

## Telecommunications Infrastructures and Services Development and Challenges in Nepal

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### Abstract

*The world's unique geographical, multilingual, multiethnic, multiracial and multi religious Himalayan country Nepal has more than 100 years history on telephony service and it has been formulating appropriate policy and regulation for the adoption of new technology, introducing the competitive market environment for the overall development of Information and Communication Technology (ICT) infrastructures and application of ICT service and tools for socio-economic transformation. The Nepalese market seems to be continuously growing and having huge demand of mobile telephony and internet subscriptions trend. The ICT infrastructure development in difficult geographical area is quite challenging and thus operators are focusing mobile telephony and mobile internet services. Nepal has been doing its best effort on formulating policy and regulation, adoption key strategies for ICT sector development and at the same time joining hands with international and regional bodies such as ITU, SAARC etc for ICT sector development. Due to geographical diversity, policy and regulatory barriers in some extent, power supply constraints and low affordability from customers on ICT tools and services, Nepal has been facing challenges on ICT infrastructure development. However, the national statistics on ICT, Networked Readiness Index and ICT Development Index show that Nepal has done quite good progress and is keeping its pace on ICT development despite the these challenges. Moreover, there seems to be quite uncovered market segments on internet service and big opportunity on ICT sector development in Nepal in the days to come.*

**Keywords:** Telecom Infrastructure, NTA, Nepal Doorsanchar, Nepal Telecom, ICT Development

### 1. Introduction

Nepal is a land-locked country sandwiched between India & People's Republic of China with area of 147,181S.km. It is multilingual, multiethnic, multiracial and multi religious country with population over 28 million. Nepal possesses unique topographic profile having the World's deepest gorge 'Kali-Gandaki' to the highest point on earth, Mt. Everest at 8848m. Geographically, it has

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been divided into three regions; Himalayan, Mountain and Terai with diverse topography and challenging landscape, with 75% rugged mountains and hills and remaining lowlands and valleys. The country's population is largely rural, with only 18 percent of the population living in urban areas [1].

Nepal Doorsanchar Department established the first telephone lines about hundred years back. This entity was transformed into Nepal Telecommunication Corporation and then into Nepal Doorsanchar Co. Ltd in 2004 under the company Act 1997. Nepal Doorsanchar Co. Ltd (also known as Nepal Telecom) and has been serving customers with different telecommunication services nationwide in Nepal. Nepal Telecom (NT) holds a large portion of the market share i.e. 47% in telephone subscribers throughout the country covering all the 75 districts and all the VDC's with voice and internet data [2]. It has been leading the nation's economy by generating massive revenues, as it is the organization that pays the largest tax to the government. In 1950 AD, NT's establishment of Cross-Bar (CB) telephone exchange (100 lines) was the first in the nation. It was a voice only exchange in Kathmandu that had Public Switched Telephony Service (PSTN) technology. Today, Nepal Telecom has adopted and implemented changes in their business model in response to rapid advancements in technology, high expectations of customers and the ever-changing market situations. After a decade long journey, Nepal Telecom is providing communication services in almost every sector throughout the country. Today, NT has no monopoly on the market due to competition from other telecom players such as Ncell, UTL, Smart Telecom, Nepal Satellite Telecom Company Ltd and around 50 Internet Service Providers (ISP) etc. After Ncell acquired by Telia Sonera group and then Celcom Axiata group, the state owned company has been facing fierce completion and many challenges and threats in the market in voice telephony as well as internet service. The current market share of around 92% belongs to Nepal Telecom and Ncell, the market seems like duopoly irrespective of the presence of other 3 telecom operators [2].

A World Bank study emphasizing the importance of internet penetration for developing economies concluded that "Every 10 % increase in broadband penetration provides a 1.38 per cent increase in GDP". This is the era of ICT and Nepal is not the exception. According to the ITU report, measuring the Information Society 2016, Nepal has improvement in Information and Communication Development Index (IDI) ranking of 142 with IDI value of 2.32 in 2015 to 142 with IDI Value of 2.50 in 2016 among 152 countries [3].

As per the Global Information Technology Report 2016 by World Economic Forum, the Networked Readiness Index [4] of Nepal has been improving. This is illustrated in table 1.

Nepal has recently experienced unprecedented mobile growth & has the potential to repeat the same for broadband data service. ITU's MIS 2013 indicates that wireless broadband Internet access remains the strongest growth sector in developing countries.

It shows that 50% of the world population lives within reach of a 3G network. Recent Nepal Telecom Authority (NTA)'s MIS report also shows the overall market growth of internet/data service is growing up exponentially in Nepal e.g. Within 7 years of time Nepal's Internet

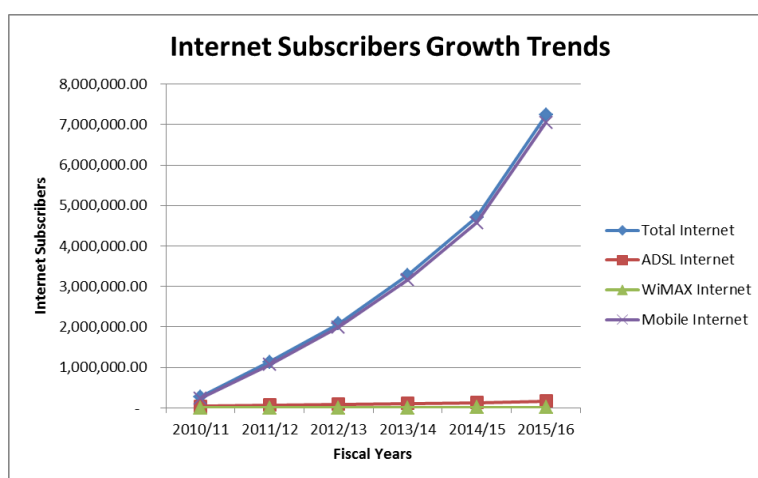
penetration has surged from 2.5% to 52% i.e. more than 20 fold. Thus there is a tremendous growth in this segment of telecom business in Nepal.

**Table 1: Networked Readiness Index of Nepal**

Year	Rank	Score
2013	126 <sup>th</sup> out of 144 Countries	2.9
2014	123 <sup>rd</sup> out of 148 Countries	3.1
2015	118 <sup>th</sup> out of 143 Countries	3.2

In Nepalese scenario, few years back, dial up service and leased line was the only possible media for internet. But at present people have many choices like ADSL, VDSL, and Fiber to Home (FTH), WiMax, WiFi, 3G, EVDO, cable TV etc. Moreover, there is not any monopoly of NT in the data market. Data customers have many options like different service provider, different bandwidth, and different technologies (fixed and wireless). So, the competition in the data service market is also becoming tougher. The trend of telephone subscriptions and internet service subscriptions in Nepal shows that service is mainly dominated by wireless i.e. mainly mobile telephony and mobile internet. The figure 1 below is the trend of service subscription from Nepal Telecom in Nepal [5]. The trend graph shows that the internet subscription is highly dominated by mobile technologies GSM (GPRS, EDGE, and 3G) and CDMA (PDSN, EVDO). Moreover, Nepal Telecom has launched 4G/LTE service from 1<sup>st</sup> January 2017 after government has amended the spectrum policy to allow operators to use 1800 MHz frequency band as technology neutral band and opened for 4G/LTE service [3].

Though the internet subscription rate is increasing exponentially, still there is huge gap to fill the under-served internet market in Nepal. In other word, 48% of Nepalese people are still out of reach of Internet The big telco operators and new entrant are focusing their target on new customer segments using mobile as well as fiber based technologies.



**Figure 1: Internet service subscription of Nepal Telecom**

### 1.1 Tele-Density scenario in Nepal

In 2016, Nepal's Tele-density has reached to 123% (Fixed: 3.24% + Mobile: 116%), where fixed lines growth rate is almost nil but mobile services growth rate is still tremendous. But here it is important to notice that Mobile penetration has already reached to 116% i.e. the market is already saturated and the service subscription mainly focused niche market and dual subsections. As of Oct 2013, there were almost 21.2M mobile subscribers in Nepal. Based on Central Bureau of Statistics (CBS) data ([www.cbs.gov.np](http://www.cbs.gov.np)) by the end of 2018 the population will reach to almost 29.1M i.e. to have 100% penetration, additional 7.9 M lines capacity is required in the next 5 years. The mobile service subscription trend in Nepal can be best explained from the trend analysis of Nepal Telecom's telephone subscriptions given in figure 2. [5]

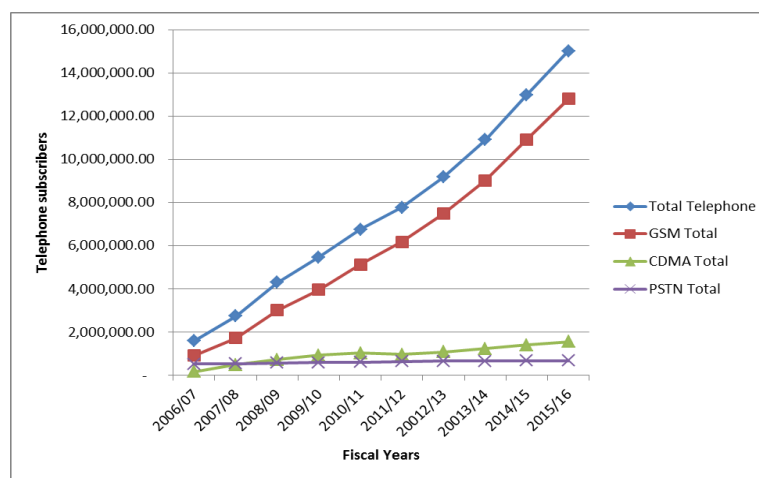


Figure 2: Telephone subscription trend of Nepal Telecom

## 2. Policy initiatives to boost ict service

The national statistics on ICT [as per MIS Report of NTA and Nepal Telecom] and international comparative statistics given by ITU, Nepal has a lot of space to work on field of ICT. Since the global demand of ICT services in various fields such as education, health, commerce, development, agriculture and infrastructure development is increasing day by day. The overall success to achieve the Millennium development goal (MDG) set by ITU, UNESCO and UN agency also dependent on development of ICT infrastructures, use of ICT tools in various applications, Nepal Government with assistance and guidance of World Bank, Asian Development Bank, ITU, UN agencies has been working for the development of ICT and minimizing the digital gap and elimination of digital poverty.

To accelerate the growth of ICT and change the socio economic condition of Nepal, Nepal government has formulated the ICT policy 2015 with the vision to transform Nepal into information and knowledge based society and economy [6]. To materialize this vision, Nepal government has set the mission and goal as; Mission: To create conditions for the intensified development and growth of ICT sector as a key driver for Nepal's sustainable development and poverty reduction strategies. Goal: To Enhance overall national ICT readiness with the objective of being at least in

the top second quartile of the international ICT development index and e-Government rankings by 2020. Likewise, IT Policy 2011 was formulated with the objectives to make information technology accessible to public and increase employment opportunities, in order to build a knowledge based society and to establish knowledge based industries [7]. Telecom Act and Regulation came effective from 1997[7] which deregulated the telecom market and the monopoly market of state owned company Nepal Doorsanchar Company Ltd was demolished and several private sector telecom operators and internet service providers (ISP) emerged in the market. To support further the Telecom Act and Telecom Regulation, Telecommunication Policy had been made effective from 2004 with the aim to provide telecom service reliable and accessible to all people throughout the country with the collaboration with private sector.

A World Bank study emphasizing the importance of internet penetration for developing economies concluded that "Every 10 % increase in broadband penetration provides a 1.38 per cent increase in GDP". This is the era of ICT and Nepal is not the exception. According to the ITU report, Measuring the Information Society 2011, Nepal increased its Information and

Communication Development Index (IDI) ranking up from 137 in 2008 to 134 in 2010 among 152 countries [8]. Nepal has experienced unprecedented mobile growth & has the potential to repeat the same for broadband data service. further to enhance the growth and keep the spirit accelerated, Nepal has formulated the Broadband Policy 2015 with the key objectives to provide secure, meaningful, affordable and reliable broadband service on demand on urban areas and universal access of broadband service in rural areas[9].

### **2.1 Key Strategies taken to Access the Broadband Service [9]**

- Roll out the 4G/LTE wireless broadband network. Nepal has launched 4G/LTE broadband service in existing GSM 2G/3G spectrum by frequency reframing. Nepal has already identified 700 MHz and 2600 Mhz frequency band for the rolling out of 4G/LTE services. The auctioning of this band will also be realized soon.
- Provide broadband internet service to all the villages of country, however the villages in Himalayan and hilly region are challenging to build network and less profitable to the operators.
- Nepal has provision of Rural Telecommunication Development Fund (RTDF) created to subsidize the service operation in remote and rural area.
- Provide broadband and Wi-Fi connectivity to all government schools, hospitals, Public service offices, municipalities, and public places utilizing the RTDF fund to reduce the digital gap and increase the socio-economic status of people from rural connectivity plan. The rural connectivity plan aims to support education, health, public service delivery, employment generation.
- Nepal has formulated the policy and regulation for mobile financial solution that help to introduce the m-commerce, mobile money and mobile wallet service in the country soon.
- Nepal has recently drafted Telecommunication Infrastructure sharing strategy 2015 and guidelines for cutting the cost in infrastructure and regulating the infrastructure for ICT services. We believe the new strategy adopted in infrastructure sharing will enable operators to cut the cost, to build the

robust and resilience infrastructure, to maintain quality of service and to support environment protection by implementing green telecom infrastructures.

## 2.2 SAARC Initiatives for Regional ICT Development

Nepal, alongside other SAARC [13] Members (Afghanistan, Bangladesh, Bhutan, India, Maldives, Pakistan and Sri Lanka), is committed to a regional ICT policy aimed at increasing penetration, quality and harmonization of ICT services.

A 'Plan of Action' for telecommunications services has evolved over three SAARC conferences in 1998, 2004 and 2008. The following aspirational goals and objectives were formulated:

- *'To promote cooperation in the enhancement of telecommunication links and utilization of information technologies within the SAARC region;*
- *To minimize disparities within and among Member States in the telecommunications field;*
- *To harness telecommunication technology for the social and economic upliftment of the region through infrastructure development by optimal sharing of available resources and enhanced cooperation in technology transfer, standardization and human resource development; and*
- *To evolve a coordinated approach on issues of common concern in international telecommunications fora.'*

At subsequent SAARC conferences, Member States committed to implementing fellowships and training program for telecommunications HR staff as well as R&D and adopting uniformly applicable low tariffs for intra-SAARC phone calls. In addition, Member States were directed to 'give priority to universal access' and 'cooperate in the development of plans and for the utilization of ICT in e-commerce, health care education and other areas by the exchange of information and expertise'. In 2009, a meeting of the Working Group on Telecommunications and Information and Communications Technology agreed in principle to a proposal regarding upgrading of national and regional telecommunications infrastructure.

An 18-point SAARC Plan of Action on Information and Media (PAIM) was formulated to achieve the ICT and media objectives that member states agreed to in the 1998 Dhaka conference. These objectives (Revised in 2004) included:

- Reducing rates for media transmission and information materials;
- Ensuring the free flow of information; and
- Enhancing the exchange of data through the Internet.

It is worth noting that the achievement of higher broadband penetration will facilitate the meeting of PAIM targets [14].

## 2.3 Key Players in the development of ICT

The overall development of ICT sector in Nepal has been led by Ministry of Information and Communication, Government of Nepal. It has facilitating role by consulting all the stakeholders, supporting coordination and cooperation, formulating appropriate policy, regulation and Acts. The Nepal Telecommunication Authority is the major stakeholder who is also the advisor of government and who monitors all the service providers, issue license, regulate the market. The state owned

telecom company, Nepal Telecom, is the leading ICT player in the country who has social and governmental obligation to provide ICT service at the every nook and corner of the country. The other players are private telecom operators such as Ncell Axiata Ltd, UTL (a JV company of Indian Telcos), Smart Telecom Ltd, and Nepal Satellite Telecom Pvt Ltd. Similarly about 50 Internet Service Providers and 10 Network Service Providers [4] are also playing the role to enhance the ICT growth and introduce digital communication innovation in Nepal.

### 3. ICT Infrastructures in Nepal

Nepal has achieved significant goals in building ICT infrastructure in such a diverse terrain country. The formulated policy, Acts, Regulation in Telecommunication sector have paved a way to outcome significant development in infrastructures. The current infrastructures in Nepal has Optical Fiber Networks: East – West Optical Fiber Network about 1000 Km that connects all Terai districts and North-South Optical Network having length of 500 Km that connects China border at Rasuwagadhi and India border at Bhairahawa, Birgunj and Biratnagar[10].

51 District headquarters are connected by Optical fiber network with Underground, OPGW and ADSS based optical cable Network [10]. Similarly Microwave Networks have been built in most of the hilly areas to connect these areas to main stream of the ICT community. Mobile backhaul network in Terai is also connected via microwave networks. Microwave network has been extended to all the districts since August 2015.

Nepal has reliable and uninterrupted Satellite Network to keep intact with global citizens. For this, a Satellite Earth Station has been built at Kathmandu. Similarly 300 KU band VSAT Network terminals [10] are installed in hilly and mountainous region to cover the uncovered region in difficult terrain. As a part of Universal service obligation, Nepal has been putting effort for connectivity in rural and remote areas.

To facilitate the ICT and IT industries, Nepal has developed a well-equipped IT park at Banepa nearby the Kathmandu valley which provides basic requirement for ICT industry. Similarly Data centre has been also managed at GIDC, Kathmandu, ICT Centre at Institute of Engineering, Pulchowk, Lalitpur.

#### 3.1 SASEC information highway project

Nepal is a participant of the South Asia Sub-regional Economic Cooperation (SASEC) Information Highway (IH) Project. The USD 11.2 million venture, a joint partnership between the Asia Development Bank (ADB) and the Government of Nepal, was approved in 2007 with the ADB contributing USD 9 million and Nepal USD 2.2 million. The two-phase project (phase one, December 2002 and phase two, December 2015) is a sub-component of the broader IH framework for the SASEC Member States, the objectives of which are:

- To improve ICT connectivity between SASEC Member States;
- To provide modern, affordable and reliable broadband information, communication and knowledge-based services within and across the borders to universities and businesses; and
- To expand ICT accessibility in remote and rural areas.

The IH project hopes to improve the quality and penetration of IH in rural areas via mobilizing the concept of social capital within rural communities and leveraging the SASEC regional exchange as a sharing facility [12, 14].

ICT human resource capital is intended to be developed through improved local content as a result of raising ICT awareness, e-literacy and training. This will necessitate the establishment of a Research and Training Centre, which will implement the processes that will achieve these goals [12, 14].

### **3.2 ICT Infrastructure Development (Work in Progress)**

Nepal has policy to support universal service obligation. The Rural Telecommunication Development Fund (RTDF) has been created to support USO. Operators have to support 2% of their income in RTDF fund [7]. The Telecom Regulator Nepal Telecommunication Authority has decided to invest this RTDF fund to build nationwide ICT infrastructure and provide subsidy for the operators who provide service in difficult terrain and remote areas (commercially not viable areas) NTA and Nepal Doorsanchar company Ltd has signed the agreement to build Optical fiber Network in Mid hill highway(province 1 to 3)[11] and similarly NTA has floated the tender to build similar network across the midhill highway for remaining parts (Province 4-7) (Source: Nepal Telecommunication Authority)

The Mid Hill Optical highway will be connected with most of the district headquarters of hilly and terrain region and this network will be messed with East-West Optical Highway and North South Optical highway to create resilience and robust network with auto protection service.

## **4. Challenges for development of ICT in Nepal**

The statistics and reference presented above shows that Nepal is still striving to develop the ICT infrastructure, increase its uses and expand it in various applications to meet MDG and transform socio economic condition through the use of ICT tools. Nepal has formulated various policy related issues and has been receiving grants, aids and support for international agencies to uplift the ICT development goals. The market is also the competitive and maturing, the affordability of the service is also increasing. However, the outcome of the ICT goals and achievement is still below the line of the expectation. There are key challenges which are creating barriers to achieve the goals and target in ICT sector. The key challenges are: power disruptions, affordability, and policy, difficult geological terrain.

- **Power disruptions:**-Nepal's power grid is insufficient and needs substantial investment. The national grid powers wireless networks and therefore subject to potentially crippling disruptions which may have the effect of suppressing ICT uptake. The government may need to mitigate this significant obstacle via the use of alternative power sources, such as solar, grid upgrades and backup battery equipment.
- **Affordability:** - At present, notebook computers and 3G Internet access prices are unaffordable to many Nepalese. Lack of affordability of both Internet access devices and services constitutes the



most significant barrier to wireless broadband adoption and development of ICT infrastructure in Nepal. The government will need to endeavor to bridge this affordability gap by considering the merit of a number of options such as: free Wi-Fi hotspots, subsidies and community Internet centers etc. These policies are especially important for the approximately 70 per cent of the population who live in isolated/rural areas.

- Policy and Regulatory Barriers:-A number of policy and regulatory barriers exist which impact wireless broadband penetration. These include:
  - A complex licensing scheme that acts to discourage enterprises from entering the domestic market and hence providing additional competition;
  - Non-transparent spectrum allocation regime and inefficient allocation of key spectrum bands (e.g. on a regional basis without reuse);
  - The lack of an effective interconnection regime; and
  - Inefficient taxes that add to the expense of purchasing new technology / equipment.

These barriers will need to be addressed by the government in order to facilitate the most efficient and effective rollout of wireless broadband services.

- Difficult Geographical Terrain:- 75% rugged mountains and hills and remaining lowlands and valleys. Therefore, it is very difficult to build ICT infrastructure in such difficult geographic condition. Similarly, Nepal does not have direct access to submarine cable system and has to rely on the terrestrial link hired from Indian and Chinese telco providers which has significantly increasing the internet cost and cost for international connectivity.

## 5. Conclusion

As per Nepal's recent success story, it has been experienced that not only the voice subscribers growth but recent 2G(GPRS/EDGE) and 3G (WCDMA), 4G/LTE mobile broadband data network expansion in Nepal including Kathmandu valley shows an overwhelming response from the data customers. It is seen that Nepal has been doing a lot of works in policy level to uplift the ICT sectors. The formulated policies, Acts, Regulations and outcome of these initiatives in terms of ICT statistics and available ICT infrastructures, it can be concluded a successful initiatives and growth towards lowering digital gap and eradicating digital poverty in Nepal. Due to diverse topographic situation and scattered settlement, Nepal faces difficulty and more challenges to build ICT infrastructure and provides broadband ICT service in Nepal.

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