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Research Brief

Stakeholders for Universal Connectivity in Nepal

Introduction

This brief summarizes the findings of a recent research on the dynamics of actors contributing to Internet diffusion in Nepal. Discussions with the stakeholders show that critical interventions are needed to provide the current Internet ecosystem with a clear, detailed and unified mandate for the Universal Connectivity (UC). Empirical research on the ground realities is needed for UC policies that are explicit in their aim to rectify the current structural and geographical imbalances.[1] Credible explanation, and not popular phraseology, should motivate the actors to plan minimize the difference in the Internet access and use across the country. Issues related to the existing scenarios of ICT manufacture/import, repair and maintenance, education and skill-force should inform the on-going UC projects.

Internet in Nepal is immature in terms of technology infrastructure and quality of service delivery. Its three specific characteristics have implications for universalizing the connectivity in the country. First, as a consumer of technology products and a cheap labor market, Nepal faces the innovations in the technology chiefly as imports. Technology transfer and diffusion alone, however, will not help graduate the country into a pronounced knowledge-based economy. Since countries with an advanced scientific and technological core have benefited more from the globalization of technology elsewhere, UC policies in Nepal should focus on developing the core and not simply on facilitating acquisition and diffusion of new Internet-based technologies. Second, most Nepali users find English, the lingua-franca of the Internet use, inaccessible. A huge disparity in quality and quantity of content is likely to cause the speakers of local languages to falter rather than flourish in the Internet future. Unless local languages are situated at the heart of policy intervention in the technological development and spread, the Internet will continue to reproduce existing socio-linguistic exclusions.

More crucially, mobile phones remain the overwhelming platform choice for most Nepali users. Poor infrastructure and low affordability of the landlines compound the mobility needs in presenting the mobiles phones as the only

[1] Martin Chautari. 2014. *Universal Connectivity in Nepal: A Policy Review*. Research Brief No. 12. Kathmandu: Martin Chautari. Available at www.martinchautari.org.np/files/ResearchBrief12-UniversalConnectivityInNepal_APolicyReview.pdf

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viable option to deliver Internet-based services. The m-governance also promises to increase transparency and to tackle corrupt practices in the public institutions. However, technological constraints such as the screen size and non-linear increase in power consumption to maintain the data traffic and the non-shared activities will limit the mobile phones only services specifically in the universal online presence scenario. Consequently, utilization of good governance facilities would depend on the use of both mobile phones and computers. Adjacent technologies such as the energy infrastructure for the Internet system and the waste management of low quality electronic waste remain key challenges. Currently, these issues are seen either as belonging to another ecosystem to be managed by yet another ministry or as a problem to follow the high-speed broadband bandwagon. The pursuit for the Internet-connected Nepal is viewed by its actors similar to the past endeavors to transform the country with imported technologies; it is the case of business as usual.

The first section of this brief introduces the current Internet ecosystem and presents a snapshot of the Internet infrastructure evolution in Nepal. According to the available data, the Internet/data users, chiefly the mobile users, are increasing exponentially, and the fixed-line Internet subscription remains negligible. Poor affordability (high Internet cost per capita GDP) and low return (specifically, the unattractiveness of the rural market) remain the major hurdles for the development of the fixed-line broadband connection. Consequently, broadband Internet is situated within a niche of the urban business population. The second section provides overall findings of the semi-structured interviews with the stakeholders in the Internet ecosystem. A majority of the stakeholders still see the Rural Telecommunication Development Fund (RTDF) at the heart of achieving Universal Connectivity (UC). They also see a lack of cohesive efforts, meaningful discourses and concrete programs to underpin an Internet connected Nepal as envisioned by various policies and roadmaps. They view the state consultations on the appropriate licensing regime for fostering fair business practices, on the modalities for sharing and distributing infrastructure resources, on the strategies for timely dissemination of new technologies and the compliance criteria for the quality of service in the Internet-based services as ineffective. The last section of the brief is a discussion on some of these key sectors, challenges and developments that will define the digital future of Nepal. There is an immediate need for Internet/broadband policies that are based on empirical evidence. The relationships between Internet and economic growth and well-being of the society are only generally understood. The proponents have yet to provide a sound narrative and detailed implementation plan to convince that a move to the Internet enabled society will not leave the minorities, poor, less educated and the persons with disability at a critical risk. Adjacent technology sectors such as energy and environment (e-waste management) has to be placed within the boundary of the Internet ecosystem and their development implications should be reflected in the Internet policy documents.

Status of the Internet in Nepal

Development of the Internet infrastructure was initiated by the private sector in Nepal. Mercantile Communications Pvt. Ltd. introduced commercial Internet service using the dial-up technology in 1995/96. They operated through a line leased from Nepal Telecom while the backbone was in Singapore. Their users were mostly a handful of the INGOs. Internet remained synonymous with e-mail services. Private Internet Service Providers (ISPs) continued to dominate the Internet market till the mobile boom. After 2009, two new telecom companies, Ncell (then Spice Nepal Private Limited) and United Telecom Limited (UTL), entered the Nepali Internet market. Nepal Doorsanchar Company Limited (NDCL or Nepal Telecom) and Ncell began to dominate the Internet market as data and voice technologies converged. The market also concentrated rapidly towards mobile carrying users from the home-based clients, the preferred use of the Internet now being social engagement.

Universal Connectivity emerges from the synthesis of efforts that ensures a quality Internet connection (connectivity) for everyone (universal access) to deliver content. The Internet ecosystem is a dynamic space of various stakeholders contributing to one or more of these components (Figure 1). Policy-makers and regulators such as the Ministry of Science, Technology and Environment (MoSTE), Ministry of Information and Communication (MoIC) and Nepal Telecommunication Authority (NTA) are directly responsible for framing and

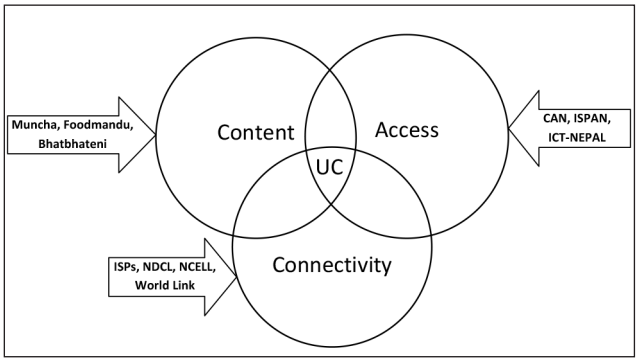


Figure 1: UC components and stakeholders

implementing the policies, laws and regulations for the telecommunications and the Internet sector. Connectivity-providers, the telecoms and ISPs, provide the physical infrastructure to bring in Internet connection to the home and mobile devices. Currently, revenues from the connectivity-providers are the major contributor to the fund everyone hopes to deliver UC from. Public-service-providers such as Muncha.com and Foodmandu are heavily reliant on the quality of these connections to deliver online transactions. Office of Controller of Certification (OCC) is set up to regulate such electronic transactions. Business-service-providers like E-Sewa (for online payments) and Xceltext.com (for bulk SMS) cater primarily to business organizations with their revenues dependent on the volume of activities. Disseminators are professional organizations and think-tanks that advocate and promote the use of information and communication technology (ICT) for national development. Software companies and the maintenance and repair industry are platform developers for Internet-based technologies, employing a large portion of the available ICT labor. Public-access enablers are commercial or public spaces that provide Internet access to general public. These include cyber-cafes, telecenters, libraries, schools and colleges.

The NTA-MIS report figures show an exponential increase in the number of the Internet users during the last decade. Among the subscribers, the share of ISPs is negligible (Figure 2) indicating the dominance of the telecom sector and ubiquity of mobile phones for the Internet use.

The World Bank indicators however reveal a need for improving the state of Internet accessibility. Only 13.3 percent of the population use the Internet in 2013 (Table 1), the broadband density (the subscription of fixed line broadband Internet per 100 person) was less than one (0.75).[2] The Internet usage is dominated by the mobile

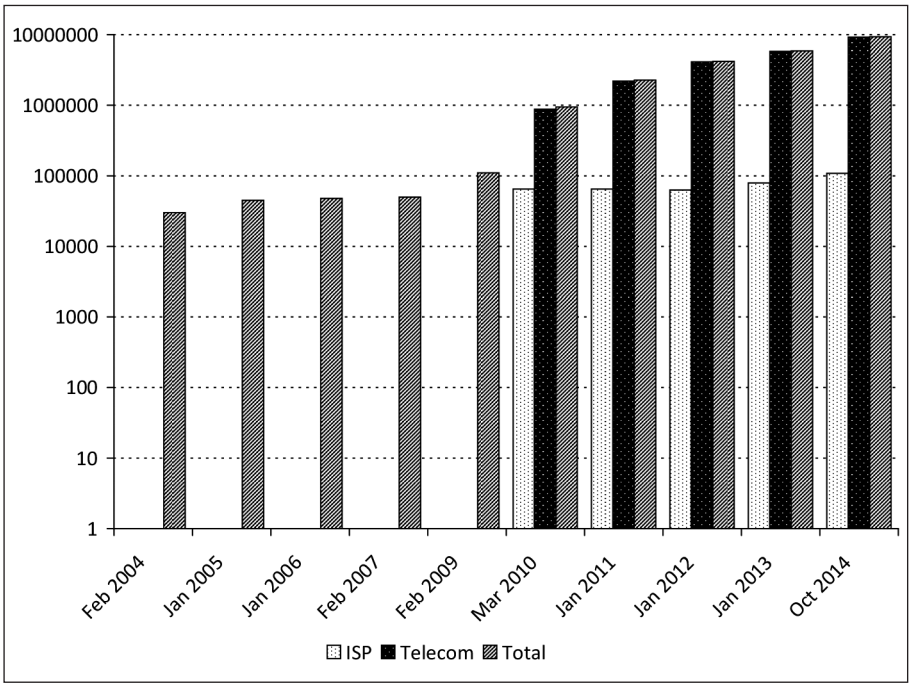


Figure 2: Internet users over the last decade in Nepal (in logarithmic scale)[3]

phone users with around 39 percent of them connecting to the Internet through their device. The usage also reflects the fact that the Internet infrastructure in South Asian countries is poor in general when compared to that of China and the Republic of Korea.[4] Internet security which includes the security of personal data,

[2] World Bank. 2014. World Development Indicators: The Information Society. Available at http://wdi.worldbank.org/table/5.12; accessed 31 January 2015.

[3] The data can be found in NTA-MIS Report Series available at www.nta.gov.np/en/mis-reports-en; accessed 15 March 2015.

[4] Republic of Korea has been used as a source for an e-government benchmarking consultation report prepared by KIPA for Nepal in 2006. See, Korea IT Industry Promotion Agency (KIPA). 2006. E-government

identity and online transactions is almost non-existent in Nepal. Both connectivity and access in Nepal are in the state of infancy.

Table 1: Comparative Development Indicators (2013)[5]

Country	Individuals using Internet (%)	Fixed-line broadband Internet subscription /100 person
Nepal	13.3	0.75
India	15.1	1.16
Bangladesh	6.5	0.63
Bhutan	29.9	2.72
Sri Lanka	21.9	1.99
China	45.8	13.63
Republic of Korea	84.8	38.04

The growth in Internet infrastructure has thus been fuelled mainly by a rapid diffusion of mobile phones and related infrastructure expansion. NDCL's optical fiber network now spans 58 districts along the east-west highway.[6] Ncell does not offer landline telephone services but provides mobile Internet to about 3.9 million customers.[7] Before the mobile boom, various ISPs brought Internet-based services to the masses. The Internet infrastructure has evolved from the dial-up to the optical-fiber based high-speed broadband. ISPs argue that Voice over Internet Protocol (VoIP) is the only way to introduce affordable communication in the low-income parts of the country.[8] Increasing out-migration demands a greater investment on this technology yet ISPs cite business risks in carrying out the infrastructure expansion themselves. Individual efforts such as the Nepal Wireless Project aim to deploy ICTs in the inaccessible mountainous areas.[9] Under the universal service obligation, NTA, the ICT sector regulator, has built telecenters at several locations throughout the country.[10] The existing state and productivity of these telecenters have not been assessed, and their sustainability remains a major issue.[11]

NTA has recently called for a robust, secure, and state-of-the-art broadband infrastructure in the country.[12] It created the RTDF to fund the 'District Level Optical Fiber Program' in a bid to develop the nationwide broadband infrastructure. The telecoms and ISPs contribute two percent of their annual income to this fund. The RTDF has swelled up to NRs 9.5 billion.[13] A committee has been developing a business model to utilize the RTDF.[14] A recent Chautari policy review, however, concluded that the large set of policies, plans, acts and guidelines related to the Internet in Nepal lack robust empirical base.[15]

Both ICT-Association of Nepal and Computer Association of Nepal (CAN) have conducted ICT awareness and basic ICT literacy programs across the country.[16] Their programs follow a top-down strategy and involve training the principals and teachers of rural

Master Plan Consulting Report. Available at http://nitc.gov.np/download.php?mod=mydoc&f=documents%2Fe-GMP.pdf; accessed 12 January 2015.

[5] The comparison is based on the data provided by the World Bank that is available at http://wdi.worldbank.org/table/5.12 and http://data.worldbank.org/topic/economy-and-growth; accessed 15 March 2015.

[6] Based on the views expressed by Saligram Parajuli, Senior Engineer, Nepal Telecom, in a discussion program organized by Martin Chautari on 11 July 2014.

[7] The data can be found in NTA-MIS Report Series available at www.nta.gov.np/en/mis-reports-en; accessed 15 March 2015.

[8] VoIP is the hardware and software that enables people to use the Internet as the transmission medium for telephone calls.

[9] See, Nepal Wireless Project website www.nepalwireless.net/; accessed 12 January 2015. A description of Mahavir Pun's work can be found in Thapa, Devinder and Sabo Oystein. 2013. How to Scale ICT4D Projects: A Salience Stakeholder Perspective. Available at https://pure.ltu.se/portal/files/91176230/IFIPWG94_2013Proceedings.pdf; accessed 12 January 2015.

[10] NTA has adopted the Universal Service Obligation (USO) under which it is responsible to ensure a baseline level of telecommunication services to every resident of Nepal. For details on plans and strategies to achieve USO see the consultation paper, Nepal Telecom Authority. 2010. Ten Year Master Plan (2011 – 2020). Available at www.nepalpost.gov.np/index.php/telecentre-portal; accessed 12 January 2015.

[11] MC interview with Rom Kant Pandey, Department of Education, Tribhuvan University, an expert on ICT education and e-learning in Nepal; August 2014.

[12] Nepal Telecom Authority. 2014. National Broadband Policy, 2071 v.s. (draft). Available at www.nta.gov.np/en/public-notice-en/433-broadband-policy-draft; accessed 12 January 2015.

[13] Himalayan News Service. 2014. NTA Receives Rs. 1.73 Billion in RTDF. Available at www.thehimalayantimes.com/fullTodays.php?headline=NTA+receives+Rs+1.73+billion+in+RTDF+&NewsID=432253; accessed 12 January 2015.

[14] Shrestha, Ramesh. 2014. Disbursement Committee to Utilise RTDF Finally Gets Full Shape. Available at http://thtimes.pugmarks.in/fullNews.php?headline=Disbursement+committee+to+utilise+RTDF+finally+gets+full+shape&NewsID=438452#sthash.mq1jMwbj.dpuf; accessed 12 January 2015.

[15] Martin Chautari. 2014. *Universal Connectivity in Nepal: A Policy Review.* Research Brief No. 12. Kathmandu: Martin Chautari. Available at www.martinchautari.org.np/files/ResearchBrief12-UniversalConnectivityInNepal_APolicyReview.pdf

[16] ICT-Association is an umbrella organization of ICT product importers, distributors, dealers and professionals with specific interest on ICT trade and industry. CAN presents itself as the umbrella association of ICT institutions, associations and individuals with specific interest on the utilization, enhancement and promotion of ICT. The two associations have a lot of overlap in their objectives.

schools and organizing technology expos in the urban areas. Citing reluctance and non-use as causes for low technology diffusion, they hope to raise the general awareness about the opportunities in local technology market and related service industry. Revenues from these expos also help fund their institutional activities. The expos are followed by less advertized conferences, whose proceedings have not been noticed by the academic ICT community.[17]

Stakeholders Analysis

With the merger of data and voice technologies, the telecoms have upgraded their existing infrastructure to support digital data traffic. The ISPs are focusing on niche products such as the plan to offer Internet protocol television (IPTV) in a bid to retain their market share. They advertize reliable connection and quality technical support as their key institutional strength over the telecoms. The ISPs claim that the government indifference discourages them to venture into the voice market and utilize technologies such as WiMax. NTA responded by pointing at their inability to expand the services nationwide thereby allowing the telecoms to dominate the Internet landscape. The associations, active in Internet/computer advocacy and awareness, call for establishing a separate ministry for information technology (IT) in order for Nepal to join the global economy in a better prepared state. Online businesses add to this the lack of progress in establishing the national payment gateway that severely limits the scope of e-commerce. This struggle for relevancy among the key stakeholders in the evolving Internet landscape has dispersive effect on the drive for Universal Connectivity in Nepal.

Contentious Urban Commercial Landscape

Subscriber number, size and revenue give a distinct leverage to the telecom operators in defining the future of Internet in their ways. The operators contribute significantly to the RTDF and the state revenue and the lead also allows them to roll out infrastructure expansion in a scale and speed that is impossible for even the biggest ISPs. Such a massive institutional advantage to a limited set of actors has induced contention in the Internet landscape. The ISPs demand fairness in the modality of auctioning the frequency spectrum. They argue that NDCL's exclusive license to WiMax blocked the spread of the Internet as the technology itself is fast becoming obsolete. Similarly, their discontent reflects onto the lawsuits filed against NTA's decision to award license to UTL and Smart telecom in April 2013. The Supreme Court decision on NTA's favor has only reinforced their doubt over the neutrality of the state regulator. No action has followed as UTL failed to acquire the license this far and as the Smart telecom fell short of expanding its services to justify the license. The ISPs see these incidents as evidences for their belief about the skewed landscape.

To provide quality broadband connectivity, the ISPs prefer the Fiber-to-the-home (FTTH) last-mile solution.[18] Since telecoms have individual mobile subscribers as their core, their programs have rendered FTTH as commercially unattractive option. NDCL thus launched its FTTH services in September 2014 only. The service has been advertised publicly since April 2015. The delay seems deliberate to the ISPs, who view the cost of laying out fibers and end-point device installations, particularly in the low request areas as a major hurdle for expansion.[19] While self regulation and separation among the telecoms and the ISPs seem to be working due to their distinct market space, their everyday relation is fraught with low-intensity problems. Neither denies, for example, the possibility of vandalism such as unplugging of the cables from the cabinet or tampering with the connections. For the state regulator, the number of unified license holders that would be optimum for Nepal's telecommunication/Internet market and the appropriate share of revenue investment remain a challenging question.

Gaps in Rural Access and Connectivity

Relative to the major trends in the metropolitan commercial hubs, plans to develop backbone-infrastructure in every district throughout the country (District Optical Fiber Network [DOFN]) are pale. Connecting cities require an overhaul of the data infrastructure for a faster and high capacity technological innovation such as Long-

[17] Official website of the conference can be found at www.itconference.org.np/2015/index.php; accessed 12 January 2015.

[18] MC interview with Sanjib Raj Bhandari, owner of Mercantile Communications Pvt. Ltd.; July 2014.

[19] MC interview with Binay Bohara, President, ISPAN; July 2014.

Term Evolution (LTE).[20] Commercially unattractive rural extremities pose infrastructural challenge. RTDF with tens of billions rupees in revenue and a couple of billions being added every year is widely seen as the obvious fund to make initiatives in the under-served regions. Thus in April 2013, NTA put out a public call for conducting a consultation on the fund utilization. Consultations are said to be on the way for utilizing RTDF to invest in the launch of a telecommunication orbital satellite under the instruction of MoIC.[21] DOFN is stated to be the first priority as the headlines of "District Optical Fiber Project" and "Connect a School, Connect a Community" resurface.[22]

Beside DOFN, ideas to develop assistive digital technologies for persons with disabilities, the ICT-based disaster management and early warning system and climate change monitoring through the ICTs have been floating around.[23] Recently, NTA has asked international companies to bid for developing the business model for the RTDF. Expanding telecom infrastructure aside, how the utilization of RTDF and the universal service obligation would contribute to benchmarking the Internet is still unclear.

CAN, ICT-association, ISPs and the Ministry of Education have distributed computers to schools. The most, however, remain unused due to chronic power cuts and lack of content. Absence of approved digital curricula is often cited as the reason for the non-use. CAN and ICT-association focus on training document processing packages to the principals with the belief that the top-down acceptance will alter institutional attitude and help enhance the acceptance for the ICTs. Little attention is paid, however, to the biggest obstacle to non-use, namely, the weak purchasing power of the rural consumers. Households that can afford a broadband Internet connection remains elusive even in the big cities. A 256 kbps ADSL connection from NDCL, for instance, costs around 30 percent of the per capita income of a Nepali.

Problems of Resource Sharing and Governance

Frequency spectrum (radio waves) is a precious resource for wireless transmissions, especially in the inaccessible geography of many locations in Nepal. Broadband services are therefore likely to be delivered through wireless technologies. The last mile cost of the wired medium pushes wireless delivery in the urban and populated areas also. Managing the effective distribution of spectrum, resolving interference issues and defining transmission standards are key issues for the state regulators NTA and MoIC. The challenge is becoming urgent as 4G arrive thick and fast. NTA allocates spectrum to the service providers in bulk, with its license grant and renewal circumscribed within a region. Since the telecoms are the main consumers of the spectrum for their burgeoning mobile based services, licensing issues with WiMax have worsened the power imbalance.[24] Industry experts worry the technology will already be outdated before the problems are sorted out.[25] The thorny issue has locked the ISPs as data-only providers with no stake on voice and video, a situation often cited as the major setback to achieve a fair ecosystem and acceleration on the delivery of quality services.[26]

NTA has defined a set of indicators to measure the quality of service for the Internet providers. However, without a third party audit mechanism, the pledge to quality remains elusive. Several indicators in the list also need elaboration. For instance, allowed number of antennas in a given locality by a provider is not stated. New antennas may be installed solely on the basis of the bandwidth requirement, coverage and capacity optimization needs. Such leniency has triggered radiation fears. NTA is not technically equipped to monitor the hazards of the tower infrastructure expansion.

Online business portals such as Muncha.com and Bhatbhateni-online want a central payment gateway managed by the central bank, Nepal Rastra Bank. Online payments are presently bank-to-bank transfers

[20] Bringing in LTE requires new spectrum and tower installations that would be in the order of tens of billion rupees. See, www.telegeography.com/products/commsupdate/articles/2014/09/17/nt-looks-to-lte-for-future-data-services/; accessed 12 January 2015.

[21] Bhuju, Kriti. 2015. Government Initiates Study to Launch Satellite. Available at www.myrepublica.com/portal/index.php?action=news_details&news_id=90680; accessed 2 February 2015.

[22] Shrestha, Ramesh. 2014. Disbursement Committee to Utilise RTDF Finally Gets Full Shape. Available at www.thehimalayantimes.com/fullNews.php?headline=Disbursement%committee%to%utilise%RTDF%finally%gets%full%shape&NewsID=438452#sthash.WYFI0DYV.dpuf; accessed 12 January 2015.

[23] MC interview with Anand Raj Khanal, Director, NTA; July 2014.

[24] MC interview Binaya Mohan Saud, Chief Executive Officer (CEO), Subisu CableNet; July 2014.

[25] MC interview with Dileep Agrawal, CEO, WorldLink; July 2014.

[26] MC interview with Binay Bohara, President, ISPAN; July 2014.

or tied to personal bank accounts with international credit card. These businesses have yet to recognize a clear government regulation structure. Although Electronic Transactions Act cites the OCC as a certifying authority for digital signatures, not many portals have applied for the mandatory license.[27] Businesses rely on international providers such as VeriSign for transaction security despite knowing it to be illegal.[28] The companies attribute the situation to the government's failure to prioritize e-commerce and online service delivery. The ISPs also cite IPTV as another example of the government apathy.

Interventions on Piecemeal Thinking

Grounded Assessment

The connection between the broadband Internet and the economic growth and social well-being is routinely portrayed as established but is in reality problematic. The 2011 report by the International Telecommunication Union (ITU) and United Nations Educational, Scientific and Cultural Organization (UNESCO) recommended national governments and communities to develop their broadband infrastructure and actively promote the Internet adoption to achieve the millennium developments goals (MDGs) by 2015. The report claims that countries failing to join in on the broadband revolution "will lose the opportunity to reap the economic and social benefits."[29] As many have since argued, the relationship between Internet connectivity and poverty is poorly understood. Empirical studies in developed countries have indeed found that the investment in the Internet led to IT-using industries and firms getting well-off.[30] The returns, however, depend on the concentration of use, income, population and skills. The potential benefits of a newly introduced technology are therefore likely to be stunted in the less-developed countries.[31] The decision to shift to the broadband revolution in Nepal should have been preceded by well-grounded large-scale studies. The cost of the fixed Internet (broadband) in the country is one the most expensive in the world (Figure 3). The negligible consumable content also puts off huge non-English reading population. The policies on the Internet ecosystem drive toward South Korea while users' behavior paradoxically remains stuck in Bangladesh. A basic research on connectivity, access and use of the Internet should be the starting point to enquire into the socio-economic transformation potential of the Internet.

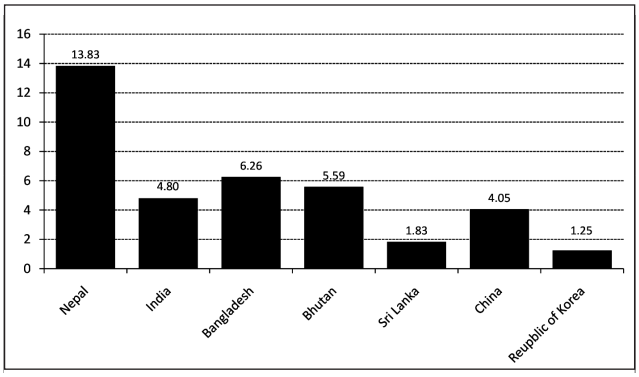


Figure 3: Percentage cost of Internet in various Asian countries with respect to per capita GDP (2013-2014)[32]

The NTA-MIS data on the access patterns of the mobile users can be analyzed in fine-tuning socio-economic models. Sadly, the available report series leave much as desired. A simple regression of the data puts the number of Internet subscribers (data users) as 26 millions in 2016, almost equal to the country's population. By 2019, the number increases above 100 millions without any slow down.[33] Clearly, the methodology to estimate the true number of Internet subscribers in the reports is questionable. The reports also do not describe volume and purpose of the Internet usage, quality of connections, and the parameters measuring Internet security. A lack of statistical clarity in the official data

[27] In fact the OCC website www.cca.gov.np/licensed-cas.html (accessed 9 February 2015) shows not a single name in the website.

[28] For the action taken by the OCC on banks and financial institutions using foreign digital signature services see, www.nepalsharemarket.com/Nepalsharemarket/Nepse/Analysis/news/news.aspx?news_id=NEW-004294; accessed 3 February 2015.

[29] Broadband Commission. 2011. *Broadband: A Platform for Progress*. Geneva: ITU/UNESCO. Available at www. broadbandcommission.org/Reports/Report_2, pdf; accessed 3 January 2015.

[30] Forman, Chris, Avi Goldfarb and Shane Greenstein. 2012. The Internet and Local Wages: A Puzzle. *American Economic Review* 102(1): 556–575.

[31] Kenny, Charles. 2003. The Internet and Economic Growth in Less-Developed Countries: A Case of Managing Expectations? *Oxford Development Studies* 31(1): 99–113.

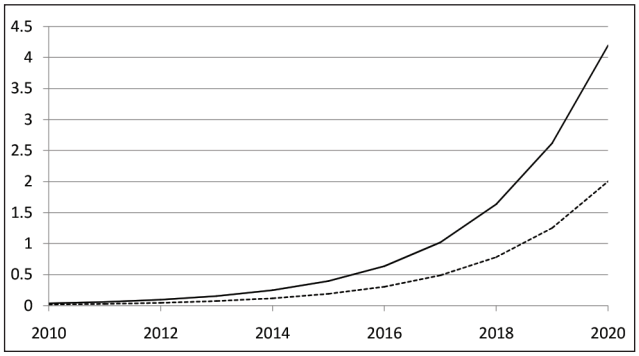
[32] The calculations were made on the data provided by the World Bank available at http://wdi.worldbank.org/table/5.12 and http://data.worldbank.org/topic/economy-and-growth; accessed 15 March 2015.

[33] Regression result was obtained from the cftool package in Matlab.

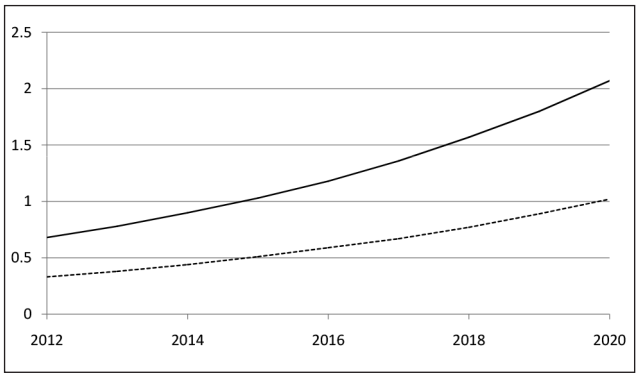
is evident too in the light of other estimates of Internet users. In 2013, the World Bank puts that as 13.2 percent (of the population ≈ 3,510,000) and the NTA-MIS as 28.63 percent (around 7,585,761), suggesting that more than half subscribers do not use the Internet. By November 2014, the NTA increases the penetration to 35.7 percent, claiming the addition of 1,854,615 new subscribers, approximately the population of Kathmandu.

Critical Adjacent Technologies – Power and Waste

The issue of Internet connectivity should be dealt in tandem with the questions about the availability and robustness of energy infrastructure. Telecoms are energy guzzlers. Telecom Italia used over two terawatt hours (TWh) in 2006 which is about one percent of the entire energy demand in the country. Similar numbers were reported by Telecom France and British Telecom, Verizon in the United States and by NTT in Japan.[34] The variation in the estimates of the energy consumption arises from the difference in defining the measurement boundary. Some studies exclude the terminal devices such as the personal computers and servers from the boundary giving a very different, and less scary, energy consumption requirement. For a moderately accurate calculation, the intermediaries such as the power consumption by the optical amplifiers and cooling units should be considered. To deliver the exponentially growing data at an ever increasing rate would require a steady increase in the availability in energy. The rise of power consumption to meet the technology advancement and upgrade can be around 16–20 percent per year.[35] Even a lower estimate of the energy consumption in Nepal's ICT sector (Figure 4), considering the power requirement in the mobile towers only, is a significant one percent of total electrical energy consumption. That amounts to 65.7 GWh today, which is sufficient for lighting about one million CFL bulbs, each of 7W power, for a period of one year.



(a) Growth estimates of the annual energy consumption in mobile phones in Nepal [36]



(b) Growth estimates of the annual energy consumption in mobile towers in Nepal [37]

Figure 4: Projection in the energy consumption due to increase in mobile users and mobile towers. Electricity consumption as a percentage of current annual electricity production capacity (6,878GWh) is shown by solid lines and as of the future production capacity (13,670GWh: after completion of Upper Tamakoshi, Likhu 4, Rasuwagadhi and Madhya Bhotekoshi projects) by dashed lines[38]

Another component conveniently missed from the analysis of the existing Internet ecosystem is the management of toxic and valuable waste (e-waste). A 2007 report submitted to MoSTE

[34] Recupero, Diego Reforgiato. 2013. Toward a Green Internet. *Science* 339(6127): 1533–1534.

[35] Fettweis, Gerhard, and Ernesto Zimmermann. 2008. ICT Energy Consumption-Trends and Challenges. Available at https://mns.ifn.et.tu-dresden.de/Lists/nPublications/Attachments/559/Fettweis_G_WPMC_08.pdf; accessed 20 March 2015.

[36] Mobile numbers from NTA-MIS reports (see also, Figure 2 above); power required for a mobile phone is taken to be that of Nokia 3210, which is equal to 0.2W.

[37] Assuming 15 percent increase in electricity demand per year. It is also assumed that a mobile tower requires power of 1000W on an average, and there are 5,222 mobile towers throughout the country. The later assumptions were based on MC interview with Tulasi Ram Shrestha, Senior Engineer, Nepal Telecom; 12 March 2015. The number of towers is for the year 2012.

[38] Hydropower data available at www.doed.gov.np/; accessed 20 February 2015. Projection growth was done by regression using cftool package of Matlab.

admits to lack of significant data to make any realistic estimate on the e-wastes in Nepal. The report is chiefly based on department of customs data on a few electronic items from 1997/98 to 2005/6.[39] The solid waste management policy of 1996 and the act of 2011 do not address e-waste policies and strategies.[40] The substandard quality is likely to amplify the waste and life span of the digital devices in Nepal. As most reports rely on global estimates, it is difficult to make any meaningful argument on the issue.[41]

Privacy, Security and Intellectual Property Rights

The ISPs and NDCL both claim that they do not monitor the activity or store browsing history of their customers unless under police requests. Costly data storage and privacy concerns are often cited for such benevolence. However, serious security concerns about the present digital-ecosystem have been raised. A scenario could have been such that the voter data held by the Election Commission (EC) of Nepal was inaccessible, corrupted or tampered. Fake voters could have been created, genuine ones erased and voters' personal information, along with their photographs, may have been mismatched.[42] The introduction of national identity cards with personal details and fingerprints is another area for the strict vigilance. For 'a database nation,' the questions about privacy and security of data often go unnoticed in academia and media.[43] Public debates over identity theft, about who owns the information such as the fingerprint taken by a company stored in the servers of a third-party technology vendor, are missing. Post the 'Snowden effect,' encroachment on the rights to privacy in response to a critical security situation in a digital communication infrastructure has been debated.[44] Back home, NTA ordered the ISPs in Nepal to block a set of websites that they considered as delivering pornographic or horror content, threatening national security, religious harmony and corrupting social morals.[45] Cases of sexual abuse, sexual predators lurking online and use of the Internet for sex-trafficking in Nepal are regularly reported in the media.[46] Serious issues have been raised on what strong or weak intellectual property laws bring to the table considering first, the introduction of a new technology does not guarantee rise in innovation; second, the old technology not generating innovative ideas/solutions/knowledge is erroneous; and the last, a greater protection of intellectual property does not necessarily correlate with development. For Nepal, Internet is an imported technology and the innovations will largely flow in from high income countries. The strength of Intellectual Property Rights (IPRs) and its exact relation to national development anticipates thus sound and open theoretical and empirical debate.[47]

Technology Transfer and Digital Exclusion

Transition to the Internet enabled digital ecosystem is the case of filling a hole from the soil dug from a fresh pit. Those who do not have access will be excluded from its benefits. The minorities, poor and less educated

[39] Pace Nepal Pvt. Ltd. 2007. Identification and Quantification of Electronic Products that will Convert into E-Waste in Nepal. Unpublished report, MoSTE. Available at http://moste.gov.np/electronic_waste; accessed 17 January 2015.

[40] His Majesty's Government. 2053 v.s. Solid Waste Management National Policy, 2053 (1996). Available at http://swmtsc.gov.np/sites/default/files/policy/Solid%20Waste%20Management%20National%20Policy%202053%20%281996%29.pdf; accessed 17 January 2015. and Government of Nepal. 2011. Solid Waste Management Act, 2011. Available at http://swmtsc.gov.np/sites/default/files/policy/Solid%20Waste%20Management%20Act%2C%202011%20%28English%29_6.pdf; accessed 17 January 2015.

[41] An estimated 50 million tons of e-waste are produced each year globally. It is estimated that only 15–20 percent of e-waste is recycled, the rest going directly into landfills and incinerators. A large part of heavy metals in landfills comes from discarded electronics. As an example, the ratio is 70 percent in the USA. See UNEP policy brief on e-waste available at www.unep.org/ietc/Portals/136/Other%20documents/PolicyBriefs/13052013_E-Waste%20Policy%20brief.pdf; accessed 17 January 2015.

[42] Basnet, Santa Bahadur, Shailesh Pandey and Yogesh Raj. 2013. Defending Data. *The Kathmandu Post*, 20 October, p. 6.

[43] See Raj, Yogesh and Santa Bahadur Basnet. 2014. Digital Democracy on Demand. *The Kathmandu Post*, 16 July, p. 6, for how technology and data are treated by the technology developers and the decision makers. For the use of the phrase, see Garfinkel, Simson. 2000. *Database Nation: The Death of Privacy in the 21st Century.* Sebastopol, CA: O'Reilly Media Inc.

[44] A recent case of Internet tapping of foreign communications by the National Security Agency (NSA) in the USA. Sanger, David E. 2014. U.S. Privacy Panel Backs N.S.A.'s Internet Tapping. Available at www.nytimes.com/2014/07/03/world/privacy-board-backs-nsa-program-that-taps-Internet-in-us.html?_r=0; accessed 17 January 2015. The covert partnerships between technology companies, service providers and government agencies in installing backdoors and trapdoors in commercial software are two such widely discussed issues in Ball, James, Julian Borger, and Glenn Greenwald. 2013. Revealed: How US and UK Spy Agencies Defeat Internet Privacy and Security. Available at www.theguardian.com/world/2013/sep/05/nsa-gchq-encryption-codes-security; accessed 17 January 2015.

[45] Sites such as Huffingtonpost and Springer were among the banned list. Reports of the news can be found at http://nepalitimes.com/news.php?id=18395 and http://nepalitimes.com/news.php?id=17427; accessed 18 January 2015.

[46] Kunze, Erin I. 2010. Sex Trafficking via the Internet: How International Agreements Address the Problem and Fail to Go Far Enough. *Journal of High Ttechnology Law* 10(2): 241–289.

[47] Park, Walter G. and Juan Carlos Ginarte. 2006. Intellectual Property Rights and Economic Growth. *Review of Development Economics* 10(4): 700–719.

and the persons with disability are at the critical risks. The question of digital exclusion formerly centered on the unequal distribution of access. Digital-divide and information-gap were the terminologies designed to convey the chasm and an increased investment in infrastructure development and establishment of public access points such as telecenters, public schools and libraries were seen as institutions to bridge the gap. Recent decades have seen a shift to discussions about adoption, levels of access, motivation and skills.[48] Two key research findings led to the shift: (i) disadvantaged groups showed resistance despite access; and (ii) a lack of access to ICT did not lead to lower skill levels. More recent studies reveal the replication of offline exclusion patterns on the online space. The politically inactive offline tend to remain so online as well.[49] However, relevance, quality, ownership and sustainability of engagement can influence the offline engagement.[50] Technology adoption therefore depends on the interrelated set of political, economic and cultural factors.[51] A study on the telecenter at Bungamati revealed that adopting technology for educational use was hindered by the qualification of the teachers and social restrictions on women for using technology.[52]

Conclusion

The Internet ecosystem has changed drastically in Nepal in the last seven years. The ISPs are no longer the dominant actors. Telecoms own a large percentage of the communication infrastructure, individual customer base and are institutionally capable of rapid large-scale expansions. The rural market does not offer an attractive investment-return and the penetration there relies on the effective use of the RTDF funds to meet the universal service obligation for telecommunication. The investment guarantee to translate the sound promises of the policies and roadmaps to the poor and the marginalized is non-existent. The proponents claim that the promises in the literature have not been acted upon because the government has failed to prioritise IT. They point to the absence of a dedicated IT ministry, delays in implementation by NTA and in establishing the payment gateway. More pressing issues, however, are: first, existing policies and plans should be reshaped with primary research on connectivity, access and use of the Internet; second, the design of digital ecosystem should address critical issues related to adjacent technologies, particularly ways to manage immense power demand and e-waste production; and the last, the rights of the poor and the marginalized in e-Nepal should be ensured particularly when the technology shows strong divisive capabilities. The present activities of the key actors in the Internet ecosystem therefore need to orient away from the case of business as usual. From a preoccupation with the struggle to be relevant now, these activities need to cohere around a unified grounded vision for universal connectivity.

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[48] Halford, Susan and Mike Savage. 2010. Reconceptualizing Digital Social Inequality. *Information, Communication & Society* 13(7): 937–955.

[49] Dutton, William H. and Grant Blank. 2011. Next Generation Users: The Internet in Britain. Available at www.oii.ox.ac.uk/publications/oxis2011_report.pdf; accessed 11 December 2014.

[50] Helsper, Ellen Johanna. 2012. A Corresponding Fields Model for the Links between Social and Digital Exclusion. *Communication Theory* 22(4): 403–426.

[51] Keller, Robert T. and Ravi R. Chinta. 1990. International Technology Transfer: Strategies for Success. *The Executive* 4(2): 33–43.

[52] Lee, Jeffrey Chih-Yih and Paul Sparks. 2014. Three Hurdles to Technology Integration: A Case Study of Technology Integration in Bungamati. *Journal of NELTA* 18(1–2): 105–114.

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