

Study on History of Telecommunication System in Bhutan



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Introduction

Bhutan had been isolated from the rest of the world for a long time particularly in terms of its telecommunications connectivity. Its mountainous landscape made it difficult to build the necessary telecoms infrastructure. However, Bhutan has made a long way since the establishment of the first telecommunication service in 1963 in the country. The Royal Government of Bhutan (RGoB) recognizes Telecommunications as an important contributor to the socio-economic development of the country. It has a vital role to play in enhancing competitiveness, increasing productivity and economic development, and promoting greater social inclusion. Telecommunications in Bhutan includes telephones, mobiles, radio, television, satellite, and the internet, etc. Recognizing the importance as well as the capital-intensive nature of a contemporary high-speed backbone network in the country, the Government took on itself to establish fiber-optic infrastructure throughout the country.

It's been two decades since Bhutanese were introduced to the internet and back then people had a very limited capacity because of the internet through satellite backhaul connectivity. Today with greater access to affordable smartphones and wider internet access due to two major telecom operators, people are not only surfing the web on their computers for information but also scrolling down the phone for almost everything, which shows the rapid development of telecommunication in the country. Not only Bhutan has witnessed progress in the telecommunication sector but also the generation of services from the era of 2G, 3G, 4G and will continue to do so with the evolution of the fifth generation of a network (5G). This paper highlights the growth of the telecommunication sector in Bhutan and the impact of new technologies.

Telecommunications Evolution Globally

Information technology and the ability to connect and communicate is a fundamental part of how our society operates. In today's digital ecosystem, telecommunication has become the foundation for businesses, governments, communities, and families to seamlessly connect and share information. Telecommunications companies possess the technology necessary for communication through the internet, phone, airwaves, cables, wires, or wirelessly. They have built the infrastructure necessary for things like searching the internet, placing phone calls, emailing, text messaging, passing video, and audio through these means to anywhere in the world. For

businesses, in particular, reliable and timely communication is the lifeblood of a company's brand reputation, productivity, and overall success.

From a security perspective, telecommunication is one of the most crucial infrastructures for protection. From natural disaster initiatives to military needs, there's a wide spectrum of institutions that depend on telecom to provide safety. It also empowers participation, where communities in remote regions were once unable to access vital resources but now because of telecommunications, these locations can procure goods and services via ships or aircraft and systematize development initiatives. This type of accessibility allows for the growth and development of our entire society. The telecom sector is an economic booster, according to Statista, the telecom sector is responsible for an estimated global spend of \$520 billion annually (*Scott telecommunication*). Not only that, thanks to technological advances, people have access to learning opportunities outside of traditional schooling. Today, one simply needs a computer, smartphone, and the internet to search, read a tutorial, or watch a how-to video on virtually any subject matter (*Scott telecommunication, 2019*).

Telecommunications have become way more advanced in the current scenario using electrical/wireless telecommunication where the history of telecommunication began with the use of smoke signals and drums in Africa, Asia, and America. In the 1970s, the first semaphore system emerged in Europe. However, it was not until the 1830s that electrical telecommunication systems started to appear when good old letters were given a twist, with the introduction of telegraphs, allowing messages to be transferred through electrical channels. Telegraphs were expensive and certainly not enough. Therefore, in the 1870s the telephones were invented, which strictly followed a wired protocol. This was followed by the introduction of radio, which enabled people to communicate to a mass audience through airwaves. After the invention of the computer, the telecommunications sector never looked back. Within a couple of decades, the innovators and scientists came up with the internet, Local Area Network (LAN) connections, and the World Wide Web (WWW).

Various ISPs allow the voice to be transferred on the internet. This technology is popularly known as VoIP. By allowing internet users to communicate over the net rather than relying on wires,

companies have reduced the cost of voice and video communication. Wireless digital technology has brought the world to the palm of our hands, with each device having the capacity to connect and communicate with the world through voice and other forms of media.

The first generation of the mobile network was launched by Nippon Telegraph and Telephone in Tokyo in 1979 followed by the United States and the United Kingdom. However, it suffered a number of drawbacks like poor coverage and low sound quality which led to the launch of the second-generation network in Finland in 1991 under GSM standard. For the first time, people were able to send text messages (SMS), pictures, and multimedia messages (MMS) on their phones. The analog past of 1G gave way to the digital future presented by 2G. Soon the era of the ‘Packet-Switching’ Revolution began in 2001 and aimed to standardize the network protocol used by vendors. Where users could access data from any location in the world which made international roaming possible. 3G also increased the data transfer speed and led to rising in new services such as video conferencing, video streaming, and voice over IP. All 3GPP cellular technologies have achieved up to 95% of coverage globally as of 2020 and are expected to remain constant as the year passes by (*Statista, technology & telecommunication, 2021*).

The fourth-generation 4G network was first launched in 2009 in Stockholm, Sweden, and Oslo, Norway. It was subsequently introduced throughout the world and made high-quality video streaming a reality for millions of consumers. Globally 83 % of the population is connected with 4G as of the end of 2020 and is expected to increase to 86% by the end of 2021 (*Statista, 2021*).

The fifth-generation 5G services are also implemented in most of the western countries and according to the Global System for Mobile Communication Association (GSMA), 5G services commercial rollout accounts to 106 globally and it has penetrated almost 7% of the global population with 5G services. It is expected that by 2025, 20% of the global connections will be provided by the 5G services (www.gsma.com GSMA website).

Telecommunications Establishment in Bhutan

It was not until 1963 when the first works for building a Telecommunications network was initiated as part of the first five-year plan for the modern economic development of the country with the

assistance of India's Project Dantak. The rudimentary telecommunications connectivity was established between Thimphu and Phuentsholing by Project Dantak.

The First Step by Step exchange was inaugurated on 1st May 1965 at Phuentsholing. Separate networks were built and were not interconnected. The vertical network: Western Bhutan linked the capital Thimphu to Phuentsholing, Central Bhutan connected Trongsa to Gelephu, Eastern network connected Trashigang to SamdrupJongkhar. The telecommunications exchanges were of an electromechanical type known as the Strowger system, using the long-distance trunk physical lines, which were of the Open Wire Carrier System.

The next major development of the telecommunications industry was in 1970 with the establishment of the Ministry of Communication with two departments; Telecommunication and Civil Wireless (high frequency (HF) radiocommunications). In 1984 Bhutan's first link with the outside world was established, with an analog microwave link from Thimphu to Hasimara (India).

The Ministry of Communications, with ITU-UNDP collaborative assistance, initiated the Bhutan Telecommunications Master Plan in 1989. The master plan was then funded by Japanese grant aid in 1991. In addition, the plan was also to integrate the nation-state through the establishment of an east-west horizontal link between Trashigang and Thimphu. The first phase of the National Telecommunications Development Plan (NTDP) was inaugurated in September 1993. The East-West microwave link was established so that citizens within Thimphu could call for the first time those in Trashigang.

In December 1993, phases two and three of the modernization plan were completed, thereby ensuring the expansion of the national network to major towns that previously had no services. Phase 4 of the NTDP commenced in 1997 and involved the integration of western Bhutan into the national network.

In June 1998 Bhutan had for the first time a national telecommunications infrastructure that linked together with the head officers of all 20 Dzongkhags. Within this network, digital switches replaced all of the older manual switches and a dedicated switch in Thimphu served as an

international gateway allowing Bhutan direct international access to over 100 countries. Modern telecommunications was introduced in Bhutan on November 17, 1991, with the opening of the first public telephone booth in the heart of Thimphu town. Telecommunications received a major boost in 1999 with the launch of the Internet and television.

Three years later, the country launched the first mobile communication service with Bhutan Telecom successfully deploying its 2G and 3G network services in the years 2003 and 2008 respectively. With greater access to smartphones, BTL piloted its first 4G services in 2013. TICL after its incorporation in 2007 was able to achieve national mobile coverage with 2G in 2012 and in June 2015 nationwide 3G coverage. To catch up with technological advancements in the country TICL officially launched its 4G services for cellular networks in 2016. Both the operators are working on the roadmap towards 5G adoption and intend to start testing soon. It is expected that the 5G services will be in operation from 2022.

Year	Development
1963	The First rudimentary telephone system launched
1972	Three separate physical wire routes (Thimphu–Phuentsholing, Trongsa–Gelephu, and Trashigang–Samdrup Jongkhar)
1973	Amateur radio broadcasts commence
1981	The First analog network established
1984	1984 First link to outside world launched (from Thimphu to Hasimara in India)
1986	Bhutan Broadcasting Service radio services launched
1989	UNDP and ITU funded implementation of the Bhutan Telecommunications Development Master Plan
1990	International gateway in the capital city (Thimphu) allowing direct international links for the first time

1991	Japanese grant aid that made possible Bhutan Telecommunications Development Master Plan received
1994	International, domestic and local calls are possible
1998	Bhutan Telecommunications Development Master Plan implemented
1999	Bhutan Telecommunications Act enacted by the National Assembly Internet and national television introduced Commercial cable television regularized
2000	Bhutan Telecommunications Authority established Bhutan Telecom established
2001	IP-based rural access pilot project implemented
2002	The first cellular mobile license was issued to Bhutan Telecom
2003	Ministry of Information & Communications established Cellular mobile services launched
2004	Internet Service Provider licenses issued to two private companies Bhutan ICT Policy & Strategies formulated
2005	Bhutan Telecom's exclusive privilege for fixed-line telephony abolished
2006	Bhutan Infocomm, communication & media Act enacted by the national assembly; Nationwide television broadcast launched; Second cellular mobile license awarded to Tashi Infocomm Ltd; Sector-specific Bhutan Telecommunication Authority evolves into a converged Bhutan Infocomm & media authority; Private newspaper licensed.
2007	Bhutan InfoComm & Media Authority becomes autonomous Local Area Networks in all 20 Dzongkhags Thimphu Wide Area Network projects implemented.
2008	Bhutan Infocomm & media appellate tribunal establishment

	<p>The second cellular mobile operator launched GSM/GPRS service Bhutan telecom launched ADSL and 3G Services.</p>
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Table no 1: Milestone in the development of the Bhutanese ICT Industry

(Source: Updated from Kezang & Whalley (2007: 73))

Evolution of Regulation systems in Bhutan

The structure of the Bhutanese telecommunications industry is presently transforming; from monopoly to managed competition and from integrated regulation and operation to separate regulation and managed competitive operation. In the 2000s, the liberalization of the telecommunication sector was taking place globally. As the transformation is taking place, two distinctive types of actors emerged: institutions and companies. The Policy and Planning Division (PPD) of the Ministry of Information and Communication, Department of Telecommunication and the Bhutan Telecommunication Authority (BTA), and later the BTA changed to Bhutan Communications Authority (BCA) in 2003 were the most significant institutions and Bhutan Telecom was the pre-eminent supplier of telecommunication.

Government policy and plans affecting the telecommunications industry were formulated by the PPD, which also coordinates telecommunication policy with those responsible for information technology (IT), media (in particular, broadcasting), and posts. PPD did partially engage in the regulation of the telecoms industry, however, with the passage of the Act by the National Assembly, planning and policy were separated from both the regulation and operation of the industry. The regulation was passed on to the BTA, which was established in January 2000 “to regulate and promote the development of the Bhutanese telecommunications sector”. BCA was a separate agency under the auspices of the Ministry of Information and Communications and was funded by the government through the Ministry of Finance’s annual budget.

At present Bhutan InfoComm and Media Authority (BICMA), the then Bhutan Communications Authority, an autonomous body, is the Communications and Media regulatory body in Bhutan. BICMA was established as per the provisions of the Information, Communications and Media Act of Bhutan 2006. BICMA is a converged regulatory body

responsible for the regulation of the Information, Communications, and Media sector in Bhutan. Its main mandates are:

- Licensing and enforcement of cable TV, broadcast media, printing presses, publications, ICT facility, and service.
- Enabling a secure, efficient, and reliable delivery of ICT and Media services at affordable prices.
- Managing access to the radio-frequency spectrum and monitoring their usage.
- Support continuous technological advancement to improve the standards of information, communications, and media.
- Facilitate the establishment of an integrated, efficient, and high-quality ICT infrastructure in the country.
- Maintain a dynamic and progressive regulatory system to promote market development, manage competition while protecting consumers and other users.
- Improve and monitor the choice of content available in the media including news, current affairs, religious knowledge, art, culture, science, technology, social sector concerns, music, sports, drama, and other subjects of public and national interest.
- Set appropriate technical standards and rules to ensure interoperability, efficient use of radio spectrum and telephone numbers.

Telecommunications service provider in Bhutan

1. Bhutan Telecom Limited (BTL)

Bhutan Telecom Limited is a Telecommunications and Internet services provider in the Kingdom of Bhutan. It is the sole fixed-line telephony provider in the country and a state-owned company. It also operates the B-Mobile mobile service and the DrukNet Internet service.

Bhutan Telecom Limited was established on 1 July 2000. They provide services in all 205 Gewogs (Blocks) in Bhutan. It operates on 900/1800 MHz GSM/GPRS/EDGE, 850 and 2100MHz UMTS/HSDPA, and 1800MHz LTE frequencies. It provides GSM Mobile services under its flagship brand B-Mobile, and Internet Services under the brand name of DrukNet.

LTE 4G was first launched in Thimphu on 24 October 2013. 4G service operates in 1800 MHz - band 3 (FDD) and is available in all the districts of Bhutan.

2. Tashi InfoComm Limited (TICL)

The company was incorporated on January 23, 2007, under the Companies Act of Bhutan 2016, after it won an international bid to operate as the second cellular operator in Bhutan. The company launched its GSM services on April 6, 2008, under the brand name "TashiCell".

TashiCell achieved nationwide mobile coverage with 2G in August 2012 and in June 2015 it became the first telecom operator in Bhutan to have nationwide 3G coverage. By early 2016, TashiCell launched 4G service in western parts of Bhutan. The nationwide 4G coverage in all 20 Dzongkhags Headquarter was achieved in December 2018. They provide mobile and internet services.

Similarly, they provide prepaid, postpaid, B-Wallet, Roaming, etc in mobile service. Not only that they also provide value-added services to the customers. Various services were introduced to attract customers thereby benefiting mobile users.

Besides the two giant Telecom operators, there are few ISPs providing internet services in the country. They are the Bitcom system, Datanet wifi, Nano, Drukcom, and Supernet. These ISPs cater to few customers mostly in urban areas.

Internet Service Providers (ISPs)

There were initially two ISP facilitators in Bhutan which are Bhutan Telecom Limited, a government-owned company, and Tashicell, a private company. Both these companies offer a range of lease lines, broadband and mobile data at competitive rates. Most businesses and companies purchase internet connections from these two ISP providers. Both the ISP providers have a bandwidth of up to 30 Mbps, while 4G data is available in all 20 Dzongkhags.

NANO is the latest Internet Service Provider (ISP) to enter the market and the third ISP facilitator in the country, after Bhutan Telecom and TashiCell, with its dedicated international line through the international gateway in Phuentsholing. NANO provides Managed ICT Services to enterprises and Managed Cyber Security Services and Network Operations. They will cater to those organizations struggling to operate and manage their IT and network infrastructure. Except for leased lines (provided through landline by Bhutan Telecom and as WIMAX by Tashicell), all internet services are paid on a volume basis.

While recent efforts have been made to upgrade the quality of service, especially during high use hours the actual internet speed consumers can avail of can be limited at times given the country only has two gateways. There are minimal downtimes which are mostly for maintenance and repairs conducted after midnight to avoid inconvenience to the public.

Including three ISP facilitators, Drukcomm Private Limited, Supernet Infocomm, Bitcom System, and Datanet Wifi are four other ISP providers in the country. Drukcomm Private Limited provides their services in Thimphu and Phuentsholing, Supernet Infocomm and Datanet Wifi also render their service in Phuentsholing and Bitcom System in Thimphu.

Apart from internet service, Drukcomm also provides services like Digital Cable TV distribution despite being Bhutan's first Digital Cable Tv service provider, speedcast's VSAT services to enable customers to manage their VSAT network and also offer a wide spectrum of services to suit every need and requirement from website designing to e-marketing, website development, and software solution. SuperNet Team is focused on delivering differentiated and enriched internet Services experiences, Managed Security Services, and enterprise (Bandwidth deployment, IT Network, and CCTV network) Services in the country. Whereas the Bitcomm system and Datanet Wifi provide computer repair and some business services.

Future of Telecommunication

The telecom industry has changed and will continue to evolve, heading into 2021. With the acceleration of IoT and 5G, telecom is undergoing a digital transformation in both technologies powering the industry and guiding how they interact with customers.

The introduction of new technology and devices is changing the telecommunication industry and for Telcos to remain competitive and ahead of the game, they need to adapt, change, and innovate their services, offerings, and business models and take full advantage of all that this technology has to offer.

Some of the technology and trends set to impact the future of the telecommunication industry include the following:

1. The 5G Network

5G is the 5th generation of mobile wireless communications technology and will account for 20% of global connections according to GSMA. Operators and carriers across the globe are supporting the shift towards 5G with an expected investment of around \$1.1 trillion in mobile CAPEX between 2020 and 2025. 5G networks provide the fastest data transfer out there while offering high speed and low latency. 5G is already being used in healthcare, education, and transportation settings. In 2021, telecom will continue to develop new ways to bring 5G to the masses, providing the most efficient network for the public (*Nathan, 2020*).

The groundwork for the 5G implementation in Bhutan has also been carried out with the allocation of trial spectrum to both the operators and the operators has begun the testing of 5G technology. It is expected to be implemented commercially by 2022.

2. Internet of Things (IoT)

IoT continues to gain traction and impact different industry verticals globally, especially since shifts towards smart cities, vehicle telematics, industrial automation, and smart manufacturing. The Internet of Things is driving change in the telecom industry in two ways. First, as internet-connected devices become more popular, it increases the need for fast and reliable connections. Secondly, utilizing the IoT creates ease for telecom providers to monitor the various communications bases remotely. IoT enables service providers to provide greater means of communication between devices and people. Utilizing the IoT ensures the highest level of efficiency, seamless business processes, and increased revenue (*Altabonna, 2020*).

The Bhutan InfoComm and Media Authority have also prioritized carrying out the study on developing the technical framework for IoT uses in the country.

3. Artificial Intelligence (AI)

Artificial Intelligence is being used in the industry to positively impact customer experience and service. By using AI, Telcos can process and analyze large volumes of big data and gain access to actionable insights that can be used to enhance customer experience, improve operations and profitability. This is done by using AI technology for network optimization and automation which will enable Telcos to detect or predict any problems or issues with the network and will allow them to identify and fix the problem before it negatively affects customers. AI is also being used to connect, engage, and support customers through the use of virtual assistants. This technology allows operators to implement self-service platforms and solutions that enable customers to do more themselves – cutting down the need for call centers and support resources in the future of the telecommunication industry.

4. FinTech

FinTech innovations, in the form of digital payments, mobile money, mobile wallets, etc. have become not just an innovative trend globally but an essential service. Telcos have the opportunity to connect with an estimated 1.7 billion unbanked customers. This is a market that has immense growth potential and who are looking for financial inclusion and simple and convenient ways to make payments. Both of these FinTech related trends will continue to impact the future of the telecommunication industry and provide Telcos with an opportunity to expand on their service offerings.

Conclusion

This paper has charted the importance, development of the Bhutanese telecommunications industry since 1963, the evolution of the regulation system in Bhutan, and the future of telecommunication. Since the official launch of television and the Internet in 1999, digital technology has spread across the country. In today's digital world, telecommunication has become the foundation for businesses, governments, communities, and families to seamlessly connect and share information. Telecommunications have become way more advanced in the current scenario

using electrical/wireless telecommunication where the history of telecommunication began with the use of smoke signals and drums.

Bhutan has also come a long way since telecommunications exchanges were of an electromechanical type known as the Strowger system, using the long-distance trunk physical lines. Within two decades Bhutan has achieved a lot in the telecommunication sector starting from having no mobile phones to claiming above mobile penetration, the launching of second-generation networks till the deployment of the fourth-generation network in the country. To catch up with the technology development Bhutan will be soon deploying the fifth-generation network in the country and have a long way to go with the evolution of telecommunications technology but the outbreak of the Coronavirus in 2020 is having a significant impact on production and supply chains globally.

Along with the global evolution and development of the Telecommunications systems, Bhutan will also keep on updating with the global happenings in this sector and work on deriving the benefits of technology evolution while closely keeping in mind the social and economic impacts of such technology.

Further, it is very important that the Ministry, Regulators, and sectors need to develop comprehensive policies, frameworks, and regulations not undermining the principle of Gross National Happiness for any innovations and evolution of telecommunication technologies.

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