International Journal on Advanced Technology, Engineering, and Information System
https://ojs.transpublika.com/index.php/IJATEIS
Online ISSN 2828-5425

https://doi.org/10.55047/ijateis.v4i2.1717

Surveying the IT Infrastructure Challenges in Afghanistan

Literature Review

Qurban Ali Frugh[1*], Mohammad Fahim Naseri[2]

[1,2]Department of Information Technology, Faculty of Computer Science, Kabul Education University, Kabul, Afghanistan
Email: [1)] qurbanalifru@gmail.com, [2)] Fahim.naseri456@gmail.com

Received: 29 March - 2025
Accepted: 30 April - 2025
Published online: 02 May - 2025

Abstract

The rapid advancement of technology has brought significant transformations across various sectors globally, including in Afghanistan. However, the country's Information Technology (IT) infrastructure remains underdeveloped, particularly in key areas such as health, e-commerce, telecommunications, e-governance, academic research, education, and culture. This research paper analyzes the challenges faced by the IT infrastructure in Afghanistan. In January 2024, there were 7.88 million internet users in Afghanistan, representing 18.4% of the total population. The aim of this study is to identify the current challenges of IT infrastructure and assess their impact on users' access to the digital world. A systematic review of scientific, research, and administrative documents was conducted to gather data. Quantitative analysis of these documents reveals that only a small segment of the population has access to technology, and their usage is primarily limited to social media and virtual spaces. The study found that Afghanistan's IT infrastructure is weak and insufficient to support the development of e-governance, e-commerce, banking, healthcare, and educational systems. Several factors contribute to these challenges, including slow internet speeds, high costs, and limited access to technology compared to neighboring countries. Based on these findings, the paper proposes potential solutions to improve the IT infrastructure in Afghanistan, with a focus on addressing the identified weaknesses and ensuring broader access to digital services.

Keywords: IT Infrastructure, Digital Media, Afghanistan Telecommunications, E-Governance Barriers, Technology Development Challenges.

1. Introduction

Afghanistan for a long period now has been fighting civil wars and unprecedented political instability while also straining limited financial resources to set up an information technology (IT) infrastructure. These socio-political challenges such as protracted conflicts, weak governance, and economic difficulties have discouraged heavy investments in technology while at the same time obstructing continuity of policies and delaying the development of nationwide connectivity. Therefore, the country is not only facing a great battle in respect of the internet penetration, but also in digital literacy and quite poor reliable infrastructure with a very definite lack in the rural and remote areas. Thus, all these aspects need to be tackled if economic and social development is to be meaningful. Investment in digital infrastructure can greatly improve service delivery as well as economic opportunities in fragile and conflict-affected countries like Afghanistan, as said by The World Bank (Wentz, Kramer, & Starr, 2008).

IT Infrastructure encompasses various components such as the electricity network, telecommunication infrastructure, and systems, fiber optic network connectivity, global internet connectivity, as well as hardware and software development. Essentially, IT Infrastructure utilizes computers, networking, software, and other technologies to effectively

Copyright: © 2025 by the authors.
This is an open access article distributed under the terms and conditions of the CC BY 4.0.

handle and process information for a wide range of sectors including government facilities, private sectors, telecommunication, business, healthcare, military, innovation, and many other areas.

There were 7.88 million internet users in January 2024. Afghanistan's internet penetration rate stood at 18.4 percent of the total population at the start of 2024 (DataReportal, 2024); (ITU, 2022). Kepios analysis indicates that internet users in Afghanistan increased by 207 thousand (+2.7 percent) between January 2023 and January 2024. Also mentioned that 34.93 million people in Afghanistan did not use the internet at the start of 2024, suggesting that 81.6 percent of the population remained offline at the beginning of the year. Speed of internet in Afghanistan average 2.25 Mbps and in the world ranked is 79th country. Number of Facebook user is 4,423,600 In Afghanistan. Total internet users in Afghanistan at the start of 2024 were 7.88 Million, when internet penetration stood at 18.4 percent in 2024. Afghanistan was home to 3.70 million social media users in January 2024, equating to 8.6 percent of the total population.

A total at 27.67 Million cellular mobile connections were actives in Afghanistan in early 2024, with this figure equivalent to 64.6 percent of the total population (ITU, 2022); (Datareportal, 2024). Afghanistan's internet bandwidth by OFC (Optical Fiber Cable) ring is the base of Network connectivity and allocated from different sites. According to (MCIT M. o., 2015), all the systems on the ring route and the systems connecting the neighboring countries are OFC. OFC in the length of 3600 KM as national Optical Fiber Network the form of a ring is been laid along the main highways of Afghanistan. Out of 4000km fiber optic network, 1000km fiber optic has built by world Bank. The overall cost of fiber projects for 24 provinces from 2007 until 2015, USD 101 million (Advisor, 2017). The remaining nine provinces not contacted through the fiber optic until 2017 on that estimated time. these nine provinces need to build 1305 Km link fiber optic cable. For the cost of link estimated USD 33 million by Afghan telecom. The international routes of Afghan fiber optic currently connect with Pakistan, Iran, Tajikistan, Uzbekistan and Turkmenistan. For extending the international route Ministry of Communication and Information Technology (MCIT) planed "In the future will connect with China, through a 480 KM connection from Faizabad City, Badakhshan to the China Border (Advisor, 2017); (MCIT A. , 2019).

IT infrastructure enables businesses to collect and analyze customer data, allowing for personalized products, services, and marketing campaigns tailored to individual preferences. Finally, it is the one success of businesses, development and efficient products.

Afghanistan does not yet have a private fiber optic network, nor has there been any private investment made in this area. Based on additional research, private Optical Fiber Cables are found to have a significant impact on the infrastructure of national or backbone networks. This is especially true for those countries with weak economies and financial systems. Technology and internet infrastructure growth are strengthened by private optical fiber cable, which benefits both the government and private commercial sector (Wentz, Kramer, & Starr, 2008).

Pakistan, Mongolia, Kenya, and Estonia are a few examples of nations where private operators have their own fiber optic networks in order to offer their clients high-quality broadband services. Three government agencies oversee or administer fiber optic in Afghanistan: controlled by ATRA (Afghanistan Telecommunication Regulatory Authority), implemented by the Ministry of Communication & IT, and overseen by Afghan Telecom. The open access policy was recently drafted by the ATRA to give the private sector a legal basis.

The aim of this paper is to examine the challenges facing IT infrastructure in Afghanistan. It seeks to understand how these challenges impact various aspects of life,

including the economy, education, and access to services. The study also aims to identify the main barriers to developing robust and inclusive digital infrastructure. By analyzing these issues, the paper will highlight critical areas for improvement and policy intervention. Ultimately, it contributes to efforts toward building a more connected and digitally empowered Afghan society.

Table 1. The historical statistics of Optical Fiber Cable (OFC) from 2014 to 2020

Progresses by year	#Provinces connected/ capital provinces	#provinces no connected	Connected Type	Area connected	Comments
2014	21	13	OFC	Only the Capital of provinces	
2015	21	13	OFC	Only the Capital of provinces	
2016	24	9	OFC	Capital and the same provinces	
2017	24	9	OFC	Capital and the same provinces	
2018	24	9	OFC	Capital and the same provinces	
2019	24	9	OFC	Capital and same provinces	
2020	24	9	OFC	Capital and same provinces	

Total bandwidth of internet for Afghanistan from different neighbors' countries until 2015 is not more than 15 Gbps. By Comparing the internet capacity in 2015 between Afghanistan and Mongolia, Afghanistan's internet capacity was 15 Gbps and Mongolia's internet capacity was 30Gbps (Ruddy & Ozdemir, 2016).

On the other hand, the FOC network, which has been established in Afghanistan as the main pillar of Afghanistan's internet. This ring network started with a capacity of 10 Gbps and can be upgraded to a maximum of 100 Gbps. According to the study (Ruddy & Ozdemir, 2016), the capacity and internet demand in Afghanistan are estimated to reach 6116 Gbps by the year 2024. In this case, the public fiber network of Afghanistan, or FOC Network, is very insignificant compared to Afghanistan's needs. What you see below is the existing capacity of the Afghanistan Fiber Optic Network (FOC), which has a maximum capability of 100Gbps internet. The existing of OFC Network is on the on the Ring route and the systems connecting the neighboring countries will be upgraded to NG-DWDM (10Gbps 40 channels in C band) with 50GHz spacing upgradable to 100 GB capacities.

Table 2. total capacity of bandwidth and length of OFC 2013-2015

Country Border City	OFC Length (KM)	Maximum Capacity (Gbps)	Existing Network Bandwidth	Occupied Network Bandwidth
Turkham Via Peshaware-Pakistan	2430	50	40G (DWDM) + 10G (SDH)	7*STM-16+1*STM-4
Spin Boldak Via Quetta Pakistan		20	2*STM – 64 (20G)	3 STM-16 2*STM-4+E1s
Sherkhan Bandar Via Tajikistan	120	5	STM -16 (2.5G)	3E1s
Hayratan Via Uzbekistan	137	10	2 STAM-16	STM-16 + STM-1+ E1s
Aqina Via Turkmenistan)	744	10	STM-16 (2.5G)	3*STM-4
Turkhundi via Turkmenistan)			STM-16 (2.5G)	2*STM-4
Ialam Qalla via Iran	936	5	STM-16 (2.5G)	1*STM-4+ E1s
Wokhan Badakhshan via China	76 only C		-	-
Total	4367	100	75	

Source: **(MCIT M. o., 2015) (MCIT A. , 2019)**

2. Literature Review

The historical trend of internet speed on the global internet network is very varied. This historical overview has surveyed data and voice in the international internet network environment for Afghanistan and Mongolia between the years 2003-2013. The history of internet speed in Afghanistan and Mongolia has been reported by (Ruddy & Ozdemir, 2016) and (MCIT, 2015). In particular, an in-depth study has been conducted to compare the historical development of the internet in Afghanistan and Mongolia. The summary of this report shows that Afghanistan and Mongolia had internet speeds of 0.1 Gbps in 2003, and in 2013, Afghanistan had an internet speed of 10.7 Gbps while Mongolia had an internet speed of 29.8 Gbps. Therefore, the growth in speed in Afghanistan has been less than that of Mongolia. You can see the details of this report in the table below.

Table 3. Historical trend of internet speed demand combining data and voice in the international environment (2003-2013)

Year	Afghanistan	Mongolia
2003	0.1%	0.1%
2004	0.1%	0.1%
2005	0.4%	0.2%
2006	0.7%	0.8%
2007	1.1%	1.2%
2008	1.4%	1.6%
2009	2.1%	9.2%
2010	2.8%	19.2%
2011	3.9%	33.3%
2012	5.2%	25.5%
2013	10.7%	29.8%

Source: (Ruddy & Ozdemir, 2016)

The forecast of internet demand from the global internet network for Afghanistan and Mongolia is also presented in the report. This forecast indicates that based on the needs and progress of society and the economic development of the people of Afghanistan, at least 153 Gbps was required in 2014, at least 221 Gbps in 2015, and at least 6116 Gbps in 2024 (Ruddy & Ozdemir, 2016). Based on this prediction made by the United Nations, unfortunately, Afghanistan lacks 15% of the internet it needs. As the author of this article, I confirm that the fundamental problems lie in the lack of information technology infrastructure, which still remains in place.

Table 4. Forecast of Internet Speed Demand in Gbps

Year	Afghanistan	Mongolia
2014	153	15
2015	221	23
2016	319	34
2017	460	51
2018	665	76
2019	962	114
2020	1,391	171
2021	2,014	256
2022	2,915	384
2023	4,222	577
2024	6,116	865

Source: (Ruddy & Ozdemir, 2016)

The challenges that exist due to the weak information technology infrastructure in Afghanistan have been surveyed in this article based on credible sources. These challenges have been prominent and significant in the areas of internet access, e-governance, advanced banking, e-commerce, telecommunications, educational systems, and other related matters. Considering that a very small percentage of the population has access to the internet, and in the areas of e-governance, advanced banking, e-commerce, telecommunications, academic research and e-learning management systems, there is a significant and fundamental need in society, and there are many problems in these areas.

Afghanistan is not among the 50 countries that use technology in health and medicine. Indonesia is the first country in this arena. Among the countries that do online shopping and online business, Afghanistan is nowhere and Thailand is the first country. The speed difference between mobile and fixed connections in Afghanistan is 2.3 to 1 and it's more different. Among the countries with fast mobile internet, Afghanistan is not included, and the United Arab Emirates is the first country with a speed of 398.5 Mbps on mobile (DataReportal, 2024); (Lambert, et al., 2012).

In other words, 18.4% of the population has access to the internet, while the least usage is in the e- governance, online banking, e-commerce, e-learning systems, particularly in academic research and educational management systems, where there is little to no efficiency. Access to telecommunications services reaches 64.6%, and in terms of the comprehensiveness of the internet and its alignment with the essential and fundamental needs of society and the people, it is very underutilized. Even in the e-commerce sector, there is no usage at all. Based on the reports used in this survey, the majority the highest internet usage is in the use of social media. Details of these challenges and issues are provided in Table 3.

Table 5. Requirements and Problems Table

Required Items	Internet Accessibility	E-Governance	Advanced Banking	E-Commerce	Telecommunication	Educational Management Systems	Remarks
Issue	Required / Problem	Required / Problem	Required / Problem	Required / Problem	Required / Problem	Required / Problem	More required
Estimated Availability	18.4% population	More less	Not available	Not available	64.6% population (Mobile)	More Less	Unstable
Comprehensive	Only Urban Population	Suspect	Local Banking	No	Urban/Rural Population	Central University	In urban

Source: (ITU, 2022)

Based on table 5, requirements and Problems is more than accessibility or internet availability. the other hand, the IT infrastructure and the status of the fiber optic network isn't enough and no accessible for the main purpose. so, fiber optic Networks also included in this research. The overall condition of the fiber optic network has not seen progress and development after the years 2014 or 2016. The maximum fiber optic network in the form of a ring under the name of Afghanistan's ring optical network has not exceeded 4000 KM. The area of Mongolia is 1,564,116 square kilometers, and with a population of 3.5 million, it has 17,091 kilometers of fiber optic cable. Unfortunately, Afghanistan, with its population of 42.8 million, has 4,000 kilometers of fiber optic cable.

The table below shows the level of internet access based on the conducted survey. Based on different years presented internet speed, number of internet users, fiber optic cable length, total population in Afghanistan and Urban population percentages also have been obtained.

Table 6. The level of internet access based on the survey

No	Years	Internet Speed (Mbps)	Internet Users (Million)	Internet user (%)	Fiber Optic Cable (Length)	Population (Million)	Urban Population %
1	22004	-	3.7	11.07	-	-	-
2	22016	-	4.01	12%	4000 KM for Fiber	33.77	27%
3	22018	5.61 Mobile 4.34 fixed connection	4.01 27.66 Mobile connections	16%	4000 KM for 9 provinces	35.95	28%
4	22020	6.82 Mobile 6.92 fixed connection	7.65 26.92 Mobile connections	23.4%	4000 KM Fiber The 9 provinces	39.6	25.4%
5	22022	5.24 Mobile 1.67 fixed connection	9.23 31.07 Offline 27.49 Mobile connections	22.9 % Online 77.1 % Offline	4000 KM Fiber	40.29	26.6 %
	22024	4.81 Mobile 3.12 fixed connection	7.88 34.93 Offline 27.67 Mobile connections	18.4 Online 81.6 Offline	4000 KM Fiber	42.8	27.1 %

Source: (ITU, 2022) (Datareportal, 2024)

All of this information it's proves the lack of IT infrastructure and weakness of internal or national networks.

The studies of authors, (DataReportal, 2024); (MCIT M. o., 2015) stressed technology adoption in fragile states, underlining how political instability and low investment further widen the digital divides. For Afghanistan, reports by (Advisor, 2017); (Wentz, Kramer, & Starr, 2008); (Hamidi, Hakimi, & Khalid, 2024) paint an accurate picture of the country's digital development challenges, such as security concerns and infrastructure deficiencies. The Technology-Organization-Environment (TOE) framework can further delineate enduring gaps in infrastructure by the examination of how technological, organizational, and environmental factors interact in the area of digital transformation.

3. Methods

The study examined issues affecting the IT infrastructure in Afghanistan using a mixed-methods approach that comprised both qualitative and quantitative methods. The research design was descriptive-analytical, focusing on historical and current data regarding the internet, mobile subscriptions, and fiber-optic network construction. Data collection was achieved through a broad literature review of academic journals and technical reports, government documents, and international development databases such as MCIT, ATRA, World Bank, GSMA Intelligence, as well as reports by Kepios and UN.

The quantitative analysis used the data including, numbers of internet users, mobile penetration rates, distances of fiber optics (kilometers), and internet bandwidth (Gb). The data has been analyzed over different time periods 2003-2024 to establish trends and growth or decline in infrastructure development. The data were compared regionally with adjoining countries, such as Iran, Pakistan, Tajikistan, and India, to situate Afghanistan in the context of South and Central Asia.

In turn, qualitative analysis includes the theme identification of issues and structural restrictions by reading policy files and expert commentary. Some of the major issues such as lack of investment, governance loopholes, slow internet speeds, and limited digital service provision were explored in detail.

Research was conducted in the first quarter of 2024. The analysis was conducted through Excel, whereas organizing and interpreting results were done through theme coding. The research study was exclusively conducted on secondary data; hence, no experimental or laboratory methods were engaged. All information sources employed were properly referenced, and ethical issues were addressed by ensuring the reliability and credibility of data. The research results give a basic frame of reference for the consideration of the IT environment in Afghanistan and highlight areas of preeminence for improvements in the infrastructure.

4. Results and Discussion

4.1. Research Results

4.1.1. IT infrastructure challenge in Afghanistan

In, the years 2016 to 2023 are compared, and according to this data set which provided in GSMA website, Afghanistan's neighboring countries have a better situation. In 2016, Afghanistan scored 23, Iran 54, Pakistan 34, India 52, and Tajikistan scored 35. This situation for the year 2023 shows a greater difference with Afghanistan, meaning that the state of mobile communication infrastructure in Afghanistan has improved less. For example, in 2023, Afghanistan improved by 31 points, which is an 8-point improvement. While Iran improved by 13 points, Pakistan 11, India 25 and Tajikistan by 37 points. In this graph, the effective and targeted information from various countries for this research has been considered. Afghanistan have been compared with other countries such as Iran, Pakistan, India, and Tajikistan. The dataset provided by SSMA shows that, unfortunately, the mobile communication infrastructure in Afghanistan is weak and the lowest among all the countries in the region. According to this information, Afghanistan has the lowest score in the information technology infrastructure among all the mentioned countries.

Maximizing impact at the lowest cost will further be the best means to improve Afghanistan's IT infrastructure under limited resources. A priority immediately would be giving most weight to interventions expanding mobile network coverage into rural areas with little or no service. For many citizens, mobile connectivity is viewed as the most accessible

form of digital infrastructure. Reinvesting in the existing network through maintenance and optimization will give quick wins. Another vital intervention is to attract private-sector investments through regulatory changes and incentives, generating competition and innovation; such targeted measures can build a basis for wider IT development by maximizing inputs already at hand.

The data set for mobile connectivity infrastructure score pressed by (Lane, 2024)

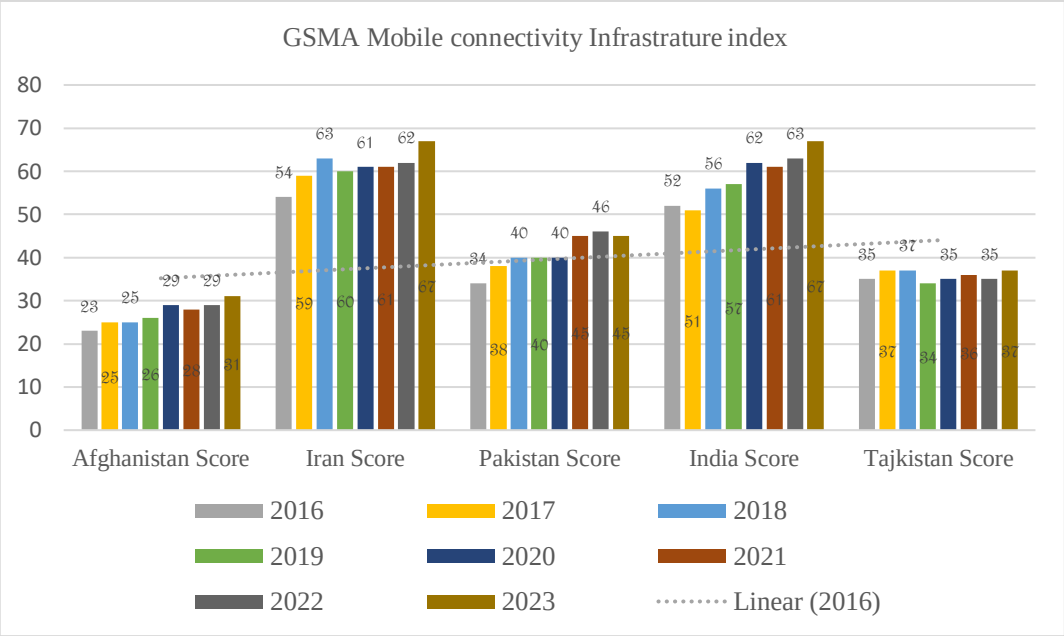

Figure 1. GSMA Mobile Connectivity Infrastructure Index for Afghanistan and Neighboring Countries (2016-2023)

In the table 7 below, the status of technology infrastructure in terms of the number of internet users, internet speed, the ranking of countries globally, and other factors has been analyzed. this table has been collected and analyzed based on important data from the datareportal website and (Samandar, 2025); (Affleck & Freeman, 2010), which has comprehensive information on various countries. This table shows that 18.4 percent of the people in Afghanistan have access to the internet, with an average speed of 2.25 Mbps. While Iran has 11.62 Mbps, Pakistan 10.28, India 49, China 214 and Russia nearly 50 Mbps have been reported. For this reason, it is clear that the internet infrastructure in Afghanistan is very weak. This table primarily compares Afghanistan with the countries of the region.

Table 7. the internet statues for Afghanistan compared to countries

Country	Internet Users (%)	Facebook Ranked	Internet Speed Medium	Internet Speed Ranked	Word Ranked Internet users	Mobile Ranked
Afghanistan	18.4	-	2.25 Mbps	178	142	-
Iran	84.11	-	11.62 Mbps	143	50	14
Pakistan	25	14	10.28 Mbps	149	133	7
India	43	1	49.09 Mbps	80	107	2
Tajikistan	41.6	122	32.09 Mbps	104	-	-
China	70.4	88	214.58 Mbps	2	-	1
Russia	84.99	8	74.92 Mbps	53	45	6

The table 8 below outlines the status of technology and information technology infrastructure in Afghanistan from 2017 to 2024. According to this table, the total population of Afghanistan, internet users, the percentage of people without internet access, social media users, people using mobile services, internet speed on mobile and fixed connections, among other factors, have been surveyed. According to this survey, 81.6 percent of the people in Afghanistan do not have access to the internet. Out of 7.88 million internet users, 3.7 million are only users of social media. In other words, approximately 50% of internet users only have access to social media and are not utilized internet for important functional or specialized areas such as e-commerce, e-governance, education, banking, telecommunications services, online businesses, and etc. The details of this discussion are shown in the table below. Therefore, the challenges of information technology infrastructure in Afghanistan are very serious. Moreover, the slow internet speed compared to regional countries shows that Afghanistan has 19.36% of Iran's internet speed, 21.88% of Pakistan's, 4.58% of India's, 7.01% of Tajikistan's, and 1% of China's internet speed (Samandar, 2025); (Group, 2021); (Samsor, 2021).

Table 8. Afghanistan Digital Survey (2017 – 2024)

Years	Population (Million)	Population (Male)	Internet User	Offline Percent (%)	Active Social media user	Mobil Connectivity (Million)	Mobile Social users (Million)	Internet Speed (mobile & Fixed
2024	42.8	50.5 %	7.88 (18.41%)	81.6	3.7 (8.6%)	27.67 (64.6%)	3.7	4.81& 3.12 Mbps
2023	41.68	50.5 %	7.67 (18.4 %)	81.6	3.15 (7.6%)	26.95 (64.7%)	3.5	5.27 & 2.25 Mbps
2022	40.29	51.3 %	9.23 (22.9%	77.1	4.15 (10.3%)	27.49 (68.2%)	3.8	2.24 & 1.67 Mbps
2021	39.38	51.3 %	8.64 (22%)	78	4.4 (11.2)	27.04 (68.7%)	3.7	4.62 & 8.91 Mbps
2020	38.49	51 %	7.65 (19.87%)	80.125	3.6 (+3.5%)	26.92 (70%)	3.6	4.82 & 6.92 Mbps
2019	36.79	51.5 %	9.7(26%)	74	3.8 (10%)	28.82 (78%)	3.6	-
2018	35.95	51.6 %	4.01 (11%)	89	3.5 (10%)	27.66 (77%)	3.2	-
2017	33.77	51.6 %	4.01(12%)	88	3.00 (9%)	25.2 (8%)	2.7	-

To find accurate information about the IT infrastructure in Afghanistan, various questionnaires, credible government sources, reports, and strategies from the Ministry of Communications, particularly documents from Afghan Telecom, have been analyzed. Unfortunately, in many cases, sufficient and accurate information is not available, and in some cases, information is not provided. Therefore, the information provided by various

departments of the Ministry of Communications and Information Technology has been included and addressed in this research. Summary of the questionnaires answered by various departments of the Ministry of Communications are as follows:

Table 9. Questionnaires and Answerers by MCIT

Questions	Answered
About the challenges and main problems of IT infrastructure	the lack of appropriate technical infrastructure, shortage of financial resources, and lack of professional and specialized personnel have been mentioned.
For the main problems of external connections with neighboring countries	political and security restrictions, and the lack of physical and technical infrastructure have been mentioned.
Regarding the number and types of servers available in the Ministry of Communications	Afghanistan has a large number of various servers to support telecommunications and information technology services. However, precise information regarding the number of servers is not available, as most servers are used for government and private services, Among the communication services, dedicated servers, and shared hosting services
Regarding the number of data centers of the Ministry of Telecommunications, their capacity, and the main types of services	it has been mentioned that the Ministry of Telecommunications and Information Technology of Afghanistan has two data centers with various capacities and types of services in the country.
Regarding which countries have active fiber optic and satellite connections	it has been stated that Afghanistan has active internet connections with Pakistan, Iran, and Turkmenistan through fiber optic cables and satellites.
The total bandwidth of internet for Afghanistan	is not available.
The maximum number of internet customers or users in the country	This information isn't available.
The maximum number of telephone subscribers in the country	This information isn't available.
which provinces do you have internet, telephone, or both services	Internet, telephone, and combined services are offered in most provinces of Afghanistan. But detailed information about service coverage in each province of Afghanistan is not available.
The number of internet backbones/connections to Afghanistan's neighboring countries and the capacity of each one at present	This information is not available.
The list of active ISPs in Afghanistan and the bandwidth they have	This information is not available.

From the list above, we can explain each aspect as follows:

1) Access to Basic Infrastructure Is Limited

Afghanistan's distant and rural areas' inadequate access to telecommunications infrastructure, due hilly and very challenge path way to these areas. the internet connectivity

and access to the high quality of internet are dream to rural area and other big challenge is the energy to support 24/7 hours due the poor electricity infrastructure in Afghanistan.

2) Lack of Cyber law in Afghanistan

The cyber security risks that Afghanistan's prolonged combat, political unrest, and insurgency present are affected on improvement of information technology infrastructures. Because of luck government support regarding the information technology investment also effect the poor IT infrastructure in Afghanistan.

In current situation Afghanistan do not has any proper cybersecurity policies, weakness in IT infrastructures such as the possibility of cyberattacks and physical infrastructure damage, affect the installation and upkeep of IT infrastructure.

3) Lack of IT specialist and IT workers are other challenges which faced Afghanistan

Afghanistan is war-torn country, the main challenges in IT infrastructure is lack of Information technology specialist to maintain and stabilize the IT infrastructure to provide stable service. This problem comes form policy and law maker and the government perspective regarding the need of good infrastructure in 21th century. In recent year all IT department run through the people with no any IT skills and education. So, need to talk about the significance of funding of funding educational programs and capacity building project in order to close the skills gap and promote regional IT infrastructure management expertise.

4) Lack of Regulatory and Legal Framework in country level

As we mention above Afghanistan goes with 40 years internal war and still yet don't have any framework to develop the IT in this country Regulatory challenges for IT infrastructures development are existent at the ministry of Communication and Information Technology (MCIT) Afghanistan. Lack of regulatory for growth and investment from governments the IT infrastructures in Afghanistan is clean cut and explicit. For monitoring the law, controlling the malfeasance and implement the growth of IT infrastructures, in Afghanistan don't have IT regulatory, policy and vision to provide the better IT infrastructures. so, the necessity for precise laws, rules, and procedures for enforcement in order to encourage international standard compliance, investment, and innovation is very important for a stable and the growth of IT infrastructure.

5) Financial Constraints and Funding

Afghanistan is indigently country special in this time Afghan government is faced the big challenge of not acceptation of other country so this challenge effected on IT infrastructure. The financial constraints on the establishment and development of Afghanistan's IT infrastructures are clear. The Constructing a sustainable information technology infrastructure is one of the most important national financial projects. Afghanistan's weak economy prevents it from being able to adapt and carry out large-scale industrial and economic projects on its own, such building a reliable and robust information technology infrastructure.

Therefore, the financial and economic limitation is one of the serious challenges for the creation and development of information technology infrastructure.

6) Social and Cultural Aspects

As we know Afghanistan is one of the countries which has low literacy population. So, this is One of the most significant concerns is the attitude and culture of the Afghan people toward technology, its use, and digital literacy. It would be beneficial to talk more about the possible effects of social and cultural factors on the uptake and application of IT infrastructure solutions in various parts of Afghanistan. If the literacy is below about the technology and other digital aspect people and government do not attention about the IT infrastructure and importance of it.

7) Lack of investment and government support

One of the major challenges facing the development of IT infrastructure in Afghanistan is the lack of government investment and support. Despite the growing need for digital transformation and connectivity, the Afghan government has consistently failed to prioritize the IT sector as a critical component of national development. Without sufficient funding, strategic planning, and long-term commitment from state institutions, the country remains far behind in building a reliable and modern technological foundation. This lack of support discourages private sector involvement, hampers innovation, and leaves the country disconnected from global advancements in information technology Solutions.

4.1.2. Proposed Solutions for Improving Afghanistan's IT Infrastructure

Based on a review of related documents, several key points have been identified that are common for good IT infrastructure and offer excellent solutions for Afghanistan's IT development. By implementing these strategies, Afghanistan's IT infrastructure and ICT programs will be optimized across different sectors. These solutions and strategies are as follows:

1) National Networks

National networks are crucial for improving the cost efficiency of internet bandwidth, sustainability, internet speed, and access to available national resources such as management systems, e-learning, e-governance, and other ICT services. Additionally, national networks ensure better data security. Many countries have successfully implemented this strategy, and it is highly recommended for Afghanistan to do the same.

2) Electricity Limitations

Electricity poses a significant challenge for IT infrastructure development in Afghanistan. The current electricity networks and power resources are very limited. Currently, electricity is imported from Tajikistan, Uzbekistan, and Turkmenistan, and this supply is mainly sufficient only for urban populations. To ensure the success of IT infrastructure projects, a comprehensive strategy to improve and expand the national electricity grid is essential.

3) Open Access Policy for Optical Fiber Cable (OFC) Networks

This strategy has been successfully employed by several countries, including Mongolia and Pakistan. With an open access policy, private sector companies can also participate in providing OFC networks or backbone infrastructure. In return for their contributions, these companies can gain economic benefits. This approach helps improve the state of IT infrastructure more rapidly, leading to enhanced speed, efficiency, and overall progress.

4) Complementing the OFC Network

Upgrading the ring route of the OFC network, increasing bandwidth, and improving speed and cost efficiency are possible through collaboration with China. As a commercial market partner, China can assist in creating and strengthening Afghanistan's national network and OFC infrastructure. This partnership will also lead to better internet speeds, lower costs, and improved access to modern technologies. The open access policy for OFC networks is also applicable in this context, and China's involvement could be highly beneficial for Afghanistan.

4.2. Discussion

The study results cleanly show that Afghanistan's IT infrastructural gap has remained a qualitatively ubiquitous divide for ages that sorely hampers any prospects for development in many socio-economic sectors. The internet penetration—the 18.4% population in the year 2024—reflects a digital divide profoundly affecting rural and underserved communities (DataReportal, 2024). The 64.6% mobile coverage is, however, not comparable to the terribly

low quality and speed of internet services averaging at a mere 2.25 Mbps (Speedtest Global Index, 2024). In stark stark contrast with Iran and India, whose levels of network and digital connectivity ability are substantially higher, with a GSMA Intelligence study, 2023 further illuminating the disparity.

The scarcity of the current optical fiber cable networking is one of the greatest hindrances; its length is merely 4,000 kilometers, traversing 24 of some 34 provinces. Compared to countries like Mongolia that span thousands of kilometers of optic cable across a vast area with a smaller population, 4,000 kilometers is an extremely insufficient stretch indeed (Ruddy & Ozdemir, 2016). There has been little progress due to the absence of involvement by the private sector since backbone infrastructure is still fully owned or controlled by the State. The open-access framework has been prepared by ATRA with limited execution (MCIT, 2023).

Despite mobile internet penetration, the application of mobile internet in sectors such as e-governance, e-commerce, or e-learning is almost non-existent. Most internet use consists of various social media platforms that give little to no contribution towards the socio-economic development of the country (World Bank, 2022). Without a direct investment, organisational reforms, and a blend of public investor's interests and support from private entities, Afghanistan will continue to appear far behind in its stride for digital transformation.

It is critical that infrastructure development, costs, and capacity building are to be prioritized to meet these challenges, especially in the most remote and underdeveloped regions. Also of critical importance are the building of digital literacy and an ability to lure private investments toward establishing a resilient and inclusive IT ecosystem.

5. Conclusion

Afghanistan's development of information technology (IT) infrastructure is beset by many problems that ultimately affect the growth of the sector. The main problems include insufficient technical infrastructure, inadequate financial resources, lack of skills in IT, security threats, and no clear regulatory framework. Besides, cultural and social barriers, especially in remote areas, and absence of government investment and campaign are prime obstacles in the country's development of IT infrastructure.

Nevertheless, there is a myriad of approaches which will go a long way in addressing the aforementioned problems. One major remedy is development of national networks that will translate into improved cost-effectiveness, speed of the internet, and access to national resources including management systems, e-governance, and many other ICT services. Another priority area would be opening up the access to the optical fiber cable (OFC) networks; expanding the national OFC backbone; and addressing the current limitations of the electricity grid with special focus on rural areas since these interventions are very feasible and bear a very important impact. The collaboration with neighboring countries, especially China, on the extension of OFC connections can also be considered as a strategic approach to improving connectivity and minimizing costs. The key challenges from implementation may include political instability, limited institutional capacity, and weak coordination between stakeholders. The creation of strong governance and consistency in national policies will be a prerequisite for addressing them.

5.1. Acknowledgments

The authors would like to thank all individuals and institutions who contributed their insights and data during the research process. Special appreciation is extended to the Ministry of Communication and Information Technology of Afghanistan for providing access to public

reports. We also acknowledge the support and feedback from our academic supervisors and research peers.

5.2. Competing interests

The authors declare that there are no competing interests associated with this publication. All views expressed in this article are solely those of the authors. No financial or personal relationships influenced the findings or interpretation of this study.

5.3. Funding

This research received no external funding. The study was conducted as part of the authors' academic and independent research efforts. No grant, sponsorship, or financial support was obtained from any government, private, or international organization.

6. References

MCIT, A. (2019). *National ICT Policy and Strategy for Afghanistan*. Kabul: https://mcit.gov.af.

Advisor, O. o. (2017). *Afghan Fiber Optic Network*. Kabul: Afghan Telecom.

Affleck, R. T., & Freeman, R. B. (2010). *Challenges for engineering design, construction, and maintenance of infrastructure in Afghanistan*. Washington D. C.: U.S. Army Corps of Engineers.

DataReportal, D. (2024, November 21). *DataReportal*. Retrieved from DataReportal: https://datareportal.com/reports/

Datareportal, D. (2024, 11 20). *Datareportal-Afghanistan*. Retrieved from Datareportal: https://datareportal.com/reports/digital-2024-afghanistan

Group, W. (2021). *Afghanistan Digital Economy Project: Strengthening IT Infrastructure and Connectivity*. https://www.worldbank.org.

Hamidi, M. S., Hakimi, M., & Khalid, K. (2024). Challenges and Opportunities of Implementing E-Government in Afghanistan: A Case Study of Da Afghanistan Breshna Sherkat, Kabul. *International Journal of Research and Analytical Reviews (IJRAR), 11*(3), 254-262.

ITU, I. (2022). *Measuring Digital Development: Facts and Figures for Afghanistan*. https://www.itu.int](https://www.itu.int.

Lambert, J. H., Karvetski, C. W., Spencer, D. K., Sotirin, B. J., Liberi, D. M., Zaghloul, H. H., . . . Linkov, I. (2012). Prioritizing infrastructure investments in Afghanistan with multiagency stakeholders and deep uncertainty of emergent conditions. *Journal of infrastructure systems, 18*(2), 155-166.

Lane, A. (2024, 11 Saturday). *The State of Mobile internet Connectivity*. EC4R 3AB, United Kingdom: GSMA.COM. Retrieved from GSMA.COM: https://www.mobileconnectivityindex.com/index.html#year=2023&zoneIsocode=AFG

MCIT, M. o. (2015). *Presentation by MCIT on Afghan Fiber Optic Ring*. Working Group on Knowledge-based Development Dushanbe,Tajikistan: International Conference "Practical steps towards a knowledge-based economy" and the Seventh session of the SPECA.

Ruddy , M., & Ozdemir, E. (2016). *An In-Depth Study on the Broadband Infrastructure in Afghanistan and Mongolia.* Bangkok 10200: Economic and Social Commission for Asia and the Pacific (ESCAP).

Saay, S., & Norta, A. (2018). An architecture for e-learning infrastructures on a national level: a case study of the Afghanistan Research and Education Network. *International Journal of Innovation and Learning*, *23*(1), 54-75.

Samandar, R. (2025). The State of Telecommunication and Internet in Afghanistan and Its

Impact. *Afghan Journal of Science*, 1- 17.

Samsor, A. M. (2021). Challenges and prospects of e-Government implementation in Afghanistan. *International Trade, Politics and Development, 5*(1), 51-70.

Wafa, Z. M. A. R. I. A. L. A. I. (2014). National Cyber Security Strategy of Afghanistan (NCSA). *Islamic Republic of Afghanistan Ministry of Communications and IT*.

Wentz, L., Kramer, F., & Starr, S. (2008). *Information and Communication Technologies for Reconstruction and Development: Afghanistan Challenges and Opportunities*. Fort Lesley J. McNair, Washington, DC: National Defense University Center for Technology and National Security Policy: http://www.ndu.edu/ctnsp/publications.html: https://reliefweb.int/report/world/.