Examining Trends in ICT statistics: How Does the Philippines Fare in ICT?

by

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ABSTRACT

In the past one and a half decades, the world has vastly changed economic transactions, data sharing, and the entire general way of life given the dynamic and innovative landscape brought about by information and communications technologies (ICT). In this paper, we firstly describe the deluge of digital data known as Big Data and its potentials for generating socio-economic statistics given issues of veracity and privacy. We also give a brief history of the internet in the Philippines, and discuss the increased internet access and usage in the country. Other ICT statistics are also examined in this discussion paper, that describe a host of issues regarding the ICT sector, particularly infrastructure and the policy environment. Finally, we provide some suggestions on how the country can make its digital dividends more inclusive.

KEY WORDS: ICT, Big Data, internet, social media, veracity, privacy, digital dividends

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1. Introduction

Information and communications technologies (ICT) has been a game changer in our ways of doing things, especially in accessing and sharing information, connecting with one another, as well as in doing business and providing services. Tools on ICT, i.e., desktops, laptops, tablets, mobile phones, and other gadgets, as well as the internet and social media (facebook, twitter, instagram, youtube, dubsmash, spotify, *etc.*), have provided us the means to transmit and exchange data much faster, whether these data are in the form of sound, text, visual images, signals or any other form or any combination of those forms.

Today, we are awash with data as a result of tools in ICT that have made data more easy to collect, store, analyze, share, re-share and re-analyze. We live in a world where everything is just a click away, all because of ICT. There is also now discussion about the next big ICT revolution: the Internet of Things (IOT). Imagine what we see in "Star Trek" movies, objects all networked, everything becomes linked with everything else, and objects giving us "feedback" … Entering your house and the entire room light up and have a temperature that you want and automatically open your television to your favorite tv show; or having your sofa buzz your phone to tell you that you have left your wallet behind; or having your refrigerator order your groceries online without you having to make a shopping list. All these requires putting chips in your tv, lights, air conditioner, sofa, your wallet and your refrigerator to enable them to talk to the rest of the world. The IOT roughly means connecting any device with an on and off switch, and a chip to the internet (and/or to each other). This includes everything from cellphones, refrigerators, air conditioners, washing machines, cars, jet engines of an airplane, *etc*. The analyst firm Gartner (2015) estimates that by 2020 there will be about 21 billion connected devices, which means for every person, there will be three devices connected to the internet by then. The relationship of connections from the IOT will be between people-people, people-things, and things-things. This is already starting.

In a world of vastly changing economic transactions, the ICT sphere is undoubtedly important to sustain economic activity. Both the public and private sectors are challenged to keep up with the pace of changes in ITC. Quiang (2009) estimates that for every 10 percent increase in high speed internet connections, economic growth increases by 1.3 percent (1.38 percent for high income economies, and 1.21 percent for low to middle income economies). As the Philippines has developed a new economic growth trajectory, it requires reliable, accessible and affordable ICT services for Philippine participation in the information economy. It is important for the Philippines to maximize the digital dividends resulting from the wider use of ICT in the country. It is crucial that policies are formulated and implemented to underscore the positive effects of ICT to economic growth, particularly in promoting a more sustained and inclusive economic growth. The provision of accessible and affordable ICT services to Philippine society can be achieved through the proper implementation of existing regulatory frameworks, the formulation of better laws, rules and regulations, increased investments in upgrading ICT infrastructures that can be shared by all, and improvements in the capacity and accountability of institutions that administer and manage the ICT sector.

ICT statistics need to be examined carefully in order to see the landscape. In 2000, the world committed to the Millennium Development Goals (MDGs), a set of 8 poverty and related goals by 2015. Given the importance of ICT in development, three ICT statistics have been monitored for the MDGs, *viz*., fixed telephone subscriptions per 100 inhabitants mobile-cellular subscriptions per 100 inhabitants, and number of internet users per 100 inhabitants.

Last September 2015, nations of the world gathered to commit to the 2030 Agenda for Sustainable Development, including the 17 Sustainable Development Goals (SDGs). Global monitoring of the SDGs involve 169 targets and 230 indicators. Six of these indicators are ICT statistics: (a) Proportion of individuals who own a mobile telephone, by sex; (b) Percentage of schools with access to: (i) the internet for pedagogical purposes; (ii) computers for pedagogical purposes; (c) Percentage of adults (15 years and older) with an account at a bank or other financial institution or with a mobile money service provider; (d) Percentage of population covered by a mobile network, by technology; (e) Fixed internet broadband subscriptions, by speed; and, (f) Proportion of individuals using the internet.

In this Discussion Paper, we firstly discuss the rise of Big Data, i.e. digital data exhaust from using tools of ICT, and the potentials of this data source as an alternative data source for statistics especially in the wake of the world's commitment to the 2030 Agenda on Sustainable Development, and the Sustainable Development Goals. Then we discuss a brief history of the internet in the Philippines, and some statistics about internet access in the country. We then further examine trends in various ICT statistics and discuss several issues regarding the ICT sector, particularly infrastructure and policy issues. We also discuss some ways forward so that the country can work on ways to having its digital dividends, i.e., the development effects of these technologies, more inclusive.

2. The Rise of Big Data

We have an enormous amount of digital data being created and shared, especially with the availability of smart phones, the internet, social media, sensors and other tools of ICT. This 2016 alone, in a span of minute, there have been 700 thousand facebook logins, 350 thousand twits, 2.8 million videos viewed on youtube and 2.4 million google searches, and 150 million emails sent (Figure 1).

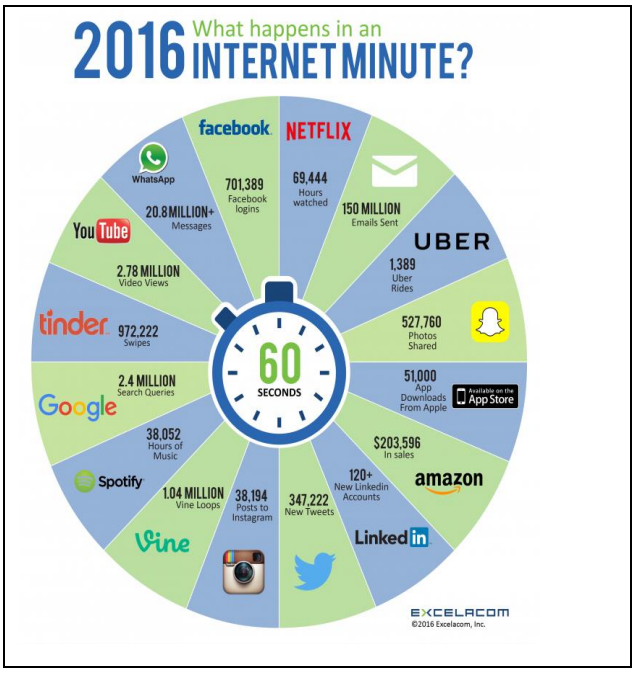


Figure 1. Infographic on "What Happens in an internet Minute"
Source: http://www.excelacom.com/resources/blog/2016-update-what-happens-in-one-internet-minute

More than a decade ago, a study from UC Berkeley by Lyman and Varian (2003) that was supported by IMB, suggested that from the beginning of time until 2003, we were only able to create five exabytes (i.e. five billion gigabytes) of data. Further, between two and three exabytes of that information was generated in 1999. Most of that data (about 92 per cent) was stored on magnetic media, primarily hard drives. Dave Turek (2012) of IBM's exascale computing suggested that in 2011, five exabytes were then being created every two days; and IBM predicted that by 2013, this amount of information would be created every ten minutes.

Every time, we make use of our mobile phones, it sends out its Global Positioning System (GPS) location, every time we use the internet and purchase something online, every time we click the Like button on Facebook, or upload photos on Instagram, or do a search on google, we are essentially creating digital information. And this in only part of the bigger picture: business develop databases from customer records, ATM transactions, and they security camera videos and images.

Google has become a buzz-word because of its search facility. Even students in school would probably be going less to the library these days to seek information, and would instead "google" it. When Google was founded close to two decades ago in September 1998, it was serving ten thousand search queries daily; a year after being launched, Google was already answering as much as 3.5 million search queries per day. (Battelle, 2005). internet Live Stats, a website that consolidates internet statistics from across several sources, estimates that today, Google now processes globally over 3.5 billion searches per day, equivalent to 1.2 trillion searches per year.

Google established in 2008 a real-time flu tracker called "Google Flu Trends" by watching where people searched for terms relating to illness and mapping that data with the US Center for Disease Control. An article in Nature (Ginsburg *et al*. 2009) reported that flu incidence estimate from Google correlates strongly with the official statistics released by the US Center for Disease Control (CDC). What was astonishing here was that while the Google statistics on flu incidence were aggregates with a delay of just one day, official statistics from the CDC took a week to put together based on administrative reports from hospitals. What was also astounding was that the flu tracker was rather quick, accurate, and cheap to generate, while official statistics were not as timely and involved huge costs.

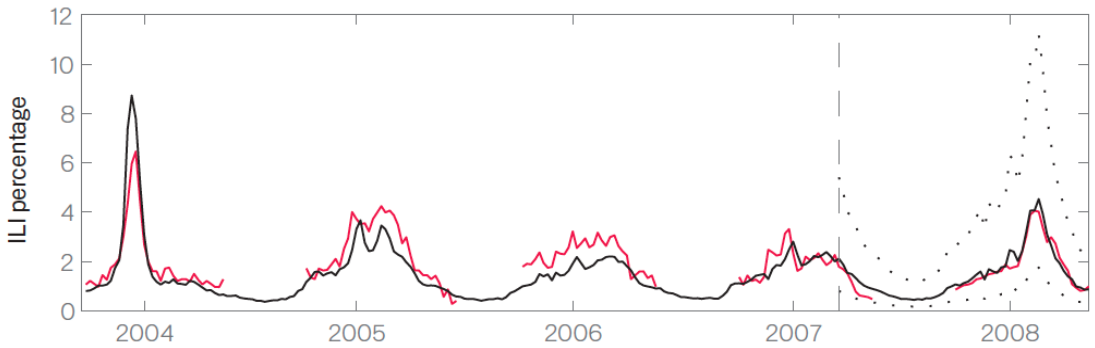


Figure 2. Model Estimates of Influence-Like Illness (ILI) Incidence from Google Flu Trends in the Mid-Atlantic Region in US (in red) vs Official Estimates in Percentages (in black) from the US Center for Disease Control (CDC).
Source: Ginsberg, *et al.*, 2009.

Currently, Google is engaged in an experiment to work on the same idea for the Flu Trends, but now for Dengue, and there are also indications of success at least for Brazil. Flu trends have also been similarly examined by other researchers using other Big Data sources. For instance, Paul and Dredze (2011) look into monitoring the incidence of flu (as measured by the CDC) with total tweets per week between mid-August 2009 and October 2010, and noticed similarly a correlation of tweets with the influenza rate in the United States, just like the Google flu trends.

This deluge of digital data from making use of electronic devices (smart phones, tablets, laptops), social media, search engines, as well as sensors and tracking devices (including climate sensors and GPS) is called Big Data, although strictly speaking there is no official definition of Big Data (Albert 2014). This buzzword in business, technology and science has taken over the hype from the other buzzword "Data Mining." The term Big Data is characterized by 3Vs: (high) volume, velocity, and variety. A fourth V, veracity, has also emerged and will be explained in later portions of this section. We have a huge amount of data from use of ICT tools at fast speed of availability, storing, sharing, and processing. Further, we have a large number of types of data, whether in text, sound, visual images, signals or any other form or any combination of those forms.

Across both the private and public sectors, more and more data is being collected and stored. For instance, firms in the business process outsourcing (BPO) sector in the country (that have had phenomenal growths in employment and provided considerable contribution to the economy in recent years) are also collecting cross-border transactions and information on clients. Thus, private sector companies have been examining their growing databases to gain insights about customer preferences based on Big Data analytics. For instance, Amazon periodically examines their customer database to inform clients that "customers who bought Product A also bought Product B, Product C or Product D …" based on predictive modeling association rules and collaborative filtering. In call centers, recorded conversations may allow not only the recording but a real-time analysis of what customers say that will enable call center agents to determine their best responses to clients through "text" analysis. Social media data, such as tweets on Twitter, are likewise examined through text analysis in terms of "polarity" (i.e., positive, negative, or neutral) of expressed sentiments on a product, such as a movie, or a political candidate. Google has also examined web-searches and found a strong correlation of search with actual sales (of cars), among other statistics (Choi & Varian, April 2009).

Big Data applications have gone beyond the realms of business into issues regarding development, especially humanitarian purposes. For instance, in the aftermath of the Haitian earthquake, project Flowminder was conducted to essentially predict population movements to prevent cholera outbreaks using digital data. The project researchers gained access through mobile phone companies regarding the location of mobile phones as transmitted by SIM (Subscriber Identity Module) cards to the cell towers. Using 1.9 million signals from 42 days before the Haiti earthquake and 158 days after the earthquake, Bengtsson et al. (2011) used the number of signals to extrapolate to the number of people moving out of the Haiti capital Port-au-Prince, who would be potentially bringing cholera with them to the places where they move to. The data on population movements would then be able to identify areas outside Port-au-Prince at risk of cholera outbreaks as a result of the outmigration in the wake of the disaster. The results of Bengtsson *et al*. (2011) were validated with information from Haiti's

National Civil Protection Agency (which counted buses and ships leaving the affected area), and with a sample survey of households conducted by the United Nations Population Fund.

Lu *et al*. (2012) conducted a follow up study of movements of the Haiti population in the aftermath of the earthquake, and discovered that the place where people went to outside the capital during the first three weeks after the earthquake were correlated with the locations to which they had significant social bonds. In consequence, population movements in the aftermath of a disaster may be significantly more predictable than was previously understood.

A few other Big Data applications on disease mapping even outside of the context of natural disasters, include malaria mapping in Kenya (Wesolowski *et al*., 2012), and on controlling the spread of the H1N1 virus in Mexico (Frias-Martinez *et al*., 2012).

Trends in poverty conditions have been traditionally obtained through an examination of results of household surveys on living conditions that collect either income, expenditure, or other nonmonetary indicators of welfare. However, in small areas, such as districts, cities, or villages, there are sparse poverty data as household surveys are designed to get aggregate pictures at national or regional levels. While work has been conducted on performing regression models on survey data to predict welfare conditions of households, and on applying these regressions to census data to yield estimates of poverty status of households in a census, this has been computer intensive, and requires results from rather infrequently collected censuses (See, e.g., Albacea, 2009).

A rather promising approach to developing data on poverty incidence at small areas in real-time involves the use of call detail records (CDR) as well as information on mobile customer behavior (to proxy poverty status of mobile users). This was tried out in Côte d'Ivoire (Smith *et al*. 2013). Since the 1990s, no full survey of the country's population has been published owing to the civil war that Côte d'Ivoire came out of. Smith *et al*. (2013) used anonymized CDRs of five million telecommunications customers between December 2011 and April 2012 to assess both the level of activity among subscribers and the locations where subscriber calls were made. Higher levels of mobile communication, expenses for top-ups and a wider range of calls are used to proxy welfare of mobile users. Using these mobile data, poverty incidence across eleven regions of Côte d'Ivoire were quantified, and the results were validated with a multidimensional poverty index created by University of Oxford, which uses indicators such as poor health, lack of education, inadequate living standard and threat from violence among other factors.

Aside from poverty mapping, various research has also been conducted socio-economic indicators in the UK (Eagle *et al*., 2010) and in Latin America (Frias-Martinez V, Virsesa, 2012). Studying transportation networks have also been looked by way of monitoring people's travel routes (Berlingerio *et al.,* 2013) using mobile data.

Legara (2015) examines Twitter use in the Philippines. She notices that tweets correlate with population density, as well as with the Gross Regional Domestic Product (see Figure 3). She further examines twitter usage, particularly in Metro Manila, and notices that twitter usage in the National Capital Region (NCR) provides a proxy of road networks in the NCR (see Figure 4). This suggests how Big Data can actually give promising insights on traffic flow that could lead to some interventions to ease problems in Metro Manila. In particular, what deserves some extra research attention would be whether current popular apps used in smartphone such as Waze, and data on people's movements as reflected in sensors can

provide information on traffic mobility or traffic flow problems that could serve as insights for intervention, especially during regular peak traffic hours.

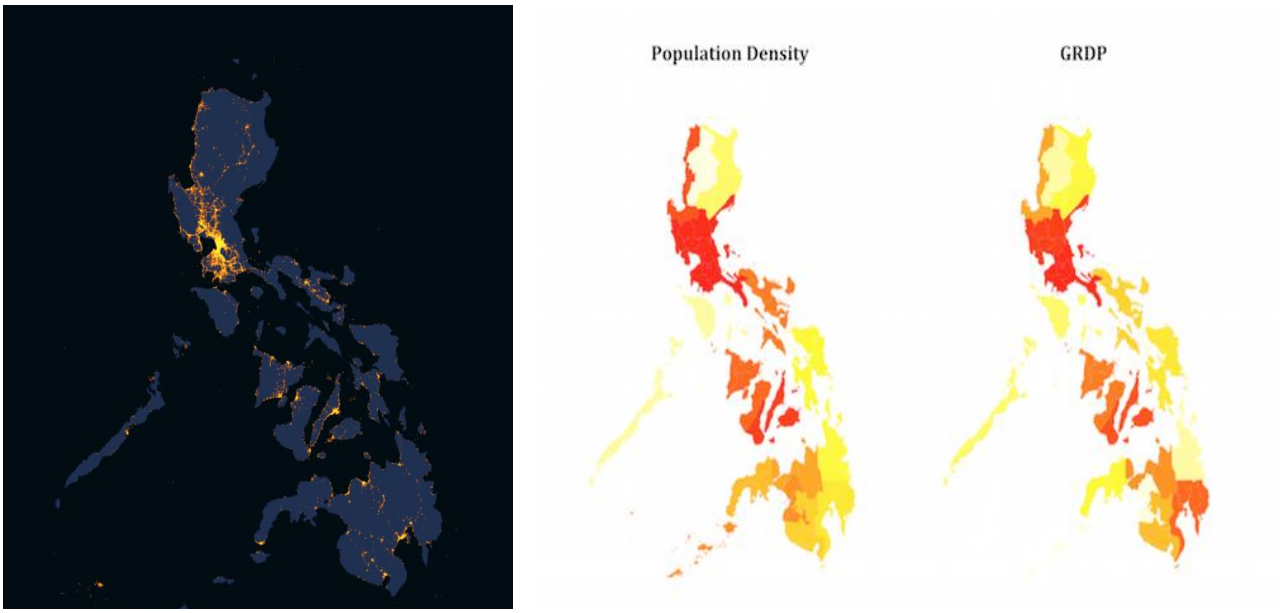


Figure 3. Geo-Tagged Twitter Data in the Philippines vis a vis Population Density and 2014 Gross Regional Domestic Product (GRDP).
Source: http://erikafille.ph/2015/09/10/urbanism-in-the-philippines/

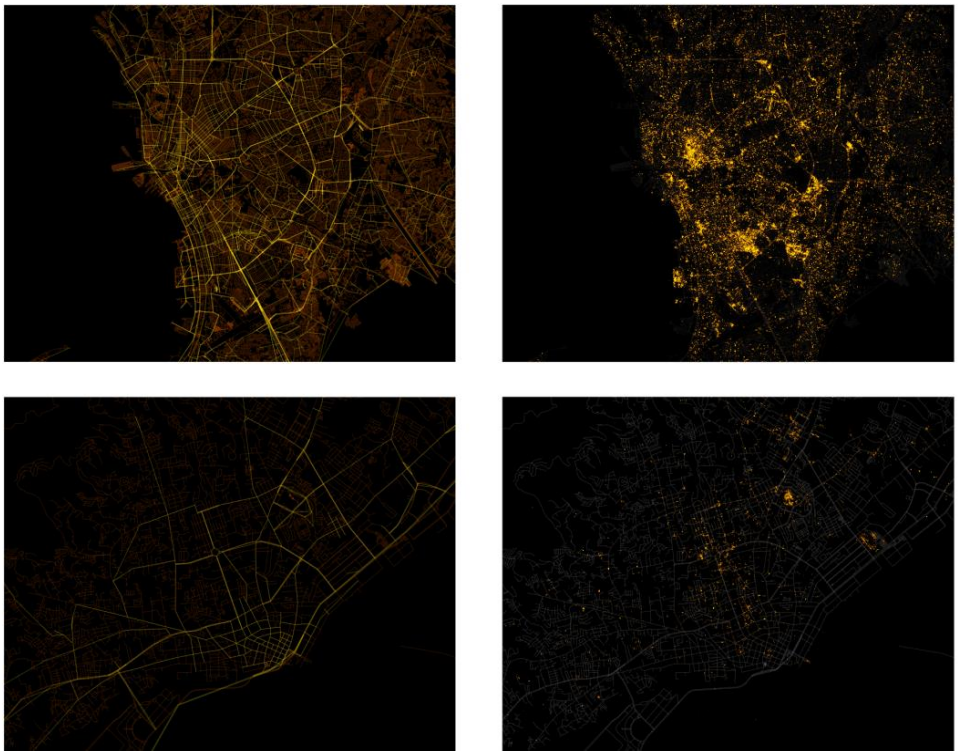


Figure 4. Geo-Tagged Twitter Data in Metro Manila vis a vis Road Network.
Source: http://erikafille.ph/2015/09/10/urbanism-in-the-philippines/

Letouze (2012) describes work of the UN Global Pulse, specifically in its Pulse Laboratory in Jakarta where some promising research has been undertaken relating tweets about rice and other basic food commodities on Twitter with official food price inflation from 25 cities in Indonesia. See Figure 5.

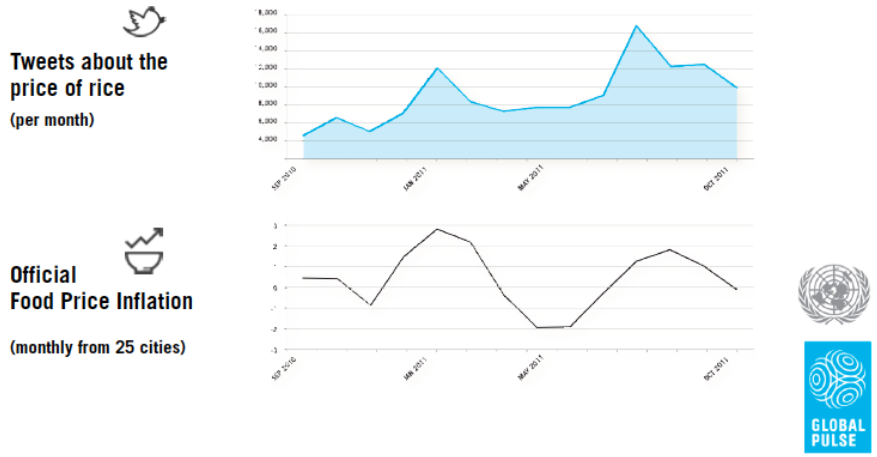


Figure 5. Tweets on Rice, Chillies, Fish, Sugar, Corn, Cooking Oils per month versus Official Food Price Inflation.
Source: Letouze (2012)

In the Philippines, there has been a lot of concern about the effects of climate change, both in terms of warmer temperatures and heavier rainfall associated with climate hazards (Thomas *et al*., 2013). In consequence, government has made huge investments in making use of climate sensors data, launching a project called the Nationwide Operational Assessment of Hazards (NOAH) in June 2012 under the Department of Science and Technology (DOST). This project aims to provide a 6-hour lead-time warning to vulnerable communities against impending floods and to use advanced tools of ICT to enhance current geo-hazard vulnerability maps. This appears to have yielded some successes, for "normal" climate disasters. Some local governments, e.g. Albay, have developed excellent disaster preparedness and have generally met targets for zero casualties also with the use of project NOAH information. Some areas in Mindanao that were previously unprepared for climate disasters have improved preparedness. For instance, while there were 676 deaths in Cagayan de Oro (CDO) due to typhoon Sendong in 2011, yet there was only 1 death in CDO due to typhoon Pablo a year later. However, for "extreme" climate events, rising tolls and costs continue. The supertyphoon Yolanda was reported to have yielded 8201 deaths, 0.9Billion USD in damages, 18 million persons affected, 1.1 million houses affected. The massive costs were in part because there was lack of understanding among LGUs and communities affected about the impending disaster despite repeated warnings from national government based on project NOAH assessments. The possibilities of examining population movement, especially most devastated, with digital traces from mobile phone usage as has been done in other countries would be important to explore.

While there may be much promise in getting information from Big Data sources, there are a host of issues also about conducting research on Big Data, how much promise it actually offers, and how it needs to be communicated (to maximize the information's leverage). The reliability of Big Data will partly depend on whether information from internet users can

proxy for information of the larger population. Further, Big Data holdings are typically in the hands of private corporations who do not necessarily make these tsunami of data available for research. If they do make this available, it will either be for a cost, and those that are publicly available are a minute portion of the actual data. For instance, only a very small subsample of twitter data is available publicly for free, and there may be questions on whether the sample made available by twitter is representative. Thus issues of availability for exploration of the use of Big Data can create new digital divides (Fan & Bifet 2012).

When we started making use of google years ago, did we ever get to think that Google would get to make use of our search behavior to monitor the flu? When mobile users in various countries began using their mobiles, were they aware that "Big Brother" would be watching over them? In other words, did we have a "Notice and Consent" for making use of information we provide, and even if we did, did we agree to future uses? While there may be scope for justifying the monitoring of peoples' movements for humanitarian purposes, including disease mapping, clearly there is a need to examine issues of privacy as there is a strong risk for abuse, a potential for harming people. Privacy is a bedrock of human dignity, and one of the fundamental human rights recognized in the UN Declaration of Human Rights. It can be thought of in terms of data protection, and thus interpreted in terms of the management of personal information, i.e., *the ability of individuals to determine who holds information about them and how is that information used.* [2]

An issue with Big Data is that users of internet services and ICT devices are most likely unaware that when they used digital technologies they were making personal information and/or unaware of what this personal information that they shared would be used for. The recent data hack[3] of records of voters at the Commission on Elections (COMELEC) not only gives concerns about the possibility of cheating in the elections, but also is a nightmare in case those engaged in cybercrime manage to combine these leaked voter data with other data holdings from bank accounts, credit cards, and consumer transactions thus harming people. The COMELEC data hacked is reported by security researcher Troy Hunt (2016), in a blog[4] to be 76GB worth of (usually) compressed files that expands out to 338GB, containing 55 million records of voters with as many as 228,605 email addresses. Aside from email addresses, there are also reportedly records of sex, marital status, place of birth, current address, profession, phone number, heights, weights, parents' names of voters, fingerprint data (taken during the time of biometrics), and in the case of 1.3M overseas voters, their passport numbers. Further, there are some reports that the data hacked also contain records of persons who requested for exemption from the gun ban, such as bagmen who may be delivering money, including their addresses, putting these people as targets for criminal elements. The hacking of the COMELEC voters data was done by two groups, LulzSec Pilipinas and Anonymous Philippines, the latter of which demonstrated in a youtube how they merely applied an SQL injection[5] to hack COMELEC. The lack of public acknowledgement of the hack by the COMELEC itself is worrisome given the need for transparency and accountability, as well the need to provide the public information on how to

[2] http://www.ohchr.org/Documents/HRBodies/HRCouncil/RegularSession/Session23/A.HRC.23.40_EN.pdf

[3] http://www.rappler.com/nation/politics/elections/2016/127315-comelec-data-hackers

[4] https://www.troyhunt.com/when-nation-is-hacked-understanding/

[5] https://www.troyhunt.com/everything-you-wanted-to-know-about-sql/

see remedies if they are vulnerable. As Albert (2014) pointed out "privacy has legal, technological, and ethical issues."

While there are currently various mechanisms to protect privacy, including asking people to opt out of studying the information they give, and anonymization methods, such as differential privacy and "space time boxes", these methods are not fool proof. Even when we anonymize, there is potential to re-identify. Ultimately, there will be a need to build institutional capacities to protect data privacy and to minimize risks for data breaches.

Some global firms such as MasterCard work on their huge data holdings by anonymizing their client records before conducting data mining, i.e., statistical analysis on these databases. Other firms not only have specific people accountable on data privacy, but also have data philanthropists who are tasked to work on making data available for public benefit but guarding privacy. This involves having anonymized databases available for analytics to researchers, particularly for development purposes, such as to examine population movements in the wake of natural disasters, to track epidemics, and to relieve traffic congestion.

The deluge of data being generated from searches, from mobile phone usage, from customer databases, and particularly even from ICT-business process outsourcing sector in the Philippines provides many benefits to consumers but they include very precise, geo-location-based personal information which pushes the boundary of confidentiality/privacy. There are legal issues on privacy, and thus a number of countries have developed legislation on privacy. In the Philippines, the Data Privacy Act of 2012 or Republic Act (RA) 10173 has been legislated. The Data Privacy Act seeks to "protect the fundamental human right of privacy, of communication while ensuring free flow of information to promote innovation and growth." The law further recognizes the huge contributions of ICT for nation-building while maintaining the obligation of government to ensure that the privacy of personal information[6] citizens are well-guarded and protected. The Data Privacy Act grants specific rights to data subjects or persons whose personal or sensitive personal information are subject to processing[7], as contemplated by law. The Act also imposes strict restrictions on the use of such information by third parties to ensure individual's privacy.

The provisions of the Data Privacy Act are clearly necessary and timely indeed in the era of Big Data. Unfortunately, implementing rules and regulations (IRRs) for this key piece of legislation have yet to be written, and the National Privacy Commission (NPC) was effectively only established by government last month with the appointment of one DOST

[6] Personal information is defined as "any information whether recorded in a material form or not, from which the identity of an individual is apparent or can be reasonably and directly ascertained by the entity holding the information, or when put together with other information would directly and certainly identify an individual." These include a person's residence, place of birth, the amount of salary, etc. The law further classifies personal information as sensitive personal information when they are: "1) about an individual's race, ethnic origin, marital status, age, color, and religious, philosophical or political affiliations; 2) about an individual's health, education, genetic or sexual life of a person, or to any proceeding for any offense committed or alleged to have been committed by such person, the disposal of such proceedings, or the sentence of any court in such proceedings; 3) issued by government agencies peculiar to an individual which includes, but not limited to, social security numbers, previous or cm-rent health records, licenses or its denials, suspension or revocation, and tax returns; and 4) specifically established by an executive order or an act of Congress to be kept classified."

[7] Processing includes "collection, recording, organization, storage, updating or modification, retrieval, consultation, use, consolidation, blocking, erasure or destruction of data."

Assistant Secretary as a commissioner. To what extent telcos are employing insights in the huge databases they collect rather than sharing individual information such as contact numbers to other firms (the latter of which is a violation of privacy) is unknown. Currently, private firms are merely policing themselves, until such time that a fully functional regulator on data privacy is performing its mandate. Even in the public sector, there appears to be a lack of seriousness in dealing with the issue of data privacy and network security to protect data holdings.

Big Data is also burdened with methodological challenges regarding veracity and reliability. An article in *Nature* (Butler 2013) reports on the discrepancy between the Google Virus Trends estimate of flu levels in the United States and the official estimate from the CDC (11% versus 6%) in January 2013 (see Figure 6). While there is no assurance that the CDC estimate is accurate, that there is divergence here between these two estimates needs further investigation.

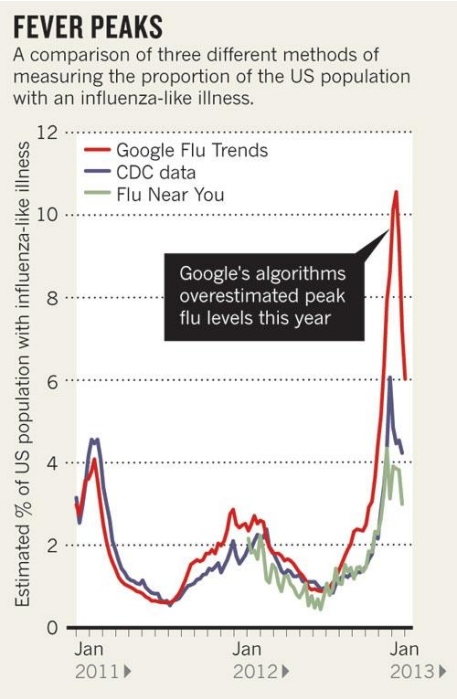


Figure 6. Discrepancy in Google Flu Trends Estimates in January 2013 with Official CDC Estimates of Influenza-Like Illness Incidence.
Source: Butler (2013)

A study of Twitter and Foursquare data before, during, and in aftermath of Hurricane Sandy (Grinberg et al. 2013) reveals that the greatest number of tweets about Hurricane Sandy came from Manhattan, which created an impression that Manhattan was the most badly hit by Hurricane Sandy, when, in fact, it was not. More recently, many have been examining digital conversations on twitter and facebook, and internet searches, and have noticed that some candidates have been getting more interest (whether positive or negative), but that some of the spikes may actually be the result of bots, i.e. web or internet robots or software applications that run automated tasks (such as scripts, including tweets) over the internet.

An article on Rappler[8] examines tweets about the Philippine presidential candidates over the period between October 26 and November 25, 2015 which captured a dataset of 116,071 tweets and described how the work of a bot artificially inflated the frequency of tweets of one candidate, leading the writers to point out that we will still be a long way in accurately measuring popularity of candidates with volume of internet conversations: "When it comes to evaluating a candidate's popularity based on their Twitter buzz, perhaps quality should matter more than quantity this election season". This is similarly pointed out by Nate Silver (2015) in his book "The Signal and the Noise" when he says that more data need not mean better data: "If the quantity of information is increasing by 2.5 quintillion bytes per day, the amount of useful information almost certainly isn't. Most of it is just noise, and the noise is increasing faster than the signal."

The more data we have, the more likely that we will have false confidence in data, and thus, it will be extremely important to find ways of ensuing veracity, the fourth V of Big Data. In other words, there ought to be ways to filter out the noise, and assure the quality of information. Big Data may be quick and cheap, but false and dirty.

3. Increasing Access and Usage of internet in the Philippines

The deluge of digital data is a result of increased access and use of the internet globally, and even in the Philippines. Last year, 2015, marked the 21st anniversary of internet in the Philippines. The late Jim Ayson (2011), one of the founders of internet in the Philippines, pointed out that as early as 1986, however, some Filipinos were experimenting online through Bulletin Board Systems (BBSs), which included Star BBS, the first free access BBS which ran a free bulletin board software called Fido. The BBS served as the foundation for electronic mode of sending messages among its users, even before the era of short message service (SMS), also called text messages, and e-mails in the country.

Through Fidonet, BBS users were able to tap ordinary landlines and use them as a medium for transferring messages, but the local Fidonet was not able to immediately connect with the international Fidonet community. When a connection was made, a local BBS was able to dial an overseas BBS and transmit messages. Although the technology was able to cut the time of sending messages abroad vis-a-vis snail mail, the transmission of message still took days, and there was a high possibility that one's BBS messages would not be sent at all.

In 1991, the local network touched base with the international Fidonet community. The linkup made it possible for a local BBS to dial up another local BBS to send and receive messages overseas. The dial up incurred costs for IDD phone charges, and this called for the imposition of a subscription scheme. The first commercial BBS, "First-Fil BBS", went online and charged 1,000 PHP for a year's worth of premium access. Access speeds at this time were limited to 1,200 bps and due to poor dial-ups, many users had access of only 300 bps.

On March 29, 1994, the Philippines connected to the internet via an IP connection to a Sprint gateway in California. This was initiated through the Philnet project, a collaboration between the Department of Science and Technology (DOST) and the academic community. When the Philippines managed to connect to the internet, the internet speed improved to 64 kbps. Since then, the Philippines has maintained connectivity with the global community at an increasing trend.

[8] http://www.rappler.com/technology/social-media/127920-kathniel-twitter-bots-elections-quality-buzz

Figure 7 show trends in internet penetration in the Philippines, as well as in other countries comprising the Association of South East Asian Nations (ASEAN), as per the International Telecommunications Union (ITU), a specialized agency of the UN for ICT. Internet penetration in the Philippines has risen from 2.0 percent in 2000 to 39.7 percent in 2014, with a steep rise in the year 2010 when penetration jumped to 25 percent from 9 percent in the previous year. Latest figures across ASEAN suggest that internet access in the Philippines ranks fifth trailing behind Singapore, Brunei Darussalam, Malaysia, and Vietnam. Thailand ranks sixth, and used to be fourth up to the year 2004, when it was overtaken by Vietnam, and has stayed in fifth place since 2010, when it was overtaken by the Philippines. According to "We are Social"[9], an agency that examines social media data, as of January 2016, internet penetration has reached 46% (translating to about 47.1 million users), compared to the rate of 46% (3.4 billion users out of 7.4 billion people) across the world. Facebook registered 1.5 billion active users globally in the same period. Active social media penetration rate was about 47 percent, representing about 48 million active users of social media (which grew by 20 percent from the previous year). Of the 48 million active users of social media, 41 million are active mobile social media users (which is 28 percent more than the numbers a year earlier). Thus, about half of Filipinos are on the net and/or social media, but this also means half are not! This is partly the reason why internet/social media surveys (which have issues about self-selection) would still be problematic to represent the pulse of the nation as we will be severely undercovering those that do not have access to the net/social media. While a slight majority of Filipinos do not have access to internet and do not make use of social media, the penetration rates have increased phenomenally in the country, and globally.

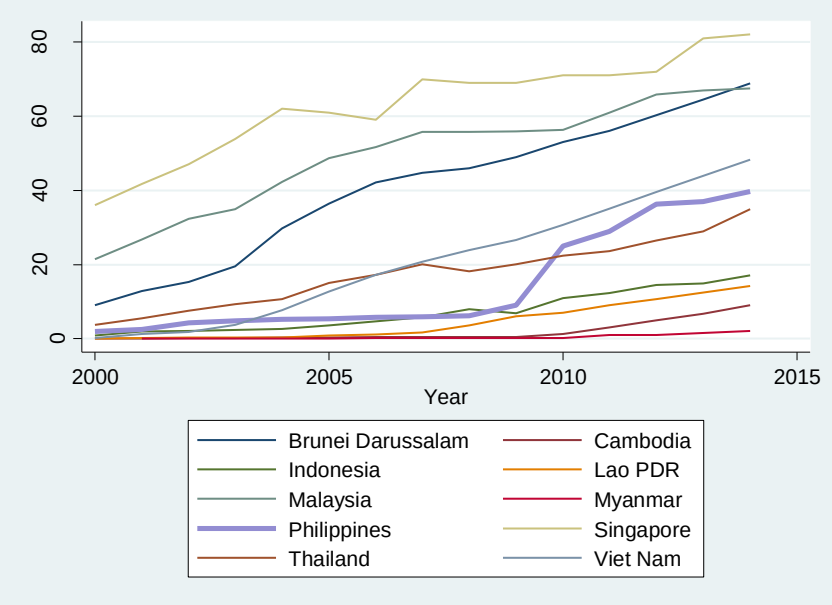


Figure 7. Internet Penetration in ASEAN economies. 2000- 2014
Source: International Telecommunication Union (ITU)

As regards time spent by internet/social media users, average daily use of the internet via personal computers (PCs) or tablets is estimated by We Are Social at 5 hours and 12 minutes, while the corresponding time use on mobiles averages 3 hours 14 minutes. Average daily use

[9] http://www.slideshare.net/wearesocialsg/digital-in-2016/309

of social media through any device is nearly 4 hours (3 hours and 42 minutes), while average tv viewing time is 2 and a half hours (2 hours and 33 minutes).

With regard to frequency of internet use, We Are Social estimates that about half (46%) of internet user in the Philippines use the internet every day, a third (30%) at least once a week (but less than daily); a sixth (16%) at least once (but less than four times) every every month; and a tenth (8%) use the internet less than once a month.

4. Trends in Various ICT Statistics

While access to internet is part of the landscape for the ICT sector, there are other aspects worth describing. Consider firstly, access to computers among households in the Philippines compared to neighbors among the Association of South East Asian Nations (ASEAN). Available data from ITU show that in 2010, 13 in every 100 households in the Philippines had access to a computer, higher than Cambodia's 9.3 (Table 1). Singapore and Malaysia have considerably higher access at 85 and 65 households with a computer. Meanwhile, in 2010, only 10.1 percent among the households in the Philippines had internet access, even lower compared to 12.5 in Viet Nam. Of course, the information from the Philippines is sourced from a 2010 survey, whereas other countries are more recent.

Table 1. Percentage of Households with Computer and Percentage of Households with internet Access: ASEAN, Various years

	Percentage of households with:			
	Computer	Year of latest available data	internet access	Year of latest available data
Brunei Darussalam	-		65.0	2010
Cambodia	9.3	2013	5.5	2013
Indonesia	15.6	2013	5.7	2013
Lao P.D.R.	-		3.4	2010
Malaysia	65.1	2013	64.7	2013
Myanmar	-		-	
Philippines	13.1	2010	10.1	2010
Singapore	85.0	2012	84.0	2012
Thailand	29.1	2013	23.2	2013
Viet Nam	16.0	2011	12.5	2010

Source: ITU

In its 2015 Measuring the Information Society Report, the ITU provides its ICT Development Index (IDI) in the years 2013 and 2014 for 167 countries. The IDI combines 11 indicators (Table 2) that measure access, use and skills, into one composite aggregate measure to monitor and compare developments in ICT. In general, the IDI presents the level of ICT developments among countries over time.

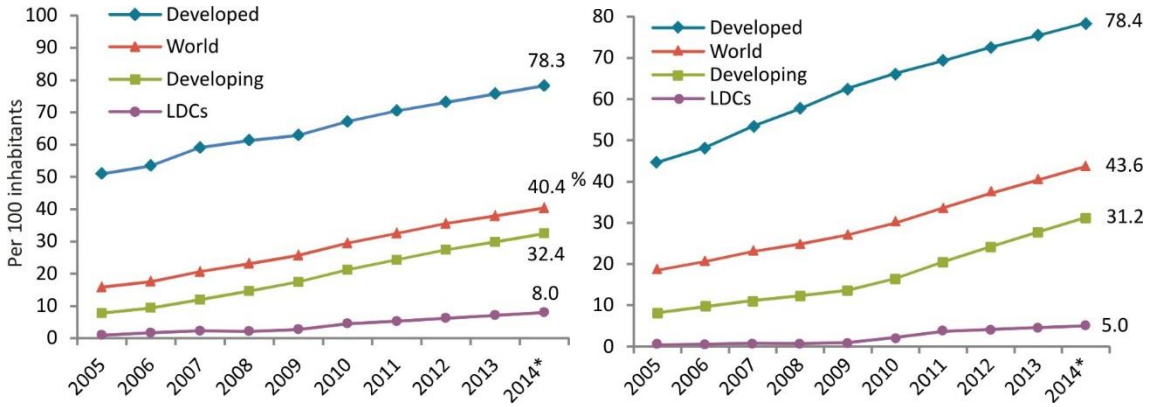
Table 2. Indicators used in the Computation of the IDI

Access sub-index	Use sub-index	Skills sub-index
Indicators on ICT infrastructure and access: 1.fixed-telephone subscriptions 2.mobile cellular telephone subscriptions 3.international internet bandwidth per internet user 4. Percentage of households with a computer 5. percentage of households with internet access	Indicators on ICT intensity and usage: 1.individuals using the internet 2.fixed (wired)-broadband subscriptions 3.wireless-broadband subscriptions	Indicators on ICT capability or skills: 1. adult literacy 2. gross secondary enrolment 3. gross tertiary enrolment

Source: ITU

Among the 167 countries covered in the ITU report, South Korea topped the list followed by Denmark and Iceland. In Asia and the Pacific, Hong Kong (China), Japan, Australia, New Zealand ranked highest after South Korea. The IDI exhibits a strong relationship with many indicators for tracking the Millennium Development Goals (MDGs), and suggests a very clear divide on ICT development between developed and developing countries.

The ITU report also found that developing countries, despite exhibiting progress, are not, on average, advancing enough to catch up with the pace of ICT development in developed countries (Figure 8).



(a) (b)

Figure 8. Percentage of (a) households with internet access and (b) Individuals using the internet, by level of development, 2005-2014

Source: ITU

The ITU took note of the continued rise in disparities in ICT development within the group of developing countries. Further, the average ITI of developing countries remained almost half that of developed countries. The gap between developed and developing countries is more pronounced in the availability and uptake of wireless-broadband and fixed broadband services. Meanwhile, the international internet bandwidth in many developing countries remains at very low levels, which is of particular importance to sustain ICT growth.

The Philippines improved its IDI ranking slightly from 105 to 98, and is ranked 15th across Asia and the Pacific, trailing ASEAN neighbors Singapore (ranked 19 globally, 6 in Asia-Pacific), Malaysia (ranked 64 globally, 8 in Asia-Pacific), Brunei Darussalam (ranked 71 globally, 9 in Asia-Pacific), and Thailand (ranked 74 globally, 10 in Asia-Pacific). The Philippines has also slightly overtaken Vietnam (ranked 102, down 94 in the previous year). For the IDI sub-indices, the country ranked 108th in access, 79th in use, and 94th in skills.

Like many countries, the Philippines has improved its use of mobiles and subscription of fixed-broadband whereas telephone density, measured as the number of fixed telephone subscriptions per 100 inhabitants, remained similar across the years in the Philippines at an average of 3 to 4 subscriptions per 100 persons (Table 3).

Table 3. Selected ICT statistics in Philippines, 2005- 2013

ICT Statistics	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Fixed telephone subscriptions (per 100 population)	3.92	4.16	4.43	4.51	4.46	3.57	3.74	3.61	3.20	3.09
Mobile cellular telephone subscriptions (per 100 population)	40.52	49.07	64.52	75.37	82.26	88.98	99.09	105.45	104.50	111.22
Fixed (wired)-broadband subscriptions (per 100 inhabitants)	0.14	0.30	0.56	1.16	1.87	1.84	8.85	14.09	18.17	23.22

Source: ITU

In 2012, the number of cellular mobile telephone subscriptions surpassed the total number of persons in the Philippines. There were around 105 mobile cellular telephone subscriptions for every 100 Filipinos in 2012, with mobile penetration increasing to 111 in 2014.

We are Social estimates that in the beginning of 2016, there have been 119 mobile connections for every 100 Filipinos. These statistics from ITU and We are Social on mobile subscriptions suggest that a number of people have multiple subscriptions. In addition, there is the possibility of overcounting subscriptions with each telco trying to claim they are number one, not paying attention to whether a subscription is truly active. This phenomenon is in need of urgent policy attention, i.e., a full registration of cellular subscribers, including pre-paid ones, and for that matter a full implementation of a national ID system.

Fixed-broadband subscription per 100 population exhibited remarkable increase to 23.22 per 100 persons in 2043 from 0.14 in 2005. Broadband has been successful building a healthy subscriber base in the country. The rate of increase was steepest in 2011 (when it increased by nearly four times the previous year).

An alternative composite index, the Networked Readiness Index (NRI) was developed by the World Economic Forum (WEF), in collaboration with Cornell University and INSEAD. The NRI was published by the WEF in their Global Information Technology Report 2015. The index rests on six principles:

i. A high-quality regulatory and business environment is critical in order to fully leverage ICTs and generate impact;
ii. ICT readiness – as measured by ICT affordability, skills, and infrastructure – is a pre-condition to generating impact;
iii. Fully leveraging ICTs requires a society-wide effort: the government, the business sector, and the population at large each have a critical role to play;
iv. ICT use should not be an end in itself. The impact that ICTs actually have on the economy and society is what ultimately matters;
v. The set of drivers – the environment, readiness, and usage – interact, co-evolve, and reinforce each other to form a virtuous cycle; and
vi. The networked readiness framework should provide clear policy guidance.

Based on 53 individual indicators, the NRI has four main categories (sub-indices on environment, readiness, usage and impact) and 10 subcategories (pillars). The four sub-indices of the NRI are Environment, Readiness, Usage, and Impact. The Environment sub-index focuses on two major areas: the political and regulatory environment, and business and innovation environment. The Readiness sub-index has the following components: Infrastructure, Affordability, and Skills. The Usage sub-index covers individual, business, and government usages. The Impact sub-index measures the economic and social impacts.

The NRI covers 143 countries in 2015 and rates each country on a scale of 1 (worst) to 7 (best) on the level of their ICT competitiveness and well-being. According to the 2015 NRI, the Philippines had an NRI value of 4.0 and it moved two places from its ranking of 78 in 2014 to 76 in 2015. Singapore and Finland held the top spots in leveraging ICT towards development., with both having an NRI value of 6.0. At the bottom of the list were Guinea and Chad with an NRI value of 2.4 and 2.3 respectively. Compared to ASEAN neighbors, the Philippines similarly trails Singapore, Malaysia, Brunei Darusalam and Thailand (see Table 4), although the country's standing improved in recent years, surpassing slightly Indonesia's standing. For the sub-indices, the Philippines had an NRI value of 3.8 in Environment, Usage, and Impact; and an NRI value of 4.5 in Readiness. Figure 3 shows the NRI values of the Philippines for the indicators under each sub-index.

Table 4. Networked Readiness Index of ASEAN member countries, 2012-2015

Country	Index				Rank			
	2012	2013	2014	2015	2012	2013	2014	2015
Brunei Darussalam	4.04	4.11	4.34	-	54	57	45	
Cambodia	3.32	3.34	3.36	3.30	108	106	108	110
Indonesia	3.74	3.84	4.04	3.91	80	76	64	79
Lao PDR	-	-	3.34	3.56	-	-	109	97
Malaysia	4.80	4.82	4.83	4.85	29	30	30	32
Myanmar	-	-	2.35	2.53	-	-	146	139
Philippines	3.64	3.73	3.89	3.98	86	86	78	76
Singapore	5.86	5.96	5.97	6.02	2	2	2	1
Thailand	3.78	3.86	4.01	4.05	77	74	67	67
Viet Nam	3.70	3.74	3.84	3.85	83	84	84	85

Source: WEF

5. Internet Speed and Prices

The relatively weak uptake of ICT services (and inadequate ICT infrastructure in the Philippines), as suggested in both the two composite indices IDI and NRI, can be attributed to relative high cost of ICT services associated with it. In comparison with ASEAN neighbor countries, data from the ITU suggests that ICT services in the Philippines are among the highest (Table 5). In purchasing power parity (PPP) USD, fixed telephone services in the country are priced at 36.15 USD per month (the highest cost in ASEAN), while mobile cellular services and fixed broadband services cost at 22.24 USD per month (second highest), and 51.59 USD per month (third highest), respectively.

Table 5. Prices of selected ICT services in PPP$ per month, 2013

	Fixed Telephone	Mobile cellular	Fixed Broadband	Mobile broadband, postpaid handset-based	Mobile broadband, prepaid handset-based	Mobile broadband, postpaid computer-based	Mobile broadband, prepaid computer-based
Brunei Darussalam	18.91	29.6	78.28	33.72	30.11	33.72	24.09
Cambodia	9.81	16.16	30.55	7	7	12.73	12.73
Indonesia	9.54	16.38	48.92	12.54	5.7	12.54	11.4
Lao PDR	12.01	17.84	41.65	12.82	0	16.02	0
Malaysia	17.99	14.2	41.52	23.91	23.91	30.2	30.2
Myanmar	-	-	-	-	-	-	-
Philippines	36.15	22.24	51.59	25.77	25.77	51.38	25.77
Singapore	9.1	9.04	20.58	32.97	12.4	20.58	0
Thailand	14.55	12.61	52.85	24.51	24.51	32.71	36.31
Viet Nam	4.44	8.81	7.15	-	-	-	-

Source: ITU

Mirandilla-Santos (2015) describes the high cost of internet in the Philippines. She indicates that the Philippines has the highest retail prices (20.35 USD per Mbps) of internet services among selected ASEAN neighbors (Table 6). She also reports that internet cost for business-grade bandwith (1Gbps) is 25-45 USD in Manila and 70USD in Cebu, whereas bandwith costs in Australia/New Zealand, Hong Kong and the US are all less than 10 USD.

Table 6. PH internet Cost: Retail Market

Philippines	20.35 USD (per Mbps)
Indonesia	16.83 USD
Malaysia	10.29 USD
Singapore	2.56 USD
Thailand	2.29 USD
Vietnam	2.25 USD

Source: Mirandilla-Santos 2015

Shahani (2015) similarly reports on the high internet costs here, i.e. monthly average cost of internet in the Philippines is $18.19 (P848.65) per Mbps—over three times the average global cost of $5.21 (P243.07), and that subscription cost here is at $31.55 (P1471.97). She suggests that internet service in the Philippines is nearly as expensive as 1 Gigabit per second (Gbps) fiber optic connection in Singapore, which is only $36.01 (P1680) a month. Further, she points out that there are internet services offered in the country that are at speeds comparable

to Singapore: in high-end Metro Manila villages, both the PLDT and Globe offer 100 Mbps fiber optic connections—for a whopping $428.68 (P20,000) monthly cost.

Despite internet cost, speed is not fast. Akamai, a cloud data network specializing in monitoring internet traffic, suggested in its "State of the internet" report on Asia Pacific that the Philippines has the second lowest average connection speed in Asia-Pacific 2.8 Megabits per second (Mbps) for the third quarter of 2015, much lower than the global average connection speed of 5.1 Mbps (Table 7). Moreover, the Philippines also ranked third in terms of lowest peak connection speed, with 25.3 Mbps, much lower than that of the global average of 32.2 Mbps.

Table 7. Average Connection Speed and Average Peak Connection Speed in Q3 2015 among Asia-Pacific Countries

Country	Average Connection Speed		Average Peak Connection Speed	
	Avg. Mbps	Global Rank	Peak Mbps	Global Rank
South Korea	20.5	1	86.6	3
Hong Kong	15.8	5	101.1	2
Japan	15.0	7	78.4	4
Singapore	12.5	17	135.4	1
Taiwan	10.1	33	77.9	5
New Zealand	8.7	42	42.0	45
Thailand	8.2	43	58.3	18
Australia	7.8	46	41.9	46
Sri Lanka	5.1	71	33.5	66
Malaysia	4.9	73	38.3	54
China	3.7	91	23.1	101
Vietnam	3.4	97	25.5	92
Indonesia	3.0	104	31.0	72
Philippines	2.8	108	25.3	94
India	2.5	116	18.7	116

Source: AKAMAI, State of the internet, Third Quarter 2015.

LIRNEasia, a regional ICT policy and regulation think tank active across the Asia Pacific, reports decreasing performance of average ISP speeds in the Philippines. In comparison to an international server, they also fall severely below the expected speed (Figure 9). By examining different internet service providers across South Asia and South East Asia, LIRNEasia also suggests that Philippine telcos have the lowest value for money (Figure 10).

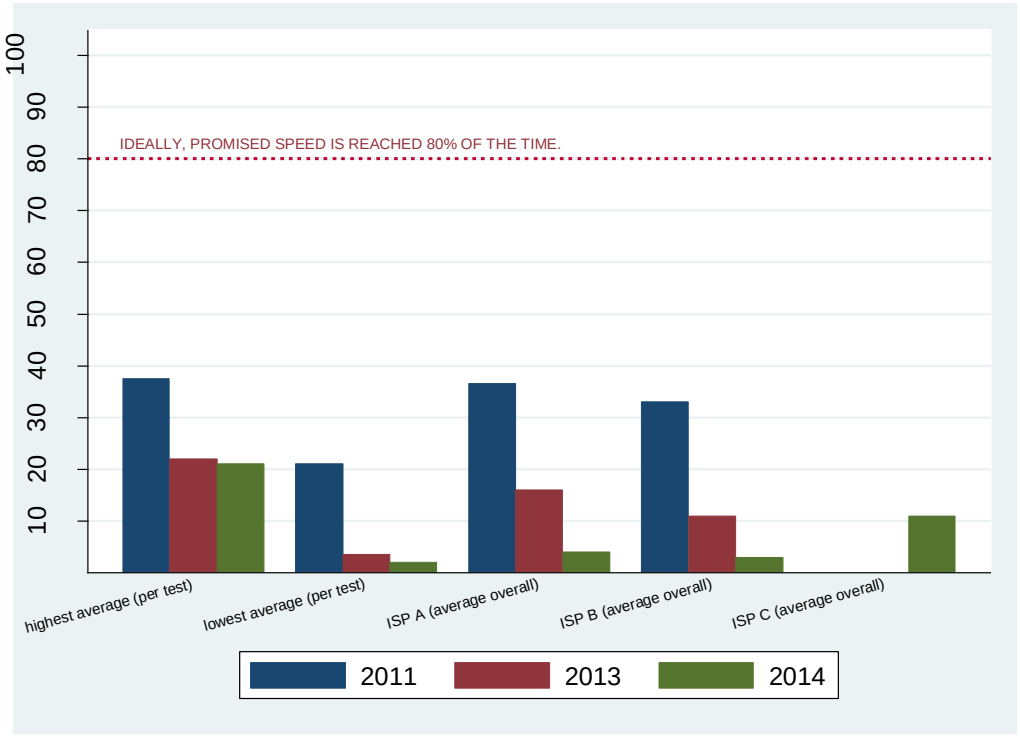


Figure 9: Actual versus Advertised ISP Speeds
Source: LIRNEasia

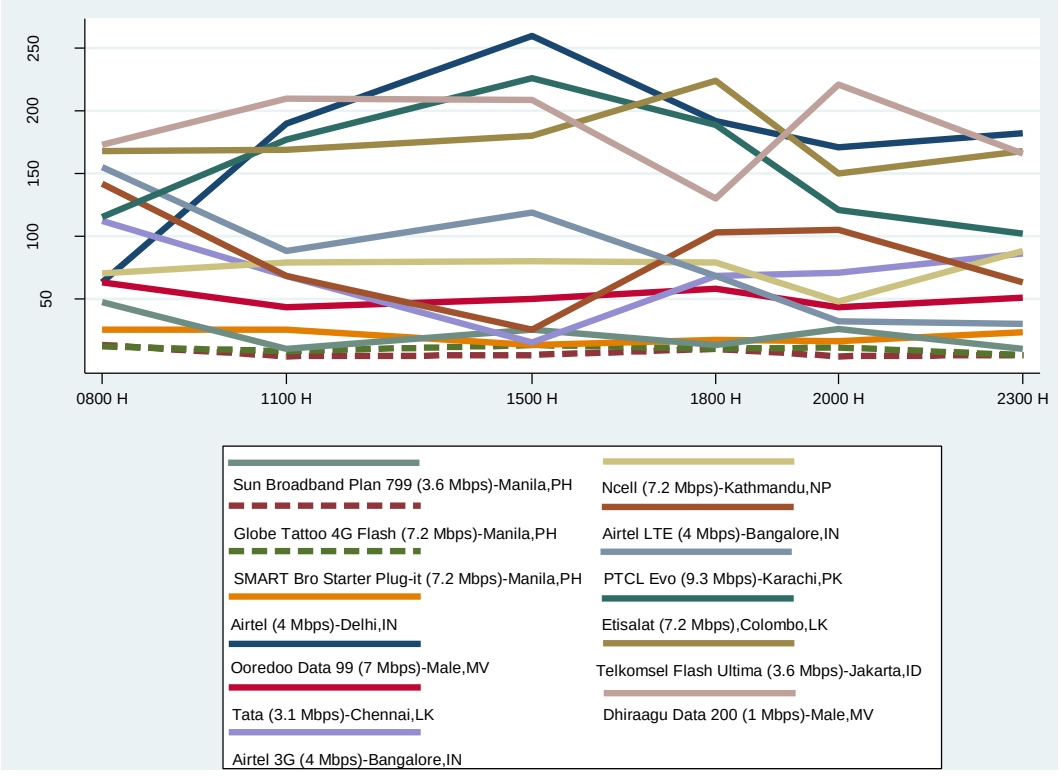


Figure 10: Value for Money (kbps per USD) in 2014
Source: LIRNEasia

Aside from the lack of ICT infrastructures, the country also has poor connectivity at an extreme cost, thus triggering the high prices for poor services that consumers have to pay. Indeed, these issues are all connected with one another, but there is another factor which has

a huge impact on all of these and this is the monopoly of fee-charging internet Exchanges (IX).

The high costs of the internet are partly attributed to the current monopoly of fee-charging internet Exchanges (IX). An IX is formed when several networks come together to exchange internet traffic among themselves. Most of them connect via an internet Service Provider (ISP). An exchange is necessary for information to get from one end-user to another. Moreover, it is beneficial to be part of the exchange because the "toll" incurred by the ISPs are reduced compared to having private connections. These tolls are paid by the ISPs for passage through their networks. As the key element of the internet is data-sharing, the exchange can become inefficient and counterproductive.

The interconnection mechanism can either be direct or indirect. Direct interconnection occurs between two networks, while indirect interconnection includes one or more other networks that agree to transport traffic among each other. The economic arrangements which allow networks to interconnect directly and indirectly are called "peering" and "transit" (Van der Berg, 2008).

The Philippines telecommunications industry is largely a duopoly dominated by two major companies, the Philippine Long Distance Telephone company (PLDT) group (which owns Smart Communications, Sun Cellular, and Cignal Digital TV) and the Globe group (which also own Bayantel). PLDT-SMART, which holds the majority of fee-charging IXs, does not have an established peering setup with local carriers. This has a huge effect on the service performance of other local ISPs which opt to interconnect through the free IX points : Philippine Open internet Exchange (PhOPENIX), Philippine internet Exchange (PhIX), and Philippine Common Routing Exchange (PHNET CORE). The other local providers represent only a minority of the internet pathways so their exchanges are limited to what they can afford. This setting translates to poor quality servicers for users. If they would be able to course through PLDT-SMART's IXs, we would expect more interconnectivity of networks; hence, we would have a faster delivery of data and faster internet service. The solution that several ICT advocates propose regarding the access of other local service providers to PLDT-SMART''s IXs is internet Peering (IP).

Peering results when two or more autonomous networks directly interconnect with each other to exchange traffic (Van der Berg 2008). Peering results to lower costs because it allows free-sharing of platforms by companies. As a consequence, companies are able to reciprocally provide access to each other's customers.

PLDT-Smart has recently responded to the call of Globe Telecom, for a peering agreement, but the initial proposal for internet peering was not mutually well received. Negotiations between the two are still currently ongoing. Meanwhile, Globe has decided to utilize fiber-to-the-home technology for its broadband plans that effectively cut the prices of their Platinum Broadband Plans.

There has been some excitement among internet users last year about the possibility of having a third major player in the local telecommunications market, with the talks of a joint venture between the local conglomerate San Miguel Corporation (SMC) and Australian telecommunications giant Telstra Corp, that could have provided a more competitive environment. The SMC is currently in possession of the bulk (90%) of a valuable and unutilized 700 Megahertz (Mhz) spectrum in addition to its 800,1800, 2300, and 2500

frequency bands. On the other hand, as regards the two big telcos, PLDT has rights to 800 MHz, 900 MHz, 1,800 MHz, and 2,100 MHz bands, while Globe holds 900 MHz, 1,800 MHz, and 2,100 MHz bands. PLDT-Smart and Globe have asked local regulators to share the 700Mhz spectrum, and were prepared to take more aggressive legal action for the 700Mhz [10]spectrum with the possible entry of Telstra in the market.

Despite SMC's current possession of the valuable 700 megahertz spectrum, the planned partnership of SMC with Telstra was expected to be rather capital intensive for Telstra with cost of building the SMC-Telstra network ranging from $US2 billion to $US3.5 billion[11] over four years, with high likelihood of cost overruns and delays, as well as challenges accessing additional infrastructure such as cell towers and fiber lines due to the absence of independent tower firms in the Philippines. In the first quarter of this year, SMC and Telstra opted not to push through with their planned joined venture given the challenges of finding a "risk-reward balance"[12] that would be mutually beneficial for the two firms.

6. Improving Institutional Capacity and Policy Environment for Monitoring ICT

As suggested by Padojinog (2005) a decade ago, ICT policies need to be implemented to narrow the digital divide by promoting competition, interconnection and convergence in the ICT sector. Table 8 shows that the laws relating to ICT are sadly not keeping up with what the present market requires to fully leverage ICT.

Table 8. Selected NRI Indicators of the Philippines, 2012-2015

NRI Indicators	Index				Rank			
	2012	2013	2014	2015	2012	2013	2014	2015
Effectiveness of law-making bodies, 1-7 (best)	2.75	3.15	3.46	3.56	112	93	79	73
Laws relating to ICTs, 1-7 (best)	3.68	4.05	3.96	3.84	84	66	72	78
Judicial independence, 1-7 (best)	2.95	3.02	3.17	3.55	102	99	99	77
Efficiency of legal system in settling disputes, 1-7 (best)	2.87	3.19	3.61	3.71	115	107	76	68
Efficiency of legal system in challenging regulations, 1-7 (best)	2.78	3.17	3.48	3.48	118	102	71	56

Source: WEF

The World Bank (2016), in its 2016 World Development Report, points out that digital dividends have not spread fast (despite improved access) and identifies two major reasons for this: a considerable proportion of the population especially in the developing world continue to be left out, and inequalities have concentrated digital dividends in the hands of a few: those with better educated, better connectivity, and more capabilities (Figure 10).

[10] At the 2015 World Radiocommunication Conference, the ITU deemed 700MHz spectrum, as suitable for mobile use for operators in Asia-Pacific and North and South America. This spectrum, which was used before for analog television broadcasting, has been of interest due to its wider coverage and ability to penetrate buildings. The ITU decision allowing greater flexibility for the deployment of mobile broadband services, using technologies such as 4G.

[11] http://www.smh.com.au/business/telstras-philippine-venture-threatened-by-legal-action-presidential-lobbying-20151218-glr8fo.html

[12] http://www.smh.com.au/business/the-economy/telstra-pulls-out-of-philippines-talks-report-20160313-gnhzrc.html

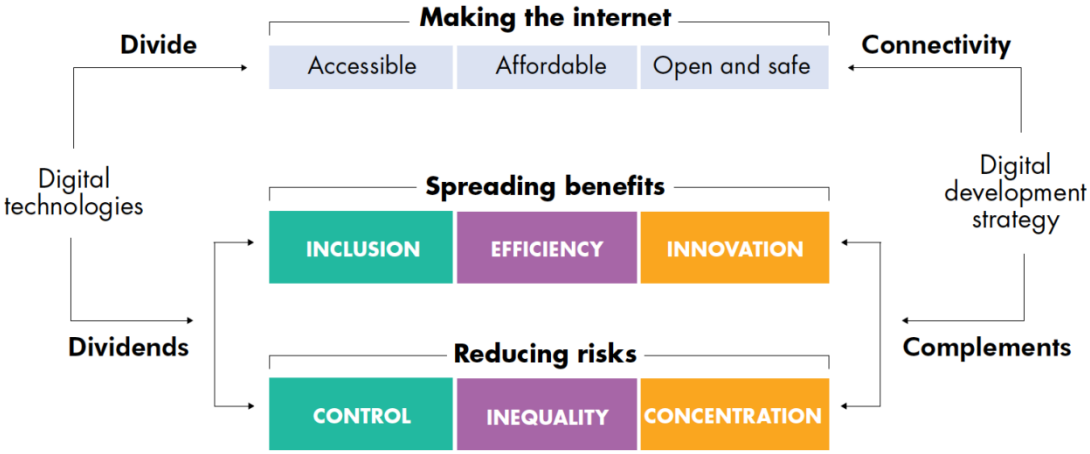


Figure 10: Why Digital Dividends are not spreading rapidly and What can be done
Source: World Development Report (2016), World Bank

While some issues on ICT services are beginning to get resolved with an improving policy environment, there is wide scope for capacity development in ICT (at the individual, institutional and enabling environment levels). As regards for instance, the internet, it is worth noting that the law governing telecommunications policy, i.e. the "Public Telecommunications Policy Act of the Philippines" (RA7925) was legislated in 1994. This law is also based on public telephony regulations meant for voice calls. It defined the internet as a value added service rather than a basic service. In addition, an internet service provider is required to secure a franchise from Congress as part of the application process for a license. Clearly, this two-decade old legislation will require significant revisions given the pace at which ICT is vastly changing. There ought to be a comprehensive overhaul of the regulatory framework, including an adjustment of regulations accordingly when they do not serve their purpose.

Last August 2015, Memorandum Circular No. 07-08-2015 was issued by the National Telecommunications Commission (NTC) to impose better internet quality standards on telcos. The circular states that broadband "for fixed-line services must have data connection speed of at least 256 kilobits per second (kbps)". The NTC claims that this is the same standard imposed by the ITU. However, this circular is an insufficient regulatory mechanism as 90% of internet users in the country use mobile services, and the circular covers fixed line services (such as DSL, fiber and cable). The standard of 256 kbps is ten times less than the public expectation for a 2 Mbps standard, that stakeholders consider to be doable.

Accountability should play a major role in the effective regulation of ICT. For the protection of the consumers, the government should be able to implement regulatory policies; assess the performance of telcos based on the standards they set; and provide penalties in order to hold them accountable for violation of the laws and regulations. In the United States, the Federal Communications Commission in the U.S. imposed a $100 million fine to AT & T Mobility for misleading customers about its "unlimited" mobile data plans and violating other relevant rules that the Commission has set for telcos. In the Philippines, it has been noted that the current penalties for violations are very low such that firms would rather pay the fees than comply. The "Public Telecommunications Policy Act of the Philippines" (RA7925) does not have a penal provision and thus the fees that the NTC could impose are based on an 80-year-old law, the Public Services Act of 1936 (Commonwealth Act 146) which sets the fine at not more than PhP 200 per day until the violation is corrected (Cabarios 2015).

It does not help there are a myriad of government agencies that are engaged in ICT without a common agenda for ICT monitoring and development

a) Government Institutions looking into ICT

As was pointed out in earlier sections, the Philippines was only officially connected to the internet in 1994, but the institution responsible for the supervision of telecommunications existed as early as 1979 by way of Executive Order (E.O.) 546 which integrated the then existing Telecommunications Control Bureau (TCB) and Board of Communications (BOC) into a single entity. At that time, the then Ministry of Transportation and Communications had administrative jurisdiction over the NTC which was responsible for monitoring radio airlines and conducting ocular inspection and enforcement of rules with respect to illegal radio equipment. The NTC slowly gained other functions during the administration of President Corazon Aquino which made the NTC an attached agency of the Department of Transportation and Communications (DOTC) through E.O. 125-A.

Under the administration of President Fidel Ramos, the country was able to formulate its first comprehensive ICT plan, the National Information Technology Plan 2000 (NITP2000), as well as establish the National Information Technology Council (NITC). The NITP2000 served as the foundation for guiding the ICT sector towards national development. The NITC was then the entity responsible for ICT matters in the country. In 1997, the government formulated IT21 which enumerates the ICT agenda of the government for the year 2000 and beyond. Under this plan, the government carried the banner of the Philippines as the "Knowledge Center for Asia" within the first decade of the 21st century. Ramos also initiated alliances with leading global IT companies for the implementation of projects under IT21. Through Administrative Order 332, government agencies were directed to connect to the internet.

During the administration of President Joseph Estrada, the government continued the enhancement of ICT processes through the Government Information Systems Plan (GISP) 2000 framework which aimed to computerize key government processes for efficient transactions. The Electronic Commerce Act was also enacted then. Also during the Estrada government, the Information Technology and eCommerce Council (ITECC) was established to serve as a mediator between the private and public sectors for ICT and eCommerce matters.

When President Gloria Macapagal-Arroyo succeeded Estrada, she devoted a portion of the General Appropriations Act (GAA) during her term as the e-Government fund, which served as the source for various ICT projects. Her administration continued and strengthened Estrada's ITECC and established the Commission on ICT (CICT), which was responsible in formulating the Philippines' Information Technology (IT) Roadmap. The IT Roadmap aimed to enhance the contributions of the ICT to the Philippine economy and focused on providing the public access to ICT. The government tried to setup a National Broadband Network (NBN) but the processes for the NBN were quickly put under scrutiny with various corruption allegations in the awarding of the million dollar contracts to the companies involved. Consequently, the government cancelled the NBN deal with these companies.

When Benigno Aquino III became president, the CICT was abolished and instead, ICT matters were placed under the jurisdiction of the Department of Science and Technology

through its Information and Communications Technology Office (ICTO) as per E.O. 47 series of 2011. Aquino also ordered the transfer of CICT's attached agencies, the National Computer Center and the Telecommunications Office to the DOST. However, the National Telecommunications Office and the Philippine Postal Corporation under the Office of the President were retained. Through EO 47, Aquino ordered the DOST to prepare a medium-term development plan for ICT research and development, and its linkages to the ICT industry, as well as a five-year Philippine Digital Strategy, a medium-term e-governance infrastructure and information systems plan. There were also talks about passing a law to establish a Department of ICT (DICT), but this did not materialize. Two very important laws, however, came about during the term of President Aquino that have bearings on ICT have been enacted during his term, the Data Privacy Act of 2012, also known as RA 10173, that was discussed in the earlier section on Big Data, and RA 10667 or the Philippine Competition Act.

b) The Philippine Competition Act

The Philippine Competition Act[13] was enacted in 2015; it aims to maintain the efficiency of market competition by prohibiting anti-competitive agreements, abuse of dominant positions and anti-competitive mergers and acquisitions. This law also established the Philippine Competition Commission (PCC), a quasi-judicial body that shall be responsible for the implementation of a national competition policy pursuant to the legislation. The PCC, given its quasi-judicial powers, can serve to protect consumers in any particular sector as it can conduct inquiries, investigate, and penalize all forms of anti-competitive agreements, abuse of dominant position, and anti-competitive mergers and acquisitions. The PCC, however, was only recently established, and is currently working on the IRRs of this key piece of legislation.

7. Investments in ICT infrastructures and human resources

More than the the policy framework that imposes quality standards and improves accountability measures, the government should also focus on other possible solutions to the issues in the ICT, such as the monitoring and regulation of the interconnectivity of networks; building better infrastructures; and expansion of the ICT services to include other sectors for development.

The improvement of ICT, especially internet speed, relies heavily on investments in ICT infrastructures in the country. One of the key attractions of the Philippines as a BPO hub is the availability of telecom infrastructure that meets the exacting requirements of the industry. The challenge is to make high quality broadband accessible to the rest of the population, as appropriate. This entails capital expenditures in both the private and public sectors. The internet effectively connects the economy because of its high capacity to spread information easily. More markets can be readily connected through the internet. National internet backbone facilities, however, are known to be poor. Shahani (2015) points out that 70% of our domestic internet traffic is routed through Hong Kong on its way to another domestic user thus providing China access to even our local messaging and email. Clearly, we need a national broadband if we want much faster internet speeds and lower costs for service.

[13] R.A. 10667. Philippine Competition Act.

Telcos claim that they have been making requisite investments in network expansion and technology upgrades to provide better and faster service, but they also have complained about the challenges in securing tower permits from local government units (LGUs)[14]. While the private sector should take the lead in providing internet services and investing in internet infrastructure, there is also justification for public investment or intervention, such as in developing a national broadband, and in working toward providing an environment of equitably shared resources in order to provide more affordable and quality access to the internet.

The government has increased the budget for ICT from 1.76 billion ($81.42 million) in 2014 to P4.37 billion ($202.40 million) in 2016. However, there has been concern that government has not thought of ICT development as an area to be mainstreamed, and has often not made the requisite investments as part of its regular budget spending about 0.6% percent or less, of its budget for government final consumption expenditures from 2013 to 2015 on ICT infrastructure. Instead, it has relied on projects to fill gaps in ICT development. Further, there are questions on individual capacities of personnel across the public sector. The fact that the COMELEC data hack resulted from the work of a fresh graduate of IT with mere SQL injections, and that some of the hacking done by another group was conducted over a long period of time (given the huge database that was hacked and the slow internet) would suggest that there was lack of sufficient security of databases.

Government will clearly need to explore partnerships with the private sectors for building new and better infrastructures and for building capacities of ICT staff that would harness ICT especially given the fast changes in technologies. Increasing foreign equity restrictions in telecommunications, which is currently set at 40 percent under the 1997 Philippine Constitution, is another channel for increasing capital and expertise in this industry.

8. Diffusion of Digital Dividends

Aside from exploring other processes for internet connectivity, it is also about time that the we obtain the maximum gains from ICT. The internet clearly promotes inclusion. Consider, micro and small firms that can now manage to connect with a potential buyer in another country through internet and social media, or those that gain knowledge and skills to trust a new business partner based on information gained from the internet. Consider also marginalized groups who fall outside the reach of social services, but who can now manage to get these social services through the internet. Digital technologies help to overcome information barriers and provide a means to improve social services. The Philippines, with its recurring struggles with natural disasters, has started to use ICT tools and Big Data for improving disaster preparedness and risk management, particularly in improving forecasting of imminent climate and hydrological hazards, to disseminating information to save lives and property.

Much more, however, can be done to harness ICT. With the implementation of the K-12 program in basic education, the extent of using ICT in the classroom and outside will need to be improved, coupled with provision of foundational ICT skills and literacy to the young. Apps can be used in and out of the classroom to stimulate creativity and problem solving. Moreover, with technology likely to get more advanced and to affect more occupations, the

[14] http://www.rappler.com/business/industries/172-telecommunications-media/82208-slow-internet-blame-red-tape

country's workers will need to continuously upgrade their skills and competencies. Much of these changes will happen even outside the formal education system, but governments can provide incentives for both firms and workers to have mechanisms for lifelong learning to meet the ever-growing demands of the information-driven economy.

Institutions in the country must develop capabilities continuously as well as foster accountability in harnessing ICT. Regulatory bodies such as the NTC and the Data Privacy Commission, and other agencies in government that are developing ICT will need to keep up with the fast evolving nature of the ICT sector, and the internet, in particular, and work with Congress to keep improving the regulatory framework. The newly established Philippine Competition Commission will likewise need to develop the capacity to investigate and prosecute complex violations to competition law. Many cases in high-income countries can provide guidance to developing countries like the Philippines as we promote competitive environments that will further enhance and sustain economic activity. E-government delivery and citizen engagement can be further developed and strengthened. The establishment of a dedicated agency as proposed in Senate Bill No. 2686 and House Bill No. 6198 or the "Department of Information and Communications Technology Act of 2015" is an important step in realizing the goal of making digital dividends inclusive.

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