The Digital Divide: A *digital Bangladesh* by 2021?

Kristen Waughen, Ph.D.
Students In Free Enterprise Sam M Walton Fellow
Elizabethtown College
Department of Math and Computer Sciences
Elizabethtown, PA 17022, USA.

Abstract

The purpose of this research was to define and identify the digital divide and the various considerations that factor into a country's technological status. The goal was to investigate the current technological position of Bangladesh, and gaps in their progress because they aim to be a Digital Bangladesh by 2021. The digital divide can be witnessed all over the world between countries and within countries, and there are various aspects that contribute to this situation. Some of the characteristics are access, education, economics, social relationships, income, age, geographical location, government, and the technological skills of teachers, students, and people. One more significant characteristic is the number of children in the household. Also, developed versus developing countries have similar issues on different scales, but together these characteristics affect the success of digital lifestyle of a region or country.

Keywords: digital divide, knowledge, poor, barriers, Internet, communication, technology, education, Bangladesh, GDP

Elements of the Divide

One important element for a country in the 21st century is its technological advancement. Availability, usage, and diffusion of the technology throughout the country are three considerations. One term often used to describe this status is the *digital divide* (Prensky, 2001). The first computer used in Bangladesh was a mainframe in 1964 (SDNP Bangladesh, 2000). What has happened since then? I will explore the following components of the *digital divide* in Bangladesh: access to the Internet and computer/mobile devices, amount of education of its citizens, role of the government and the community, the skills of the teachers, and quality and quantity of the information available. Additionally, I examine the influence of skilled engineers and the country's economic status particularly the gross domestic product (GDP).

The term *digital divide* was first referred to in the late 1990s. Traditionally, the *digital divide* was defined as the *haves* or people that have the technology and the people that do not have access to technology as the *have nots* (Prensky, 2001). There are two points to this definition, namely the availability of and access to technology in general. This is a very broad term, as the type of technology is not specified. Servon (2008) further defined the digital divide as the inequality of access to technology between citizens of other countries or the people from the same country and focuses on the access to technology such as cellular phones, television, or computers (laptops, desktops, tablets).

Access

One explanation for the difference in usage is the timeline of when the digital age came to be a realization. Prensky (2001) coined the phrases *digital native* and *digital immigrant*. A *digital native* is defined as one who has been using and surrounded by technology his or her entire life and a *digital immigrant* is defined as one born before the digital age, but has adopted varying amounts of technology into his or her life. Napoli and Obar (2013) invented the term *mobile native* as a novice user with a low literacy level. The nonexistent technology curriculum means that this generation was not taught these skills.

Although more of the world is joining the digital age, it is estimated that only 39% of the world's population is connected and using the Internet (ITU, 2013). The International Telecommunication Union (ITU) also calculated that 77% of the population in the developed world accessed the Internet as compared to 31% of the population in the developing world. The digital divide can also be a socioeconomic measurement used to differentiate technological inequality. A concern among researchers is the social aspect of the digital divide. Fuchs (2009) stated that the digital divide should also be examined from within countries, looking at the differences or inequalities of people. Fuchs (2009) found that the gaps in the areas of access, skills, benefits, and engagement are partially due to the structure of the class of people. The findings showed the higher the income, social relationships, education, and technological skills, the higher the access, usage, and benefits of the technology. The digital divide should be considered an interconnected and complex situation (Fuchs, 2009). Several global studies have been done on the digital divide in various parts of the world including the United States, the Netherlands, and Germany. The dominant multidimensional facets for the highest access rates listed income as a primary factor followed by education, age, gender, and number of school-age children in the home.

Education

The general education system in Bangladesh is structured into three tiers. Starting in primary school, children aged 6-10 receive 5 years of education. The students then advance to secondary school for 7 years of school. The next step is the tertiary level for another 2-6 years of formal education. Unfortunately, according to UNICEF (2014), in Bangladesh, 34% of preschool age children are not in school while 16.2% of primary school age (6-10 years old) children are not in school. A much higher 30.7% of the lower secondary school age (11-13 years old) children also lack access to education. This represents 5.6 million children not in school in Bangladesh. This problem is not isolated to Bangladesh alone, but is common in the region of South Asia.

The beginning of this century showed alarming statistics for education in Bangladesh. Of the total number of teachers teaching primary education levels in Bangladesh, only 48.3% have earned the minimum education/training required (World Development Indicators database, 2004). The completion rate is calculated with the total number of students in the final year of primary school and subtracting the students who are repeating the year divided by the total number of students that are of graduation age. In 2009, the completion rate of Bangladeshi primary schools was 88% for girls and 90% for boys (Nation Master, 2014). There has been a big push for improving the educational system. The disparity of students is decreasing and the adjusted net enrollment for the primary years of education has increased from 80% in 2000 to 94% in 2012 for South Asia according to The Millennium Development Goals Report (2014).

Some of the common economic factors that can be used when comparing countries are the gross domestic product (GDP), Human Development Index (HDI), Gini index, purchasing power parity (PPP), and gross domestic income (GDI). Fuchs (2009) used beta coefficients to determine that economic performance is a primary influencing factor of physical Internet access rates. Other important factors included geography, equality, and democracy. Fuchs (2009) asserted that the global digital divide would not close as long as global and national inequalities exist and the disparity of the divide would not be solved without technological and economic solutions.

Blignaut (2009) stated that providing the technology and access to the technology is not the solution to close the digital divide. The ability to use the technology to empower and actively involve the user may bridge the divide. The knowledge of what the technology can do to assist people in their lives and the gratification from its use is part of the solution (Blignaut, 2009). Blignaut made it clear that there are two dimensions to the digital divide: access and usage. The usage factor concerns the usage patterns of the technology and the emotional satisfaction or gratification from that usage.

With the implementation of smart phones, tablets, and laptops, it is possible that some may think that we can simply send these devices to developing countries to close the gap to solve the problem. However, with a closer look one can see that this approach may only address the relative divide, but the absolute divide may not be addressed. The relative divide is the relationship of the amount of technology in a developed country as compared to the amount of technology in a developing country (James, 2011). Simple sending equipment will raise the inventory level, but not the efficient use of generating and distributing information. The reference to the digital divide in this paper is not only the ability to search and retrieve data/information, but also the ability to create and disseminate data/information.

Grassroots innovation (Heeks, 2012) is the process of providing technology to the poor. The country of Bangladesh is a young and developing country that gained its independence in 1971 from India, and has the eighth densest population in the world and is one of the poorest with a Gross Domestic Product (GDP) of $129.9 billion (The World Bank Group, 2014). A few of statistics of the country include a growth rate of 6.0%, and a GDP per capita of $2810. The population below poverty line is 31.5% (Index Mundi, 2010), the Gini index, which measures economic inequality is 32.12 (Index Mundi, 2010). This coefficient ranges between 0 and 1 which translates into 0% to 100% and measures the distribution of income from the completely equal distribution of 0 (The World Bank Group, 2014). The Human Development Index (HDI) is .509 (United Nations Bangladesh, 2014), and the Gross Domestic Index (GDI) is $900 (World Bank, 2013).

There are many signs of improvement, and efforts to use technology. As of 2014, the population is 166,280,712 people in a country measuring 142,615 square kilometers, which is 1203 people per square kilometer as compared to 35 people per square kilometer in the United States (The World Bank, 2014). The country first experienced connectivity in 1996 (Internet World Stats, 2014). As of June 2013, there were approximately 10 million Internet users which is a 7% penetration rate, and 3,352,680 Facebook users which is a 2.1% penetration rate (Internet World Stats, 2014). In 2014, the broadband speed was 4.49 Mbps (Internet World Stats, 2014), and as of 2013 mobile penetration has increased to 73% (Budde, 2014). Bangladesh now ranks 93 out of 108 countries for mobile use at 2.09 Mbps and 129 out of 192 countries for Broadband speed at 5.33Mbps (Ookla Net Index Explorer, 2014). In 2013, the number of fixed line subscribers flat-lined (Budde, 2014). They have experienced issues with government restrictions on VoIP (Voice over Internet Protocol) and bans on the sale of pre-activated SIM cards without valid subscriber identification (Budde, 2014). In February 2000, the government deregulated very small aperture terminals (VSAT), which has allowed the number of ISPs to increase and since November 2010 there were 105 nationwide ISPs operating in the country with the top two being GrameenPhone and Citycell (OpenNet, 2012).

Forty percent of rural Bangladesh is in the dark after 6:00 pm due to the lack of power. Grameen Shakti, a division of the Grameen Foundation aims to provide renewable energy technology to people living in rural villages (Grameen Shakti, 2009). The goal is to offer alternative energy sources through solar, biogas, and inexpensive clean energy (Grameen Shakti, 2009). They also aim to educate the people about the care of the environment, and assist the people to learn how to generate more income and improve their quality of life (Grameen Shakti, 2009). Since 1996, Grameen Shakti has 1,511 offices and has affected 50,000 villages accounting for approximately 10.8 million people. The villages may now have power for longer during the day and allow for more productivity (when electric is required). Eight million people are now able to light their homes and businesses from solar power. This allows devices to be in use or charging longer than was previously possible.

Government and Community

In 2000, the Government of Bangladesh eliminated the financial import duties associated with computers and peripheral equipment in order to make this technology more affordable and promote their utilization (SDNP, 2000). Unfortunately, some of the government policies still hinder their use and 90% of the computers remain in Dhaka the capital city of Bangladesh. For the rural population, the equipment is still not attainable financially. The Bangladeshi Government claims to want to help the country become a middle class country with a knowledge based society by 2021 (OpenNet Initiative, 2012). There is a national Information and Communication Technology (ICT) Policy that contains plans for the research and development of an ICT infrastructure, the legal issues, and the use of ICTs for the areas of e-commerce, e-governance, healthcare, agriculture, social welfare, and transportation issues (OpenNet Initiative, 2012). An ICT is defined here as the computers and digital and peripheral equipment normally found in educational settings. Other evidence of government support for a more digital country is the free *wifi* zones at Shahjalal University and Dhaka University, some online textbooks, and newly constructed computer labs in 128 schools covering 64 districts (OpenNet Initiative, 2012).

While in Bangladesh, I observed various levels of usage and users of technology. I noted the gender of those using technology was mostly younger men and boys. It was also interesting to see the excitement on the children's faces when I showed them the image display from my camera. They enjoyed seeing their picture immediately after it was taken. Additionally, most of them used their phones to take still photos or videos, but were not able to share their pictures in a venue like *Flickr* or other social media outlets.

In the city of Dhaka, many of the younger population also had phones, but they were used for communicating rather than picture taking. There were some people using smart phones, but they were the minority. While in Bogra, I watched the farmers bring their freshly harvested cow's milk to a milk collection station where it was quality tested before being transported to a chiller on its way to Grameen Danone for yogurt production. Most of the milk collection data that I observed was recorded and transmitted by hand.

Additionally, I had the opportunity to go to a rural village to meet the bankers of the local branch of the Grameen Bank. The Grameen Bank is a microcredit financial institution that awards small loan amounts to women only. A branch office serves several villages. Most of the branch offices are equipped with computers for record keeping and connect to other branches through an intranet (Grameen Communications, 2014). There are over 2500 branches. After my meeting at the branch office, I travelled into the rural village that is serviced by that local branch and met with approximately 40 women entrepreneurs. Their meetinghouse was a rather large rectangular screened in dwelling with a tin roof. There was a table in the front corner of the room where the banker counted the women's money and updated their loan records. Paper work is only done at the village level and consists of recording updated calculations in the passbook of the borrower (Grameen Communications, 2014). I attended their regular meeting and observed a male representative from the branch office who was there to receive their payments. The bank representative did have use of a calculator. Professor Yunus began this form of micro lending in Bangladesh to empower women and their families.

In the rural villages of Bangladesh, the *community* is an essential factor to survival. A study was done by Islam and Gronlund (2011) that investigated 420 rural Bangladeshi farmers. They identified that out of the farmers surveyed, 69% were between the ages of 26-50 and 43% had an education between grade 1 and 10 and 30% had no formal education at all (Islam & Gronlund, 2011). Interestingly, this study revealed that income, education, and amount of land or farm size were not dominant factors in the ownership of mobile phones, and *modernity*, having children or grandchildren, is a stronger predictor of phone ownership (Islam & Gronlund, 2011).

As of 2011, 70.2% of people in developed countries were connected to the Internet and only 24.4% of people in developing countries were connected (Napoli & Obar, 2013). Another recently coined term is *leapfrogging*, which refers to the ability to gain access to the Internet using mobile phones and not a personal computer (Napoli & Obar, 2013). The result is not only the absence of the personal computer, but also the technological skills and experience required to use it. Additionally, there are limitations with cellular devices that should also be considered. In order to contribute to *global conversations*, information must be disseminated and retrieved (Napoli & Obar, 2013). The World Wide Web Consortium formed a subgroup called the Mobile Web Initiative, which was given the task of examining the use of mobile devices as a medium for participation in social development (Napoli & Obar, 2013). Napoli and Obar (2013) also pointed out that while some countries are using mobile devices, not all these countries have access to the Internet via broadband. In 2011, it was estimated that there were 14 million mobile-only users in the world (Napoli & Obar, 2013). Another factor to note is that not all phones are smartphones and are called *feature phones*. These phones do not use touch screen technology, do not have a QWERTY keypad, and do not use an operating system. In the rural villages, most of the Bangladeshis I saw were using *feature phones*.

It is important to note the differences between mobile phones and personal computers (PC). The technological capabilities of these two devices used to vary greatly in memory, speed, and storage capacity (Napoli & Obar, 2013). These differences affected their usage in a variety of ways. Originally, mobile phones were not able to process information like a PC. The mobile phone lacked processing power, which limited its functionality and decreased performance. For more demanding functional requirements, mobile devices were not good replacements for PCs. However, in the past 5 years the processing ability of mobile phones/devices has increased significantly. The smart phone can now be used for information creation, retrieval, and dissemination. As of 2013, Napoli and Obar stated that the PC is still the primary device for working with large amounts of data and that the mobile device is still used mainly to retrieve information. One metaphor is that information retrieval from a PC is similar to scuba diving deep in a body of water versus from a mobile device which is like snorkeling in more shallow water (Napoli & Obar, 2013). To illustrate this with numbers, one study from Ishii (2004) found that PC based information retrievals included an average of 8.64 categories of websites versus an information search from a mobile device used an average of 3.58 categories.

Other newer technologies such as the *cloud* (cloud computing) can be used to store information that can later be accessed from almost anywhere.

According to Keizer (2013), 20% of all internet browsing was from mobile phones, and there was a 53% increase in the last year of global mobile phone usage. Due to the smaller physical size of the mobile device, there are limits on the amount of information displayed for the user to see on the screen. According to Napoli and Obar (2013), less than 10% of the content on the worldwide web is *mobile ready*. The content that is not *mobile ready* often can be seen on the mobile devices but with much less size ratio or available features than the full site accessed from a PC. To some users, this difference is a source of frustration; however, to the users in developing countries without access to PCs, they may not be aware of this difference. One other possible solution to address this deficit is the creation of the *app*. *App* is short for applications and is a software program that runs on electronic devices, smart phones, computers, or the Internet. *Apps* can provide content in many forms. Apps have been created for almost every subject in schools, and the cost of app can range from free to a nominal fee.

Napoli and Obar (2013) noted that the use of smartphones and other mobile devices as a possible solution to the digital divide is a gap in the literature. The use of integrated technology including hardware and software was supported in an educational curriculum through the Common Core State Standards (CCSS) from the United States, which are the latest curriculum standards to be revised worldwide (Silva, 2014). Silva (2014) noted that a 5-year study (2000-2005) in the North Carolina schools resulted in both positive and negative outcomes and more importantly, the negative effects were noted in the students that come from low income households. A 2012 study involved 32 countries of various economies, and a program that is focused on the older students (15 years) in the subjects of mathematics, reading, and science. The students took tests that were delivered both in paper mode and computer mode. The results revealed that some countries showed better results in the paper mode (Poland, Chinese Tapei, and Israel) while the students from the U.S., Italy, Slovak Republic, and Brazil scored better on the computer portion of the test (Silva, 2014). Two notable conclusions were noted from this study. One was the use of technology that is supported with capital has a more positive impact on the curriculum and increased student results. Another notable conclusion was the amount of usage and the amount of home usage influenced the results. The more daily usage and the more usage at home yielded higher test scores (Silva, 2014).

Skills of Teachers

There are current efforts in education to use mobile technology to assist teachers preparing to teach their classes in English. The teachers are using mobile technology such as iPods and CD players to enhance their professional development curriculum. Mobile technology has the potential to significantly affect the educational arena (Onguko & Ngatia, 2010). The second language of Bangladesh is English; however, according to English In Action (2009), teaching and learning English is difficult. One issue is the qualifications of the teachers. In Bangladesh, one of five teachers does not have the proper qualifications. It is essential to prepare the teachers for the material they will be teaching.

There is a 9 year (2008-2017) initiative called English In Action (EIA) that strives to teach Bangladeshi children the skills to communicate in English in order for them to participate in more global opportunities. Additionally, The Open University in the U.K. is working to assist with the development of the teachers in the EIA initiative. Shohel and Power (2010) stated that there are more than 30,000 poor children who are not involved in primary education and are participants in the Underprivileged Children's Education Program (UCEP) Bangladesh. UCEP is a nongovernment provider of general education and vocational skills. This program allows the children to attend school and continue to work. The attendance rate is high at over 94% (Shohel & Power, 2010). In the EIA model, there are four tracts (Communicate, Connect, Create, and Community). In the communicate tract, a program called the Secondary Teaching and Learning Programme (STLP) was designed to develop and support the teachers in a blended format. The teachers use iPods or other portable music devices to listen to professional development materials on their own. They are able to improve their skills in English, technology (iPods and speakers), and collaboration as they work on their own and with each other. Of the first 12 teachers in the program, the only reported problem with the technology (iPods and speakers only) was the volume was not loud enough through the smaller portable speakers (Shohel & Power, 2010). This effort serves as an optimistic initiative to bring technology and education together with the goal of using the technology for a positive change. A teacher can use a portable device to access the World Wide Web and use free websites that offer educational materials such as websites, videos, podcasts, blogs, wikis, or apps.

As of August 2014, 31.5% of the Bangladeshi people live below the poverty line (CIA World Fact Book, 2014). Furthermore, academicians and development agencies are now identifying poverty as not just tied to economics but also information (Ashraf & Malik, 2011).

Some have suggested that educating people especially in rural areas can empower them and play a major role in the decreasing of information poverty. It has been noted in the academic literature and in my own travels through Bangladesh that the rural villages are each different and some may operate differently such as being a village close to a river or port versus an interior or landlocked village.

A village library is called Gonokendra Pathagar. The Bangladesh Rural Advancement Committee (BRAC) organized and established the village libraries to provide access to educational materials to empower and create a *learning society* (Ashraf & Malik, 2011). These areas became common areas in the village and people came for discussions and activities. One of the benefits provided by gonokendras includes computer-training programs by BRAC members. The trainings take place in the city and then the librarians return to the village to be the on-site trainer. There are also multimedia opportunities including software programs developed by BRAC and in collaboration with UNICEF, programs created solely by BRAC, and the use of educational CDs. These outlets address social awareness, environmental issues, health, and general education. BRAC initiated this program and referred to it as the Information Technology program (Ashraf & Malik, 2011). This effort has proven useful and advantageous specifically for disseminating farming related information. The farmers can be educated to understand topics such as soil textures, irrigation techniques, fertilizers, and crop rotation. Bangladesh is mainly an agrarian culture which is also subject to natural disasters each year such as floods, drought, monsoons, and the breaking of rivers. This information could help the farmers to better cultivate the land for more prosperity.

Information Quality and Quantity

In a study conducted at the University of Dhaka, the research focus was the quality and quantity of the information from the students' point of view. The results indicated that digital information is most desired over printed media. The qualities considered most valuable when looking for information included easy access followed by complete and well directed information and then relevancy and current information (Islam, 2013). Results also showed that the students use Google, Yahoo!, and MSN in that order of popular search engine for their information, however out of 180 students 139 claimed that the search engines only partially provided the information that they needed. This could be due to the computer skills of the students as 116 students said they learned their computer skills on their own followed by those who claimed to be only partially competent with the computer. The higher-level computer skills of the students at this university could be due to the fact that the University of Dhaka claims to be one of the leading universities in Asia (University of Dhaka, 2009).

There is a significant amount of research emphasizing the importance education can make toward changing lives. This is true for developed and developing countries. Education can influence other areas such as political, social, and economic (Chowdhury & Alam, 2011). In the 21st century, a prime focus in education is technology and engineering. Prior to 1947, there were no educational opportunities in engineering in Bangladesh and those that were interested had to travel to the University of Calcutta, India to pursue their education. The first school was established in 1876 by the British Colonial Government and called the Dacca Survey School. The school was renamed to Ahsanullah Engineering College in 1947 and promoted to university status. In 1962, the name was changed to East Pakistan University of Engineering and Technology. Once Bangladesh became independent from Pakistan, the school was again renamed to be the Bangladesh University of Engineering and Technology (BUET) (Chowdhury & Alam, 2011). While the school was transitioning through various names, it also lacked the teachers or skilled professionals to teach the classes. Science and technology classes which are often prerequisite classes for engineering courses were not readily available in the rural schools. This contributed to the deficit of teachers (Chowdhury & Alam, 2011). Another limitation of Bangladesh's engineering program is the number of students accepted into the programs. In 2011, there were only 20,000 openings in all of the college diploma level institutes offering engineering degrees. Additionally, there are at most 480 openings for these 20,000 students to matriculate into a degree program at Dhaka University of Engineering and Technology. One more limitation is the uneven distribution of universities throughout Bangladesh. This restricts some of the students in the rural areas. In 2005, Bangladesh was graduating 44 engineering students per one million Bangladeshi citizens. As of 2011, this figure has increased to 7000 engineering graduate students; however, this number still lags behind 700,000 graduates in China or 40,000 in Brazil (Chowdhury & Alam, 2011). The Bangladeshi Government is taking a more prominent role to positively change this issue because without technology and engineering, the country will continue to fall behind the rest of the world and not prosper economically or thrive.

GDP Compared To Technological Skill

How does the gross domestic product affect the development and prosperity of the country as a whole? The country's GDP is a measure of growth in earnings and economic activity. As of 2011, the GDP for Bangladesh was 7%. A technologically capable society is better equipped to affect its socioeconomic development. There are functional areas that engineers can have a major influence: research, development and improvement, design, construction, and production. According to Rashid (n.d.), all types of engineering can have a major influence on the socio economic status of a country. The highest ratio of graduate engineering students per billion U.S. dollars is India with 868 and China has 268, while the lowest two are Pakistan with 111 and Brazil with 57. Bangladesh is in the middle with 126 (Chowdhury & Alam, 2011). Huang et al. (2009) stated that there is a direct linear relationship between the technical skills in the industrial sector as a major contributor to the national GDP and the long-term growth of the GDP. One other problem with trained engineers is retention. It is common for trained engineers to work in other countries to make more money. Chowdhury and Alam (2011) referred to this as *brain drain*, which is not a positive aspect for their home country's socioeconomic status. In order to succeed with *brain drain*, Bangladesh would need to increase its number of trained engineers by 20%. While Bangladesh is still behind most other developing countries educationally and socio-economically, one thing that is known is the importance of the training and education of the engineers is a vital skill for the country's prosperity and sustainability of their long term GDP.

Conclusion

Bangladesh is a young independent country that is making strides to join the digital world. These observations are confirmed in the literature, and it is in my experience that Bangladeshi citizens have the potential to realize the benefits of using technology. There has been an increase in school enrollment and usage of technology. Although it is important to note that simply accessing and retrieving information is not bridging the digital divide, there must also be creation and dissemination of information. This means that just providing the technology is not good enough, and there needs to be guidance and education. With this effort, Bangladesh should continue to strive toward the goal of being a *Digital Bangladesh* by 2021 (Budde, 2014).

References

Blignaut, P. (2009). A bilateral perspective on the digital divide in South Africa. *Perspectives on Global development and Technology*, 8, 581-601. doi:10.1163/156915009X12583611836091

Budde, P. (2014). Paul Budde Communications Pty Ltd. Retrieved from http://www.budde.com/Research

Fuchs, C. (2009). The role of income inequality in a multivariate cross-national analysis of the digital divide. *Social Science Computer Review*, 27*(1)*, 41-58. doi:10.1177/0894439308321628

Grameen Communications. (2014). Grameen Bank: Bank for the poor. A short history of Grameen Bank. Retrieved from http://www.grameen-info.org/index.php?option=com_content&task=view&id=19&Itemid=114

Grameen Intel Social Business Ltd. (2011). Grameen Intel Social Business Ltd. Retrieved from http://www.muhammadyunus.org/index.php/social-business/grameen-intel

Grameen Shakti. (2009). Grameen Shakti. Retrieved from http://www.gshakti.org/index.php?option=com_content&view=article&id=58&Itemid=62

Heeks, R. (2012). IT innovation for the bottom of the pyramid. *Communications of the ACM. 55(12),* 24-27. doi: 10.1145/2380656.2380665

Index Mundi. (2010). Retrieved from http://www.indexmundi.com/facts.bangladesh/gini-index

Ishii, K. (2004). Internet use via mobile phone in Japan. *Telecommunications Policy, 28,* 43-58. doi:10.1016/j.telpol.2003.07.001

Islam, Md. Maidul. (2013). Measuring Dhaka University Students' Internet Use Behavior of the Department of Information Science and Library Management. *Library Philosophy and Practice.* Paper 920. Retrieved from http://www.DigitalCommons.unl.edu/libphilprac/920

Islam, M., & Gronlund, A. (2011). Bangladesh calling: farmers' technology use practices as a driver for development. *Information Technology for Development, 17(2),* 95-111. doi:10.1080/02681102.2010.526093

ITU (International telecommunication Union). (2014). ITU releases latest global technology development figures. Retrieved from http://www.itu.int/net/pressoffice/press_releases/2013/05.aspx#.U-BPTWt5mK2

James. J. (2011). Are changes in the digital divide consistent with global equality or inequality? *The Information Society, 27,* 121-128. doi: 10.1080/01972243.2011.548705

Napoli, P., & Obar, J. (2013). Mobile leapfrogging and digital divide policy: Assessing the limitations of mobile Internet access. *Fordham University Schools of Business Research Paper*, (2263800).

Nation Master. (2014). Bangladesh primary completion rate stats. Retrieved from http://www.nationmaster.com/country-info/profiles/Bangladesh/Education/Primary-completion-rate

Onguko, B. & Ngatia, S. (2010). Mobile learning: Small technologies massive contribution. *Education in a Digital World 2.0 Series*. Retrieved from, http://www.learncentral.org/node/65720

Ookla Net Index Explorer. (2014). Bangladesh. Retrieved from http://www.explorer.netindex.com/maps

OpenNet Initiative. (2012). Bangladesh. Retrieved from http://www.opennet.net/countries/bangladesh

Prensky, M. (2001). Digital natives, digital immigrants. *On the Horizon* (MCB University Press). 9*(*5). Retrieved from http://www.marcprensky.com/writing/Prensky%20-20Digital%20Natives,%20 Digital%20Immigrants%20-%20Part1.pdf

Servon, L. (2008). *Bridging the digital divide: Technology, community and public policy*. Hoboken, NJ: John Wiley & Sons.

Shohel, M. M. C., & Power, T. (2010). Introducing mobile technology for enhancing teaching and learning in Bangladesh: teacher perspectives. *Open learning*, *25*(3), 201-215.

Silva, J. (2014). What international studies say about the importance and limitations of using computers to teach mathematics in secondary schools. *Springer International Publishing*, *8543*. doi:10.1007/978-3-319-08434-3_1.

UNICEF Regional Office for South Asia. (2014). Global Initiative on Out-of-School Children. South Asia Regional Study Covering Bangladesh, India, Pakistan and Sri Lanka. Retrieved from http://www.learningforpeace.unicef.org/wp-content/uploads/2014/01/SouthAsia_OOSCI_Study_27Jan_014Final.pdf

United Nations Bangladesh. (2014). United Nations Bangladesh. Retrieved from http://www.un-bd.org/bgd/

Wikipedia. (2014). Wikipedia. Retrieved from http://www.En.wikipedia.org/wiki/Wikipedia#editing

The World Bank Group. (2014). Bangladesh. World Bank, Washington, DC. Retrieved from http://www.worldbank.org/en/country/bangladesh

University of Dhaka. (2009). Brief History. Retrieved from http://www.du.ac.bd/the_university/index.php