APT Expert Mission for Mongolia in 2019:

Technical Assistance Report for

National Broadband Strategic Plan of Mongolia for 2021-2025

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NIA NATIONAL INFORMATION SOCIETY AGENCY

Disclaimer

This study has been prepared for CITA by the Expert Mission Programme of Asia-Pacific Telecommunity (APT) in collaboration with National Information Society Agency (NIA) of the Republic of Korea.

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List of Abbreviations

ADSL	Asymmetric Digital Subscriber Line
APT	Asia-Pacific Telecommunity
ARPU	Average Revenue per User
BA	Business Analytics
BGP	Border Gateway Protocol
CDMA	Code Division Multiple Access
CITA	Communications and Information Technology Authority of Mongolia
CPE	Customer Premise Equipment
CRC	Communications Regulatory Commission of Mongolia
CS	Cabinet Secretariat of the Government of Mongolia
DWDM	Dense Wavelength Division Multiplexing
EGDI	e-Government Development Index
EHR	Electronic Health Record
EPART	e-Participation
EPI	e-Participation Index
ePRS	e-Property Registration System
ERMC	Europe-Russia-Mongolia-China
ESB	Enterprise Service Bus
FTTH	Fiber to the Home
FTTx	Fiber to the x
GDC	Government Data Center
GDEC	Government Data Exchange Center of Mongolia
GDES	Government Data Exchange System of Mongolia
GIA	General Intelligence Agency of Mongolia
GNI	Gross National Income
GoM	Government of Mongolia
GSM	Global System for Mobile Communications
GSMA	Global System for Mobile Communications Association

HCI	Human Capital Index
ICT	Information and Communication Technology
IDI	ICT Development Index
IoT	Internet of Things
IPTV	Internet Protocol Television
ISP	Internet Service Provider
ITPTA	Information Technology, Post and Telecommunication Agency
ITU	International Telecommunication Union
ITU-R	International Telecommunication Union Radiocommunication Sector
IX	Internet eXchange
IXP	Internet eXchange Point
LLC	Limited Liability Company
LLU	Local Loop Unbundling
LTE	Long Term Evolution
MBB	Mobile Broadband
MIX	Mongolian Internet eXchange
MNT	Mongolian Tugrik
MUST	Mongolian University of Science and Technology
NDC	National Data Center
NEA	National Enterprise Architecture
NIA	National Information Society Agency of Korea
NSO	National Statistical Office of Mongolia
NUM	National University of Mongolia
OGD	Open Government Data
OSI	Online Service Index
OTT	Over The Top Service
RFID	Radio Frequency Identification
ROI	Return on Investment
SDGs	Sustainable Development Goals
SICT	School of Information and Communications Technology, MUST
SMEs	Small and Medium-sized Enterprises
TA	Technical Assistance

TCMO	Total Cost Mobile Ownership
TII	Telecommunication Infrastructure Index
TLDs	Top Level Domains
TVWS	TV White Spaces
UCC	User-created Content
UCRA	Unfair Competition Regulatory Authority of Mongolia
UGC	User-generated Content
UNCTAD	United Nations Conference on Trade and Development
UNESCO	United Nations Educational, Scientific and Cultural Organization
UPU	Universal Postal Union
USOs	Universal Service Obligations
USOF	Universal Service Obligations Fund, CITA
VSAT	Very Small Aperture Terminal
VPN	Virtual Private Network
UNCTAD	United Nations Conference on Trade and Development
WB	The World Bank
WBCN	Wireless Broadband Communication Network
WBL	Work Base Learning
WHO	World Health Organization
WEF	World Economic Forum
WiMax	Worldwide Interoperability for Microwave Access
WTTx	Wireless to the x
XYP	eXchange Your Platform

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Executive Summary

Mongolia is the second least densely populated country in the world: 3.23 million people live across 1.5 million square kilometers. Mongolia is a large landlocked country, sharing borders with the Russian Federation to the north and China to the east, south and west. The territory stretches 2,400 kilometers from east to west and 1,280 kilometers from north to south. Approximately half of the Mongolian population resides in the capital of Ulaanbaatar, with another half dispersed across the country's rural areas. Furthermore, Mongolia has a long tradition of pastoral nomadism, which serves a unique setting in the context of broadband infrastructure. Given the country's huge and challenging geography, the cost of providing rural communications infrastructure is high. Thus, the distribution of a small population across a vast geographic area and a long tradition of nomadic lifestyle present a major challenge to nationwide broadband access.

With technical assistance (TA) through Expert Mission of Asia-Pacific Telecommunity (APT), APT and NIA intend to help the Government of Mongolia (GoM), particularly the Communication and Information Technology Authority (CITA), establish National Broadband Strategic Plan for the period of 2021 - 2025. As requested, this report mainly focuses on the analysis of current status of broadband in Mongolia and assist in planning what actions the GoM could consider in order to promote broadband infrastructure and service at the national level. This TA report is about supporting the planning of the National Broadband Strategic Plan, not about establishing the National Broadband Strategic Plan itself on behalf of the GoM.

This report is organized into six parts. It begins with an introductory chapter that provides an overview of the background of the TA and the policy context of broadband. Chapter 2 through 3 assess the current status of broadband and ecosystem of broadband in Mongolia. An assessment of the current status of broadband and ecosystem in a country is critical to developing National Broadband Strategic Plan, especially when determining the priority areas of intervention. The evaluation of current status of broadband in Mongolia mainly relies on international studies conducted by different institutes to measure development of the broadband sector and identify weaknesses and strengths, largely due to insufficient data on some of the broadband related sectors in Mongolia. Based on the assessment of current state of broadband development in Mongolia, the country needs to rebalance towards demand-side issues. More work needs to be done to improve network performance, useful applications, digital skills and locally relevant content. As seen in the most successful countries which have created a sustainable ecosystem balancing supply and demand, it is important to cultivate a virtuous circle of fostering broadband roll-out and take-up, reinforcing each other. The GoM needs to focus its attention on developing policies that not only facilitate and encourage the building of broadband networks, but to ensure that the largest number of citizens can and do use them.

Chapter 4 proposes a tentative structure of National Broadband Strategic Plan so that the GoM can proceed immediately to the next step after this TA for planning. There is no formal structure of broad strategic plan. Every country will have their own individual approach and style. In order to demonstrate widely accepted common components of broadband strategic plan, a typical table of content has been provided.

Chapter 5 provides examples of vision statement for broadband in Mongolia. Vision serves as a clear guide for choosing future courses of action for broadband, inspiring members of the government and society towards accomplishing the future desired state of broadband. Several examples are provided to provide a starting point for discussing vision statement for broadband in Mongolia. The exemplary visions incorporate core values of broadband such as universal availability, affordability, contribution to socio-economic development, and milestone into the vision.

The last chapter explores priority initiative and projects to further advance broadband in Mongolia. The National Broadband Strategic Plan will be put into effect by means of specific initiatives or projects, some of which are already underway, and some of which are yet to be newly introduced. The catalogue of prioritized initiatives and projects encompasses both supply- and demand-side issues. Supply-side issues are mainly related to lowering costs of network rollout and extending broadband infrastructure into underserved and unserved areas. One of the most important goals is to ensure availability of broadband services to the widest user base nationwide. This means that networks need to be built out to reach as many people as possible. There should not be any part or area of the country without broadband network coverage. On the other hand, demand-side issues add new challenges of promoting local content and increasing relevance of broadband services to users through useful and attractive applications. As the availability of broadband increases, the focus of policy tends to shift from solving supply-side challenges to addressing demand-side dilemmas.

1. Introduction

Broadband has been typically defined as high-speed data transmission. Transmission speed has been the key component when discussing broadband, even though there is no definitive bandwidth. Broadband, however, is not just about high-capacity data transmission. Rather, it is an enabling platform for smart services and applications for socio-economic development. Put it differently, the potential benefits of broadband are closely connected to the services and applications enabled by broadband. Although there are some direct effects from deployment of the broadband infrastructure and indirect effects from broadband-enabled innovation, efficiency gains, and enhanced competitiveness, as well as new products and services are far more substantial.[1]

According to a World Bank study, low-income and middle-income countries experienced "about a 1.38 percent increase in GDP for each 10 percent increase in broadband penetration" between 2000 and 2006.[2] In addition, it is believed that there is a strong link between broadband and employment. A Brookings Institution study found a positive association between broadband use and employment in several industries. Among U.S. states, every 1 percent increase in broadband penetration projected an annual employment increase of 0.2 to 0.3 percent.[3] The growth potential of today's information and knowledge-based economy depends on ubiquitous broadband connectivity.

Since broadband is an enabling platform that impacts not only the ICT sector but also other sectors of the economy, broadband infrastructure is widely accepted as a new social overhead capital in information society. Like electricity a century ago, broadband is a foundation for economic growth, job creation, global competitiveness, and a better way of life.

Broadband is often regarded as an ecosystem embracing interdependent supply and demand. Broadband ecosystem approach highlights interactions between supply (network platforms) and demand (services and applications). Thus, it is essential to create an environment for supply-side growth, but it is no less important to stimulate

1. OECD, Broadband and the Economy, DSTI/ICCP/IE(2007)3/FINAL, OECD Ministerial Meeting on The Future of the Internet Economy, p. 11 (June 17-18, 2008), available at http://www.oecd.org/dataoecd/62/7/40781696.pdfFuture of the Internet Economy, p. 11 (June 17-18, 2008), available at http://www.oecd.org/dataoecd/62/7/40781696.pdf

2. Christine Zhen-Wei Qiang and Carlo M. Rossotto, IC4D: Extending Reach and Increasing Impact, Chapter 3: Economic Impacts of Broadband, GICT Dept. World Bank, p. 45 (2009)

3. Robert Crandall, William Lehr and Robert Litan, "The Effects of Broadband Deployment on Output and Employment: A Cross-sectional Analysis of U.S. Data," Issues in Economic Policy, Brookings Institution, Number 6, July 2007

demand and take-up of broadband. Since mere access to broadband infrastructure alone is not enough, demand is vitally important in creating a sustainable broadband ecosystem. How broadband applications and services are used is of paramount importance for achieving national development. In addition to supply-side policies designed to encourage broadband coverage, demand-side policies targeted at promoting ICT skills, affordability, e-Government, e-Health, e-Commerce and ICT use by business and citizens should be included. Thus, it is essential for a country to balance the ability to establish infrastructure and the capability to exploit the full value and potential of broadband.

It is also important to note that broadband is not an end itself, but rather an enabler for improving education, healthcare, the environment, energy efficiency, public safety, and the delivery of public services. In this context, the purpose of this National Broadband Strategic Plan is to harmonize activities across the country and to provide a whole-of-government approach to broadband development in Mongolia with a view to achieving medium- and long-term strategic objectives.

Although the market is the primary force shaping supply and demand of broadband services, governments have a significant role to play both in facilitating market-oriented broadband policies and promoting universal broadband access in underserved and unserved areas and populations. Mongolia has a competitive and liberalized telecommunication market, but there are serious impediments to Mongolia realizing the full benefits of broadband – such as limited market size and lack of landline infrastructure. To address these barriers, the Government of Mongolia (GoM) needs to formulate a National Broadband Strategic Plan and should exert concerted efforts, based on the Plan, to promote enabling environment and sustainable market operation, focusing on the application and take-up of broadband, promotion of local contents, in addition to facilitating the extension of physical networks.

1.1 Background of the Project

This project to provide technical assistance (TA) on Broadband Strategic Plan for Mongolia has been developed under the Expert Mission Programme of the Asia-Pacific Telecommunity (APT) in collaboration with the National Information Society Agency (NIA) of the Republic of Korea. APT is the most prominent intergovernmental organization in the Asia-Pacific Region focusing on telecommunications/ICTs. APT fosters the development of telecommunication services and information infrastructure throughout the Asia-Pacific Region, particularly focusing on less developed areas. APT also plays a vital role in providing its Members expertise and assistance in achieving policy and regulatory goals, affordable national broadband access, environmental settings to foster investment and innovation, effective harnessing of the benefits of emerging technologies and capacity building. In order to facilitate those activities, APT provides

its Members with a variety of programs. The APT's Expert Mission is an APT initiative to provide expert assistance to member countries to meet their specific needs.

As Mongolia needs to further develop broadband infrastructure and service, Mongolia asked APT through Expert Mission to examine broadband ecosystem of Mongolia as well as international assessment of broadband and ICT, in addition to a review and analysis of the previously formulated National Broadband Plan. Also, Mongolia needed assistance on that what types of information are needed for formulating broadband plan together with a broad outline of the contents for the National Broadband Strategic Plan.

In this regard, this TA intends to help the GoM, particularly the Communication and Information Technology Authority (CITA), establish National Broadband Strategic Plan for the period of 2021 - 2025.[4] The TA mainly focuses on assisting in planning what actions the GoM could consider in order to promote broadband infrastructure and services at the national level, in addition to the analysis of current status of broadband in Mongolia. It is not about establishing the National Broadband Strategic Pan itself on behalf of the GoM, but more about supporting the planning.

This Expert Mission to provide TA, was implemented in collaboration with the National Information Society Agency (NIA) of the Republic of Korea. NIA is an affiliate member of APT and has provided APT Members with its expertise through the Expert Mission, especially in the area of promoting informatization and supporting development of related policies for national agencies and local autonomies.

The Mongolian government announced the 'Mongolia Sustainable Development Vision 2030[5] in the form of legislation in 2016. The Vision 2030 include expanded coverage of IT and telecommunications in the seventh goal of energy and infrastructure, mandating concrete plans to launch the installation of high-speed network in the provinces. Following the Vision 2030, Mongolia established the State Policy on the Development of Information and Communications Technology 2017-2025. One of the key goals of the State Policy on the Development of Information and Communications Technology 2017-

4. The planning period of the National Broadband Strategic Plan is recommended to be consistent with those of higher plans, especially the Phase II of Vision 2030 and the State Policy on the Development of Information and Communications Technology (2017-2025).

5. 'Mongolia Sustainable Development Vision 2030' was endorsed by decree No. 19 of 2016 issued by the Parliament of Mongolia. The Vision 2030 is scheduled to be implemented in three stages of five years and the first phase starting from 2016. The Vision 2030 consists of four major policy areas: economic policy, social sustainable development, environment sustainable development, and sustainable development governance. Four policy areas include 43 objectives and 20 main indicators specifying target level of Mongolia to be reached by the year 2030. The policy document also outlines sustainable development objectives in the information and communications sector such as development and utilization of infrastructure, improving access, removing digital divide and enabling public access to broadband.

2025 is to expand national broadband network and infrastructure of ICT with the support of government and private sectors to meet the growing needs and demands for ICT services. The CITA is responsible for establishing National Broadband Strategic Plan and broadband development in Mongolia.

According to the Vision 2030, during the Phase II (2021-2025), 90 percent of total population will be connected to high-speed Internet network, while 70 percent of rural population will use broadband Internet services, and not less than 50 percent of public services will be provided to citizens online[6]. The State Policy on the Development of Information and Communications Technology 2017-2025 proposes that 70 percent of households be connected to broadband Internet by 2025. The State Policy on the Development of ICT was planned to be implemented in two phases. Although Phase 1 has not had specific plans, Phase 2 seems to require a plan to achieve policy goals in a systematic way.

< Table 1> Target Indicators of State Policy on the Development of ICT 2017-2025

Policy Fields	Area	Unit	2016	Target by 2020	Target by 2025
ICT Network & Infrastructure	Bandwidth of high speed network connecting Asia and Europe	Gbit/sec	120	10 times increase (350)	80 times increase
	Capacity of the backbone network connection across all Aimags	Gbit/sec	10	100 (100)	500
	High-speed broadband network connection at Aimag centers	Gbit/sec	1	10 (100)	20
	Capacity of Soums and settlements	Mbit/sec	155	516 (400)	2048
ICT Service	Percentage of households connected to broadband Internet	%	29	50	70
	Percentage of population who uses the Internet	%	27	60	90

* Numbers in parentheses show the current status as of 2018.

Source: The State Policy on the Development of Information and Communications Technology 2017-2025, CITA 2019

6. In the target 2.5 Infrastructure, Objective 7 Phase I (2016-2020): 70 percent of total population will be connected to high speed Internet network, will benefit from same price and tariffs regardless of locations and information flow transmitted through high-speed information network connecting Asia and Europe will increase 10-fold.

Phase III (2026-2030): 95 percent of total population will be connected to high-speed Internet network, not less than 85 percent of public services will be provided to citizens online and a national satellite will be launched and utilized.

Against this backdrop, the new National Broadband Strategic Plan ranging from 2021 to 2025 anticipates the development of advanced broadband infrastructure and services that will be universally accessible across the country with high quality at an affordable price. By 2025, broadband infrastructure in Mongolia should meet the needs of its citizens, business and the public sector, while producing a wide range of innovative applications and services required for sustainable economic and social development.

As noted earlier, broadband is often viewed as an ecosystem and the broadband ecosystem consisting of networks, services, applications, content and devices is expected to be fully integrated into the economic and social landscape of Mongolia. Therefore, a right combination of these elements of broadband ecosystem will bring an enabling platform for economic growth through innovation and good governance.

As Mongolia needs to further develop broadband infrastructure and service, this TA intends to examine broadband ecosystem of Mongolia as well as international assessment of broadband and ICT, in addition to a review and analysis of the previously formulated National Broadband Plan. Also, this TA provides what types of information are needed for formulating broadband plan together with a broad outline of the contents for the National Broadband Strategic Plan. Finally, it attempts to identify areas of focus that the GoM should consider to further extend broadband infrastructure and promote services at the national level.

1.2 Policy Context in Mongolia

This section deals with the policy context surrounding broadband in Mongolia and discusses specific issues that have shaped the landscape of Mongolia broadband ecosystem. Mongolia is the second least densely populated country in the world: 3.23 million people live across 1.5 million square kilometers. Mongolia is a large landlocked country, sharing borders with the Russian Federation to the north and China to the east, south and west. The territory stretches 2,400 kilometers from east to west and 1,280 kilometers from north to south. Approximately half of the Mongolian population resides in the capital of Ulaanbaatar, with another half dispersed across the country's rural areas.

Mongolia has a long tradition of pastoral nomadism, which serves a unique setting in the context of broadband infrastructure. Nomadic herders don't have their permanent place of residence. Geographical mobility is common for the sake of food, pasture, dwelling, and water. Also, Mongolia is largely filled with an inhospitable terrain of jagged mountains and bleak deserts.[7] Given the country's huge and challenging geography, the cost of providing rural communications infrastructure is high. Furthermore, the

7. The land ranges from desert to semi-desert to grassy steppe, with mountains in the west and south-west. Arable land is estimated to constitute only 0.8 percent of the country.

distribution of a small population across a vast geographic area and a long tradition of nomadic lifestyle present a major barrier to nationwide broadband access. The key challenge, therefore, is how to provide the rural population with broadband connectivity, overcoming the physical challenges facing the country. Developing an extensive national broadband strategic plan would be an important step towards elaborating more specific broadband development policies while overcoming the challenges.

With a large size of rural communities – some inhabited by just a handful of families – telecom operators are faced with a difficult task when it comes to ensuring connectivity for rural areas in Mongolia. Providing communications services to a handful of families is surely uneconomical from the perspective of telecommunication operators. Moreover, the road network in the country is not well developed, posing an additional problem to deployment. Also, being landlocked and resulting reliance on terrestrial networks for the international connection is partly causing high cost of network deployment in the country. The combination of a limited domestic market, sparsely distributed population coupled with nomadic lifestyle and landlocked vast territory make it uneconomical for Mongolia's mobile operators to expand coverage to rural communities.

As part of the transition to a market-based economy, the GoM has been fully committed to modernizing its telecommunications network and introducing advanced technologies and services. Since liberalizing its telecom market in the mid-1990s, Mongolia has become a dynamic market that encourages competition and facilitates extensive deployment of infrastructure. Over the recent years, significant investment has been made in the expansion of both fixed and mobile networks. The GoM considers national infrastructure development as a high priority for national development, regarding the telecommunication infrastructure as essential to the overall development of the country, the improvement of living standards, increasing foreign investment, boosting tourism and private sector development, and implementation of innovative changes.

Since the telecommunications reform program by the GoM in the mid-1990s, there has been effective liberalization of all market segments, partial privatization of the fixed-line incumbent operator, Mongolia Telecom, and establishment of an independent regulator in 2001, Communications Regulatory Commission (CRC)[8] of Mongolia. As a result, competition is in place for both fixed and mobile markets, including local, long-distance, and international, Internet, VoIP, and VSATs. The Internet market is not big but growing steadily. Various government initiatives such as the e-Mongolia National Program have helped to spread Internet awareness and usage throughout the country. Not all areas of Mongolia are connected to the Internet, good progress has been made, with most universities and research institutes, schools, government organizations, agencies, banks,

8. The CRC was established by the Communications Act of 2001, and is charged with regulating and supervising a wide range of subjects including competition issues, the provision of networks and services for fixed line and wireless telecommunications, television, radio, and satellite transmission, spectrum management, postal services and the Internet to ensure that the public interest is well-served. The CRC's jurisdiction covers all regions of Mongolia.

and many companies in Ulaanbaatar being online. Market penetration in urban areas continues to be strong in the urban centers, while the rural sector is catching up with Aimag centers equipping high-speed Internet access. Around 85 percent of households in rural areas and 54.7 percent of households in the capital city live in ger districts[9], which in turn demonstrates that delivering fixed Internet services to these areas is not commercially profitable. Equally important, a certain segment of the Mongolian population, particularly low-income families and those aged fifty or above, largely remain underserved.

In this context, the GoM needs to find a "High Capacity, Low Cost" solution for unserved/underserved areas and disadvantaged socio-economic groups to provide sustainable Internet services. This solution does not only depend solely on technology, but also requires proper public-private collaboration combined with multi-faceted balance of government support to network work roll-out, appropriate regulation, financing and investment, affordable prices, relevant applications, and ICT training.

In addition, due to Mongolia's small-scale domestic telecommunication market, broadband is rather expected to play a key role in providing access to global markets, together with enabling digital transformation of society. In a nutshell, Mongolia is facing a unique combination of market structure and geography that affect its national broadband plan, along with challenges not only for making broadband service nation-wide and universal but also making broadband an enabling platform for national development.

2. Current State of Broadband in Mongolia

2.1 State of broadband from international perspective

An assessment of the current status of broadband in a country is critical to developing a national broadband master plan or strategy, especially when determining the priority areas of intervention and/or policy focus. In other words, information on the current status is vital in that it provides an indication as to the current level of development of the broadband sector, as well as analyzing where further investment and improvement are needed. Therefore, an assessment of current status is crucial both to developing a policy and to guiding policymaking. However, due to insufficient data on some of the broadband-related sectors in Mongolia, the scope for evidence-based evaluation of current status is limited, leading to rely on international studies conducted by different institutes to measure development of the broadband sector and identify weaknesses and strengths. A range of assessment tools has been developed to measure a country's

9. A ger district is a form of residential district in Mongolian settlements. They usually consist of parcels with one or more detached houses or gers.

current state of broadband. Fortunately, Mongolia has been assessed multiple times as part of international studies. In fact, there are fair amount of resources for the assessment of the current environment of Mongolian broadband. The methodology used for the analysis of current state is a combination of desk research based on the data provided by CITA, web-based information collection, and meetings with stakeholders relevant to the broadband environment in Mongolia.

2.1.1 Telecommunication & Broadband

2.1.1.1 The Inclusive Internet Index[10]

- According to the Inclusive Internet Index 2019[11], Mongolia ranked 53rd out of 100 countries for the overall Index score based on the combined score of availability, affordability, relevance, and readiness.

  • Availability refers to the percentage of the population covered by at least an LTE/WiMAX mobile network, being measured by the percentage of inhabitants that live within range of LTE/LTE-Advanced; mobile WiMAX/Wireless MAN or other more advanced mobile-cellular networks; regardless of whether they are subscribers or not. Mongolia ranked 57th out of 100 countries for availability.

  • Affordability represents the cost of access relative to income and the level of competition in the Internet marketplace. Mongolia performed well in affordability, being ranked as 37th out of 100 countries.

  • Relevance denotes the existence and extent of local language content and relevant content. Mongolia ranked 52nd out of 100 countries.

  • Readiness means the capacity to access the Internet, including skills, cultural acceptance, and supporting policy. Mongolia ranked 85th in readiness at the lower end.

< Table 2> The Inclusive Internet Index 2019 for Mongolia

	Overall	Availability	Affordability	Relevance	Readiness
Score/100	70.7	63.7	82.4	75.4	53.5
Rank/100	53	57	37	52	85

Source: The Inclusive Internet Index 2019

- Mongolia performed well relative to other lower-middle-income countries (ranking 4th out of 23 lower-middle-income countries), with a global rank of 53rd out of 100. Affordability, ranked 7th out of 21 Asian nations (37th globally), is a key

10. https://theinclusiveinternet.eiu.com

11 . The Inclusive Internet Index, commissioned by Facebook and conducted by the Economic Intelligence Unit, covers 100 countries. The Index provides a rigorous benchmark of national-level Internet inclusion across four categories: availability, affordability, relevance, and readiness.

strength, but Readiness (85th globally) is undermined by very low online trust & safety (99th).[12]

- According to the UN Broadband Commission, entry-level broadband services should be made affordable in developing countries at less than 2 percent of monthly Gross National Income (GNI) per capita by 2025. This lowers the Commission's existing affordability threshold target, from less than 5 percent by 2020 to less than 2 percent, which is expected to make broadband services (fixed or mobile) more affordable to a much greater number of people.
- In terms of Broadband Commission targets, prepaid handset-based mobile-broadband basket (500 MB) was 2.41 percent of GNI (USD 6.76) per capita in 2017, ranking 114th out of 186 countries. For postpaid computer-based mobile-broadband basket (1 GB) in 2017 was 1.78 percent of GNI (USD 4.88) per capita in 2017, ranking 85th out of 186 countries. For fixed-broadband, price basket was 2.14 percent of GNI (USD 5.86) per capita in 2017, ranking 71st out of 184 countries. But speed in Mbits/second is relatively lower than similar group countries, recording just 1 Mbits/second. Monthly fixed broadband price for residential subscription was USD 5.9 in 2017, ranking 110th out of 184 countries.[13]
- In Mongolia, mobile broadband and fixed broadband meet 5 percent of GNI per capita which is the 2015 Broadband Commission target. In light of the 2025 Broadband Commission target, computer-based mobile broadband already meets this standard, while prepaid handset-based mobile broadband and fixed broadband do not show a big difference.

2.1.1.2 The Mobile Connectivity Index 2018

- The Mobile Connectivity Index is designed to measure the performance of mobile connectivity of countries, focusing specifically on mobile connectivity rather than Internet connectivity in general (including fixed Internet).
- It is an input index to measure a set of major enabling characteristics, rather than an output index that measures Internet take-up and usage.
- The Index measures the performance of 163 countries, accounting for 99 percent of the world's population, against the four key enablers of mobile internet connectivity. The four key enablers for the Index are[14]:
  - Infrastructure – the availability of high-performance mobile internet network

12. Literacy ranked 62nd and policy ranked 59th. Literacy measures the level of education and preparedness to use the Internet. Trust & Safety measures Internet safety and cultural acceptance of the Internet. Policy measures the existence of national strategies that promote the safe and widespread use of the Internet.

13. ITU, Measuring the Information Society Report, 2018, Volume 1

14. GSMA Intelligence

coverage;

• Affordability – the availability of mobile services and devices at price points that reflect the level of income across a national population;

• Consumer readiness – citizens with the awareness and skills needed to value and use the internet, and a cultural environment that promotes gender equality;

• Content and services – the availability of online content and services accessible and relevant to the local population.

- The index consists of twelve dimensions in four enablers. And fourteen dimensions are built up through 35 indicators. As an output of these measurements, it groups countries in clusters according to the strength of the enabling environment for mobile connectivity allowing comparisons and contrasts to be drawn between groups of nations.

< Figure 1 > Mobile Connectivity Index

Infrastructure	Affordability	Consumer Readiness	Context
- Mobile Infrastructure - Network Performance - Other Enabling Infrastructure - Spectrum	- Mobile Tariffs - Handset Price - Income Inequality - Taxation	- Basic Skills - Gender Equality	- Local Relevance - Availability
39 Indicators			

Source: GSMA

- Mongolia scored 56.5 in Mobile Connectivity Index 2018, being classified as one of Transitioners[15]. According to Mobile Connectivity Index 2018, consumer readiness is satisfactory, but availability of relevant content and services is in need of improvement. The affordability increased slightly, but the overall index and the other three enablers decreased year on year.

< Table 3> Mobile Connectivity Index 2017 for Mongolia:
Scores of Enablers (Score/100)

	Index score	Infrastructure	Affordability	Consumer Readiness	Content & Services
2018	56.5 (↓)	52.7(↑)	56.9(↓)	81.4 (↓)	41.8 (↓)
2017	58.8	45.2	73.7	84.5	42.4
Level	M	M	M	H	M

* Low: 0~20 Medium: 41~60 High: 81~100
Source: GSMA, 2018

[15]. Transitioners score above 50 and perform well on at least two enablers and generally have mobile internet penetration rates between 30 percent and 50 percent.

< Table 4 > Mobile Connectivity Index 2018 for Mongolia:
Scores of Dimensions

Enabler	Dimension	Score 2018
Infrastructure	Network Coverage	68.7(61.7)
	Network Performance	38.4(18.7)
	Other Enabling Infrastructure	65.3(62.6)
	Spectrum	37.5(42.8)
Affordability	Mobile Tariffs	48.9(50.8)
	Handset Price	30.5(79.0)
	Inequality	80.5(80.0)
	Taxation	84.9(85.2)
Consumer Readiness	Mobile Ownership*	71.4
	Basic Skills	75.6(74.5)
	Gender Equality	92.2(94.5)
Content & Services	Local Relevance	63.0(62.4)
	Availability	18.2(22.4)
	Online Security*	46.5

* Newly added dimensions in 2018

** Numbers in parentheses are the values for 2017. Source: GSMA, 2018

Among the fourteen dimensions, Mongolia continues to perform strongly in gender equality (92.2), taxation (84.9), inequality (80.5), but network performance (38.4), spectrum management (37.5) and availability of content & services (18.2) need to be greatly improved. Mongolians receive several over-the-top (OTT) services from abroad via the public Internet. Aside from the internet-based services, most of the content in the country is offered through IPTV, satellite TV, and cable TV. It is also important to note that the measured handset price score dropped significantly from 79 in 2017 to 30.5 in 2018.

< Table 5 > Mobile Connectivity Index for Mongolia:
Scores of Indicators 2014, 2017 & 2018

Dimension	Indicator	Score (2018)	Score (2017)	Score (2014)
Network Performance	Mobile download speed	18.31	7.89	2.75
	Mobile latencies	71.13	38.56	0
	Mobile upload speeds	25.8	9.72	1.81
Content & Services	E-Government Score	59.72	51.45	61.42
	Mobile Social Media Penetration	67.26	61.77	28.04
	Apps developed per person	70.14	73.47	66.77
	Number of mobile apps accessible in local languages	20.73	24.47	16.44

Source: GSMA, 2018

- As seen in the table above, the indicator values, excluding e-Government scores, have improved compared to 2014. Despite this progress, Mongolia still faces many challenges. There is a significant lack of content in Mongolian language. As a result, the development of locally relevant content remains a significant barrier to mobile broadband. Among the indicators, the e-Government is the only drop and requires a detailed analysis. The speed of the internet is gradually improving, but the speed should be further improved.

2.1.1.3 Mobile subscribers

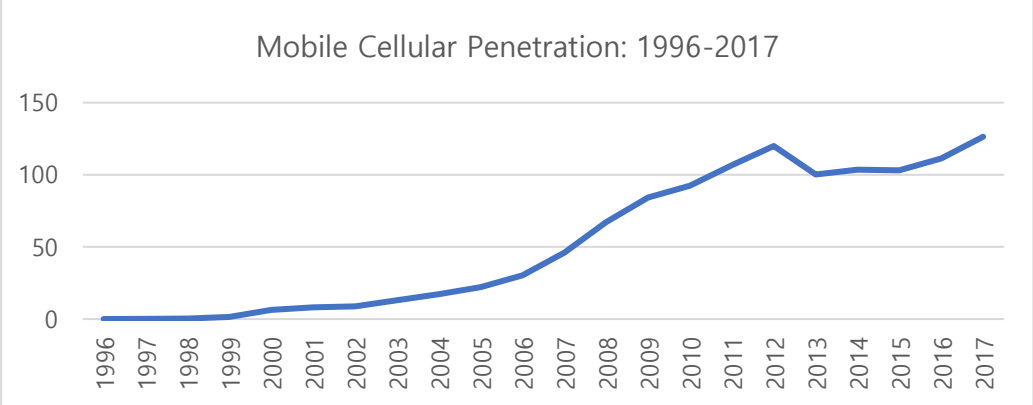
- Mobile subscriptions are estimated to have reached 4.22 million out of 3.24 million as of June 2019, equivalent to 130.24 percent penetration rate. According to ITU, mobile-cellular subscriptions per 100 inhabitants was 126.4 at the end of 2018, whereas it exceeded 130 percent this year, according to CRC. It shows that the number of mobile subscribers is increasing, though the growth rate of mobile subscribers is slowing down because the Mongolian mobile market seems to reach a saturation point.
- With the launch of 4G services, mobile broadband penetration has strongly grown in recent years. Mobile broadband subscriptions per 100 inhabitants are over 80 percent in 2018. According to CRC, the total sum of 3G subscribers and 4G subscribers is estimated at more than 3.9 million, equivalent to nearly 124 percent of the population.

< Table 6 > Mobile-cellular and Mobile-broadband subscriptions 2018

Mobile Subscriptions	%
Mobile-cellular subscriptions per 100 inhabitants	126.4 (130.38)
Mobile-broadband subscriptions per 100 inhabitants	80.8 (124.0)

* Numbers in parentheses are the estimates by CRC. Source: ICT Profile, ITU

< Figure 2 > Mobile-cellular subscriptions: 1996-2017



Source: ITU

2.1.1.4 Fixed subscribers

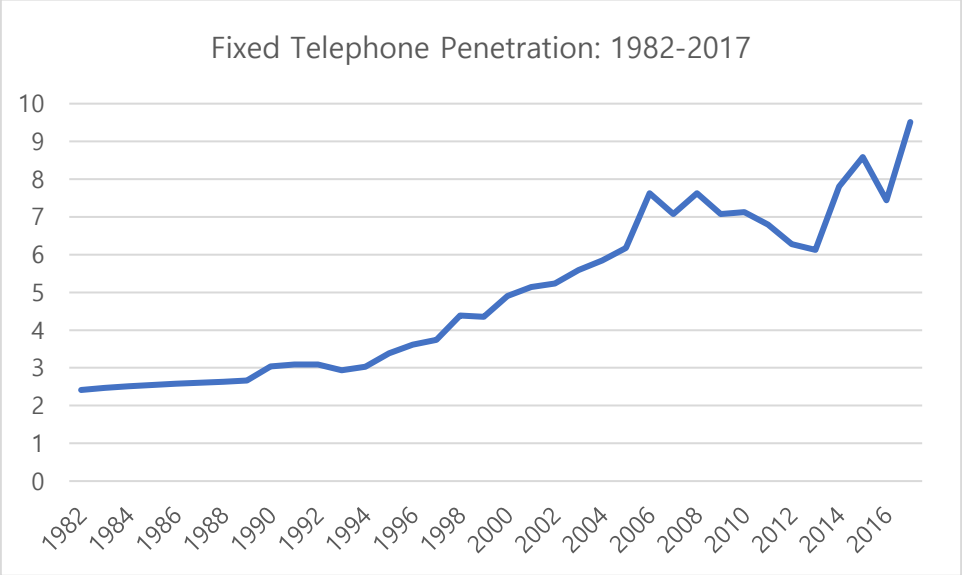
- Mongolia is one of the least densely populated countries in the world. Furthermore, due to a large volume of rural communities scattered around the country and its underdeveloped fixed subscriber networks, the fixed-line market is not well developed. Fixed-telephone subscriptions per 100 inhabitants was recorded at less than 10 percent in 2018.

< Table 7 > Fixed subscriptions in Mongolia: 2017

Fixed Subscriptions	%
Fixed-telephone subscriptions per 100 inhabitants	9.5
Fixed (wired)-broadband subscriptions per 100 inhabitants	9.27

Source: World Development Indicators, The World Bank

< Figure 3 > Fixed telephone penetration: 1982-2017

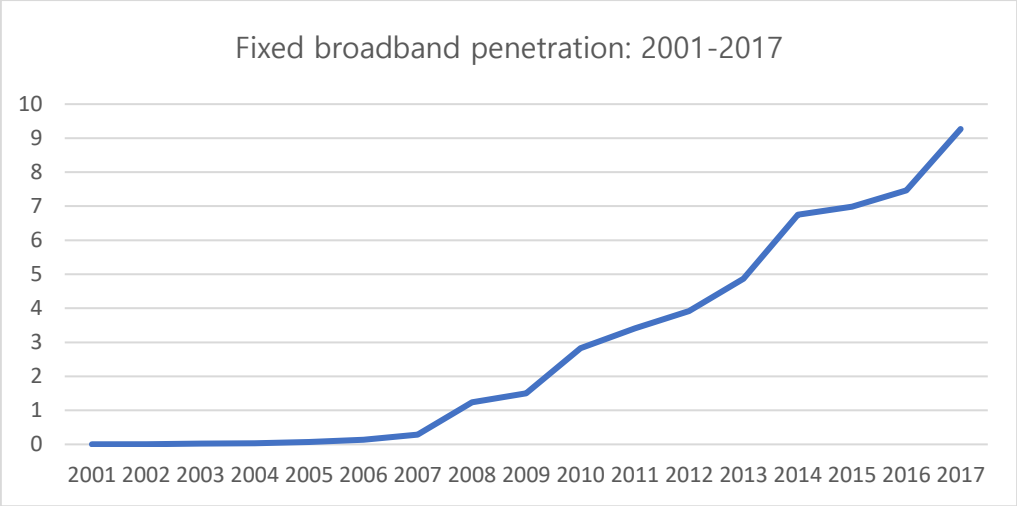


Source: ITU

- The latest value for fixed broadband subscriptions per 100 inhabitants in Mongolia was reported at less than 10 percent in 2018[16], according to the data provided by CRC. Among the fixed broadband users, fiber optic cable users account for the majority, higher than 90 percent of the total fixed broadband users.

16. The number of fixed broadband subscribers is estimated to reach 306,150 in 2018.

<Figure 4> Fixed broadband penetration: 2001-2017



Source: ITU

< Table 8> Fixed broadband subscriptions by technology

	2012	2013	2014	2015	2016	2017	2018
DSL	36,695	40,684	29,244	24,123	24,842	20,251	20,038
Fiber Optic	65,256	107,886	168,008	157,244	179,662	247,164	275,078
WiMAX	24,587	24,322	16,394	10,265	8,673	1,469	427
Total	126,538	172,892	213,646	191,632	213,177	268,884	295,543

* WiMAX includes both fixed WiMAX (802.16-2004) and mobile WiMAX (802.16e- 2005).
Source: CITA, 2019

2.1.2 Internet

2.1.2.1 Internet users

- Number of Internet users helps measure how widespread Internet use is within a country. There are different perspectives on Internet users for Mongolia. According to CRC, Internet users in Mongolia have reached 2.2 million, accounting for 70 percent of the country's population. Internet World Stats also reports 2.2 million of Internet users, while the ITU and the World Bank present 700,000 Internet users. Based on ITU statistics, Internet users in Mongolia are 23.7 percent of total population, whereas CRC reports around 70 percent of the population. This difference is big enough to deserve further examination. It seems unreasonable that the number of internet users in Mongolia is almost the same as households with Internet access at home. Given the number of 3G and 4G subscribers, the number of Internet users is projected to be much more than the statistics by the ITU and the World Bank. According to the statistics provided by three mobile operators except Mobicom, the data users among mobile subscribers in the last three months take at least more than 67 percent of 3G and

4G subscribers.[17] If the number of fixed broadband subscribers is added, the number of Internet users is projected to reach more than 70 percent of the entire population as the CRC reports.

< Table 9> Internet users and household in Mongolia

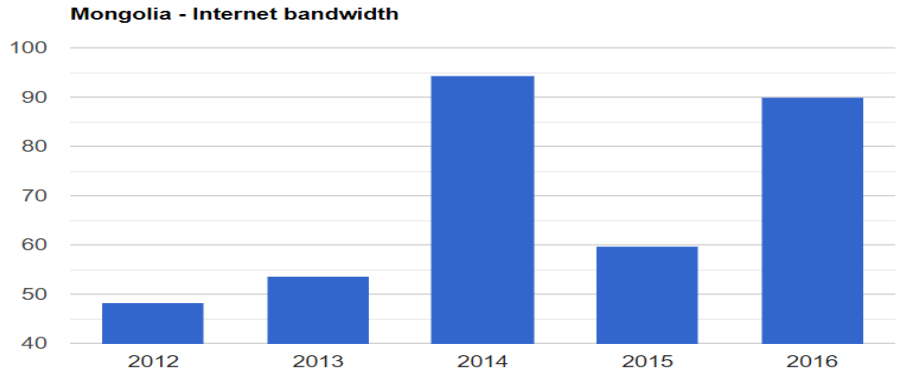
Internet users and households	%
Individuals using the Internet (%)	23.7
Households with Internet access at home (%)	23

Source: ICT Profile, ITU

2.1.2.2 International Internet bandwidth

- International Internet bandwidth is the contracted capacity of international connections between countries for transmitting Internet traffic. In 2016, Mongolia ranked 34th out of 139 countries (89.98 Kbps) for international Internet bandwidth per Internet user, according to ITU.[18] Mongolia experienced a year-on-year average growth rate of 25.21 percent for the time period 2012 to 2016.

<Figure 5> International Bandwidth per user for Mongolia 2012-2016



Source: ITU

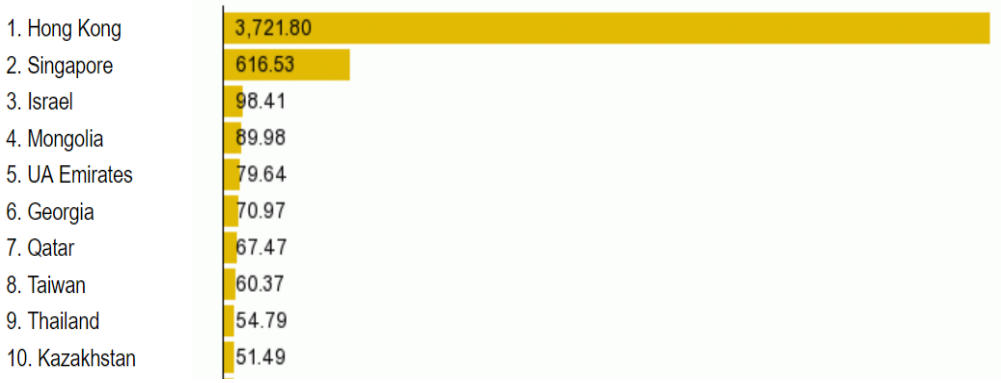
- Since 2013, international Internet bandwidth per user has been moving up and down. In 2016, Mongolia was one of the top five countries in Asia in terms of international Internet bandwidth per user. Nonetheless, it is lower than the world average, though higher than the world median.
- There are four international bandwidth service providers: ICNC, Gemnet LLC, Mobicom Networks LLC, and MT Networks LLC. The total capacity of wholesale

17. According to the three mobile operators providing the data on the number of data users in the last three months, 81.3 percent of Unitel subscribers, 57.9 percent of Skytel subscribers, and 41.9 percent of G-mobile subscribers are data users in the last three months. This gives 67.7 percent of mobile data users on average in the last three months.

18. The world average for 2016 was 151.1 kilobits per second and the highest value was in Luxembourg: 6887.71 kilobits per second.

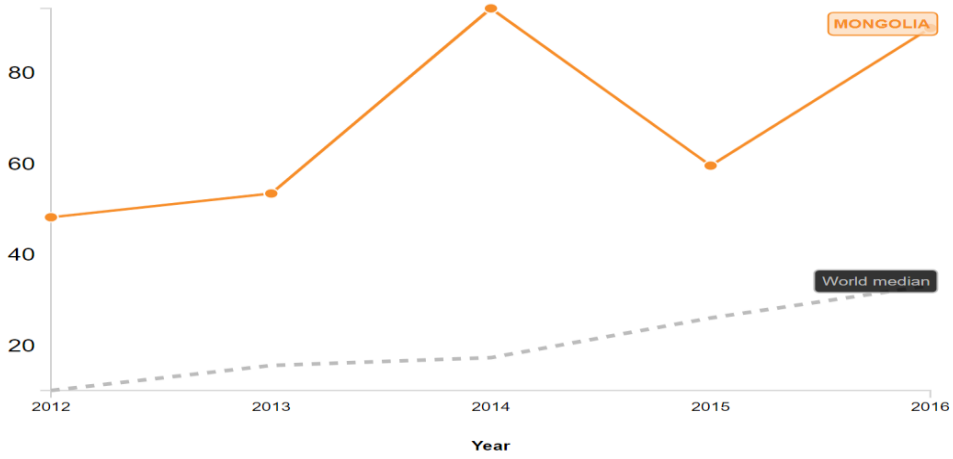
international bandwidth is 140 Gbps. As of year-end 2018, Gemnet's share of international bandwidth was around 80 percent.

<Figure 6> International Bandwidth per user in Asia 2016 (kilobits/second)



Source: TheGlobalEconomy.com

<Figure 7> International Internet Bandwidth per User (kilobits/second)



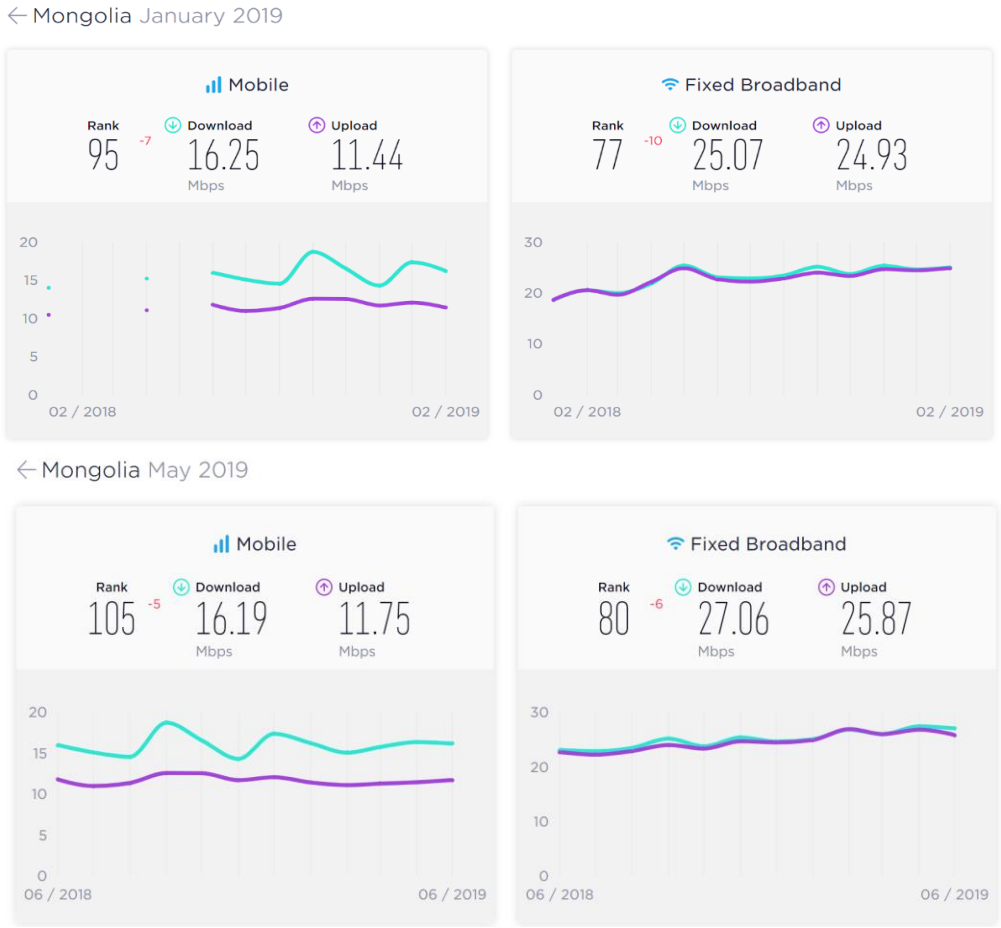
Source: TCdata360, World Bank

2.1.2.3 Internet speed

- Mongolia ranked 95th in the world for mobile speeds and 77th for fixed broadband speeds during January 2019. For fixed broadband performance, Mongolia's download speeds were clocked at 25.07 Mbps, whereas mobile download speeds at 16.25.[19]
- After five months later, the ranking of mobile speed dropped to 105th and fixed broadband speed to 80th in June this year. In July, the ranking of mobile speed moved up to 99th and fixed broadband speed to 76th. As discussed in Mobile Connectivity Index earlier, mobile network performance should be improved.

19. To measure Internet speed, a test is initiated each time. A snapshot of what the internet looks like in that place and time is recorded. When aggregated together, these individual experiences represent the typical internet performance for a given location.

<Figure 8> Internet speed in Mongolia 2019

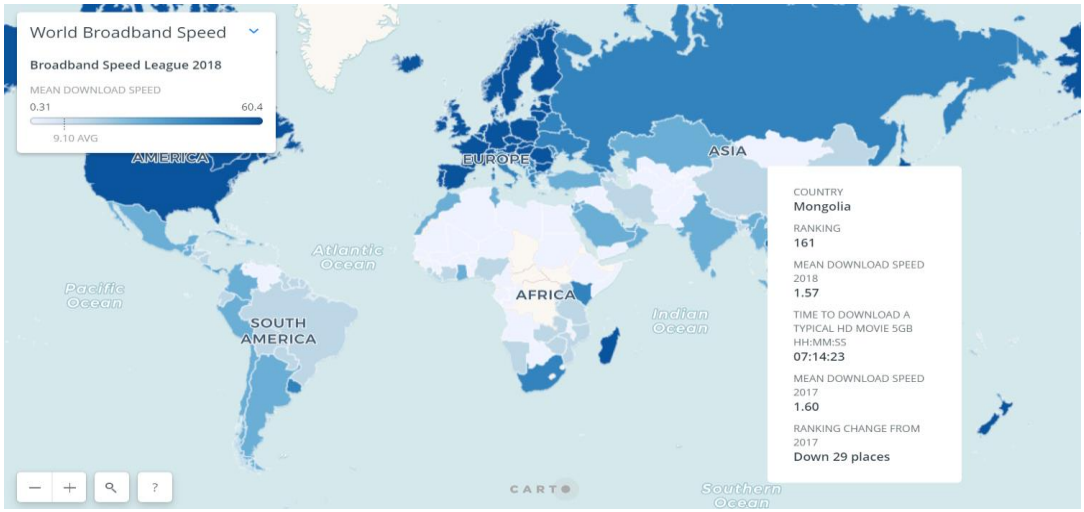


Source: Speed Test Intelligence

2.1.2.4 Broadband speed

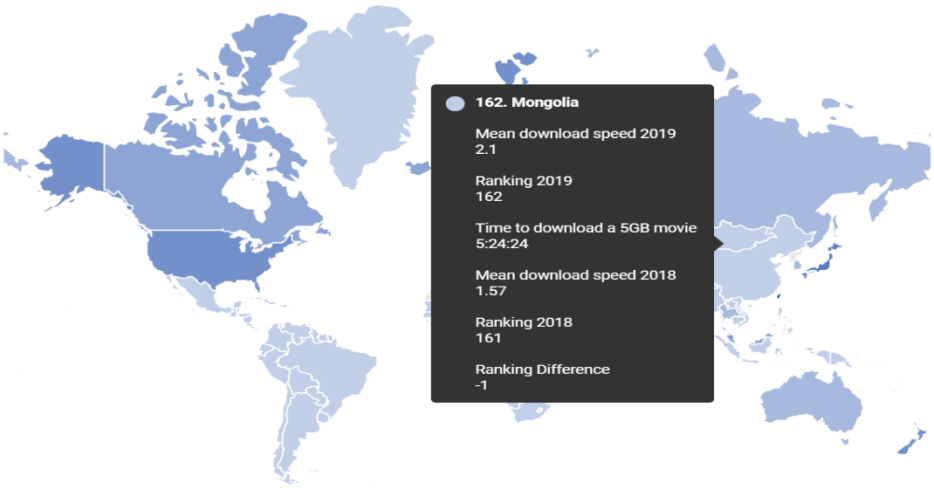
- Much differently from the way a regular speed test 'snapshot' is captured, Internet speed test using physical equipment to constantly measure the speed available on specific lines across a long period of time is often performed to track broadband speed.
- The Worldwide Broadband Speed League, which tracked broadband speed measurements in 200 countries over 12-month periods (from June 2017 to May 2018), found that the average download speed for Mongolia was 1.57 Mbps in 2018, being ranked 161st out of 200 countries. The average download speed should be regarded as a realistic reflection of real-world user experience rather than available bandwidth.
- In 2019, Mongolia ranked 162nd, with an average speed increase from 1.57 Mbps in the previous year to 2.1 Mbps in 2018. The average speed changes year-on-year, but the results of international ranking are reassuringly consistent.

<Figure 9> Broadband speed in Mongolia 2018



Source: Broadband Speed League 2018
(https://www.cable.co.uk/broadband/speed/worldwidespeedleague/#resources)

<Figure 10> Broadband speed in Mongolia 2019



Source: Broadband Speed League 2018
(https://www.cable.co.uk/broadband/speed/worldwidespeedleague/#resources)

- The distribution of broadband subscriptions by speed tier is dominated by 72% of subscribers with 2Mbps up to 10Mbps and 26.5% with up to 2Mbps above 256Kbps. Very few subscribers are above 10 Mbps.

< Table 10> Fixed broadband subscriptions by speed tiers

Speed tier	Percentage of Total Fixed Subscriptions (%)
Downstream speeds equal to, or greater than 256 kbits/s – 2 Mbits/s	26.5
2 Mbits/s – 10 Mbits/s	72.9
Equal to or above 10 Mbits/s	0.58

Source: CITA, 2019

2.1.3 Affordability

- Based on the criterion by the UN Broadband Commission, both fixed- and mobile broadband in Mongolia are surely affordable. As pointed out in the discussion of the Inclusive Internet Index, prepaid handset-based mobile-broadband basket (500 MB) was 2.41 percent of GNI (USD 6.76) per capita in 2017, while fixed-broadband price basket was 2.14 percent of GNI (USD 5.86) per capita in the same year. Not much different from the Inclusive Internet Index, fixed broadband price on average was 2.1 percent of GNI per capita while mobile-broadband basket (500 MB) amounted to 1.6 percent, according to ITU.

< Table 11> Key affordability indicators for Mongolia 2016

Key affordability indicator	Mongolia	Asia Pacific	World
Mobile-cellular prices (% GNI per capita)	0.8	3.2	5.2
Fixed-broadband prices (% GNI per capita)	2.1	14.5	13.9
Mobile-broadband prices 500MB (% GNI per capita)	1.6	2.7	3.7

Source: ITU (as of June 2017)

- Mongolia ranked 19th for fixed broadband Internet tariffs. Monthly subscription charges for fixed broadband Internet service is $20.69, approximately 7 percent of monthly income.[20]
- According to Broadband Pricing League, Mongolia's average cost of broadband per month was USD 17.97 (16th out of 196 countries). Average cost of broadband has decreased year on year by USD 4.19, pulling up the rankings from 23rd in 2017.

< Table 12> Top 25 countries with lowest average cost of broadband 2018

Rank	Country	Continental region	Average cost of broadband (Per month in USD)	Average cost of broadband (Per megabit per month in USD)
1	Ukraine	CIS (FORMER USSR)	$5.00	$0.04
2	Sri Lanka	ASIA (EX. NEAR EAST)	$5.65	$0.49
3	Iran	ASIA (EX. NEAR EAST)	$8.20	$2.89
4	Russian Federation	CIS (FORMER USSR)	$9.77	$0.32
5	Belarus	CIS (FORMER USSR)	$10.46	$0.75
6	Moldova	CIS (FORMER USSR)	$11.28	$0.27
7	Syria	NEAR EAST	$13.00	$4.30
8	Israel	NEAR EAST	$13.02	$0.42
9	Egypt	NORTHERN AFRICA	$13.58	$4.48
10	Romania	EASTERN EUROPE	$14.42	$0.66
11	Argentina	SOUTH AMERICA	$15.51	$1.29
12	Turkey	NEAR EAST	$15.96	$0.47

20. The GNI per capita in Mongolia was recorded at 3,580 US dollars in 2018, according to the World Bank.

13	Kazakhstan	CIS (FORMER USSR)	$16.14	$11.23
14	Nepal	ASIA (EX. NEAR EAST)	$16.47	$1.37
15	Lithuania	BALTICS	$16.84	$0.09
16	Mongolia	ASIA (EX. NEAR EAST)	$17.97	$3.87
17	Poland	EASTERN EUROPE	$18.27	$0.11
18	Hungary	EASTERN EUROPE	$18.37	$0.25
19	Latvia	BALTICS	$18.68	$0.31
20	Georgia	CIS (FORMER USSR)	$18.70	$2.06
21	Serbia	EASTERN EUROPE	$19.24	$1.09
22	Venezuela	SOUTH AMERICA	$20.03	$7.64
23	Uzbekistan	CIS (FORMER USSR)	$21.26	$4.56
24	Slovakia	EASTERN EUROPE	$21.62	$0.88
25	Yemen	NEAR EAST	$22.17	$20.24

Source: Broadband Pricing League Table 2018

- As discussed earlier, it is obvious that Mongolia largely meets the affordability criterion. However, it should be noted that a significant segment of the population earns less than average income. According to the estimation, jointly conducted by National Statistical Office (NSO) and the World Bank, the poverty rate in Mongolia reached 29.6 percent in 2016.[21] This shows that more than a quarter of Mongolian population live in poverty. Even in Mongolia which have achieved the 5 percent affordability target, broadband service is still too expensive for at least the bottom 20 percent of income earners in the country.

2.1.4 Popular websites

- Facebook is the most popular website among Mongolians, followed by Youtube and Google, according to SimilarWeb, based on the number of monthly unique visitors together with the number of page views.

< Table 13> Top 10 popular websites in Mongolia: March 2019

Rank	Website	Category
1	facebook.com	Social Network
2	youtube.com	TV and Video
3	google.com	Search Engine
4	google.mn	Search Engine
5	yahoo.com	News and Media
6	instagram.com	Social Network
7	unegui.mn	Shopping
8	khanbank.com	Financial Management
9	wikipedia.org	Dictionaries and Encyclopedia
10	yandex.ru	Search Engine

(Google.mn has Mongolian and English language options.)

Source: SimilarWeb (https://www.similarweb.com/top-websites/mongolia)

21. https://www.worldbank.org › press-release › 2017/10/17

- Based on a combination of daily visitors and pageviews on a website over a 3-month period, Alexa's top websites in Mongolia include Google.com and Youtube.com, followed by Gogo.mn, Xopom.com, and Ikon.mn.

<Figure 11> Alexa's Top Websites by the Number of Visitors and Total Page Views[22]

#	WEBSITE	TIME / DAY	PAGES / VISIT
01	GOOGLE.COM	07M 42S	9.54
02	YOUTUBE.COM	08M 47S	5.02
03	GOGO.MN	02M 44S	2.50
04	XOPOM.COM	02M 12S	2.19
05	IKON.MN	03M 12S	2.50
06	FACEBOOK.COM	09M 43S	4.03
07	GOOGLE.MN	07M 00S	7.57
08	NEWS.MN	05M 29S	3.69
09	CAAK.MN	04M 32S	2.88
10	YAHOO.COM	04M 01S	3.60

#	WEBSITE	TIME / DAY	PAGES / VISIT
11	ZINDAA.MN	01M 50S	1.76
12	UPDOWN.MN	01M 50S	1.73
13	EBARIMT.MN	04M 04S	2.03
14	UBINFO.MN	07M 03S	5.90
15	UNEGUI.MN	14M 38S	9.30
16	KHANBANK.COM	08M 41S	2.50
17	WIKIPEDIA.ORG	04M 15S	3.15
18	BLOGSPOT.COM	03M 07S	2.43
19	OLLOO.MN	03M 46S	2.90
20	PEAK.MN	01M 16S	1.50

Source: https://www.alexa.com/topsites/countries/MN

- Applications and content in local language cannot be overemphasized. To secure higher wireless broadband penetration rates customers must be able to access relevant and useful applications and content in local language. These applications and content in local language are one of the primary drivers of demand for broadband, and penetration rates are not likely to grow at desirable rates without developing them.
- The number of Mongolian websites has grown rapidly, and these websites and portals play a key role in digital content development and Internet use. The portals offer various types of information such as news, education, business, finance and economy, entertainment, etc. Some of the popular portals in Mongolia include www.gogo.mn., www.news.mn., www.ikon.mn www.Caak.mn, www.Zindaa.mn., www.uptown.mn., www.Shuud.mn. Concerning most viewed contents by Mongolia, they include dramas and serials, comedies, political news and programs, and commercial and entertainment shows.
- According to a survey by CITA, the most popular and useful websites in Mongolian language include[23]:
  - M+ (People can access books and magazines online and listen to audiobooks or

22. Alexa's Traffic Ranking is based on the traffic data provided by users in Alexa's global data panel over 3 months period. A site's ranking is based on a combined measure of Unique Visitors and Pageviews. Unique Visitors are determined by the number of unique Alexa users who visit a site on a given day. Pageviews are the total number of Alexa user URL requests for a site.

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podcasts.)

• LOOK TV (An application for movies and entertainment shows which is downloadable for later viewing. It can also be expanded one's movie library and TV channels are watched on a mobile device.)

• ORI (The country's first local OTT streaming service in Mongolian language offers on-demand and live TV content. The service is available via subscription, on the web, iOS, and Android.)

• LENDMN (It is the first Mongolian Fintech service to promote financial inclusion and smarter payment solutions. LendMN, a mobile app, delivers a convenient new service for deeper financial inclusion. It introduced mobile-based microlending to the borrowers who are blacklisted from significant financial services such as mortgages if they default on a small loan from the bank.)

• KHANBANK (Kahn Bank's application for smartphones and tablets, one of Mongolia's largest banks, provides a more convenient, easy and reliable internet banking service.)

• SOCIALPAY (Golomt Bank application for the easiest and most efficient way to conduct financial transactions without bank account details, but only using either mobile phone number, email address, Twitter or Facebook account to send funds to recipients. Also, it enables you to transfer funds to recipients around using GPS locator.)

• SMARTCAR (This app allows you to check your vehicle information to pay your vehicle tax or check your tax payment status and also get other car transportation services without time delays.)

• UB BIKE (With this bike rental application, you can rent a bike for 1000 MNT for an hour to get you where you want to go without getting stuck in traffic.)

- In Mongolia, the number of fully functional websites with dynamic content is increasing rapidly, compared to the past when most websites were static with basic and limited information. The increase shows that organizations, service providers and users are starting to use the Internet as an information and knowledge source, and Mongolian users seem to actively use them in their daily lives.
- In the public sector all government organizations have developed their own websites. Popular government websites include www.mta.mn. (Mongolia National Tax Administration), www.mof.gov.mn (Ministry of Finance). www.pmis.gov.mn (official website of the Government of Mongolia), www.legalinfo.mn. (legal information system), www.mongolbank.mn (Bank of

Mongolia), and www.open-government.mn. (open government portal).

- Personal websites or blogs are also growing in number. Platforms for user-generated content (UGC) or user-created content (UCC) are being developed and popular portals such gogo, olloo, and News.mn serve as an information and knowledge base where Mongolian Internet users can share experience, information, and knowledge. In addition, mobile commerce is shaping the future of e-commerce in Mongolia, as in other countries around the world.

2.1.5 Social media users

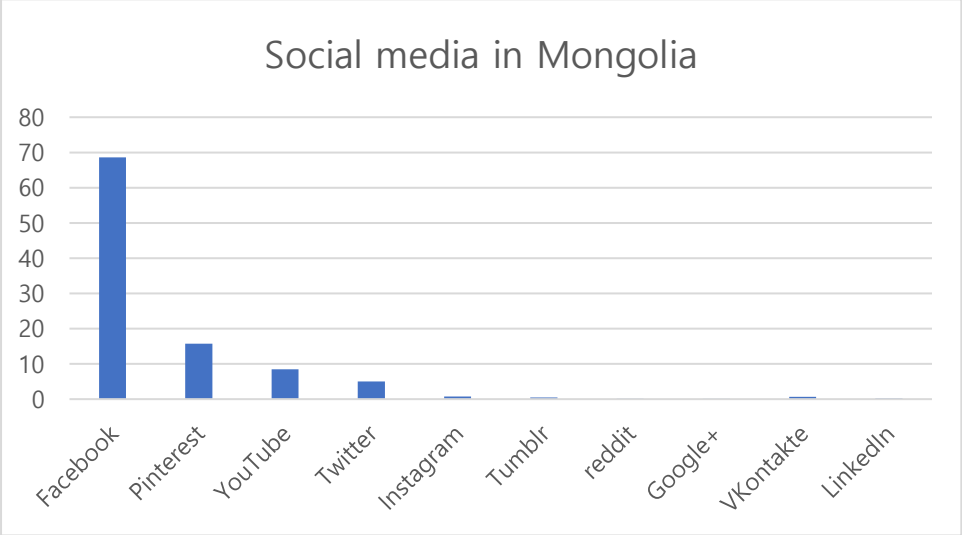
- Active social media users are estimated to reach 2.2 million in Mongolia (70 percent of the population), of which over 95 percent are mobile users. As of June 2019, Facebook users account for more than two-thirds of SNS, followed by Pinterest and Youtube.

< Table 14> Social media statistics in Mongolia

Social Media	Percentage (%)
Facebook	68.61
Pinterest	15.78
YouTube	8.46
Twitter	4.99
Instagram	0.76
VKontakte	0.69

Source: GlobalStats, June 2019

<Figure 12> Social media statistics in Mongolia

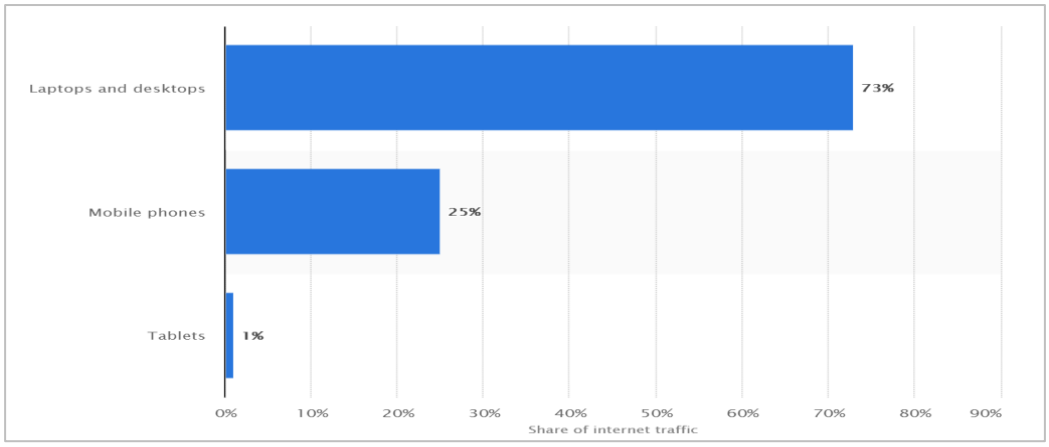


Source: GlobalStats, June 2019

2.1.6 Share of Web traffic by device

- As of January 2018, around 73 percent of internet traffic in Mongolia was accessed with laptops and desktop computers. On the other hand, web traffic from mobile phones accounted for only 25 percent. The remaining 1 percent was occupied by tablets.
- Although the proportion of households with computer is around 35 percent whereas the mobile penetration is higher than 130 percent, laptop or desktop occupies almost three-fourths of Internet traffic, showing that the number of mobile Internet users or traffic volume is relatively small.

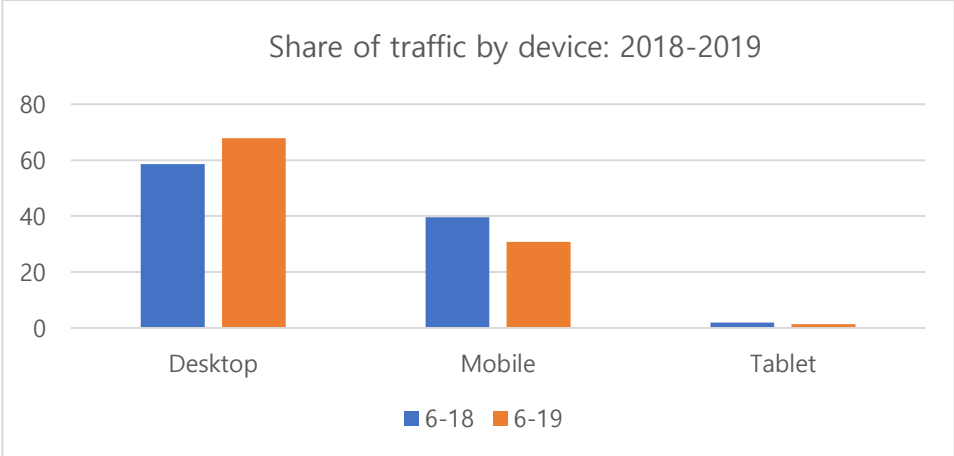
<Figure 13> Share of Web traffic by device as of January 2018



Source: Statista (https://www.statista.com/statistics/804143/share-of-internet-traffic-by-device-mongolia/)

- Looking at the change in share of traffic by device from June 2018 to June 2019, the share of desktop increased while share of mobile decreased by about 9 percent. Traffic volumes of desktop or laptop have been increasing year on year mainly because desktop or laptop users increasingly access OTT (Over the Top Service) video content and online games via the Internet.

<Figure 14> Share of Web traffic by device: June 2018-June 2019



Source: GlobalStats

< Table 15> Households with a computer

Year	2014	2015	2016
Percentage (%)	30.3	34.3	35.7

Source: ICT Profile, ITU

- Proportion of households with Internet access[24] at home (2017): 23 percent

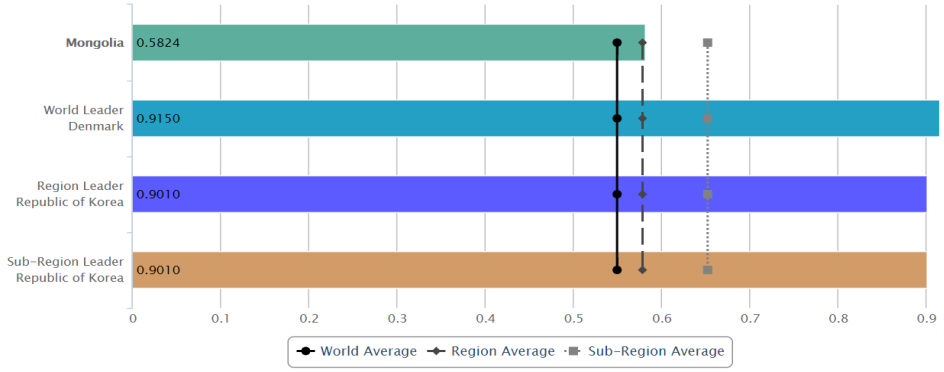
2.2 e-Government and ICT

2.2.1 UN e-Government Survey

2.2.1.1 e-Government Development Index (EGDI)[25]

- Mongolia ranked 92nd out of 193 countries in UN e-Government Survey 2018, dropping eight places when compared to the 2016 Survey.
- EGDI for Mongolia (0.5824) is little higher than the world average (0.5491) and the region average (0.5779). Mongolia is classified as high EGDI group (between 0.50 and 0.75).

<Figure 15> EGDI for Mongolia 2018



Source:https://publicadministration.un.org/egovkb/en-us/Data/Country-Information/id/113-Mongolia/dataYear/2018

24. Household with Internet access means that the Internet is available for use by all members of the household at any time. It is not assumed to be only a computer; it may also be a mobile phone, tablet, PDA, digital TV, and so on. Access can be via a fixed or mobile network.

25. The UN E-Government Development Index is a composite indicator measuring the willingness and capacity of a country to use ICT to deliver public services. It is an average of three scores on the three most important dimensions of e-Government, namely: scope and quality of online services (Online Service Index), development status of telecommunication infrastructure (Telecommunication Infrastructure Index,) and inherent human capital (Human Capital Index).

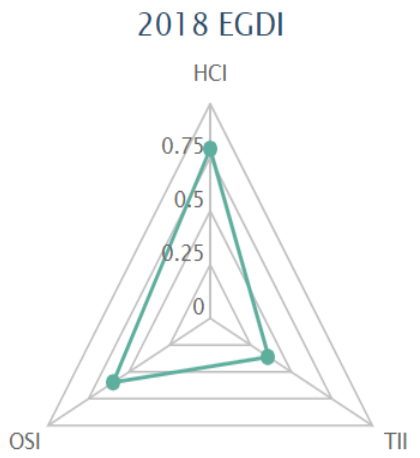
- Among the three dimensions of evaluation, the Telecommunications Infrastructure Index (TII) is significantly low comparing to other indices, scoring 0.3062. On the other hand, the Online Service Index (OSI) recorded 0.5972 and the Human Capital Index (HCI) recorded 0.7899. Consequently, low TII due to low fixed telephony and fixed broadband subscriptions resulted in pulling down overall EGDI.

< Table 16> UN EGDI for Mongolia and selected countries 2018

< UN EGDI (2018) >

Ranking	Country	Index Value	2016 Ranking (Change in Ranking)
1	Denmark	0.9150	9 (△8)
2	Australia	0.9053	2 (-)
3	Korea*	0.9010	( )
4	United Kingdom	0.8999	1 (▼ 3)
7	Singapore	0.8817	4 (▼ 3)
32	Russian Federation	0.3753	35 (△3)
65	China	0.6811	63 (▼ 2)
92	Mongolia	0.5824	84 (▼ 8)

*Region leader in Asia



Source: UN e-Government Survey 2018

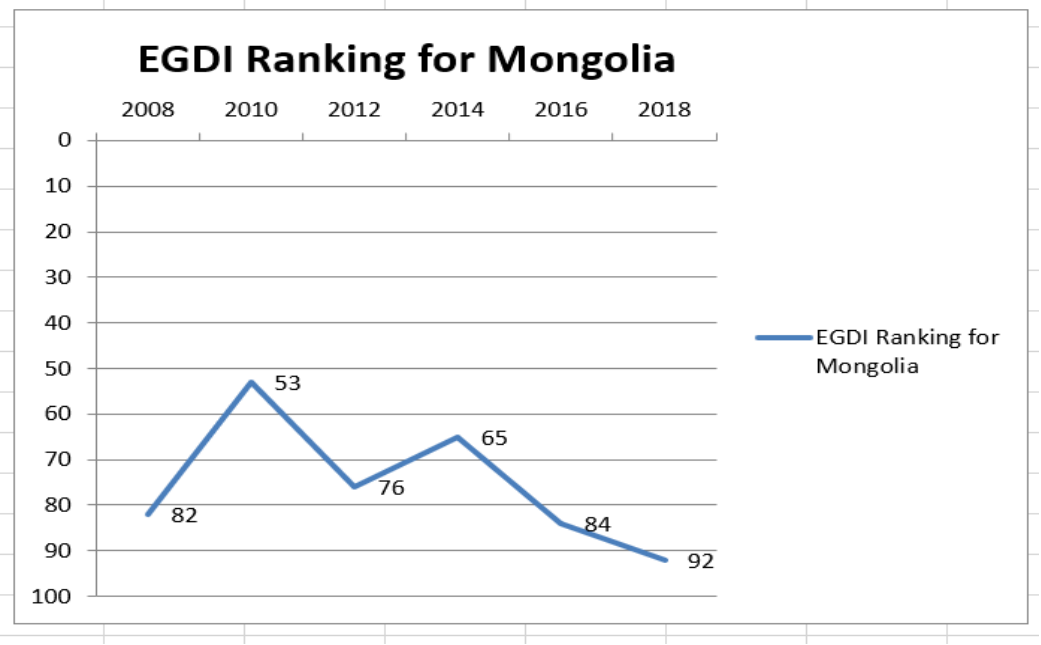
- Looking at the Mongolia's e-Government development trend over the past decade, Mongolia ranked 82nd in 2008, and 53rd in 2010, the highest in history. Since then, it has gradually retreated and dropped to 92nd in 2018. The main reason for this decline seems to be the lack of investment in e-Government due to economic difficulties. The growth of Mongolia's economy has rapidly decelerated since 2011 because of declining foreign direct investment and falling commodity prices. This slowed growth has caused serious economic difficulties, including large revenue shortfalls and cuts in government investment, which require the government to reduce public spending, including investment in ICT and e-Government.

< Table 17> UN EGDI Ranking for Mongolia: 2008-2018

Year	2008	2010	2012	2014	2016	2018
EGDI Ranking	82	53	76	65	84	92

Source: UN e-Government Survey 2008-2018

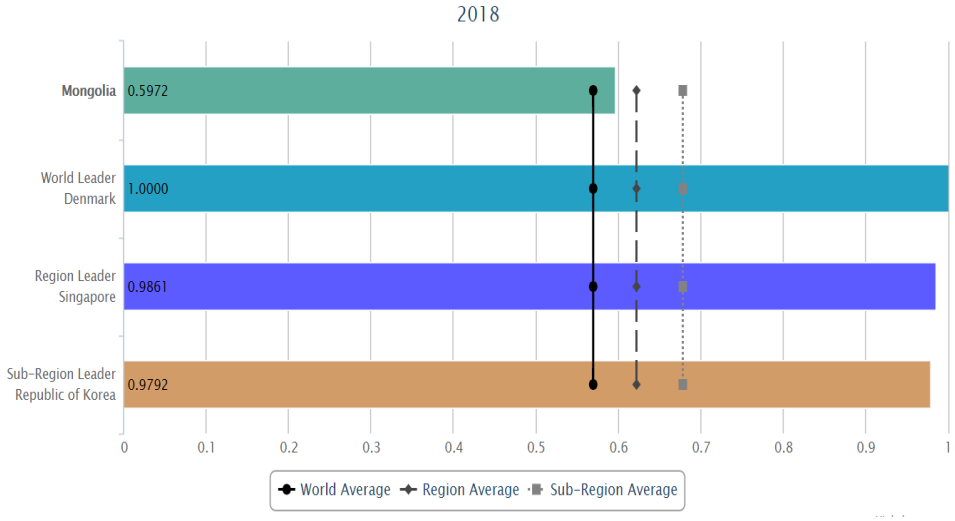
<Figure 16> Changes in EGDI for Mongolia: 2008-2018



Source: UN e-Government Survey 2008-2018

- For OSI, with a score of 0.5972, Mongolia is higher than World average (0.5691), but lower than Region average (0.6216)

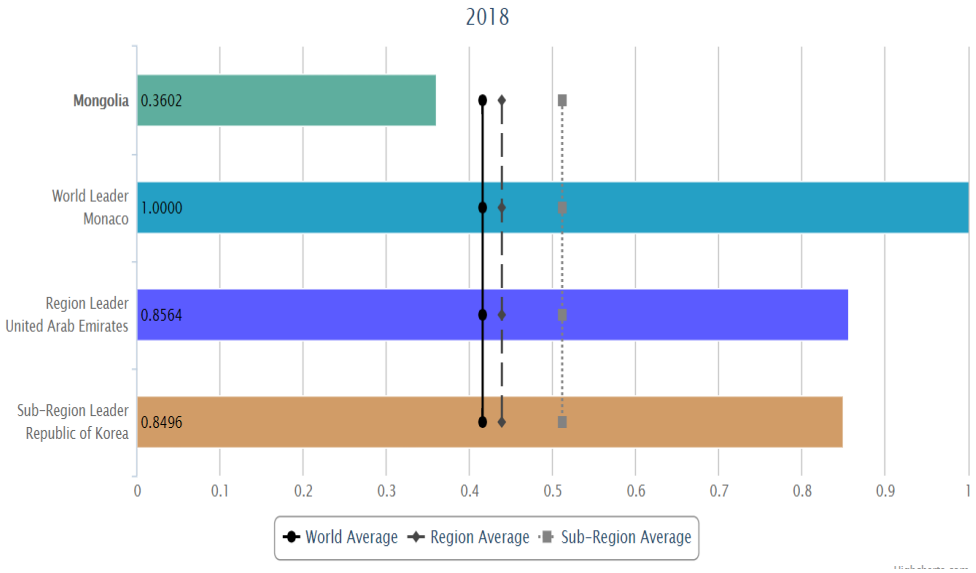
<Figure 17> OSI for Mongolia 2018



Source: UN e-Government Survey 2018

- For TII, Mongolia (0.3602) is below both World average (0.4155) and Region average (0.4385).

<Figure 18> TII for Mongolia 2018

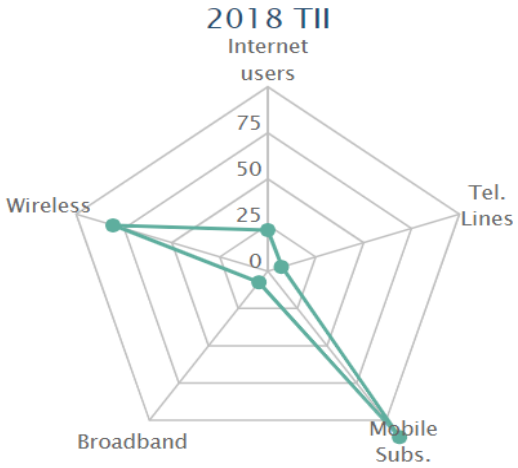


Source: UN e-Government Survey 2018

- The TII for Mongolia reveals that the country does not get a good score due to low fixed telephone and fixed broadband subscriptions along with a relatively low level of Internet users, as shown in Figure 19.

- The fixed broadband market has been growing strongly over the past few years. Although further strong growth is expected in the near future, it implies that the GoM should promote the fixed broadband market through expanded broadband opportunity to the home and enterprise.

<Figure 19> Sub-indices of TII for Mongolia 2018

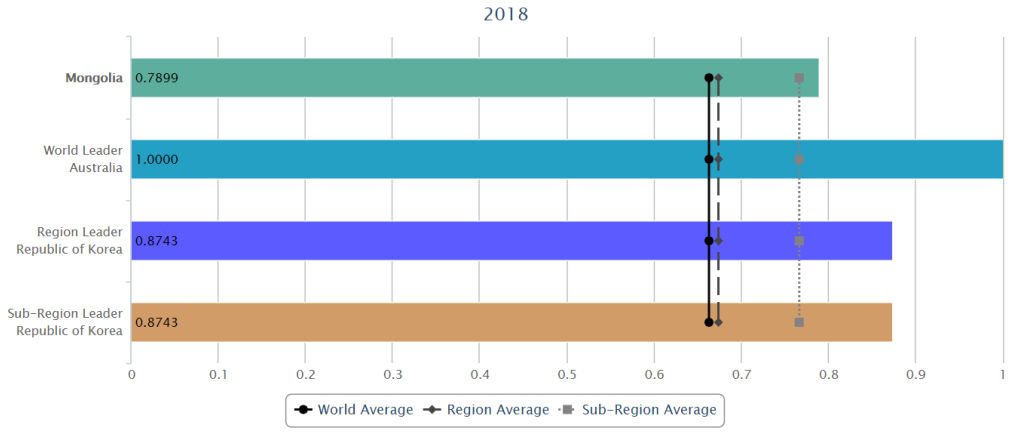


Source: UN e-Government Survey 2018

- With a score of 0.7899, Mongolia exceeded both World average and Region

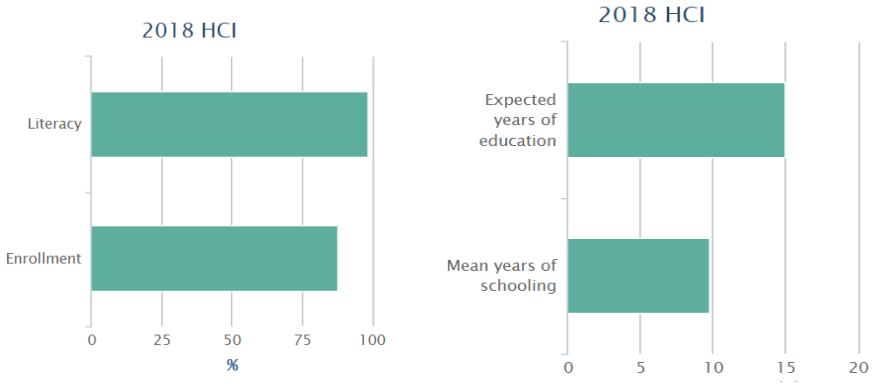
average in HCI. For sub-indices of HCI, adult literacy rate recorded at 98.4 percent; gross enrollment ratio 87.9 percent; expanded years of schooling[26] 15.1 years; and mean years of schooling[27] 9.8 years.

<Figure 20> HCI for Mongolia 2018



Source: UN e-Government Survey 2018

<Figure 21> Sub-indices of HCI for Mongolia 2018



Source: UN e-Government Survey 2018

2.2.1.2 UN E-Participation Index (EPI)

- Mongolia ranked 65th in E-Participation Index out of 193 countries in UN e-Government Survey 2018. EPART Index for Mongolia (0.7360) is much higher than World EPART average (0.5654), and higher than Region average (0.6126)

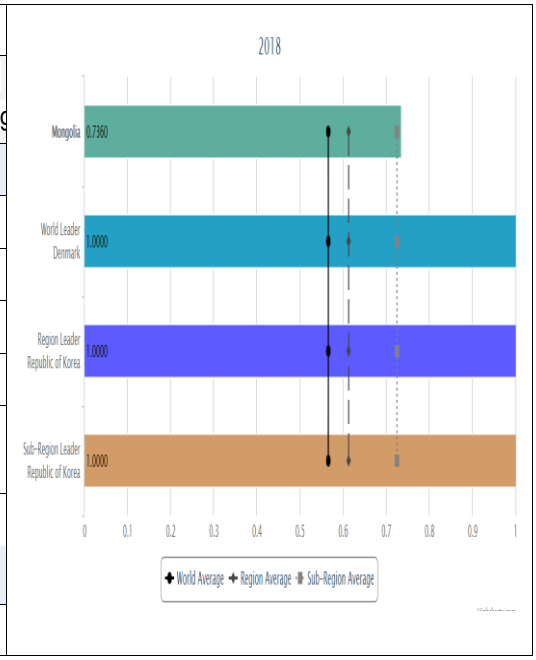
26. Expected years of schooling is the number of years of schooling that a child of school entrance age can expect to receive if prevailing patterns of age-specific enrolment rates persist throughout the child's life.

27. Average number of years of education is the number of years of schooling received by people ages 25 and older, converted from actual education attainment levels using official durations of each level.

< Table 18> UN E-Participation index for Mongolia and selected countries 2018

< UN E-Participation Index (2018) >

Ranking	Country	Index Value	2016 Ranking (Change in Ranking
1	Korea	1.0000	1 (-)
1	Denmark	1.0000	22 (△21)
1	Finland	1.0000	8 (△7)
4	Netherlands	0.9888	5 (△1)
13	Singapore	0.9663	8 (▼ 5)
23	Russia Federation	0.9213	32 (△9)
29	China	0.9045	22(▼ 9)
65	Mongolia	0.7360	39 (▼ 26)



Source: UN e-Government Survey 2018

- E-information, the first stage of E-Participation, focuses on enabling participation by providing citizens with public information and access to information without or upon demand. The second stage which is E-consultation is about engaging citizens in contributions to and deliberation on public policies and services. The third stage, E-decision-making, concentrates on empowering citizens through co-design of policy option and co-production of service components and delivery modalities. Among the three stages, the third stage recorded highest score, demonstrating that Mongolian citizens actively engage in public policy development using ICTs.

< Table 19> Utilization of E-Participation by stages[28] in Mongolia 2018

	Rank	EPI	1st Stage	2nd Stage	3rd Stage	Total
Mongolia	65	0.736	73.33%	69.57%	81.82%	74.46 %

Source: UN e-Government Survey 2018

- Starting from 45th in 2008, Mongolia advanced to 24th on EPI in 2012, but this upward trend was reversed from 2014, slipping further down to 65th in 2018.

28. The E-Participation Index (EPI) focuses on the use of online services to facilitate provision of information by governments to citizens (1st stage: e-information sharing), interaction with stakeholders (2nd stage: e-consultation), and engagement in decision-making processes (3rd stage: e-decision making).

< Table 20> Changes in UN E-Participation Index Ranking for Mongolia

Year	2008	2010	2012	2014	2016	2018
E-Participation Ranking	45	28	24	30	39	65

Source: UN e-Government Survey 2008-2018

2.2.2 ITU ICT Development Index

- The ICT Development Index (IDI) is a composite index that combines 11 indicators into one benchmark measure. It is used to monitor and compare developments in information and communication technology between countries and over time.

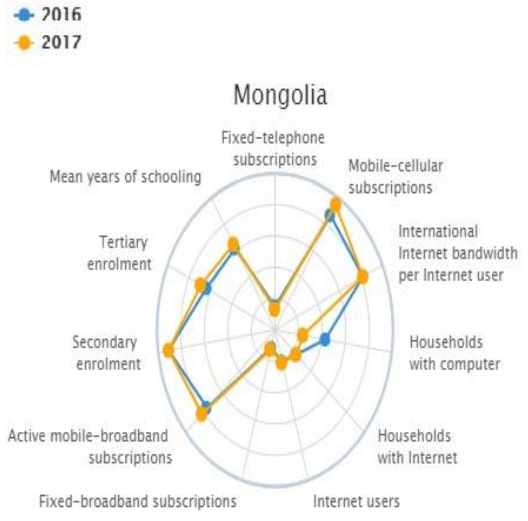
- Mongolia ranked 91st out of 176 countries in ICT Development Index 2017. In the global rankings, Mongolia slipped four places from 87th in 2016. Active mobile broadband subscriptions (0.82) and mobile-cellular subscriptions (0.95) together with international Internet bandwidth per Internet user (0.82) are relatively higher, whereas fixed-broadband subscriptions (0.07), Internet users (0.22) and households with Internet (0.24) are significantly lower than other assessment pillars.

- Mongolia ranked 110th (4.74) in IDI Access sub-index, down 14 places from 96th (5.03) in 2016. It was not only the most substantial fall (down 0.29 points) among 176 countries but the greatest fall (down 14 places).

< Table 21> ITU IDI 2017 for Mongolia and selected countries

< ITU IDI 2017>

Ranking	Country	IDI Value 2017	IDI Value 2016	Rank 2016 (Change in Ranking)
1	Iceland	8.98	8.78	2 (△1)
2	Korea	8.85	8.80	1 (▼ 1)
3	Switzerland	8.74	8.66	4 (△1)
4	Denmark	8.71	8.68	5 (▼ 1)
5	United Kingdom	8.65	8.53	5 ( )
45	Russia Federation	7.07	6.91	43(▼ 2)
80	China	5.60	5.17	83(△3)
91	Mongolia	4.96	4.91	87 (▼ 4)



Source: ITU IDI 2017

- Mongolia ranked 96th (3.90) in IDI Use sub-index. The IDI Use sub-index value itself improved, but the global ranking went down five places from 91st (3.64) in 2016.
- For IDI Skills sub-index, Mongolia ranked 52nd with a score of 7.51, up 6 places from 58th (7.23) in 2016.
- Mongolia's IDI value is slightly higher than the Asia-Pacific average, but Use sub-index is lower than the Asia-Pacific average. Percentage of households with computer and percentage of individuals using the Internet are lower than the Asia Pacific average.[29] On the other hand, active mobile-broadband subscriptions per 100 inhabitants and Skills sub-index are consistently higher than the Asia Pacific average.

< Table 22> IDI comparison between Mongolia and Asia & the Pacific

	Mongolia	Asia-Pacific
IDI Value 2017	4.96	4.83
IDI ACCESS SUB-INDEX	5.27	4.74
✓ Fixed-telephone subscriptions per 100 inhabitants	7.60	10
✓ Mobile-cellular telephone subscriptions per 100 inhabitants	113.63	98.90
✓ International internet bandwidth per Internet user (Bit/s)	166055.85	48,000
✓ Percentage of households with computer	23.59	37.80
✓ Percentage of households with Internet access	45.50	23.57
IDI USE SUB-INDEX	3.99	3.90
✓ Percentage of individuals using the Internet	22.27	41.50
✓ Fixed (wired)-broadband subscriptions per 100 inhabitants	7.63	11.30

29. According to ITU, percentage of households with a computer in Mongolia is 32.6 percent. Households using computers decreased from 43% in 2016 to 23.59% in 2017, requiring analysis and countermeasures for the cause.

✓ Active mobile-broadband subscriptions per 100 inhabitants	82.00	47.40
IDI SKILLS SUB-INDEX	7.51	5.65
✓ Mean years of schooling	9.80	8.15
✓ Secondary gross enrolment ratio	91.46	83.06
✓ Tertiary gross enrolment ratio	68.57	34.65

Source: ITU ICT Development Index 2017

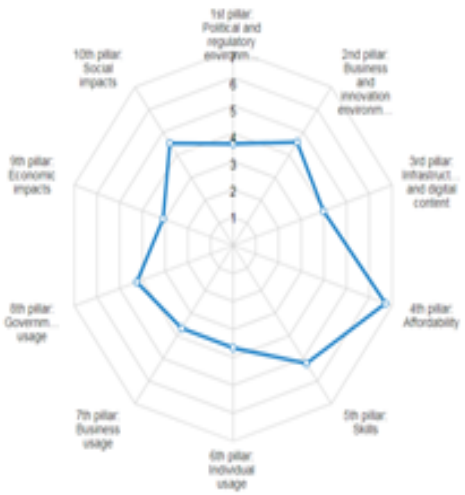
2.2.3 Networked Readiness Index by World Economic Forum

- Networked Readiness Index by the World Economic Forum measures how well an economy is using information and communications technologies to boost competitiveness and well-being. Data is gathered from international agencies such as the International Telecommunication Union, UNESCO, other UN agencies and the World Bank.
- Mongolia ranked 57th out of 139 countries in Networked Readiness Index 2016. Among ten pillars, environment (3.8), readiness (3.9), usage (2.9), impact (3.1) are very low. Individual usage (2.0) is still the lowest, although has been growing in recent years.

< Table 23> NRI 2016 for Mongolia and selected countries

< WEF NRI (2016) >

Ranking	Country	Value
1	Singapore	6.0
2	Finland	6.0
3	Sweden	5.8
4	Norway	5.8
5	USA	5.8
13	Korea	5.6
41	Russia Federation	4.5
57	Mongolia	4.3
59	China	4.2



Source: WEF GITR 2016

2.3 UNCTAD B2C E-commerce index

- The UNCTAD B2C E-commerce Index reflects the processes involved in an online shopping B2C transaction which is made up of Internet users, B2C web presence, delivery and payment. The sources for the UNCTAD B2C E-commerce Index indicators include ITU for Internet users, Netcraft for secure servers per 1 million inhabitants, World Bank Global FINDEX Database for account penetration, and UPU for postal reliability.
- Mongolia ranked 58th out of 151 countries in UNCTAD B2C E-commerce index 2018. According to the Index, Mongolia is one of the Top 10 developing and transition economies in the UNCTAD B2C E-commerce in East, South & Southeast Asia.
- Overall, Mongolia rated favorably on share of individuals with an account. However, share of individuals using the Internet is too low. Postal reliability and number of secure servers used as a proxy for e-commerce shops should be improved. Given the low Internet use far below average, the country's level of online shopping might be lower than the index rank. This may partly reflect the fact that Mongolians prefer to shop in person and the share of the population with a credit card is less than 4 percent, factors not measured in the Index.
- The index is calculated as the average of four indicators (i.e., each indicator carries the same weight) using data for 2017 or the latest available.
  - Account ownership at a financial institution or with a mobile-money-service provider (% of population ages 15+) (Source: World Bank)
  - Individuals using the Internet (% of population) (Source: ITU)
  - Postal Reliability Index (Source: UPU)
  - Secure Internet servers (per 1 million people) (Source: Netcraft)

< Table 24> UNCTAD B2C E-commerce index 2018, Mongolia

2018 Rank	Share of individuals using the Internet (2017 or latest)	Share of individuals with an account (15+, 2017 or latest)	Secure Internet servers (normalized) (2017)	UPU postal reliability score (2017 or latest)	2017 Rank
58	22	93	68	81	55

Source: UNCTAD, 2018

2.4 Telecommunication market

2.4.1 Mobile market

Despite the tough circumstances of second-largest landlocked country with second least population density in the world, Mongolia has made major strides in telecommunication coverage, particularly using wireless communications. 3G covers 77.7 percent of the population and 100 percent of Soums across the country in area, while 4G coverage is 45.4 percent in population and 99.38 percent in area.

The mobile market is competitive and dynamic, served by four mobile operators: Mobicom, Unitel[30], Skytel and G-Mobile[31]. In 2018, Mobicom held the largest share of the market with 37.8 percent followed by Unitel who held 34.03 percent. Skytel and G-Mobile are distant third and fourth with a share of 16.51 percent and 11.66 percent respectively. Mobile penetration (subscriptions per 100 inhabitants) was over 100 in 2014 when 97 percent of households had a mobile phone.[32] Mobile-broadband population coverage continues to be strong with the launch of 3G service in 2009 and LTE in 2016. Although 3G continues to lead the mobile market currently, 4G is expected to dominate both the number of connections and the data generated. Furthermore, the young generation, up to age 24, who use mobile data the most, accounts for 45.5 percent of the population pyramid in Mongolia, suggesting further growth in the mobile market.

< Table 25> Mobile operators in Mongolia

Name of Operator	Year licensed	Structure of ownership	Wireless Connectivity
Mobicom Corporation LLC	1995	Japan (99%) private company	GSM, 4G
Unitel LLC	2005	Mongolian private company	GSM, 4G
Skytel LLC	1999	Mongolian private company	CDMA, 4G
G-Mobile LLC	2006	Mongolian private company	3G(CDMA2000), 4G

Source: CRC, 2019

30. Unitel launched service in 2006 as a joint venture between Korea and Mongolian investors. The Korean investors had sold their shares and Unitel became a 100 percent Mongolia company in 2010.

31. G-mobile is the Mongolian's newest mobile operator, founded in 2006. The operator is focusing its operations in rural areas.

32. NSO Mongolia, 2014

< Table 26> Market share of mobile operators by year

Name of Operator	2010	2011	2012	2013	2014	2015	2016	2017	2018
Mobicom Corporation LLC	44.23	42.91	46.03	46.25	40.03	41.81	39.21	38.64	37.80
Skytel LLC	21.92	19.66	15.84	16.60	15.98	14.99	16.00	15.25	16.51
Unitel LLC	18.50	21.21	29.01	29.48	32.37	30.87	31.68	35.16	34.03
G-Mobile LLC	15.35	16.21	9.12	7.66	11.62	12.33	13.11	10.95	11.66

Source: CRC, 2019

Mongolia is a mobile-first country with largely mobile service. Fixed-line infrastructure, particularly subscriber network, is not well developed, which has contributed to the rapid growth of mobile market. Increase in mobile broadband penetration is driving Mongolia's broadband market. Overall growth rate of mobile subscription is shrinking and 3G subscription accounts for an increasing proportion of total subscriptions with a share of almost 60 percent. While the fixed market has been expanding at a relatively slow pace, the mobile market has undergone remarkable growth. The national policy contributed to a competitive telecommunications segment with two CDMA and two GSM mobile telephone service operators.[33] Mongolia's mobile subscriber market has performed fair growth over the past five years. Market penetration has increased from 103.53 percent in 2014 to 130.38 in 2018 with an annual growth rate of 5.37 percent during the period. A slower growth is foreseen over another five years to 2025 even though 4G LTE services strongly increase the uptake of mobile broadband.

The Mongolian telecommunications market was estimated to be worth approximately USD 451 million in 2016. Mobile revenue in 2016 was USD 233 million. Mobile communications as a proportion of total telecommunications revenues in Mongolia from 2014 to 2016 shows that mobile communications accounted for 62.2 percent of total telecoms services revenues, bringing in USD 224 million of the 360 million total telecoms services revenue in 2016. The total telecoms services revenues continue to increase, while mobile revenue is decreasing mainly due to lowered prices, resulting in a decline in mobile communications as a proportion of total telecommunications revenues. This could make additional investment by the mobile operators tough.

< Table 27> Total Telecommunication and Mobile Revenues in Mongolia, 2014-2016

Year	Total Telecommunication Revenues (USD Million) (A)	Mobile Revenue (USD Millions) (B)	B/A
2014	360	224	62.2%
2015	404	251	62.1%
2016	451	233	51.7%

Source: ITU, Measuring the Information Society Report 2018

33. Mobile market share by technology: GSM 73.8 %, CDMA 26.2 % in 2017, according to CRC.

2.4.2 Fixed market

As Mongolia has proceeded directly to the pervasive use of mobile and wireless technologies, the penetration of fixed lines is somewhat limited. Despite the predominance of mobile subscription, the number of fixed subscribers increased by nearly 150 percent between 2010 and 2018. There were only 143,138 subscribers, then the market grew to more than 200,000 subscribers in 2014. At the end of 2018, fixed subscribers exceeded 350,000. Much of the recent increase was due to all-out triple-play marketing from operators, including Univision (a member of the Unitel Group) and Skymedia (a subsidiary of Skytel). Triple-play subscribers increased by 37.52% between 2016 and 2018.

< Table 28> Fixed-line subscribers and subscription rate by year

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018
No. of Subscribers	143,138	143,856	151,945	192,882	228,327	255,634	257,816	292,594	354,559
Subscription Rate	7.12%	6.79%	6.28%	6.12%	7.81%	8.36%	8.05%	9.51%	11.4%

Source: CRC, 2019

Fixed-line subscription for residential consumers accounts for more than 93% while organizational use is only 6.8% of the total fixed-line subscribers. Residential broadband connection has made possible an entirely new online experience, such as watching a video stream, downloading music in seconds, video and voice chats, and real-time gaming. Also, Internet is essential to business success in this information society. Internet has transformed business, providing email marketing, social media customer support, and so on.

< Table 29> Fixed-line subscribers by residential consumers and organizations

Residential use/Organizational use	No. of subscribers	% of total fixed subscriptions
Residential subscriptions	285,358	93.2
Subscriptions for organizations	20,792	6.8

Source: CRC, 2019

Univision LLC has maintained the largest market share in the Mongolian fixed market since 2015, with 55% of market share in 2018, followed by Skymdia LLC with almost 18 percent market share. A standout contributor to the strong performance of Univision LLC and Skymedia LLC is their triple-play services. The incumbent operator Telecom Mongolia[34] used to be the country's largest fixed-line carrier until 2014. However, the

[34]. Telecom Mongolia was established in 1992 and partly privatized in 1995 when a 40 per cent stake was sold to Korea Telecom. Telecom Mongila split into a network company and a service provider company in 2007. In the same year, Skynmedia LLC was awarded a license to provide fixed telecommunications services within and between cities using Internet Protocol (IP), launching new broadband services in Mongolia. In 2017, Korea Telecom made an offer to the Government of Mongolia on selling its 40 percent or 10 million 348 thousand 111

gap between first-tier Univision LLC and Telecom Mongolia is further widening. Different from most other developing countries, there is a comparatively high degree of competition among six operators in the fixed market. Nevertheless, fixed-line penetration in Mongolia is low due to a very high mobile penetration. Fixed broadband subscriptions are now largely bundled into triple play offers. Fixed broadband choices include fiber optic cable and Wi-MAX, with fiber optic accounting for the largest share of subscriptions. With the launch of 4G service in 2016, fiber-optic broadband service seemed to have a contraction from 2015 to 2016, suggesting some end users migrated from fiber to mobile. Fixed broadband subscription has recovered from the previous growth rate since 2017. This regained growth rate seems to be the result of users accessing OTT video content over the public Internet as well as the upsurge in online gaming. Due to limited availability of fixed broadband services, subscribers are largely in urban areas – about 83 percent of all subscribers are in Ulaanbaatar. Broadband penetration is very concentrated in the capital city, showing big fixed broadband divides between Ulaanbaatar and the rest of the country. Outside Ulaanbaatar fixed broadband remains a great challenge.

< Table 30> Number of fixed broadband subscribers in UB and other areas

	Region/Year	2016	2017	2018
Number of fixed broadband subscribers	Ulaanbaatar (A)	186,228	236,064	253,500
	Others	39,919	49,029	52,650
	Total (B)	226,147	285,093	306,150
	A/B (%)	82.35	82.8	82.8

Source: CRC, 2019

< Table 31> Triple-play subscribers by year

Year	IPTV	IPTV+VOIP	IPTV+VOIP+INTERNET	Total
2013	6,727	454	78,819	86,000
2014	10,074	3,786	113,251	127,111
2015	10,387	7,971	144,442	162,800
2016	13,612	752	174,917	189,281
2017	16,016	692	225,089	241,797
2018	18,971	3025	273,193	295,189

Source: CRC, 2019

shares at the rate USD 2 million 550 thousand. After the Cabinet resolved to purchase 40 percent of the shares of Mongolia Telecom Company, Mongolia Telecom's 40 percent stake was bought back by the Mongolian government.

< Table 32> Market Share of fixed line subscription 2011-2018 (%)

Name of Operator	2011	2012	2013	2014	2015	2016	2017	2018
Telecom Mongolia	84.99	78.81	52.20	37.99	29.92	28.19	21.50	16.06
Univision LLC	5.26	18.24	30.39	32.43	35.94	38.57	47.14	55.05
Skymedia LLC		3.66	9.10	18.69	22.82	22.98	21.63	17.99
Mobinet LLC			2.52	6.26	7.46	6.58	7.73	5.26
UB Railway Joint Stock Company	7.64	6.35	4.20	3.30	2.67	2.51	2.00	1.51
Cybersecurity Authority	2.11	2.19	1.58	1.33	1.19	1.18	-	-

Source: CRC, 2019

Domestic fiber optic cable was primarily installed by the GoM. Now the physical assets are owned and operated by ICNC[35], which rolled out 17,989 km of fiber optic cables along its tracks running from Sukhbaatar at the Russian border to Zamyn-Uud at the China border. ICNC deployed and operates 42 percent of the national fiber-optic network across 21 Aimags and 285 Soums. Mobicom Network LLC installed its own 11,643 km fiber optic cable and Skynetworks LLC also have established 10,990 km fiber-optic network in the country. In addition, Gemnet, a wholesale network operator, maintains 1+1 protected fiber cable with full reliability installed from the southern border of Mongolia to the northern border of Mongolia. It is equipped with DWDM which can be upgraded to 400 Gbps.

< Table 33> Fiber optic cables by company[36]

Company	Length (Km)
Information and Communication Networking Company	17,989
Mobicom Network LLC	11,643
Skynetworks LLC	10,880
Gemnet LLC	2,265
MT Networks	241
Total	43,018

Source: CRC, 2019

35. ICNC was established in 2006 as a state- owned company according to the Government policy to separate network assets and operations from the telecommunications services. It is delegated to run the state-owned information and communications national backbone network consisted of international, long distance and local transmission networks and is responsible for ensuring reliable operation & maintenance and interconnection to telecom operators. The company also provides co-location services to mobile operators and telecom service providers on their facilities along with towers throughout Ulaanbaatar city and 21 Aimags.

36. Railcom, a subsidiary of Mongolian Railway, operates a 1,400-kilometer fiber network along the country's primary north-south railway. But it is not included in the table mainly because now it does not have a license. The fiber network is for only internal use.

Mongolia is now connected from north to south and east to west by fiber optic cables. The operators have focused on expanding network and capacity to support the growing popularity of fixed broadband services, extending fiber optic deployment into Mongolia's sparsely populated rural regions.

2.4.3 International connection

As a landlocked country, Mongolia established international terrestrial cable networks by connecting the domestic backbones with trans-border terrestrial cables. International connectivity is achieved through terrestrial connections to China and Russia, and from there traffic is routed to overland Asia-Europe networks and through submarine cables. Notwithstanding its large landlocked territory, international traffic is carried through cross-border connections to its two large neighbors. There are four companies providing international network service: ICNC, Mobicom Networks LLC, Gemnet LLC, and MT Networks LLC. The domestic backbone networks of these companies are connected to the global network via several agreements, including TransTeleCom of Russian Federation, Megaphone Cinterra, China Telecom of China, China Mobile, Global Crossing of Frankfurt, Interoute companies of USA. Gemnet, a Mongolian telecommunications and Internet wholesale provider, also signed a commercial agreement in 2009 with Level 3 Communications of Broomfield, Colorado to provide Internet protocol services. Level 3 delivers high-speed Internet Protocol (IP) services to support ISP customers of Gemnet. The GemNet network delivers a high-capacity, low-latency transit route – via Mongolia – between Asia and Europe and between Asia and the United States. Gemnet occupies approximately 80 percent of international bandwidth. Gemnet reduced price by 30% to 35% in recent years.[37] The price of I Mbps per month is around 50,000 MNT, relatively lower than other providers with the price of 80,000 MNT, such as Mobicom and ICNC.[38]

The total capacity of international Internet bandwidth was 140 Gbps in 2018, while international Internet bandwidth per user was 89.98 kb/s, as seen in Figure 7. Mongolia experienced a year-on-year average growth rate of 25.21% for the time period 2012 to 2016. International Internet bandwidth increased by 40% between 2016 and 2018 while the average cost per 1 Mbps fell to less than half. International Internet bandwidth is the contracted capacity of international connections between countries for transmitting Internet traffic. International Internet bandwidth (bit/s) per Internet user is calculated by dividing by the total number of Internet users. There are different perspectives on the number of Internet users in Mongolia. When we adopt the statistics by CRC,

37. www.gemnet.mn

38. Information from interviews with ICNC and CITA

International Internet bandwidth (bit/s) per Internet user is reduced to less than half of the current level.

< Table 34> International Internet bandwidth and pricing

Year	International Internet Bandwidth Capacity (Gbps)	International Internet Bandwidth per capita	International Capacity Pricing
2018	140	N/A	Average IP transit 65,000 MNT per 1Mbps per month
2017	120	N/A	IP transit 150,000 MNT per 1Mbps per month
2016	100	N/A	IP transit 150,000 MNT per 1Mbps per month

Source: CITA, 2019

2.4.4 Internet eXchange

Internet eXchange Point (IXP) is the place where members of the IXP exchange traffic. The primary purpose of an IXP is to allow networks to interconnect directly, via the exchange, rather than through one or more third-party networks. Thus, local traffic stays local and International circuits are used for just international traffic. The primary advantages of direct interconnection are cost, latency, and bandwidth.

The Mongolian Internet Exchange (MIX) was established in 2001 by Infocon[39] and now has 33 participants. MIX is a neutral exchange point for transfer of local Internet traffic each other directly at the local level rather than via foreign countries, thereby reducing the average per-bit delivery cost and reducing latency. MIX is a Layer 3 router-based exchange point and was initially located in the premise of Telecom Mongolia which was transferred to the ICNC later.

MIX installed Cisco Nexus 7010 Switch designed to switch 15 Tera bps required for data centers in 2010. It supports Ethernet 10Gbps and it can be extended by 40Gbps and 100Gbps modules, also providing 256 of 10G ports and 384 of 1G ports.[40] It has double

39. In January 2001, a group of leading Mongolian ISPs met in Ulaanbaatar to explore the creation of a national IXP. At the time, all Mongolian ISPs were interconnected via Tier-1 and Tier-2 providers in the United States or Hong Kong, China. As a result, satellite latencies amounted to over half a second) for each packet of data in each direction. And so, costs were unnecessarily high. In 2001 MIX was originally built with 1.5 Mbps speed by Infocon, but it was closed. Later in 2002 Micom Network MTC installed new equipment (Cisco Catalyst 2924 Switch).

40. The maximum speed of transmission is 4.1 Tbps. The power generator has two pairs of connecting blocks with three main sources. The average injury time is 364652 hours=30 years MTBF. Supervisor has 4Gb RAM, Dual

supervisor that can be upgraded throughout the service. Members of MIX run peering by Border Gateway Protocol (BGP) routing configurations between them. MIX is planning to convert Layer 3 IXP to Layer 2 IXP because the router has become very quickly overwhelmed by the rapid growth of the Internet in router-based Layer 3 exchange. Layer 2 is the accepted international standard and a real IXP.[41] Most IXPs use L2 switching because L2 switching is simpler, which Ethernet switch is the interconnection media and IXP is one LAN. IXPs are large Layer 2 LANs that are built with Ethernet switches. Each ISP brings a router, connects it to the Ethernet switch provided at the IXP. Each ISP peers with other participants at the IXP using BGP. Two switches at the IXP are required for redundancy, while ISPs use dual routers for redundancy or load sharing.

2.4.3 Laws and Government policy

2.4.3.1 Laws

The development of broadband infrastructure is regarded as a high priority in the GoM. The government considers broadband as essential to the country's socio-economic development. In an effort to reform the telecommunication industry in the mid-1990s, the government effectively liberalized telecommunication market sectors. Steps taken include partial privatization of the incumbent telecommunication operator (Telecom Mongolia) in 1995, creation of a regulatory authority in 2001, the Communications Regulatory Commission (CRC), and the introduction of competition in the mobile and Internet markets. There is a relatively high degree of competition between operators in the country's telecommunication markets, resulting in high levels of access and affordability.

The Universal Service Obligations Fund (USOF) was legally established by Mongolian Communications Law in 2001 and started operation in 2007. The USOF is a Government special fund to safeguard non-discriminatory access to common ICT services to people regardless of their location and living standards, especially people in rural and remote areas. Considering the ICT development trends and social needs, annual action plan for the USOF has been developed to reflect projects and activities to be funded and approved by the Prime Minister of Mongolia.

Besides this institutional framework, the GoM has enacted new laws or revised existing laws in recent years in a bid to strengthen its legal framework for telecommunication business and ICT. The Law on Communications came into effect in 1995 and has been

Core Intel (R) Xeon (R) CPU, 2G boot flash, and external compact flash 8G with CMP MGMT ports, which allows remote control.

41. Layer 3 (router based) is marketing concept used by Transit ISPs.

amended nine times. Most recently the GoM amended the law in May this year. Recent amendment has provided a clear administrative process for the Government organizations, including GoM, CITA, and CRC. In addition, the amendment includes promotion of fair competition, collaboration of cross-sectoral policy for ICT deployment, establishment of IT audit in Mongolia, and establishment of research institutions in ICT sector.

The law stipulates an individual licensing regime, not the general authorization regime most prevalent in developed countries. The spectrum management framework is defined by the Radio Wave Law, though these provisions need to be read in conjunction with the Radio Wave Law of 2005. The law includes a basic universal service framework and provisions for the Universal Service Obligation Fund. The amendment of the law in 2008 transferred the responsibility and operation of the fund to the CITA. Number portability and service provider selection are not set forth in the law. Also, the law provides no explicit rules for granting telecom operators the right of way over public and private properties.

The Universal Service Obligation Fund supports various programs and projects of five major fields for creating an enabling environment needed to deliver information and communications services to rural areas: mobile communication, Internet, post, radio, television services, and research and promotion. All communications service providers contribute 2 percent of their taxable revenues to the Fund in order to financially support rural and remote ICT access. In the first four years of operation, MNT 10.6 billion (USD 7.4 million) was collected, primarily from telecom operators, with the majority of this disbursed.

Following the regulation on 'Composition and Spending of Universal Service Obligation Fund in 2006, 'Regulation on Accumulation and Use of the USOF Resources,' approved by the Government Resolution No.151 of 2009, complying to Laws on Communications and Post as well as Government Special Funds authorized to collect fund resources from ICT service providers, equivalent to 2 percent of their income tax paid and donation, loans assistance. The USOF raised MNT 3.2 billion in 2018 and spent MNT 2.86 billion of funds to implement the projects listed in the table below.

< Table 35> USOF key activities by year

Year	Key Activities in Detail
2018	A total of 14 projects have been successfully implemented. · Mobile communication in rural and remote areas - 3 projects · Infrastructure - 3 projects · Radio and Television - 1 project · Research and Promotion - 7 projects
2017	A total of 8 projects have been successfully implemented. · Mobile communication in rural and remote areas - 1 project · Internet - 2 projects · Radio and Television - 1 project

	· Post - 1 project · Research and Promotion - 3 projects
2016	A total of 7 projects have been successfully implemented. · Mobile communication in rural and remote areas - 1 project · Internet - 2 projects · Post - 1 project · Research and Promotion - 3 projects
2015	A total of 5 projects have been successfully implemented. · Mobile communication in rural and remote areas - 1 project · Post - 1 project · Research and Promotion - 3 projects
2014	A total of 10 projects have been successfully implemented. · Mobile communication in rural and remote areas - 2 projects · Internet - 1 project · Infrastructure - 2 projects · Radio and Television - 1 project · Post - 1 project · Research and Promotion - 3 projects

Source: CITA, 2019

< Table 36> USOF collected and invested by year: 2014-2018

Year	Funds collected(MNT)	Funds invested(MNT)
2018	3,205,638,192	2,861,777,089
2017	2,235,647,597	2,200,245,307
2016	2,207,263,919	2,306,900,485
2015	2,658,686,145	1,207,252,787
2014	3,907,230,712	2,682,693,204

Source: CITA, 2019

Besides, the GoM enacted digital signature legislation (Law on electronic signature) aimed at promoting the development of a public key infrastructure in 2014 (Decree No. 45 from September 2014). Digital signature is a means to bind information to an entity. It is the foundation for trusted online transactions. In order to make digital signature legally binding and ensure the security of digital signature, the CRC has approved a number of regulations related to public key infrastructure such as “Common rules on the usage of public key infrastructure”, “Common rules on issuing certification”, ″Regulation for setting up certifying authority and conducting certification activities” and “Regulation on setting up digital signature database and its usage”. ITPTA issued

decree No. 04 from March 25, 2015 approving “Policy guidelines on the public key infrastructure of e-signature” and “Conditions and requirements to issue digital signature certificates”. In addition, the Cyber Security department of the General Intelligence Agency (GIA) of Mongolia has drafted a new law on information security and submitted for approval to the Parliament in February 2016. The first legislation regarding cybersecurity was included in the Mongolian Criminal Law in 2002, “crime against computer information.”

2.4.3.2 Sector organization and governance

The GoM directly controlled the fixed-line infrastructure network before 2005, and Telecom Mongolia used it exclusively. The ownership of fixed infrastructure was transferred to a state-owned company ICNC in 2005. The role of service provision remains in Telecom Mongolia but provides non-exclusive retail services through ICNC's network. The mobile sector is dominated by Mobicom, followed by Unitel with no big gap. To ensure the competitive market, the CRC works with the Unfair Competition Regulatory Authority (UCRA) to regulate. The UCRA issues the dominance designation, but the CRC carries out the market analysis and performs the related monitoring and tariff determination. The CRC has settled many disputes, mostly regarding interconnection and access issues. Also, a special council was established to coordinate inter-agency procedures. In practice, the CRC approves tariffs for the Telecom Mongolia and ICNC (designated as a dominant provider).

In Mongolia, there are three classes of license. A Class License is a type of general authorization in which the terms, conditions and/or obligations are common to all license holders.

- Class A (Network Construction and Operation) has six different categories covering fixed, mobile, internet and broadcasting, with further sub-divisions for fixed networks.
- Class B (Services) has 13 different categories covering fixed and mobile calls, wireless local loop, broadcasting, internet, VoIP, international internet connectivity, local area networks, cable TV and directories.
- Class C (Registration Certificates) covers internet cafés, hardware and software, end terminals, equipment manufacturing, consultancy, and third-party wholesale intermediaries.

The licensing process is routine, and the information requirements are defined in detail. It typically takes about a month to get a license. The licenses do not define the technologies to be used. Spectrum authorizations define services, in accordance with internationally defined bands for use. Once a license is obtained, permission for rights of way over public and private properties is not generally a problem, even though there are no specified procedures described in any official documents. Under the

circumstance of no clear provisions for rights of way and infrastructure sharing, the operators usually negotiate deals with the owners of public and private property and with the infrastructure providers. In practice, ICNC has the main infrastructure (ducts, transmission, local loops) which other service providers can lease. Sharing the infrastructure of other operators is not mandatory.; so, for example, each mobile operator builds its own masts instead of sharing them. It has been reported that ICNC wholesale rates have been set high, resulting in complaints from service providers.

2.4.3.3 Government policy

CITA is responsible for developing and implementing policies of communications, posts, broadcasting and information technologies. CITA is the ICT policy-making body of the GoM under the auspices of the Prime Minister. It has published several policy documents, setting the framework for the development of broadband infrastructure and service for several years. The National High-Speed Broadband (2011-2015) program has developed a legal and regulatory framework to support the expansion of high-speed broadband networks, including speed targets of 100 Mbps in urban areas and 50 Mbps in rural areas.

Government Policy for Development of Information and Communications 2017-2025 (Government Resolution No. 42, February 2017) specifies long-term development goals and sectoral goals by laying down a variety of measures for Mongolians to benefit from ICT. The government policy puts a special emphasis on Mongolia's global market competitiveness by putting knowledge-intensive advanced technology and export-oriented national industrial development first. Policy implementation is divided into two phases, 2016-2020 and 2020-2025, which presents eight strategic goals linked to other sectors. The eight strategic objectives include improvement of information and communications infrastructure and development of contents in local language. The key principles of this policy document are reflected in the ‘Long-term sustainable development policy of Mongolia – 2030’.

Mongolia Sustainable Development Vision 2030 is the national development vision to be achieved by 2030, making SDGs the mainstream of national development policy. It was approved by the Mongolian Parliament as Resolution 19 of 2016. The Vision 2030 articulates that by 2030, Mongolia aims to be one of the best middle-income countries on a per capita basis. According to the vision, the country aims to maintain a stable multi-sectoral economic and ecological balance and achieve a society dominated by a middle- and upper income class with a stable and democratic governance structure. The long-term vision is planned to be implemented in three phases of five years from 2016, 2021 and 2026, respectively. The vision consists of four key pillars: sustainable economic development, sustainable social development, environmental environment, and governance for sustainable development. The Vision 2030 delineates sustainable development objectives in the information and communications sector as well, such as

development and utilization of infrastructure, improving access, removing digital divide and enabling public access to broadband.

In detail, Target 2.1.5. (Energy and Infrastructure) in the Vision 2030 aims to expand the reach of information technology and telecommunications, expand high-speed network and its usage in rural areas, launch national satellites, presenting the specific phase-by-phase goals shown in the following table. Phase II is particularly relevant to the formulation of Mongolian National Broadband Strategic Plan 2021-2025 because Phase II in planning period coincides with the Broadband Strategic Plan. The Broadband Strategic Plan 2021-2025 should be based on the long-term strategic direction and development priorities presented by Phase II, a high-level plan focused primarily on strengthening the foundation of the economy to set the stage for future economic growth and social change.

< Table 37> Objective 7 of Vision 2030 by phase

Phase	Planning Period	Key Targets
Phase I	2016-2020	Provide high-speed internet connection for 70 percent of the population, enforce the same price/tariff across all territories, and increase the information flow speed running through the high-speed network connecting Asia and Europe by 10 times.
Phase II	2021-2025	Provide high-speed Internet connection for 90 percent of the population, ensure that at least 70 percent of the rural populations use broadband Internet services, and digitize no less than 50 percent of public services.
Phase III	2026-2030	Provide high-speed Internet connection for 95 percent of the total population, digitize no less than 85 percent of public services, and launch and use a national satellite.

Source: Mongolia Sustainable Development Vision 2030, p. 21

In addition to these long- and medium-term policies, the GoM has taken a variety of policy actions to make Internet services cheaper, drive more investment in network expansion, and provide more relevant online services. Decree No. 123 from 2016 of the Government of Mongolia on “Some measures to deliver Internet services in Mongolia at the same price and tariffs” and the order No. 40 from 2016 by Chairman of ITPTA on “Policy guidelines on fixed broadband Internet services” have been issued and are in effect. Application of the same price and tariffs regardless of geographical location is specified in the long-term sustainable development goals of Mongolia. “The Policy guidelines on fixed broadband internet services” No. 40 approved by the ITPTA, 2016, define that “fixed broadband Internet is a connectivity which allows information download speed be not less than 1Mbps and information upload speed be not less than 300 Kbps.”

Furthermore, the GoM has created an enabling and favorable legal environment to introduce mobile communication system and technology of next generation in Mongolia. The order No. 10 from 2015 issued by Chairman of ITPTA approved “Policy guidelines on

introduction of mobile communication system of next-generation in Mongolia" and order No.68 from 2015 issued by CRC approved "Regulatory guidelines on introduction of mobile communication system of next generation." As a result, mobile operator Unitel first introduced 4G LTE technology in Ulaanbaatar in April 2016.

Due to its geographical nature, the lack of terrestrial backbone networks in northwestern and southeastern Mongolia, satellites play an important role in connecting Mongolia and serving remote areas. Against this backdrop, the National Satellite Program (2012-2016) was implemented after the approval by decree No. 137 from 2012 by the Government of Mongolia. One of the main technologies to deliver all types of communications services throughout the vast territory equally, efficiently and with low expenses is to have a geostationary satellite. Currently, there are about 10 public and private organizations, which provide satellite communication services, and these services tend to expand further in the future. As part of building the capacity of domestic universities to prepare domestic professionals, Mongolia introduced master's degrees program on Satellite communications in 2016 at the School of Information and Communications Technology (SICT) of the Mongolian University of Science and Technology (MUST) and the School of Applied Sciences and Engineering of the National University of Mongolia (NUM).

The GoM, as an anchor tenant of broadband infrastructure, has actively promoted the use of ICTs in the government such as e-Government, e-Education, e-Health, etc. Services such as health, education, and government services will greatly increase the demand for broadband services. The investments on broadband services supported by these anchor tenants contribute to achieve improved connectivity and service delivery to the wider community.

e-Government Programs 2012-2016 (Government Resolution No. 101, April 2012) had been implemented to achieve more transparent operation of government organizations, more open and greater citizen participation in public policy development, more convenient delivery of public service at no additional burden, promotion of e-service and enhancing quality of public services. The key flagship projects included 'Public services digital machines or e-Kiosks (Tuts machine)', 'Development of modules for integrated web portals of public services', 'Digital system of Public services', and 'Integrated center of public services.'

Since the e-Kiosk machine was first introduced to provide easy and convenient access to public services in 17 locations in Ulaanbaatar city in June 2013, additional 108 e-Kiosk machines were procured with public funds, installing in 77 locations in Ulaanbaatar city and 33 in Aimag centers. Based on mobile technology, citizens can access public services, making payments for service either by cash or by card. Citizens can inquire or instantly view population registration, property registration, corporate registration and tax information or request services from the e-Kiosk machine by means of fingerprints and citizen ID cards. Currently, 28 services are available through e-Kiosk. In 2018, more than 2.78 million cases of services were provided through the e-Kiosk machines.

< Table 38> Number of e-Kiosks and services available

	Number of e-Kiosks	Number of Services
Ulaanbaatar	77	28
Aimag Centers	33	
Total	110	

Source: CITA, 2019

< Table 39> 28 Public services offered by e-Kiosk

General Authority for State Registration	General Department of Taxation Authority, Customs General Administration, Mongol Bank, and national Police Agency, Ministry of Road & Transport Development	General Authority for Social Insurance, Transportation Agency of UB, NDC, Ministry of Energy, General Executive Agency of Court Decision, Ministry of Education, Culture, Science and Sports
1. Reference of birth registration 2. Reference of citizen identity card 3. Reference of residence address 4. Unmarried reference 5. Marital status reference 6. Reference of divorce registration 7. Reference of Property ownership 8. Immovable property reference 9. Reference of legal entity registration 10. Reference of no legal entity ownership	1. Inquiries on taxes 2. Reference of amount owed to Customs authority 3. Reference of exchange rate 4. Renewal of driver's license 5. Reference of driver's license 6. Reference of commercial driver's license 7. Reference of vehicle ownership 8. Reference of vehicle ownership/previous history	1. Reference of Social insurance premium 2. Pension rights 3. Employer 4. Personal account of social insurance 5. Issuing truck driving license for class E and C 6. License of truck vehicle 7. Access to e-system of public services 8. Electricity bill Payment 9. Reference of no debt and obligation record 10. Reference of educational document

Source: CITA, 2019

< Table 40> Number of services provided by e-Kiosk

Year	2015	2016	2017	2018	2019*
No. of services	1,228,445	1,912,959	2,252,459	2,781,606	2,243,143

* As of the end of September 2019. Source: NDC, 2019

In addition, citizens can be provided public services at the nearest service centers and organizations, and can send comments, suggestions, complaints and applications to ministries, agencies and public organizations. The General Authority for State Registration, the National Statistical Office of Mongolia, the Customs General Administration and General Department of Taxation, Ulaanbaatar Electricity

Distribution Network - a state-owned company, Ulaanbaatar city, General Police Department of the National Police Agency, the National Data Center and other organizations gradually introduced 18 types of services to citizens during 2013-2015.

Furthermore, to identify the priority public services which should be put online, a survey was conducted among legal entities, organizations, and citizens of the Ulaanbaatar city. A total of 25 services was selected and they were available on ezasag.mn portal system.[42] A driver's license, vehicle registration, migration and social security related services of government used to be provided by www.ezasag.mn portal site. Furthermore, the list of 496 public services to offer online was approved by the Government of Mongolia by the decree No.259. The decree calls for renewal of the list of public services linking to the state's electronic information exchange system and the list of state services to be provided electronically.

< Table 41> Popular e-Government services

Rank	Name of Service	Ministry/Agency
1	Reference of citizen identity card	General Authority for State Registration
2	Reference of Social insurance premium	General Authority for Social Insurance
3	Reference of resident	General Authority for State Registration
4	Immovable property reference	General Authority for State Registration
5	Marital status	General Authority for State Registration
6	Reference of Driver's license	The National Police Agency
7	Unmarried reference	General Authority for State Registration
8	Reference of birth registration	General Authority for State Registration
9	Reference of property ownership	General Authority for State Registration
10	Renewal of driver's license	The National Police Agency

Source: CITA, 2019

42. The portal is out of service and is now under renovation.

Currently, the Cabinet Secretariat (CS) of the Government of Mongolia is implementing Smart Government Project to improve access, transparency, and efficiency of public services leveraging ICTs. Digital transformation of the government and delivery of citizen-centered service are priorities of the GoM. The Parliament of Mongolia approved a law on Smart Government Project Financial Agreement between Mongolia and International Development Association in 2016. The project comprises of four components. The first component, aiming to enhance civic engagement and citizen feedback mechanisms, comprises of following activities: technical assistance; investment support; and support government to develop a business analytics (BA) program. The second component, enabling foundations for smart government, supports the public agencies put in place a robust framework for service delivery and expedites the pace of eService delivery in response to citizen's needs.[43] The third component helps to develop a vibrant open data ecosystem defined by a sustainable pipeline of high-quality data, continuous engagement with user communities and demand-driven, innovative co-creation.[44] The fourth component, project implementation support will help to establish the project implementation unit (PIU) at the Cabinet Secretariat (CS).

Within the scope of the project, GoM is committed to enhancing capacity of the Government Data Exchange Center (GDEC) by developing the Government Data Exchange System (GDES), named as XYP (Exchange Your Platform), and upgrading fundamental infrastructure for the XYP GDES. One of these tasks is to develop an open-source platform for the state information exchange system as a technical solution. Developed with the ESB (Enterprise Service Bus) architecture of the information exchange system, it can quickly and easily provide safe and secure functionalities and information exchange between government agencies.[45]

2.5 Summary

While not all components normally required to support fair competition are completely clear in the legal or regulatory framework, Mongolian telecommunication market is fairly competitive. The incumbent service provider has been partly privatized, although the main infrastructure is still state-owned. The mobile sector continues to be a main growth area, increasingly expanding mobile broadband services. Even with slow growth,

43. The second component includes technical assistance for design & implementation of National Enterprise Architecture (NEA), technical assistance and investment support for NDC (Disaster recovery center), investment support to establish an Innovation Support Program, and eProperty Registration System (ePRS).

44. The third component includes design and implementation of an Open Data Initiative and data production capabilities of the National Statistics Office (NSO).

45. According to the Decree A/61 dated December 28, 2016 by the Director of Communications and Information Technology Department, "The National Information and Exchange Policy Guidelines" has been finalized by the National Data Center with the establishment of XYP data exchange platform among government organizations, 2016-2020.

many service providers offer fixed broadband.

Based on the assessment of current state of broadband development in Mongolia, the country needs to rebalance towards demand-side issues. Contrary to the supply push approach, expanding broadband infrastructure is only part of the challenge. More work needs to be done to address network performance, useful applications, digital skills and locally relevant content. There is no shortcut to creating a balanced ecosystem for broadband. It is very unlikely to succeed by improving one or two dimensions of broadband ecosystem. As seen in the most successful countries which have created a sustainable ecosystem balancing supply and demand, it is important to cultivate a virtuous circle of fostering broadband roll-out and take-up, reinforcing each other. In other words, measures to increase the availability of broadband to end-users and measures to create the demand side such as increasing citizens' interest in broadband services and fostering take-up should be undertaken at the same time in a balanced way. Policy measures such as increasing the amount and attractiveness of digital content and services are required on the demand side to facilitate the use of broadband by as many users as possible Low take-up and demand will undermine the business case of any broadband network. Fewer users means that networks incur correspondingly higher cost because all the costs are spread over a smaller user base, making them relatively more expensive to build, maintain and operate. Thus, it is important for the GoM to focus its attention on developing policies that not only facilitate and encourage the building of broadband networks, but to ensure that the largest number of citizens can and do use them.[46]

3. Assessment of Broadband Ecosystem in Mongolia

3.1 Applications

Applications consisting of function-specific software to perform certain tasks are increasingly driving broadband use and development.[47] Users benefit directly from the applications and content they use through broadband networks. Applications enable people to buy and sell products, interact with the government and find information of their interests. Broadband applications can also help businesses improve productivity and competitiveness. These productivity gains and enhanced competitiveness will surely benefit the whole economy. As shown in Table 13, both Mongolian consumers and businesses are increasingly turning to applications and content that utilize Youtube, Facebook, and other social media. YouTube and Facebook take a large portion of the

46. World Bank Group, Broadband Strategies Toolkit, 2014, p. 9

47. Ibid, p.35

total traffic over mobile broadband connections. Around seventy percent of Mongolians are active social media users. Among them, more than 95 percent are mobile users. Indeed, social networking applications are driving mobile broadband use in Mongolia. The social network services can bring connectivity for creating relationships with other people in the country with vast distances and sparse population. Checking Facebook and reading news are the top two online activities for Mongolians. However, Mongolians still have difficulties finding useful local applications and local content in local language online. There are not many web sites in native language.

As one of the anchor tenants of broadband, the GoM has actively promoted e-Government, providing various online services through e-Kiosk machines and portal system. Also, e-participation portal (www.11-11.mn) was established to enable the Mongolian citizens to send opinions and comments file complaints about government services. In addition, other key e-Government applications including e-procurement, e-immigration, e-Tax, e-Visa were developed. Government initiatives, like the e-Mongolia National Program in the mid-1990s and the e-Government Programs 2012-2016, have contributed significantly to raise e-Government awareness and adoption across the country. Despite the increased awareness and availability of e-Government services, the level of take-up of electronic services is still not high, which needs to increase user adoption. Besides, as the UN e-Government Survey shows, Mongolia is experiencing a decline in the global e-Government ranking.

Looking into e-Commerce, Mongolia's e-Commerce market is gradually emerging as the support ecosystem strengthens.[48] The progress is clear thanks to government support and incentives. For instance, in a bid to promote e-Commerce in the early 2000s, 'Tentative Program on E-commerce in Mongolia' was implemented to increase competitiveness of businesses by promoting e-Commerce that creates a new environment where traders do business regardless of location and time.

An effective ecosystem that makes up an e-Commerce business is essential to the success of e-Commerce. In terms of the individual components of the ecosystem, the number of smartphone users in the country reached more than 2.4 million in 2017, corresponding to 64 percent of the total population. In addition, a total of 2.2 million people regularly uses social media. The proportion of individuals with financial institution account is around 93 percent. Mongolian commercial banks offer a wide range of online payment options: Internet banking, mobile payment, and smartphone banking systems. Meanwhile, well-developed delivery infrastructure is important for the development of e-Commerce. However, about half of the population in Mongolia cannot receive postal delivery at home. Poor delivery infrastructure leads to late deliveries, damage or loss of parcels, and poor return procedures.[49] To resolve the

48. E-commerce Development Center estimates that 25 percent of all Mongolian consumers shop online.

49. A.T. Kearney 2011

delivery problem, Mongol Post started using What3Words[50] in 2016, becoming the world's first national mail carrier to use it. In addition, consumer protection and data protection legislation should be in place to ensure confidence in e-commerce.

3.2 Devices

The number of devices continues to grow and the variety of devices connecting to the Internet increases. Desktop computers, various devices including laptop computers, tablets, smartphones, e-readers, and handheld gaming devices are connected to the Internet. In Mongolia, the national PC penetration rate increased from 14% in 2011 to 22.3% in 2012, and steadily increased afterward. In 2016, more than 35% of households own personal computers in Mongolia. However, the proportion of households with computer is lower than the Asia Pacific and world average. On the other hand, mobile phone subscriptions are much larger than the total population. As of 2019, about 30 percent of internet traffic in Mongolia was accessed with mobile phones, showing that mobile is the preferred channel of interaction for Mongolians.

Due to the low level of income, it seems that relatively high import tariffs on PCs and ICT products led to a low computer penetration rate, which may prevent Mongolians from reaping the benefits of ICT. Mongolia imposes a five percent import tax on most imported goods, but PCs and other ICT products such as tablets and mobiles are subject to 15.5 percent import tax including 10 percent VAT.

< Table 42> Percentage of households with computer by year

Year	2011	2012	2013	2014	2015	2016
Percentage of households with computer	14.0	22.3	22.3	30.3	34.3	35.8

Source: WEF, Networked Readiness Index 2012-2017

< Table 43> International comparison of households with a computer in 2016

	Mongolia	Asia & Pacific	World
Percentage of households with computer (%)	35.8(23.6*)	37.8	46.6

Source: ITU (as of June 2017), * ITU statistics

< Table 44> Number of Smartphones: 2015-2018

Year	2015	2016	2017	2018
No. of Smartphones	1,927,797	2,356,627	2,439,236	3,302,052

Source: CRC, 2019

50. What3Words is an online application that divides the world's surface into 57 trillion 3-square meter areas, assigning each a unique three-word sequence. That sequence then becomes the location's address.

The adoption of new technologies such as radio-frequency identification (RFID) and Internet of Things (IoT) is gradually increasing in Mongolia and these technologies will enable millions of objects to connect each other, machines, and humans. IoT, for instance, will create whole new classes of devices, increasing the number of IoT devices exponentially. Thus, IoT involves extending Internet connectivity beyond standard devices, such as PCs and smartphones. IoT has fundamentally different requirements on broadband networks. With more devices going online as a result of the IoT, Mongolia is advised to prepare network deployment for efficient transmission and exchange of data in advance.

3.3 Networks

The basic elements of supply in the broadband infrastructure consist of at least four levels: 1) international connectivity; 2) domestic backbones; 3) metropolitan connectivity; and 4) local connectivity.[51] For international connectivity, Mongolia is connected by terrestrial and satellite international links. Each of the ISPs has its own international connection to the neighboring countries through wholesale IP transit providers. The price of international bandwidth per Mbps was MNT 150,000 (about USD 56) at the end of 2016. Prices continued to fall, dropping to MNT 65,000 (about USD 25) per Mbps in 2018, as shown in Table 34. There are international fiber connections at Sukhbaatar on the northern border with Russia, and Zamiin-Uud in the southern border with China. They form part of a relatively low-latency terrestrial path between Europe and Asia via national networks in Russia and China.

< Table 45> Wired and wireless coverage

Wired/Wireless Coverage	No. of Soums covered	% of Soums covered
Wired	102	30.8
Wireless	331	100

Source: CITA, 2019

For domestic backbones, constructing a backbone network covering the entire country is a top priority for Mongolia.[52] Multiple operators provide fiber connectivity, although most network infrastructure is concentrated along the country's north-south railway corridor. Mongolia's domestic fiber optic networks span more than 43,000 kilometers. The network of state-owned ICNC covers 17,989 kilometers. In the west, the network links Ulgii, Hovd, UlaanGoM, Ulaistai, Altai, Murun, Bulgan, Tseterleg, Arvaihkeer, Bayankhongol, Dalanzadgad, and Mandalgobi. In the east, it connects Ulaanbaatar, Undurkhaan, Baruun-Urt, and Choibalsan. Mobicom Networks and Skynetworks (Skytel and Unitel) each operate approximately 11,000 kilometers of network.

51. Kim YS, Kelly, and Raja, Building Broadband: Strategies and Policies for the Developing World, 2010

52. Out of 331 Soums, there are 11 Soums not connected to the National Backbone yet.

Wireless technology has been more extensive in Mongolia and mobile phones have increasingly become common in the country. Wireless technology has helped Mongolia increase access to telecommunications, bypassing fixed access infrastructure. 2G covers all Soums and the total population in Mongolia, while 3G covers the total number of Soum centers, though covering 77.7 percent of the population. Since the introduction of 4G in April 2016, 4G coverage is spreading across the country rapidly. 4G service is currently available to 45.4 percent of the population and more than 90 percent of Soum centers. Unitel offers the highest coverage of both population and region, followed by Mobicom.

< Table 46> Percentage of population and Soums covered by mobile network

Mobile Technology	% (population)	% (Soums)
2G	100	100
3G	77.7	100
4G(LTE)	45.4	99.39

Source: CRC, 2019

< Table 47> Mobile coverage by operator

Name of Operator	Technology	% of population covered	% of Soums covered
Mobicom Corporation LLC	GSM, 3G	32.1	41.4
	4G/LTE	20.1	66.7
Unitel LLC	GSM 3G	20.2	98.2
	4G/LTE	23.9	97.8
Skytel LLC	CDMA2000	19.5	81.2
	4G/LTE	0.8	-
G-Mobile LLC	3 G/CDMA2000	5.9	43.2
	4G/LTE	0.6	-

Source: CRC, 2019

The current major challenge facing Mongolia is how to overcome the large urban/rural broadband divide. The lack of reliable broadband infrastructure and affordable service in rural and remote areas will impede Mongolia's digital future. Users in rural and remote areas without broadband connection are less likely to be attracted to broadband services because the prices are higher and levels of service lower than for urban users. By the way, despite of the GOM's efforts to lower wholesale Internet tariff and transmission tariff, the dominance of the state-owned infrastructure company ICNC over fiber optic networks in rural areas has placed a high price on rural transmission networks. The company continues to hold a dominant role in rural fiber deployment and charge expensive fees for rural transmission networks. The GOM should further encourage the operators to deploy networks especially in rural areas, which facilitates fair competition of rural transmission networks and ensures coverage in rural areas. Also, Private network operators must be able to roll out their fiber alone or in a consortium and compete for fiber optic backbone infrastructure. More importantly, policy makers and regulators should bear in mind that protecting revenues of state-owned infrastructure company could act as a stumbling block in providing broadband for the rural and remote

areas. Wholesale access to network infrastructure should be provided effectively on fair and transparent terms at reasonable prices, not discriminating against any operators.

Separation of the incumbent operator into services and infrastructure was originally intended to facilitate the sharing of networks and facilities along with ensuring cost-effective access to remote corners of Mongolia with a large territory but sparse population. This separation was expected to lower rural fiber optic charges and bring fair competition. In this context, there should be no concern that a preoccupation or barrier to entry, rather than fair competition, will create a monopoly market and high prices in the rural backbone. Thus, it is needed to increase the transparency between the cost of operating the network and the costs of the services provided to the operator by the state-owned company.

3.4 Adoption and take-up

Internet users in Mongolia are estimated to reach 2.2 million, corresponding to 70 percent of the country's population. However, it is not clear that the statistics is consistent with the definition of Internet users which refers to the number of people who have used the Internet in the last three months for any location. Although the number of fixed subscribers increased steadily, fixed subscribers were amounted to about 350,000 in 2018. Subscription to fixed broadband is available mainly to urban areas, especially Ulaanbaatar, with high population density. The latest value for fixed broadband penetration in Mongolia was around 10 percent. Overall fixed broadband penetration is expected to remain relatively low compared to wireless broadband.

By contrast, there has been a rapid expansion of mobile broadband internet services on the back of the large-scale launch of 4G services. Mongolia has seen a significant increase in mobile broadband penetration over the last three years since 2016 from 103 percent to 130 percent in 2018, recording an annual average growth rate of 6.9 percent. Although growth will slow, mobile broadband adoption will continue to increase across different demographic groups and regions. Although the mobile broadband divide is less than fixed broadband, 57.6 percent of mobile broadband subscribers are concentrated in Ulaanbaatar.

< Table 48> Number of mobile subscribers and subscription rate by year

(unit: thousands)

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018
No. of Subscribers	2,510	2,942	3,375	2,876	3,027	3,068	3,368	3,886	4,222
Subscription Rate	92.55	106.55	119.93	100.30	103.53	103.07	111.24	126.35	130.38

Source: CRC, 2019

< Table 49> Mobile broadband divide

	Region/Year	2018	%
Number of mobile broadband subscribers	Ulaanbaatar	2,297,525	57.6
	Others	1,690,274	42.4
	Total	3,987,999	100

Source: CRC, 2019

3.5 Local content

Motivating people to use broadband services is to make them expect and convince that broadband will enrich their lives, provide convenience, provide entertainment, and improve their business, which is all related to application and content.[53] In this regard, broadband take-up and the availability of compelling content are closely related. The availability and use of local digital content will increase broadband service adoption, creation of cultural content, development of sectoral applications, and new business opportunities for industry. Ensuring a sustainable supply of local, relevant digital content creates incentives and reasons for subscribers to go broadband. Thus, content is an imperative for driving broadband adoption for those who are not currently connected.

In the past few years, the use and development of digital content has been increasing in Mongolia. As a result, public and private services such as e-library, finance, entertainment, and transportation are increasingly becoming accessible online and going mobile. Furthermore, demand for high-quality video and entertainment content is a major factor in driving the demand for high capacity broadband connection.

Six major content categories constitute the digital content and services ecosystem - entertainment, information, utilities (including e-Government services), business services, sharing platforms, and communications. And four major players have a significant role in the development of the ecosystem: governments, brands, operators, and content developers. Among the six categories, the primary forms of content motivating people to get connected are information and entertainment, but the secondary motivators include utilities, such as e-Government services.

Looking at the experience of Korea, the country provides an example of government involvement in content generation. The Korean case indicates that the development of digital content ecosystem is supply-driven, suggesting the need to overbuild content and services in the early stages. Entertainment and information content in local language were the primary drivers of user growth in Korea, with utilities playing an important secondary role. Content ecosystem tends to reach its critical mass due to the network effects of content and platform sharing. Needless to say, a strong content ecosystem

53. The World Bank Group, Broadband Strategies Toolkit, 2014, p.40

requires strong fixed and mobile infrastructure. Additionally, the widely used devices and hardware components have a significant impact both on the type and nature of the content being consumed and on the frequency of consumption. Finally, support for local language and character rendering by major operating systems and platform vendors also plays a critical role in driving local content ecosystem.

Given the low level of household spending per capita and the advertising spending, sustainability could be achieved through government spending in Mongolia. The GoM should play a key role in creating momentum for widespread broadband adoption by providing compelling services such as e-Government, e-Education, e-Health, etc. These would attract Mongolian citizens by reducing the distance and time barriers to using government services, and these e-services would also improve the efficiency of the government. For other content categories such as entertainment and sharing platforms, the government can be a trigger, providing cost-saving opportunities for content developers and providers. In this vein, CITA should support the creation and, more importantly, the local hosting of local content to ensure sustained usage. Being landlocked and not close to submarine cable landing points, Mongolia should pay relatively high cost of international Internet transit. To provide end-users with both more capacity and less latency, CITA should actively engage content delivery network (CDN) service providers to host their caches in Mongolia.

3.6 Comparison of policies between Mongolia and the WB Recommendation

Approaches to broadband adopted by each country include strategies that lead to the formulation of policies and regulations. These strategies tend to evolve with the maturity of broadband market, considering changes in both supply and demand. They create the base for policy design and implementation in the initial stage by making the strategic framework for executing policies and regulations. Policies and programs for broadband market development can be split into three stages that somewhat overlap. The three stages follow a logical sequence of promotion, oversight, and universalization.[54] As broadband market grows, the role of government evolves from market promotion to oversight to universalization of broadband service. The initial focus is on the supply-side promotion combined with a continued focus on regulation over competition to ensure that markets remain fair and efficient. In the later stages, however, strategies shift more towards universalization, warranting that broadband is both accessible and used widely.

The GoM has focused on developing a national broadband backbone network and establishing an enabling legal environment for competition and investment by

54. Yongsoo Kim, Tim Kelly and Siddhartha Raja, Building Broadband: Strategies and Policies for the Developing World, GICT Dept. World Bank (Jan.2010), available at http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/282822-1208273252769/Building_broadband.pdf.

facilitating market entry. The government has also taken various policy measures to further broadband infrastructure and service corresponding to each development stage of Mongolian broadband market. In this sense, a benchmark approach can assist in identifying policy areas for further improvement by comparing the policy actions taken by the GoM with policies recommended by the World Bank for developing the broadband ecosystem according to development stage. The result is shown in Table 50.

< Table 50> Comparison of policies between Mongolia and the WB Recommendation

	Early stage: Promote	Mass market: Oversee	Universal service: Universalize
Goal	Focus on promotional policies as a pump-primer to spread broadband networks	Facilitate competition through consistent, facilitating regulation	Universalize broadband service as the market grows Networks
Networks	☑ Develop an enabling environment through policies and regulation that promote investment and market entry (Action Program of the Government of Mongolia 2016-2020, National Broadband Program 2011-2015, State Policy on the Development of ICT 2017-2025) ▽ Reduce administrative burdens and provide incentives and subsidies for R&D, pilots, and network rollout (Order No. 10 from 2015 by Chairman of ITPTA on "Policy guidelines on introduction of mobile communication system of next generation', Order No. 40 from 2016 by Chairman of ITPTA on "Policy guidelines on fixed broadband Internet services") ☑ Allocate and assign spectrum for wireless broadband services (4G bands for four mobile operators from 2016)	▽ Consider infrastructure sharing, including local loop unbundling (Separation of service from infrastructure, Infrastructure sharing procedure by CRC, Fiber optic cable swap and lease among the operators, Passive infrastructure sharing in practice) ▽ Reallocate spectrum to expand available bandwidth (Reallocation of TVWS)	☐ Undertake deployment of open access to broadband networks in rural or remote areas, using public/private partnerships, as appropriate ☐ Coordinate access to rights-of-way Services
Services	☑ Provide broadband networks to schools, government agencies, etc. government as an anchor tenant (Government agencies and most schools are connected to the Internet, 220 primary, 48 secondary, 15 tertiary health institutions are connected online.) ☐ Standardize and monitor service quality	▽ Create an enabling environment for intra- and intermodal competition (Law of Mongolia on Competition 2010, Government Agency for Fair Competition and Consumer Protection was established in 2005, but no specific law on telecommunication competition) ☑ Ensure non-discriminatory access for service, application, and content providers (Cost-based general principles of interconnection with ICNC in place)	☐ Consider expanding universal service obligation to include broadband

Applications	▽ Promote government-led demand aggregation (Ministry of Education, Culture, and Sports, Ministry of Health) ▽ Government agencies as early adopters and innovators ▽ Provide e-Government and e-learning applications (e-Kiosks, e-textbooks) ☐ Promote creation of digital content ☐ Develop local content and hardware sector (Local content development strategy in progress)	☐ Support secure, private, reliable e-commerce transactions ☑ Introduce intellectual property protections (Patent Law of Mongolia, 1993 (amended in 2016) Law of Mongolia on Trademarks and Geographical Indications (last amended in 2010), Law of Mongolia on Copyright and Related Rights (last amended in 2006, Intellectual Property Office)	▽ Develop advanced e-Government programs (National program on unified registration system 2008-2012, National e-Government program 2012-2016, Smart Government Project 2015-2020) ☐ Offer grants to community champions and broadband demand aggregators
Users	☐ Provide low-cost computers and other user devices, such as in education (One Laptop per Child on pilot) ☐ Deliver digital literacy programs	☐ Promote ethics on information use	☐ Expand universal service programs to underserved communities ☐ Construct community access centers ☐ Provide subsidies for poor households to buy user devices (such as computers)

Source: Adapted from Yongsoo Kim, Tim Kelly and Siddhartha Raja (2010)

Note: ☑ fully adopted and implemented
▽ partially adopted or implemented
☐ never implemented or under review
( ) Specific actions taken for the corresponding item above

In summary, among the phased broadband policies proposed by the World Bank, Mongolia did not review or implement promotion of creation of digital content, development of local content, and delivery of digital literacy programs in the first phase. In the next phase of mass market, network dimension such as infrastructure sharing and reallocation of spectrum to expand available bandwidth was partially implemented but supporting e-commerce transactions in applications dimension was not reviewed or implemented. In the final phase of universal broadband service, deployment of open access to broadband networks in rural or remote areas through public/private partnerships, expanding universal service obligation to include broadband, expanding universal service programs to underserved communities, and providing subsidies for poor households in user dimension have been neglected. Given the current state of Mongolia, promoting creation of digital content, development of local content, support of secure, private, and reliable e-commerce transactions should be included in the National Broadband Strategic Plan 2021-2025.

4. Framework of National Broadband Strategic Plan 2021-2025

A tentative structure of strategic planning is proposed so that the GoM can proceed immediately to the next step without spending too much time on the structure of the National Broadband Strategic Plan after this TA. There is no formal structure of strategic plan or master plan. Every country will have their own individual approach and style. In order to demonstrate widely accepted common components of broadband strategic plan, a typical table of content is provided.

Message from the Prime Minister

Foreword from the Chairman of CITA

Message from PM and piece of writing from the Chairman of CITA can be placed at the beginning of the new Broadband Strategic Plan to show their commitment and leadership in broadband. These messages signal their support for the new Broadband Strategic Plan.

Executive Summary

Executive summary summarizes the whole Broadband Strategic Plan in a way that readers can rapidly become acquainted with a large body of material without having to read it all. It usually contains a brief statement of the problem or proposal covered in the National Broadband Strategic Plan 2021-2025, background information, concise analysis and main conclusions.

National Broadband Strategic Plan Team

Expressing acknowledgement of a group of individuals assembled to formulate and contributed to the Broadband Strategic Plan.

List of Figures

List of Tables

List of Abbreviations

List of abbreviations may be helpful to the reader if abbreviations are used extensively in the National Broadband Strategic Plan 2021-2025.

National Broadband Strategic Plan 2021-2025

I. Introduction

Define broadband concept and describe need for and purpose of a new National Broadband Strategic Plan and describe the purpose of the National Broadband Strategic Plan 2021-2025. The purpose of the Broadband Strategic Plan 2021-2025

is to set out a vision and mid-term strategy that should be immediately undertaken to further advance broadband in Mongolia, with the objective of creating a dynamic high-speed broadband infrastructure and service to meet the needs of the Mongolian citizens in a modern digital economy.

II. National Broadband Strategic Plan 2021-2025 in the national policy context

State how the National Broadband Strategic Plan 2021-2025 is related to higher plans, such as Mongolia Sustainable Development Vision 2030 and the State Policy on the Development of Information and Communications Technology (2017-2025) and explain why broadband is important in the context of sustainable development of Mongolia.

III. Value and potential of broadband

Describe the power of broadband by recent research, which shows that broadband fosters GDP growth, creates jobs and stimulates innovation, while also enabling improvements in government services, education, health care and other social services.

IV. Current state assessment for broadband in Mongolia

V. Building the Mongolian broadband ecosystem

Identify building blocks of broadband ecosystem and discuss how to build a virtuous circle of interrelated components for broadband development in Mongolia. It might be useful to use a figure representing the relationships among the key building blocks of broadband ecosystem.

VI. Vision

A description of what GoM would like to achieve or accomplish for broadband within the planning period, serving as a clear guide for choosing future courses of action

VII. Guiding principles

To create enabling and favorable conditions for an advanced and universally accessible broadband infrastructure and service that promote social and economic development and inclusion, state some principles that guide the implementation of the National Broadband Strategic Plan 2021-2025. Example of guiding principles include:

- *Openness at the infrastructure level: open and non-discriminatory access for multiple services providers;*
- *Service and technological neutrality: no preference to any particular type of technology, while ensuring the use of common standards;*
- *Universality: universal access to broadband services, including a focus on*

services in rural and remote areas and communities;

- *Equality: bridging the digital divides between those with the resources and capabilities to access broadband services and those who are marginalized from services;*
- *Inclusion: ensuring that there is not only equity in access but also in the capabilities to enable the more equitable use and production of broadband services, applications and content;*
- *Collaboration: public and private sector collaboration to optimally leverage existing infrastructure for development of broadband and cross-agency cooperation and collaboration to overcome the intrinsic and complex interdependence of broadband ecosystem; and*
- *Competition: service and facility competition to drive innovation and lower costs*

VIII. Key strategic areas with catalogue of priority projects

Organize key strategic projects or policy actions based on the major components of broadband development. Priority projects are clustered around relevant key strategic thrusts or flagships. This TA recommends eleven strategic areas as follows:

a. *Completely connected Mongolia*
b. *Connecting Mongolia cost-effectively*
c. *Preparing for 5G*
d. *Reducing the costs of delivering broadband services while improving quality of service by establishing additional IXP*
e. *Increasing caching capacity to save international bandwidth*
f. *Launching free public Wi-Fi in public places*
g. *Establishing information system for facilitating infrastructure sharing*
h. *Preferential tariffs for disabled/disadvantaged groups*
i. *Strengthening ICT Training*
j. *Developing more useful applications*
k. *Promoting local content*

IX. Implementation structure and performance indicators

The policy goals of the National Broadband Strategic Plan 2021-2025 and the related policy actions are very challenging. It is therefore crucial for stakeholders to start acting immediately with strong commitment to accomplish the goals. Moreover, collaboration and coordination among stakeholders are essential to implement the shared targets jointly set in the Plan. As the lead agency of the Plan, the CITA will play a key role as the focal point for implementation and monitoring progress.

To expedite implementation of the Plan and to facilitate collaboration and coordination, the establishment of Broadband Steering Committee or National Broadband Committee under the leadership of the Prime Minister is recommended,

consisting of high-level representatives of the key Government Ministries and industry stakeholders, including telecommunication operators. Under the Steering Committee, multiple subcommittees and working groups need to be organized, as appropriate.

Also, to measure progress and achievement of policy goals, target indicators should be specified by policy goals.

* Please add or delete, make changes as appropriate.

5. Vision

Successful broadband plans start with a clear vision of what broadband development should be. Vision for broadband is an articulation of what the GoM would like to achieve or accomplish within the planning period. Vision for broadband often entails service goals (including national and rural coverage), transmission capacity, service quality, and demand-side issues such as ICT literacy and skills development.

Vision serves as a clear guide for choosing future courses of action for broadband, inspiring members of the government and society towards accomplishing the future desired state of broadband. More importantly, the vision should be closely aligned with national development strategy. As a rule of thumb, effective visions contain up to 22 words, making them easy to communicate and remember. If the vision is too long, it would be hard to remember and understand.

There are several ways to establish a vision. The process of visioning is usually a participatory process that is open to all stakeholders. Steps in making a vision include:

(i) Identifying and consulting stakeholders
(ii) Inviting stakeholders to present or explain their own vision for e-Government
(iii) Drafting a common vision based on stakeholders' visions
(iv) Aligning vision with more general national development needs and opportunities
(v) Consolidating and agreeing on final vision

A consensus does not exist on the characteristics of a 'good' or 'bad' vision statement. Commonly accepted traits of powerful visions include:

(i) Conciseness: being able to be easily understood and remembered
(ii) Clarity: directly pointing a prime goal
(iii) Future orientation: describing where the government is going rather than the current state
(iv) Stability: offering a long-term perspective, not subject to frequent changes
(v) Challenging: not something that can be easily achieved and discarded
(vi) Inspiring: motivating members of society and is something that the members view as desirable

When working on the vision for broadband, it is advised to incorporate core values of broadband such as universal availability, affordability, contribution to socio-economic development, and milestone into the vision. Several examples are provided below, which might be a useful starting point for exploring the vision for broadband in Mongolia.

- Example 1: To transform Mongolia into digital society by making broadband infrastructure and services available to all Mongolians at affordable prices by 2025 (20 words)
- Example 2: Better broadband, More opportunities, Better lives for all Mongolians (9 words)
- Example 3: Delivering prosperous digital future of Mongolia through broadband development (9 words)
- Example 4: 90 percent of Mongolians will use broadband services at 2 percent or less of the average monthly income by 2025(20 words)
- Example 5: To develop sustainable broadband infrastructure by 2025 for affordable use by all Mongolians to accelerate socio-economic development (17 words)
- Example 6: Universal and affordable broadband in Mongolia by 2025 (8 words)

6. Recommendation for Key Strategic Areas

The National Broadband Strategic Plan 2021-2025 will be put into effect by means of specific initiatives or projects, some of which are already underway, and some of which are yet to be newly introduced. The most important instrument for the implementation of the Plan is thus the catalogue of prioritized initiatives and projects, which will have to be updated periodically. The catalogue of prioritized initiatives and projects encompasses both supply- and demand-side issues. Supply-side issues are mainly related to lowering costs of network rollout and extending broadband infrastructure into underserved and unserved areas. One of the most important goals is to ensure availability of broadband services to the widest user base nationwide. This means that networks need to be built out to reach as many people as possible. There should not be any part or area of the country without broadband network coverage. On the other hand, demand-side issues add new challenges of promoting local content and increasing relevance of broadband services to users through useful and attractive applications. As the availability of broadband increases, the focus of policy tends to shift from solving supply-side challenges to addressing demand-side dilemmas.[55]

55. World Bank, Digital Dividends, 2016

6.1 Completely connected Mongolia

The GoM needs to have the same sense of mission it had back when making a priority of providing 2G service to every Mongolian. Now 3G service is available to all Mongolians and all regions. As broadband has now become an essential service, the GoM should take special measures to improve people's daily lives in rural and remote areas and to provide them with a standard of living equal to that of Ulaanbaatar. The question is not whether someone in rural Soums can watch the video on YouTube or use Facebook, but whether the rural community can survive. Broadband in rural areas means access to e-Education, important news updates, market information and most importantly, connection to the world.

The cost of providing Internet access to rural Mongolians is more expensive than urban people because building networks in rural Mongolia is incredibly expensive. In addition, rural populations generally earn less than urban counterparts. Moreover, the biggest barrier to getting broadband in remote Soums of the country is low population density. Broadband providers simply would not offer service unless commercially profitable. In many sparsely populated Soums in remote areas, the broadband gap is highly likely to get worse in terms of speed and network quality. Operators tend to focus on the more densely populated and profitable areas of the country. There should be serious discussions about how to get broadband into rural and remote areas. Although the government has taken policy measures to make it cheaper to deploy networks in rural areas and to make telecommunication charges same regardless of locations, if operators cannot sustain their business due to small number of customers, those measures are invalid and do not work. So far, much of the work the GoM has done in getting broadband to rural Mongolia has centered around providing USOF to mobile operators in order to financially support rural and remote mobile access.

There are still 11 Soums left unconnected to the National Backbone as shown in the table below. The CITA and the operators jointly need to establish a specific timeline for connecting these areas to the National Backbone by 2025. Higher priority should be placed on higher population density areas. If the operators are not willing to invest in the areas on a voluntary basis, USOF should be funded. The rationale behind providing USOF to these unserved and underserved areas is clear because the challenge for these areas is how to overcome an uneconomical cost-benefit equation for universal coverage. Most of these Soums have a high-cost topography with high mountains and remote areas coupled with small number of populations. Due to the high costs of building fiber optic cable and a very small number of subscribers, returns on investment are low. In addition to providing USOF, upon completion of fiber optic deployment for these 11 Soums, the cost of access should be low enough to provide commercial services.

< Table 51> List of Soums left unconnected to the National Backbone

No	Name of Soum	Affiliated Aimag	Nearest adjacent Soum or Aimag
1	Khashaat	Arkhangai	
2	Khuvsgul	Dornogovi	Ulaanbadrakh
3	Khatanbulag		
4	Dashbalbar	Dornod	Gurvanzagal
5	Chuluunkhoroot		
6	Khalkhgol		
7	Mungunmorit	Tuv	Baganuur
8	Bayan-Unjuul		Altanbulag
9	Bayanjargalan		Arkhust
10	Altai	Govi-Altai	Tseel
11	Khankh	Khuvsgul	Khatgal

Source: CITA, 2019

6.2 Connecting Mongolia cost-effectively

Pushing fiber closer to customers is the ideal, but expensive. It is very unlikely that the operators will come up with vast amount of money to pay for it. Since fiber optic cables are expensive to deploy, the GoM needs to seek for cost-effective alternatives. The most useful forms of wireless for rural areas are fixed wireless links. These links generally use unlicensed spectrum at high-frequency ranges to transmit signals from one point to the next.

In addition, WTTx is a new approach for solving the old last mile problem. The technology can potentially overcome challenges related to the last-mile connectivity for unconnected premises, such as high fixed-line engineering costs and the difficulty of securing site access to privately-owned land. WTTx is a 4G and 4.5G based broadband access solution, which uses wireless to provide fiber-like broadband experience. Operators can reuse existing mobile broadband LTE infrastructure and provide customer premise equipment (CPE) to offer broadband services to homes and small and medium-sized enterprises (SME). Compared with fixed broadband, WTTx is of low cost, rapid deployment and quick return on investment (ROI). Compared with other wired broadband (WBB) services like WiMAX, WTTx has robust and mature ecosystem. WTTx is the essential way of broadband connection other than fiber, cable and copper, and it is suitable for areas from densely populated urban centers to sparsely populated rural areas. Unitel already launched ‘Ger Internet’ in 2017 through WTTX. Over 50,000 households and 200,000 individuals are enjoying Ger Internet.

Also, wireless networks making use of unlicensed TV broadcast spectrum called white spaces would be valuable as a replacement for DSL/cable in remote areas. TV white space (TVWS) devices are designed to operate using unassigned TV channels without interfering

with licensed broadcasters or other authorized wireless telecommunications licensees. These devices would operate on a 'no protection and no interference' basis. If TVWS can be used under conditions that do not cause harmful interference to broadcasting receivers and wireless microphones. TVWS devices would facilitate the introduction of more economical wireless broadband and Internet services to consumers in areas that are currently unserved or underserved. It can greatly contribute to promote the development of various broadband services, such as e-Health, e-Education, public safety and emergency rescue in remote areas. Using TV white spaces spectrum will increase broadband access in rural communities.

Many rural and remote areas in Mongolia suffer from unavailability of broadband. It is time to pay attention to the active use of TVWs technology to solve this problem. It creates two-way communications at relatively high data rates, over long distances. Authorized spectrum databases maintain a list of all available channels by location. Certified TV white space devices ask the spectrum database for channel availability at their locations. TV white space database tells devices which frequencies to use. It calculates which channels do not interfere with TV signals. This is dependent on time and location. Sharing spectrum dynamically means doing more with a limited resource. For areas where broadband infrastructure is difficult to establish due to the vast territory in Mongolia, it seems appropriate for the CITA to develop a specific plan for active and extensive use of TVWS in order to maximize economic benefits that can be derived from the use of finite resources.

6.3 Preparing for 5G

A decade after the introduction of 4G, the first 5G commercial services were launched in Korea, the United States, and other advanced countries. The 5th generation mobile communication is considered as a core infrastructure of the 4th Industrial Revolution. 5G is becoming an innovative next-generation network platform creating new values for future society by converging with other industries. Innovative convergence services can be provided in each area of home, industry, and society based on the 5G infrastructure which connects large numbers of mobile, accommodating a large amount of traffic.

The characteristic of the 5G frequency band is that it uses a high frequency and a very high-frequency band. 3.5 GHz band is used for the middle band and 28 GHz is used for the high-frequency band. There is a big difference compared to the LTE frequency band since 5G uses higher frequency and even very high frequency for mmWave. The lower the frequency, the better the diffraction rate, and the better to avoid obstacles. This means that 3.5GHz and 28GHz, which are used for 5G service, could not be able to communicate effectively when the devices are in the shadow area or in the areas with substantial amount of obstacles in between. Therefore, in case of 5G service, we could guess that there will be higher upfront cost for building more base stations than in the case of conventional LTE system.

Mongolia uses 400 MHz and 800 MHz for CDMA 2G services. GSM 2G services use 900 MHz and 1800 MHz bands. WCDMA 3G services are using 800 MHz and 2.1 GHz. Mongolia has

specified various frequency bands in the range of 400 MHz to 3.6 GHz for 4G or 5G next generation mobile communications. Current 4G services are using 700 MHz, 1.8 GHz, 2.6 GHz, and 3.5 GHz.

Many countries have established 5G Task Forces to prepare for the introduction of 5G. Mongolia has yet to establish concrete plans for the introduction of 5G. To help smooth evolution of mobile broadband towards the 5G and prepare the necessary foundations, it is recommended to establish the National 5G Task Force, consisting of all stakeholders with an interest in 5G, such as government, operators, equipment vendors, and user groups. The Task Force should take an active role to create the best enabling environment for the private sector to invest in deploying 5G, including measures for greater regulatory certainty vis-à-vis operators' business cases. Also, it is necessary to secure the frequency in advance while looking at trends of other countries. ITU-R classifies Mongolia as Region 1, which corresponds to EU and African countries. Therefore, it is necessary to refer to the frequency distribution of European countries. The EU prioritizes the 3400-3800 MHz band at 5G frequencies in sub-5 GHz bands. However, not all of the 400 MHz bandwidth is used, and it varies from country to country. Mongolia is distributed in the 3400 ~ 3800MHz band for aeronautical mobile, amateur, fixed, and mobile (excluding aeronautical movement in the 3500 ~ 3800MHz band). In the 24.25-27.5 GHz band, it is allocated for fixed, inter-satellite, mobile, and standard frequency/time signals. Mongolia, like the other Region 1 countries, it is necessary to recover the frequency of the existing radio station and relocate it to another frequency when securing the 5G frequency.

Soon after investing heavily in 4G, it is burdensome for mobile operators to invest in 5G. Operators may want to delay 5G investments as long as possible, while existing networks are upgraded. However, when 4G service is expanded and mobile market is mature, 5G service should be prepared for introduction. Mongolia is recommended to target an early market introduction for 5G on a pilot basis in Ulaanbaatar at first within the planning period of this Plan.

6.4 Reducing the costs of delivering broadband services while improving quality of service by establishing additional IXP

Any opportunities that contribute to reduce the costs of broadband services and improve performance should be identified along with updated requirements for efficient and cost-effective delivery of broadband services, including establishing additional Internet eXchange points.

The impact of an IXP is instrumental in developing the local Internet ecosystem. IXPs can attract a range of local and international operators, which then can trigger innovation and more business opportunities. In addition, IXPs can improve local users’ quality of access by providing more direct network connections for local content providers and consumers. Speeds for accessing local content can be improved because local traffic is routed directly

through IXPs. Also, IXPs can improve the level of stability and continuity of access.

At present, there is a single centralized IXP - MIX, causing inefficiencies, latencies, and the waste of bandwidth to some extent. To avoid the need for data from numerous regions to travel around the MIX in Ulaanbaatar, at least two IXP facilities should be considered.[56] IXPs commonly are spread across a country to allow local networks to efficiently exchange information. IXPs route local Internet traffic locally. When Mongolia establishes an additional IXP, local Internet traffic will be exchanged more efficiently and routed locally, thereby reducing costs and network delays, while increasing content upload speeds. In summary, additional IXPs would greatly help Internet data reach end-users more efficiently and cost-effectively. An additional IXP is also expected to provide significant benefits of lowering Internet access costs for end-users by decreasing operating costs of ISPs.

Generally, IXPs are not expensive to start. An IXP can usually be established at minimal cost. Under a sustainable funding and management model, ISPs and other network operators, which benefit from using IXPs, can often cover the initial start-up and monthly operating costs. In addition, the improvements in access speed facilitated by IXPs often result in incentives for local developers to produce more relevant local content and applications. Local content providers can offer consumers a better online experience because IXPs enable faster content-transmission speeds. Overall, these benefits to local content development and delivery make the Internet more socially and economically beneficial to Mongolians. In establishing an additional IXP, the location and management of IXPs should be as neutral as possible.

6.5 Increasing caching capacity to save international bandwidth

For many users around the world, bandwidth is still scarce and expensive. So is in Mongolia. Majority of Internet traffic generated by Mongolian users tends to be international, resulting in large capital outflows to the Internet transit providers of the neighboring countries. Caches across the network can help ISPs to offer popular content on the network by storing web content and serving it from local network, thereby saving bandwidth while delivering faster web access to end users.

The CITA and CRC together need to encourage service providers and operators to strengthen caching for popular foreign contents, storing a cached version of foreign contents in multiple locations. Real-time entertainment services on the Internet, including video traffic is a large and continually increasing part of international Internet traffic in Mongolia. Video streaming traffic is overflowing networks, leading to the saturation of peering links between networks and then to a degradation of the quality of experience perceived by end-users.[57]

56. An IXP is simply a physical location where different IP networks meet to exchange local traffic with each other via a switch. The IXP saves on transit fees for ISPs, reducing the flow of local data that transits externally.

57. G. Maier, A. Feldmann, V. Paxson, and M. Allman, “On dominant characteristics of residential broadband

6.6 Launching free public Wi-Fi in public places

Free Wi-Fi will be considered for public places around Ulaanbaatar. Public places around the capital city attract tourists, small businesses, and residents. Free Wi-Fi is an outstanding means to empower visitors and residents to learn more about what is happening, what is available locally, and what to do. With a free Wi-Fi program, local communities are increasingly willing to provide relevant information and content to keep visitors stay in the area. Free Wi-Fi can contribute to increase tourism and business growth. Free Wi-Fi will be first piloted in Sukhbaatar square and spread to other areas according to the results and citizens' response. Although there are issues with ISPs for introducing free public WiFi, the City of Ulaanbaatar should consider launching free WiFi in public places in close cooperation with operators.

6.7 Establishing information system for facilitating infrastructure sharing

Broadband service providers can reduce the cost of installing and maintaining infrastructure through both active and passive infrastructure sharing. Due to 'economy of scale' in telecom industry, infrastructure sharing is becoming the requirement and process of business where competitors are becoming partners to lower their increasing investments. Infrastructure sharing contributes to avoid or minimize duplication. Particularly in rural areas. sharing infrastructure is an alternative that can lower the cost of network deployment. The problem for rural and remote areas is the high cost of building network infrastructure, which leads to high prices.[58]

Not only to avoid redundant and overlapping investment in network infrastructure but to further promote sharing of broadband infrastructure, the CRC needs to launch a collaboration framework for all relevant operators and ISPs to share resources and harmonize plans before embarking on telecommunications infrastructure capital projects. This collaboration framework will include the centralization of information about passive and active infrastructure and map of telecommunications infrastructure by establishing Information System on Infrastructure. Detailed information will be presented in the form of tables, charts, and maps at the Aimag and Soum levels in the information system for infrastructure sharing, which is intended to help operators easily identify opportunities for infrastructure sharing. In a series of interviews with operators, they expressed that if other

Internet traffic," 2009

58 . In many countries, infrastructure sharing has been instituted in areas where competing physical infrastructures were not economically viable (such as in rural or remote areas) or where the construction of competing infrastructures could prove unacceptable for social or political reasons (too much civil works disruption or too many wireless towers at prime locations).

operators also provided data, they would be willing to actively provide data to the system and the system would benefit each other. Based on the data from the system, statistics on broadband infrastructure in Mongolia can be published, which will also serve as an input for future broadband plan.

6.8 Preferential tariffs for disabled/disadvantaged groups

For people with disabilities, broadband is a flexible and adaptable tool for receiving convenient and effective services in a range of social, economic, and health-related fields.[59] Thus, ensuring the availability and affordability of broadband is critical to people with disabilities. However, despite increasing availability, many people with disabilities remain offline simply because they cannot afford broadband services. Majority of disabled people in Mongolia, as elsewhere, live in poverty with limited opportunities for accessing education, health, housing, and labor market. Taking account of the interests of those with disabilities, the GoM should take specific measures to make broadband services available to end-users with disabilities. A certain percentage discount on the price of telecommunication charges, including broadband services should be considered.

Since broadband access is increasingly a requirement of socio-economic inclusion, the GoM should consider an introduction of government program to provide subsidies or reduced tariffs for low-income families that need broadband service. It is widely known that the high price of broadband services is the most obvious obstacle to broadband connection for low-income families. High-priced monthly subscriptions are very difficult for low-income households to sustain. Thus, if household income is below poverty line, the government should provide financial incentives to facilitate wider use of broadband for low-income families.

6.9 Strengthening ICT Training

People need ICT training to become digitally literate and to engage in e-services over the Internet. Digital literacy is essential skills in a broadband environment to effectively utilize and communicate using various digital platforms. Digital literacy enables people to set up online businesses, or to use broadband services, such as social networking sites, to enhance their ongoing livelihood and economic activity as well. Thus, digital literacy focuses on the end-user experience and skills required to live in an increasingly digital society.

Digital literacy is a key factor to increase broadband adoption. The government, businesses and individuals need the skills and capabilities to reap the benefits of broadband access. The

59. US Chamber of Commerce, The Impact of Broadband on People with Disabilities, 2009

skills gap in basic competences, as well as in digital literacy, prevents many people from participating fully in the digital economy. Not to leave anyone behind, the GoM needs to build ICT learning centers in Soum centers and Aimags to educate and train government employees and public with the ICT skills. Number and location of ICT learning centers to be established by 2025 will be reviewed after conducting a study on the details of ICT learning centers. ICT learning centers will be equipped with Internet-connected computers and will be staffed by tutors available to assist trainees.

6.10 Developing more useful applications

6.10.1 e-Government

It is obvious that building broadband infrastructure alone will not be enough if there is no demand for broadband services. e-Government services can serve as a demand driver for broadband. Generally, e-Government services include: 1) providing government information online; 2) conducting online interaction and transactions with the government; and 3) participating in the decision-making process online. Although e-Government may not be the main driver of broadband demand, e-Government services can contribute to the overall usefulness of broadband services by making interaction and transaction with the government easier, faster, and more transparent. In this respect, the CITA needs to make a comprehensive plan in detail for advanced e-Government in close partnership with the involved ministries and agencies.

The new e-Government Plan will identify and organize key applications for e-Government based on both frequently asked services by citizens and mission critical functions essential to the operation of government. The focus of new e-Government plan should be set on developing one-stop integrated services. So far, Mongolia focused on providing online certificates or reference services online through e-Kiosks and portals. From now on, building on the computerization of state registries and XYP in progress, the government should put efforts to provide online one-stop services to its citizens and businesses by streamlining, interconnecting government business processes, and eliminating required paper documents and certificates. In addition, e-Government target should be placed on restoring the highest ranking the Mongolia ever recorded in UN e-Government Survey.

6.10.2 e-Health

e-Health has a great potential to advance the goal of universal health coverage and improve the quality and efficiency of health services. Broadband helps to achieve significant productivity gains and narrow discrepancies in geographic coverage of health services. Corresponding to the advancement in medical arts, the need for bandwidth of e-Health applications has increased. Since medical records have become more extensive and digital images have become larger, adequate bandwidth should be provided. The CITA in alliance with

the Ministry of Health should seek to provide better health services by taking comprehensive measures aimed at developing digital system in healthcare, storing patients' information electronically, introducing advanced ICT in hospitals.

In Mongolia, although 220 primary level health care institutions, all 48 secondary and 15 tertiary institutions are connected to the national high-speed fiber-optic network, the bandwidth is not sufficient for e-Health applications. The Ministry of Health should target increasing efficiency and expanding the scope of health care by using broadband. e-Health policy measures should include broadband connectivity for hospitals and clinics, digitization of health records to enable quick and easy access for health professionals and use of broadband for telemedicine to provide citizens living in remote locations with health care service.

6.10.3 e-Education

Education is vital to the development of a skilled workforce. The education sector should play a key role in preparing Mongolians for a digital future. Broadband-enabled technologies are improving the effectiveness of instruction and enhancing learning outcomes in schools, higher educational institutions and the vocational training sector. ICTs can support teachers by increasing their efficiency in and outside the classroom; help teachers respond better to students' individual needs; and facilitate communication between teachers, students, parents and administrators. It can also support learners by accessing to online educational content and resources in and outside of school. Such impacts, however, rely on the wide availability and effective utilization of broadband in education.

Mongolia began relatively late in Information and Communication Technology (ICT) education in formal education, and computer education and informatics have been included as subjects in Mongolia's secondary school curriculum since 1988 and university curriculum since 1982. Although ICT education was embedded in school curriculum in the 1980s, there are still not enough teachers to teach informatics courses, and repairs and maintenance in the event of computer failure are not well supported. Therefore, it is necessary to increase the number of informatics teachers and retrain them, and to devise repair support measures in case of computer failure. The Ministry of Education, Culture, Science, and Sports in close cooperation with the CITA needs to take proactive steps to connect broadband Internet to all secondary schools and provide schools and educational institutions with the bandwidth needed to access e-learning and online curriculum content by 2025.

To promote the national program of ICT-enabled education and continue a lifelong e-learning system, it seems that the GoM should establish a professional institution that is fully responsible for e-Education related policies and initiatives that continuously require expertise and professional knowledge. Officials in the Ministry of Education, Culture, Science, and Sports usually are hard-pressed by routine work obligations and have little time to fully devote themselves to wide-scale use of ICTs in the Mongolian education system. For these reasons, to effectively pursue long-term plans and projects in the e-education, it is strongly advised to

consider establishing an e-Education institution by guaranteeing budget for it.

6.10.4 e-Commerce

As more goods and services are traded online, companies' online presence is becoming increasingly important. e-Commerce in Mongolia is being fueled by the rapid spread of smartphones and social media. More than 90 percent of the bank customers are bank cardholders. Long ago, mobile subscription rate exceeded 100 percent. Internet service in Mongolia is affordable for most of the population except socio-economically disadvantaged groups. The number of smartphone users reached more than 2.4 million in 2017. Furthermore, a total of 2.2 million people regularly uses social media. At the same time, Mongolia is being faced with various barriers to overcome to take full advantage of the evolving digital economy. Those barriers include absence of e-Commerce law and regulations, insufficient data protection and information security, lack of consumer protection, and poor delivery system.

By leveraging Mongolia's key strengths such as high mobile subscription rate and widespread use of social media, Mongolia's e-Commerce market has grown gradually since 'Tentative Program on E-commerce in Mongolia' in the early 2000s, but the market still remains in its infancy. Affordable broadband service is just one of the main pillars facilitating businesses and consumers to engage in e-Commerce. Besides, the GoM should make strong efforts to lay the foundation for e-Commerce by enacting e-Commerce law and regulations along with strengthening information security. Also, since e-Commerce requires fast, reliable delivery with effective tracking systems, the Mongol Post is required to modernize its delivery system with an electronic network connecting retail outlets and local post offices across the country. In addition, legal framework for taxation and classification for business registration should be properly prepared as well as those for prevention of sale of prohibited items and counterfeits.

6.11 Promoting local content

Currently, there is no uniform definition of local content. A definition by UNESCO states that local content must be relevant and comprehensible to local users.[60] So, local content refers to content that is in the local language and relevant to the local context and uses local sources. Local content includes government services, commercial content, entertainment content as well as user-generated content. In addition, it contains content that preserves national identity, culture, and local traditions. Thus, local content can virtually be construed as a lens through which national identity and values are disseminated, while preserving societal norms and cultural heritage. In this respect, it is desirable for Mongolia to unlock its valuable content by putting online so that it can be not only enjoyed by Mongolians but shared by the world.

60. UNESCO, "Public Service Applications of the Internet in Developing Countries, Promotion of Infrastructure and Use of the Internet in Developing Countries.", 2001

Content is linked to applications and services, meaning the information viewed, created and shared. Useful content is an important factor of broadband adoption. Attractive content and useful services are imperatives in increasing the demand for broadband. Putting it the other way, lack of attractive and useful local content is the main reason for not adopting broadband.[61] As broadband access is more widely provided, local content development is essential particularly in countries with limited local content. Many of non-broadband adopters claim that broadband services are simply not relevant to them due to the lack of attractive local content. Notwithstanding its true national importance, content in Mongolian language is very limited. Widely consumed contents by Mongolian are mostly foreign contents.

Although 3.2.39 of Action Program of the Government of Mongolia for 2016-2020 calls for a policy to support developers of "Mongol content," but any policy action has not been undertaken. It is clearly known that developers create local content and validate business models, but governments have a role in developing enabling factors for creation and use of digital content, taking measures to support cultural diversity and local content-related entrepreneurship, and acting as a facilitator by enhancing capabilities and removing unnecessary regulatory barriers.[62] In this respect, the GoM should formulate a comprehensive plan to promote local content, including Mongolian classical art and nomadic civilization as well as all educational contents such as textbooks.

There are many challenges to create local content. The building blocks for producing local content, such as software development kits, may not be available in Mongolian language. Entrepreneurs often need the ability to both fund and sell their local content services, which can be ensured through various means including an appropriate copyright law and its enforcement. Under the circumstances, the government should play a key role in promoting local content by helping local content producers overcome these challenges. Above all, the Prime Minister should take conscious actions to make a strong political commitment to envision the development of local content industry as a national agenda. Following the vision for local content industry, the GOM needs to strengthen policy efforts to ensure that local, relevant and interesting content is produced to increase the demand for broadband services in Mongolia. The policy efforts will include both financial assistance and technical support. Direct grants and facilities to produce local content, tax credit, and low-interest loans to local content industry should be considered for financial assistance. In addition, the CITA is recommended to conduct a feasibility study for establishing a content industry park dedicated to the provision of centralized facilities for producing contents and marketing, while integrating training with a clustering of content companies. Furthermore, in addition to create an effective enabling environment for the development of local content, it is important to support content-related entrepreneurship by empowering the digital youth to become

61. According to the UN Broadband Commission for Sustainable Development, lack of relevant local content and applications, low digital literacy and unaffordability are the drawbacks why the use of broadband has not fully matched its increasing supply.

62. OECD, OECD Policy guidance for digital content, 2008

producers of content.

Last but not least, it is vital to embrace the idea of open government data (OGD) where public sector data is deemed to be available for use free of charge unless specifically exempted for protection of national security interests, personal privacy, the preservation of private interests or where protected by copyright, or the application of national access legislation and rules. There are a lot of examples of beneficial and convenient applications that use open data across the world. Opening public data to anyone for easy access not only improves transparency of the government, but also creates new economic value by developing local apps relevant to consumers.

<Appendix 1> Mobile Connectivity Index 2018 Indicator Values for Mongolia

Indicator	2018 Value	2014 Value
2G Coverage	99.0	99.0
3G Coverage	95.0	83.75
4G Coverage	27.30	10.46
Mobile download speeds	18.31	8.24
Mobile upload speeds	25.80	5.68
Mobile latencies	71.13	19.47
Access to electricity	80.49	79.88
Servers per population	72.49	46.47
International Internet bandwidth per user	51.33	62.81
IXPs per population	40.04	42.75
Digital dividend spectrum (MHz per operator)	41.38	0
Other spectrum below 1GHz (MHz per operator)	41.83	41.83
Spectrum in 1-3GHz bands (MHz per operator)	30.0	24.17
Entry basket (100MB)	43.06	37.86
Medium basket (500MB)	49.56	43.33
High basket (1GB)	54.15	48.48
Device price	30.46	35.59
Tax as a % of TCMO	69.81	73.27
Mobile-specific taxes as % of TCMO	100.0	100.0
Inequality	80.55	86.73
Mobile ownership	71.42	67.75
Literacy	98.30	98.30
School Life Expectancy	70.20	65.56
Mean Years of Schooling	69.05	68.25
Tertiary Enrolment	64.84	62.20
Gender parity in schooling	100.0	100.0
Gender parity in account ownership	100.0	100.0
Gender parity in income	70.17	61.63
WBL Score	83.13	83.13
Gender gap in social media use	100.0	100.0
Gender gap in mobile ownership	100.0	100.0
TLDs per capita	49.0	43.19
E-Government Score	59.72	61.42
Mobile Social Media Penetration	67.26	28.04
Apps developed per person	70.14	62.56
Number of apps in national language	20.73	15.16
Accessibility of top-ranked apps	15.73	6.59
Cybersecurity Index	46.50	41.20