world, many people may not have the needed skills, and others may find it expensive to use it when compared to the perceived benefits. The potential users in the developing countries may be broadly classified into three categories based on their literacy. It should be noted that ten languages account for nearly 90% of the content in the internet. We may call these ten languages as the "internet languages".

1. *Literate group:* Can read and write in one of the ten internet languages. As such there is no language impediment in using the internet. While no precise figures are available, it is estimated that majority of the people in the offline group are not literate i.e. are not able read or write in any of the ten internet languages.
2. *Semi-Literate group:* People in this group can read and write in their native language but not in any of the ten internet languages. It is estimated by McKinsey that slightly over 70% of the offline population is semi-literate.

3. *Illiterate group:* The people in this group can't read and write either in their native language or in the internet languages. McKinsey group estimates that about 30% of the offline population is in this group.

Can a person who can't read and write in any language use the internet? Currently, the answer is "no".

While technically it is possible, to have a 100% voice based user interface, there are very few meaningful applications that don't need any requirement for reading and typing. At the most another person can help the illiterate person use the internet, just like they help the family members to turn on the television, or filling the forms, or some other work that requires reading and writing skills. These people by themselves can't use the internet. The government and industry should develop different strategies, to develop useful internet /online application for the people who can't read and write any language. This is a significant group accounting for 30% or nearly 1.5 billion of the offline population, to be left out of the connected community. We could achieve near universal utilization of cell phones as they don't need reading and writing skills. In India, over a billion people including 300 million illiterates, participated in electronic voting without any problems. If there is enough focus and will, the industry and the governments could surely, come up with ways to make them a part of the connected community. They should set up dedicated research labs to develop meaningful applications to this group of people who can't read and write. Part of the funds to expand the internet should be devoted to this group.

In the *semi-literate group* where people can read and write in their native language, the challenges are somewhat different than faced by the illiterate group. There is very little content or applications in native languages on the internet. However, some content can be displayed in local languages by converting the output in the internet languages into local languages. For example, Microsoft Office, offers to display content in more than 100 languages. This can be useful to some extent, as the users can read the newspapers for example, in their own language if the local languages fonts are activated in their computer. There is an urgent need to develop the internet applications and content in local languages. In October 2014, Mark Zuckerberg, the CEO of the Facebook, had announced innovation challenge award prizes totaling one million US Dollars, to develop localized content in India. The awards will be given to those who develop a leading application, or web site, or an idea that best meets the needs of the women, students, migrant labor, and farmers in India. The application has to be relevant to their lives, and should be readable in their own language. Unless the importance of literacy or lack of it, is recognized as a major challenge it is impossible to provide internet access to all the people. There is an urgent need to develop platforms to localize the content. Companies like Facebook, and Google are actively working on addressing this issue.

5.3 Affordability

The literate group who can read and write in the internet languages faces the problem of "affordability" and usefulness of internet to their lives. Internet access can be purchased in different ways.

1. *Individual ownership*: The user owns the device (computer or mobile phone), and pays for the usage and the data plan.
2. *Device Sharing*: The user doesn't buy the mobile phone, but uses his own SIM card on a retailer or friend's mobile phone. Thus the user pays for the SIM card only. Typically a user pays a tiny amount whenever the uses the mobile phone.
3. *Community Computer Center*: Each small community will set up a computer / internet center housing desktop computers with high bandwidth internet connection. The center may charge a nominal fee for using the computer. The users will pay for the usage of the computer. The center may also house "internet facilitators" or "helpers" to help the users, access and use the internet effectively.
4. *Wi*-Fi Communities: A community will acquire the high-capacity Wi-Max infrastructure to provide free Wi-Fi to the users in the community. The users need to own the device but need not pay the usage charges.

The governments and industry can provide subsidies and funds to set up the community computer centers and the Wi-Max infrastructure. The US government charges a dedicated fee on every cellular bill, to provide funds for broadband expansion into the unconnected areas.

Affordability also depends on the economic value received from the use of the internet. If the economic value is higher than the costs of using the internet, then affordability will not be a factor. Thus there is a need to develop economically meaningful internet application to the offline populations. The industry, the government should come forward to encourage the development of internet applications relevant and useful to the needs of the offline population. The applications with commercial and economic benefits like localized market exchanges (replicating weekly village markets), a classified online advertisement service for the region, and other innovative applications specific to the location, will attract the users to use the internet.

5.4 Classification of Internet Users

In addition to the literacy skills, the user population of internet can also be divided into several groups based on the purpose for which the internet is used.

1. Basic Users: People in this group use the internet for simple browsing, e-mail, messaging, and occasional online shopping. Many of them get on to the internet, to read the newspapers and magazines online. They can be considered as information seekers. The bandwidth requirements are moderate any cell phone with data capabilities (like 2.5 G) can handle their minimum needs.
2. Multi-media and gaming users: Many of the users in this group use internet to listen to music, watch movies, extensively interact with social networking sites, upload & photos and videos, and play video games. The band width requirements are heavy. They need at least a 3G connection. While cell phones are used to perform many of these applications, the personal computers, laptops, and tablet computers are better suited.
3. The commercial / Economic users: Majority of the offline people are self-employed small business people. Many of them are farmers, farm labor, fishermen, vendors of produce like vegetables, artisans, and so on. They want to use the internet to promote their services and businesses through the internet. They need to have a reliable internet service, so that they can upload the information about their services and respond to the customer inquiries promptly. Some of them also use e-commerce sites to sell their products. Their bandwidth requirements vary from moderate to high depending on the type of business. Desktop, laptop, and tablet computers are more appropriate for these applications.
4. Professional Group: These users use the internet, for education (online learning), public health, healthcare applications, doing collaborative projects, sharing knowledge, etc. This group also needs a reliable internet connections, with 3G coverage. They need desktop, laptop, or tablet computers to create the content, and interact with others.
5. Institutional commerce group: This group uses internet, to interact with governments, online banking, mobile money, micro loans & insurance, etc. Personal computers, laptops, and tablet computers are more appropriate for this group also. Reliable and secure internet with 3G level bandwidth is needed.

5.5 Matching Users and Internet Requirements

From the above discussion, it is clear that the needs of all the categories of internet users are not the same. At this point in time the illiterates and semi-literates have no capabilities to use the internet for any meaningful purposes. The account for nearly sixty percent of the offline population of over four billion people. For the remaining categories of users, the internet requirements are summarized below.

- *Basic Users:* Mobile Phones with digital data capabilities (2.5G or above)
- *Multi-media and Gaming Users:* Mobile Smart Phones with high band width (3G or higher). Computers are more convenient.
- *Commercial /Economic Users:* Reliable internet service with 2 Mb band width or higher. Computers with broad band connection.
- *Professional Group:* Reliable internet service with 2 Mb band width or higher. Computers with broad band connection.
- *Institutional Commerce Group:* Reliable internet service with 2 Mb band width or higher. Computers with broad band connection.

Internet for All? Conclusion

It is clear that it is not possible to provide internet access to the illiterate, and semi-literate people at least at the present time. They account for over 2.5 billion of the 4.3 billion offline population. Even if connectivity is provided to them free of cost they will not be able to use the internet. The industry and the governments have to come up with ways, and applications to make the illiterate people use the internet. They need to start thinking about "Internet for the illiterates".

The remaining two billion people may be able to use the internet provided they find it economically useful, and if they can afford it. The governments and the industry leaders appear to be thinking that they can expand the internet access to all, through mobile connections as almost all the people use mobile phones. However as explained above internet through mobile phones can be used for only basic internet applications. The mobile internet is not suitable for many useful internet applications like e-commerce, education, healthcare, e-governance, and so on. Mobile phone internet can be used only for a few economically meaningful applications. While mobile phones and smart phones are useful for quick and fast communications, they are not suitable for content creation. Ideally, to get maximum benefit, the offline populations should be using both the mobile phones and the computers with broad band connection, to achieve the maximum benefits from the internet.

6. Action Plan for the Governments and the Industry

The following action plan is suggested for the industry and the governments to progress towards the goal of expanding internet opportunities to all.

Infrastructure and Coverage

1. The governments and telecom operators should continue and accelerate their current plans to expand coverage under 3G and 4G (LTE) networks. Eventually, around 85% of the geographical area in the world can be covered by these signals economically. The remaining area is too remote with scattered population to expand 3G network economically.
2. Companies like Facebook, and Google are working to provide internet signals to remote areas through drones and balloons. They are making good progress in this area. It is likely, that the entire world will have access to the Internet signals during the next five years.
3. As explained, the mobile internet is not effective for many applications especially in the areas of e-commerce, online learning, healthcare applications, etc. as mobile internet is not suitable for content creation. The government and the industry should continue to expand the cable and fiber optic network, to provide wired and wireless broad band connections to the computers across all the geographical regions.

Software Applications

1. *Local content*: The government and industry should promote the development of internet applications based on local languages. This is important to motivate the offline population to use the internet. The government should follow the Facebook initiative and announce research grants to develop internet content in local languages. They should plan to develop a platform to enable each region to develop or adapt internet applications to local languages.
2. *Bandwidth reduction*: Encourage the development of tools to reduce the bandwidth requirements of internet applications. Again the Facebook's connectivity lab is doing extraordinary work in this area. The low-bandwidth applications can be used effectively through mobile internet.
3. *Internet for the illiterate*: Software engineers should work to develop useful internet applications that do not require any literacy in terms of reading and writing skills. They could be voice, or gesture based applications (like Apple's SIRI). Elimination of the literacy requirements, will help vast majority of the offline population to become internet users.

User Skills and Training

1. *Adult Literacy*: Lack of literacy skills is one of the major impediments to the use of internet by the offline population. The governments should provide help to the local communities to set up adult learning centers. Improving the literacy rates will bring in numerous direct and indirect benefits in many other areas.

2. *Internet Centers*: The governments or other organizations should help the communities to set up computer / internet center, to provide affordable access to broad band internet through personal computers. These centers should also provide training in the various aspects of the internet and its usage.

The action plan with the roles of the government, and industry, is summarized in Table 2

Table 2: Roles of Government, Industry, and Entrepreneurs

Internet Components	Government 1, Direct 2. Grants	Industry IT & Telecom Companies	Local Entrepreneurs
Infrastructure			
Expansion to 3G,4G, LTE networks	X 1,2	X	
Internet signals in remote regions of the world	X (2)	X ex: Drones, Balloons	
Broadband Infrastructure (Fiber Optics, Wireless Broadband	X (1,2)	X	
Software			
Applications Development in Local languages and localized needs	X (2)	X	X
Development of Applications with low band width requirements		X	
Development of user interfaces for the illiterate and semi-literate ex: Voice, Bio-Metric, and Gesture based interfaces	X(2)	X	
User Capabilities & Training			
Literacy training for adults and schools for Children	X (1,2)	X	X
Community Internet Centers with facilitators to help the users with the internet	X (1,2)	X	X

To achieve universal connectivity, the governments, the industry, and the local entrepreneurs can play a significant role. While the governments can undertake the infrastructure development directly, they can also provide grants for literacy centers, community internet centers, and to develop user friendly software. If there is a will, there is a way.

With persistent focus, the governments and the industry can achieve universal connectivity and provide opportunities for everyone to participate and benefit from the knowledge-based societies.

References

Adera Edith Ofwona, et.al. and International Development Center, "ICT Pathways to Poverty Reduction: Empirical evidence fromEast and Southern Africa", International Development Center, Ottawa, Practical Action Publishing, Warwickshire, UK, 2014.

Ambient Insight Research, "The worldwide market for self-paced e-learning products and services: 2011–2016 forecast and analysis", Ambient Insight Research, January 2013.

Chauhan Chetan, "Prime Minister Narendra Modi Connecting India Message on New Year's Eve", Hindustan Times Online, October 16, 2014.

Cisco, "Cisco® Visual Networking Index™ global forecast and service adoption for 2013 to 2018", Cisco, June 2014.

CzernichNi"na, et al., "Broadband Infrastructure and economic growth, CESifo working paper", number 2861, 2009.

De Los Ríos, C. 2010. "Impacto del uso de internet en el bienestar de los hogaresperuanos: evidencia de un panel de hogares", 2007–2009. DIRSI, Lima, Peru, and IDRC, Ottawa, Canada.

Deloitte, LLP, "Value of connectivity: Economic and social benefits of expanding internet access", Deloitte UK Economic Consulting, Feb. 2014.

8.Elder Laurent, et.al. , " Information Lives of the Poor: FIGHTING POVERTY WITH TECHNOLOGY", International Development Center, Ottawa, Canada, 2013.

Ericsson, "Ericsson mobility report: On the pulse of the networked society", Ericsson, June 2014.

GSMA, "The mobile economy 2014", GSMA, 2014.

ITU, State of broadband report 2013, Broadband Commission for Digital Development, ITU, September 2013

Manyika James and Roxburgh Charles, "The great transformer: The impact of the Internet on economic growth and prosperity", McKinsey Global Institute (MGI), October 2011.

McKinsey and Company, "Online and upcoming: The Internet's impact on aspiring countries", McKinsey & Company, January 2012.

McKinsey and Company, "Lions go digital: The Internet's transformative impact in Africa", McKinsey and Company, November 2013.

Sprague Kara, et.al.,"Offline and falling behind: Barriers to Internet adoption", Insight & Publications, McKinsey & Company, Sep. 2014.

Sridhar, K.S.; Sridhar, V. 2007. "Telecommunications infrastructure and economic growth: evidence from developing countries". National Institute of Public Finance and Policy, New Delhi, India.Working paper 04/14.

May, J.; Dutton, V.; Munyakazi, L. n.d. "Information and communication technologies as an escape from poverty traps: evidence from East Africa". PICTURE Africa, IDRC, Ottawa, Canada.

Torero, M.; Von Braun, J. 2006.Impacts of ICT on low-income rural households.In Torero, M.; Von Braun, J. (editors). "Informationand communication technologies for development and povertyreduction: the potential of telecommunications". Johns Hopkins University Press, Baltimore, USA.

Waverman, L.; Meschi, M.; Fuss, M.A. 2005."The impact of telecoms on economic growth in developing countries. In Africa: theimpact of mobile phones". Vodafone Group, Newbury, UK.

World Bank, "Information and communications for development 2009: Extending reach and increasing impact", World Bank, June 2009.

World Bank. 2010. "At the tipping point: The implications of Kenya's ICT revolution. Kenya economic update (edition 3)".World Bank, Washington, DC, USA.

World Bank, "World development indicators," World Bank, 2013 estimates, accessed 2014. Sourced from the International Telecommunication Union (ITU), World telecommunication/ICT development report" and database, and World Bank estimates.

World Bank. 2010. "At the tipping point: The implications of Kenya's ICT revolution. Kenya economic update (edition 3)".World Bank, Washington, DC, USA.