Consultant's Report

Project Number: 105417
December 2015

Regional: Digital Economy Study in Central and West Asia (Unleashing the Potential of the Internet in Central Asia, South Asia, the Caucasus and Beyond)

Prepared by Peter Lovelock

Internet Society Asia Limited

Asian Development Bank

Unleashing the Potential of the Internet in Central Asia, South Asia, the Caucasus and Beyond

Table of Contents

Preface 1

Introduction 2

Conceptual Framework 2

Socioeconomic Context 4

Outline of the Report 7

I. Subregional Overview of Internet Connectivity 8

Internet Penetration 8

Subregional Clusters 11

Mobile Teledensity 13

Broadband Penetration 14

II. International and Regional Internet Bandwidth 17

Subregional Internet Bandwidth 18

International Bandwidth Supply: Landline and Submarine Cables 21

IP Transit Pricing and IXPs 26

IXPs in the Central Asia+5 Subregion 28

III. National Connectivity 31

Broadband Penetration 31

Broadband: Availability, Affordability and Accessibility 32

Conclusion 44

IV. Digital Economy Opportunities and Constraints 46

Finance 47

E-government 52

Education 58

ICTs for Children with Special Needs and Disabilities 65

Conclusion 65

V. Policy Recommendations 67

Preface

This report is a joint project between the Asian Development Bank (ADB), the United Nations Commission on Economic and Social Development (ESCAP) and the Internet Society (ISOC) to assess the status of Internet connectivity and identify key elements to transition from a basic Internet economy to a thriving digital economy and society.

This report is the third in a series of studies by ISOC that assesses subregional Internet ecosystems and the level of progress toward achieving a digital economy, in which the Internet is the underlying driver of all sectors across an economy.[1] For ESCAP, the report is part of its efforts to build momentum and awareness for enhanced subregional cooperation for ICT connectivity for development under the Asia-Pacific Information Superhighway (AP-IS) initiative. For ADB, the study contributes to its ICT for development focus, which aims to help developing country members capture the opportunities presented by the Internet and evolving technologies and harness them for empowerment and growth.

The report focuses on 10 countries—Afghanistan, Armenia, Azerbaijan, Georgia, Kazakhstan, the Kyrgyz Republic, Pakistan, Tajikistan, Turkmenistan, and Uzbekistan—in the Caucasus, and Central and South Asia (hereinafter 'Central Asia+5'). On top of the shared history or interlinked socioeconomic development among these countries, the Central Asia+5 countries all suffer from under-developed Internet ecosystems. The landlocked nature of the majority of these countries has put them at a distinct disadvantage with limited access to cost-effective international bandwidth, which make them reliant on transit and interconnections with their neighbors.

Despite the constraints, many of these countries have achieved steady growth in Internet take up and usage in recent years by successfully expanding coverage services and bringing the price of access down. As much of the rest of the world forges ahead into the digital economy through the pervasive diffusion of smartphones, the Internet and broadband, it is imperative that the Central Asia+5 countries work on removing barriers to the diffusion and development of an open and competitive Internet ecosystem.

Taking these issues into account, this report examines the current landscape of Internet connectivity in these countries. It identifies both bottlenecks and opportunities to develop the Internet ecosystem from the supply-side, and usage and regulatory perspectives. It also looks at how the Internet can be used to advance social and economic development goals such as education, health and empowerment, with examples from the 10 countries. This report advocates for the Central Asia+5 countries to proactively digitize public, commercial, and social programs, and provides a set of policy recommendations to pave the way to transition toward a digital economy and society.

[1] The first report published in 2013 looked at 20 countries in Africa and the second published in 2015 focused on 10 ASEAN countries. See ISOC and Analysys Mason (2013), "Lifting barriers to Internet development in Africa: suggestions for improving connectivity", http://www.internetsociety.org/doc/lifting-barriers-internet-development-africa-suggestions-improving-connectivity; ISOC and TRPC (2015), "Unleashing the Potential of the Internet for ASEAN Economies", http://www.internetsociety.org/doc/unleashing-potential-internet-asean-economies

Introduction

Conceptual Framework

The conceptual framework of this study builds upon insights from the 2015 ISOC report "*Unlocking the Potential of the Internet for the ASEAN Economies*" and, prior to that, the 2013 report *"Lifting barriers to Internet development in Africa: suggestions for improving connectivity"*. The Internet is, in the parlance of economists, a General Purpose Technology (GPT).[2] That means not only does it create a demand and supply for Internet goods and services, for example Internet access and content services, *but it also becomes the bedrock of a modern digital economy as the Internet extends its reach into all other corners of the economy and society*. The goods and services it creates directly consist of, among other things, Internet Protocol (IP) parts and components for computers and other "connected devices", Internet access and services by smartphones using mobile broadband wireless access networks, and applications and content over the World Wide Web. For example, the next generation of TV sets and games devices connect *directly* to the Internet, offering entertainment, information services, social media connectivity, and so on. When the Internet becomes available *throughout* society, it increasingly becomes the means by which *all* businesses and markets work irrespective of which industrial sector they fall into. The Internet becomes the foundation for all non-Internet sectors of the economy, and for that reason, economists refer to it as a *general* purpose technology.

Reinforcing this approach are the findings from a recent study by the World Bank assessing evidence from over 100 developing economies.[3] The report found that firms grow faster and are more productive in countries where Internet access is more widely available. More significantly, the study revealed that, while firms of all varieties, no matter the level of technology, size or export orientation, benefit from the Internet, it is small and medium enterprises (SMEs) that benefit proportionally more from the Internet.

The World Bank report uses the three conditions underpinning universal access and service—**availability, affordability, and accessibility**—to examine the supply side of Internet connectivity, the premise being that all three conditions need to be met to drive the take up of access and usage. This is an important premise and one that has been followed in previous ISOC reports in this series on subregional Internet connectivity. However, focusing on supply side connectivity only tells one part of the story, and given the transformational impact of Internet access—an impact that is becoming more widely recognized and appreciated—means that nascent, or un-realized demand, is not being taken fully into account as a potential driver of growth in its own right. This has important consequences.

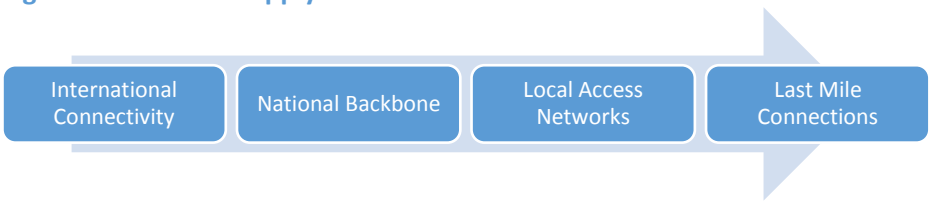
The approach that this and earlier ISOC Internet connectivity reports have taken is to use an Internet access supply chain model to look at constraints upon the supply of Internet access. The primary

[2] S. Basu, and J. Fernald (2008), "Information and Communication Technology as a General Purpose Technology: Evidence from U.S. Industry Data", Federal Reserve Bank of San Francisco Economic Review

[3] G. Clarke, C. Qiang, and L. Xu, (2015), "*The internet as a general-purpose technology: firm-level evidence from around the world",* Policy Research Working Paper (No. WPS 7192), World Bank Group, http://documents.worldbank.org/curated/en/2015/02/23981049/internet-general-purpose-technology-firm-level-evidence-around-world

elements of the Internet supply chain are international bandwidth capacity, national backbone supply, local access networks, and last mile connections (Figure i.1).

Figure i.1: Internet Supply Chain



Source: ISOC (2013), "Lifting barriers to Internet development in Africa: suggestions for improving connectivity"

One issue that began coming through in the earlier Africa report, and was developed more fully in the ASEAN study, was the importance of extending supply to address nascent demand (what was thought of previously as 'uneconomic demand'), precisely because of the extended benefits that accrue to so many other areas of social and economic development by providing connectivity. As explored in these earlier reports, the supply-chain approach has been the story of *insufficient supply-insufficient realized demand*. What becomes apparent when this framework is applied to the Central Asia+5 countries under review is that it is the latter issue—unrealized demand— that may be the more important determinant. As such, it is as important to focus on stimulating demand as it is on extending supply.

In other words, the demand for broadband connectivity across many of the communities in these countries will be driven by what can be done with it (e.g. access to social media, streamed content, financial services, healthcare, etc.), rather than simply connectivity or communications. This transforms fundamental considerations such as the affordability of a broadband connection. From an end user's perspective, what may otherwise appear "unaffordable" in communications terms may in fact become reasonable when the access enables other basic services such as payments, education and healthcare. For governments, digitizing key socioeconomic services and providing them over the Internet is also a more cost-effective way of delivering public services. However, such e-government services will only be effective if citizens are online and are able to use them. This therefore becomes an important conclusion to arrive at both for policy makers as well as for those looking to generate a return on infrastructural investments.

A second and interrelated premise of the report is that as productive use of the Internet becomes pervasive throughout society, a transformation takes place toward a fully-developed **digital economy**. This transformation, and the conditions that are necessary for it to occur, is also the central theme of the ISOC report on the ASEAN economies. For this transformation to succeed two conditions are required: that the networks ***interconnect*** (so any user of one network can communicate with any user of another), and that their software platforms are designed to be ***interoperable*** with one another (so applications and content can be used across networks, and give rise, for example, to collaborative

working at any distance). Neither of these conditions is guaranteed, although in some cases they may be the result of a regulatory requirement.[4]

The importance of interconnectivity and interoperability is that, once established, they open the way for, and encourage, innovative additional services, content and applications. Many of these may call for changes in the business models associated with traditional goods and services. These developments in business strategies are part of the shift from a purely Internet economy toward a digital economy in which a broad range of non-IT goods and services utilize the Internet in their design, production, distribution and consumption. Crucial to this development is the widespread existence of public and private communications networks that utilize IP that enable the interconnection and interoperability to take place. Using this conceptual framework is particularly pertinent for lower-income countries going through rapid network, *and especially rapid mobile network*, development. If they can achieve comprehensive levels of national coverage, interconnectivity and interoperability, the foundations of a shift from a nascent Internet economy toward a fully developed digital economy and society can be established.

Socioeconomic Context

The socioeconomic and demographical characteristics of the 10 countries under review in this report—Afghanistan, Armenia, Georgia, Kazakhstan, the Kyrgyz Republic, Pakistan, Tajikistan, Turkmenistan, and Uzbekistan—show a set of 'natural disadvantages' acting as barriers to Internet diffusion, such as low population densities in some cases and vast rural areas and hinterlands in others that can be difficult to cover by physical networks, i.e., they are 'uneconomic'. In many cases, nevertheless, the countries have experienced rapid rates of economic growth in recent years—on average around 5% per annum. The demographics also point to comparatively young populations who are likely to be the early adopters of new and mobile technologies (see Figure i.2), and who will be agents of adoption, diffusion and change.

Taken together as a single entity and using World Bank data, by 2014 the combined nominal gross domestic product (GDP) of USD636 billion would make the subregion the 20th largest economy in the world, just behind Switzerland and Sweden.[5] However, most of these countries experience high levels of

[4] For example, in most cases telecommunications networks interconnect, in some cases owing to regulatory requirement and in others owing to the commercial self-interest of the parties involved. By contrast, banking networks accessed through ATMs or over mobile phone networks, frequently do not interconnect. Where they do, it usually arises from a commercial self-interest in permitting their customers to send and receive money transfers. Proprietorial online payment systems similarly tend not to interconnect, but where the industry uses trusted third parties then users can interconnect with each of the networks that are party to the system. In each of these cases, interconnection is only as good as what can be sent and received between the networks, and that is determined by the degree of interoperability and capacity established between them. For example, an ATM may allow a customer to access multiple banks, but not all ATM systems will allow a transfer of funds between the accounts of different banks. See ISOC and TRPC (2015), "Unleashing the Potential of the Internet for ASEAN Economies", http://www.internetsociety.org/doc/unleashing-potential-internet-asean-economies

[5] World Bank (2014), "GDP Ranking", http://data.worldbank.org/data-catalog/GDP-ranking-table. According to the World Bank the combined GDP in 2014 of the 10 countries totaled USD635 billion, placing them—as a region—just behind the GDP of Switzerland (USD685 billion) and Sweden (USD750 billion).

poverty and unemployment and, as six of them were previously part of the former Soviet Union, its dissolution has resulted in considerable challenges of adjustment to the structure of their economies.[6] This is especially true of the energy-exporting countries—notably Azerbaijan, Kazakhstan and Turkmenistan—but all 10 also suffer from limited access to basic services, such as electricity, water and sanitation, education, social welfare, transport and others, with the lack of such services often acutely felt in rural areas. In addition, a number of countries in this group face significant security issues.

The 10 countries in this report are all at very different stages of economic development. According to the World Bank's income classifications, Azerbaijan, Kazakhstan and Turkmenistan are considered upper-middle-income countries, Armenia, Georgia, the Kyrgyz Republic, Pakistan and Uzbekistan are lower-middle-income countries, and Afghanistan and Tajikistan are low-income countries. Table i.1 illustrates the varying levels of economic development, population size and density, and urbanization of the 10 countries. The economic development differential is best exemplified in comparing Kazakhstan (with the highest GDP per capita at USD12,276) and Afghanistan (with the lowest GDP per capita at USD666).

Table i.1: Development Indicators of the Central Asia+5 Countries (2014)

	GDP Per Capita (Current USD)	Population	Mean Age	Population Density (People per sq km)	Urban Population (% of total)
Kazakhstan	12,276	17,289,111	29.7	6	53
Turkmenistan	9,032	5,307,171	26.6	11	50
Azerbaijan	7,884	9,537,823	30.1	115	54
Georgia	3,670	4,504,100	37.7	79	53
Armenia	3,647	2,983,990	33.7	105	63
Uzbekistan	2,038	30,742,500	27.1	72	36
Pakistan	1,334	185,132,926	22.6	240	38
Kyrgyz Republic	1,269	5,834,200	25.7	30	36
Tajikistan	1,099	8,408,947	23.5	60	27
Afghanistan	666	31,280,518	18.1	48	26

Source: World Development Indicators (2015), http://data.worldbank.org/indicator, CIA World Factbook (2014), "Age Structure", https://www.cia.gov/library/publications/the-world-factbook/

The vast landmass of many of these countries is reflected in the population density statistics, with Kazakhstan the least densely populated at six people per square km. However, by contrast, Pakistan has a population density of 240 and a population of over 185 million—more than all other countries in this study combined.

[6] The six countries—Armenia, Azerbaijan, Kazakhstan, the Kyrgyz Republic, Tajikistan, and Uzbekistan—are also current members of the nine-member Commonwealth of Independent States (CIS).

According to the United Nations (UN), over 54% of the world's population live in urban areas, however the average is much lower in this subregion.[7] In Afghanistan, the Kyrgyz Republic, Pakistan, Tajikistan, and Uzbekistan, less than half of the population live in urban areas. If a youthful population is conducive to Internet adoption, low population densities and populations spread over large distances are not. Telecommunication service providers and Internet service providers (ISPs) inevitably prioritize highly populated urban center where the returns on investment are higher and quicker to realize. The resulting urban and rural divide within countries and efforts to expand universal access and service by various countries are further explored in Chapter III.

[7] United Nations (2014), "World Urbanization Prospects", http://esa.un.org/unpd/wup/FinalReport/WUP2014-Report.pdf

Outline of the Report

The report is divided into five sections:

I. Subregional Overview of Internet Connectivity;
II. International and Subregional Internet Bandwidth;
III. National Connectivity;
IV. Digital Economy Opportunities and Constraints; and
V. Policy Recommendations

Chapter I provides a snapshot of the status of Internet connectivity in the subregion of the Central Asia+5 countries and elaborates the relationship between the level of economic development and the level of Internet diffusion and broadband penetration.

Chapter II assesses the status of subregional Internet connectivity by investigating the available bandwidth and the costs of transit, which will directly impact the rest of the Internet supply chain, including cost, quality and access. The impact of a limited presence of Internet exchange points (IXPs) on costs and bit-rate is also explored.

Chapter III looks at national connectivity, and explores how the interplay of coverage and affordability of broadband services along with institutional conditions affect Internet take up in the 10 countries.

Chapter IV identifies examples of the Internet extending and transforming key development initiatives and government services, including health, education and the empowerment of marginalized groups. These examples are indicative of emerging signs of a digital economy, sometimes in spite of limited connectivity. They are also illustrative of potential drivers for expanding broadband connectivity—in other words, a crucial focus is on the demand side of the equation, and it is one that may not yet be fully appreciated.

Lastly, **Chapter V** provides a set of policy recommendations, looking into what *more* can be done to improve the connectivity, interconnectivity and interoperability landscapes both within and across these countries.

I. Subregional Overview of Internet Connectivity

This section reviews the status of Internet connectivity across the Central Asia+5 countries, looking at basic Internet penetration through to broadband subscription levels. Analysis shows that these 10 countries can be categorized into three distinct clusters, which largely align with the level of economic growth of the countries. Exceptions in the correlation between income level and Internet penetration do exist, however, implying that other forces come into play, raising a set of issues to be explored in later chapters.

Internet Penetration[8]

All Central Asia+5 countries in this report have shown growth in Internet penetration over the past five years. Overall, the subregion's Internet population has more than doubled, from 27 million in 2009 to 64 million in 2014.[9] These figures, however, mask significant divergence between countries, as well as significant room for growth.

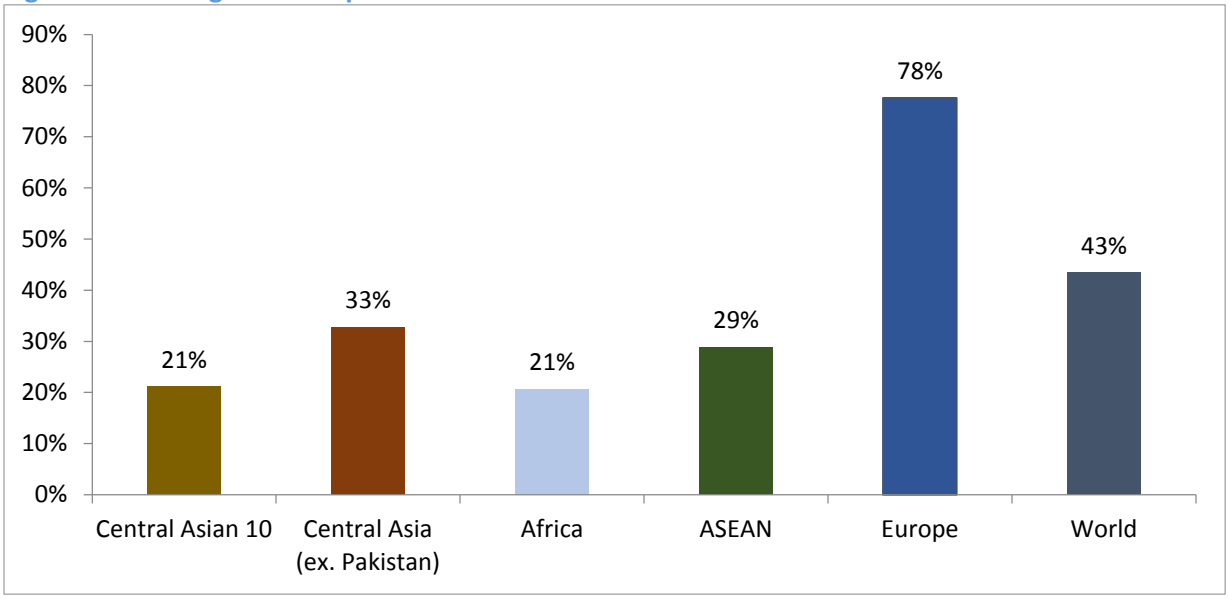
The average penetration rate across the subregion, as of 2014, was still only 21%—significantly lower than the average globally (43%) and lower than that for the ASEAN subregion (29%), but on par with the African continent as shown in Figure 1.1.[10] However, once Pakistan, with a population of 185 million people—more than half the subregion's total—is excluded, average Internet penetration for the remaining nine countries increases significantly to 33%.

[8] This report uses the number of Internet users per 100 inhabitants as a measure of Internet penetration within a country. According to the ITU definition, Internet users are individuals who have used the Internet (from any location) in the last 12 months. Internet can be used via a computer, mobile phone, personal digital assistant, games machine, digital TV etc.

[9] International Telecommunication Union (ITU) (2015), ITU World Telecommunication/ICT Indicators Database 2015, Percentage of Individuals Using the Internet.

[10] Average Internet penetration rate is calculated using a weighted average taking into account each country's population size.

Figure 1.1: Subregional Comparison of Internet Penetration

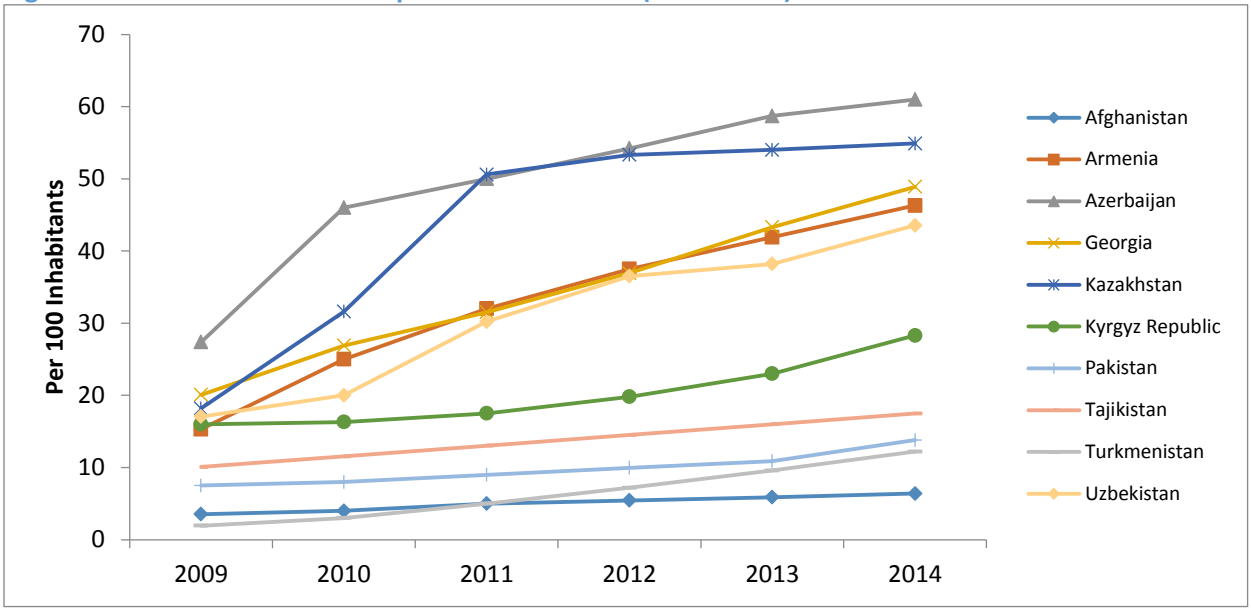


Source: TRPC analysis using data from the ITU (2015), "World Telecommunication/ICT Indicators database"

The lag in connectivity across the Central Asia+5 countries can be partially explained by geographical factors. With the exception of Georgia and Pakistan, all eight other countries are landlocked, and unable to benefit from direct submarine cable access. Moreover, the countries' mountainous and/or desert terrain adds to the difficulty in deploying telecommunications and Internet infrastructure. Landlocked countries must either use satellite access, which can be prohibitively expensive as well as being comparatively slow, or depend upon neighboring countries for terrestrial access through to submarine cable landing stations. Landlocked countries therefore have to bear bandwidth transit and interconnection costs imposed by their neighbors in addition to cable infrastructure costs. Aside from the geographic constraints, these countries often find themselves subject to the market structure and conditions of bandwidth access in neighboring countries when effecting international transit.[11] For such land-locked countries, this interreliance further increases the importance of the reliability and robustness of the existing terrestrial networks and of subregional connectivity. It also spells opportunity for coastal countries or relatively less bottlenecked countries among this group to serve the neighboring landlocked countries. These issues are picked up on and explored in later chapters.

[11] ESCAP (2015), "Secretariat discussion paper for the open-ended Working Group on the Asia-Pacific Information Superhighway", http://www.unescap.org/resources/secretariat-discussion-paper-open-ended-working-group-asia-pacific-information

Figure 1.2: Internet Penetration per 100 Inhabitants (2009–2014)



Source: ITU (2015), "World Telecommunication/ICT Indicators Database"

There is also significant variation in Internet adoption across the 10 countries, with penetration rates varying widely, from 6% in Afghanistan to almost 10 times higher at 61% in Azerbaijan. Furthermore, while one group of countries, encompassing Armenia, Azerbaijan, Georgia, Kazakhstan and Uzbekistan, have enjoyed strong growth through this period, showing on average a two-fold increase from 2009 to 2014 (Figure 1.2), others, such as Afghanistan, Pakistan, Tajikistan and Turkmenistan, all of which started from a base of 10% and below in 2009, have experienced slow growth, which suggests a systemic constraint.[12] What needs to be noted though, that is even *within* countries, there are significant differences in Internet adoption, especially among urban and rural citizens. Those living in urban cities are more likely to be more educated and affluent, however as we explore later, income levels alone do not fully explain Internet adoption.

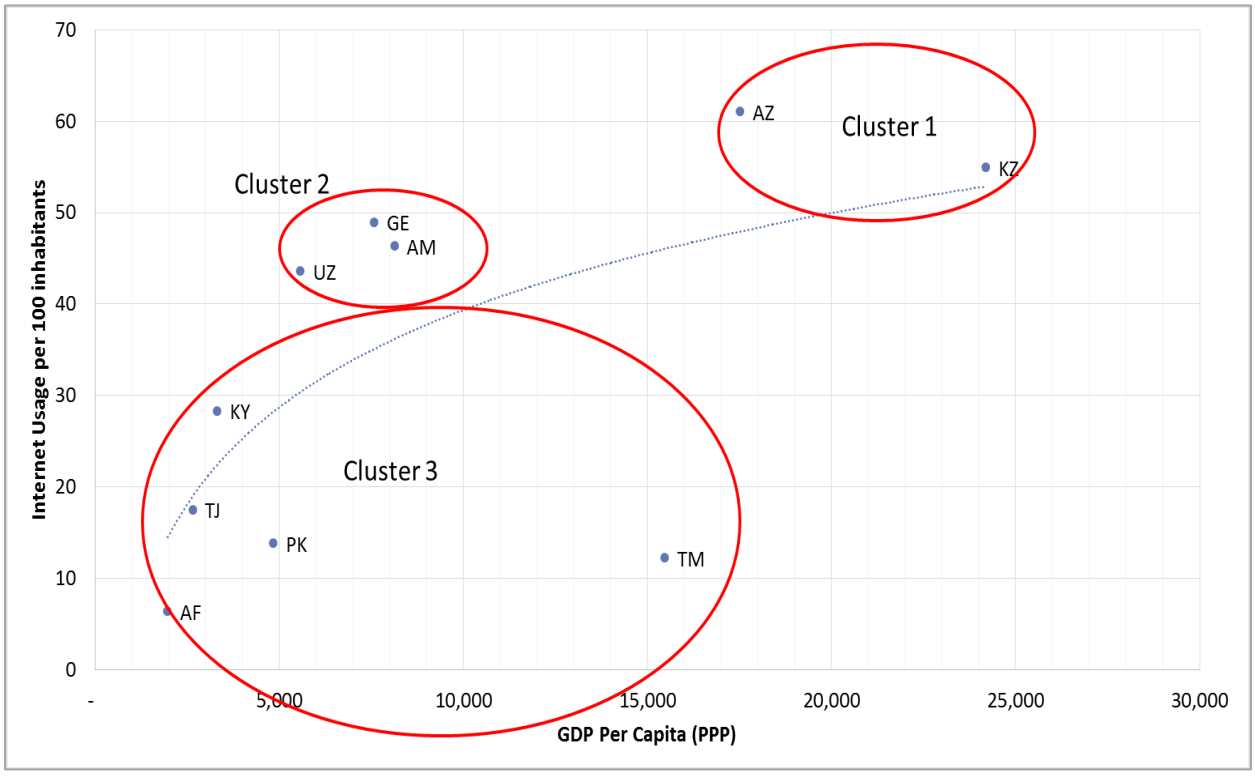
The low levels of connectivity mean that there is room for growth. While policy makers cannot control for geographical factors, they can still play influential roles in stimulating demand and supply through policy. Under other circumstances, it might be expected that the lower the base the faster the catch-up. Given that this has not been the case across the Central Asia+5 countries, there are clearly factors holding back the growth of national Internet penetration rates in this cluster of countries. The reasons for this divergence are explored below.

[12] From 2009 to 2014, Armenia's Internet penetration level jumped from 15% to 46%, Azerbaijan's from 27% to 61%, Georgia from 21% to 49%, Kazakhstan's from 27% to 55%, and Uzbekistan from 18% to 44%.

Subregional Clusters

As shown in earlier studies in the series,[13] the level of economic development is important, but it is not the sole criteria determining the level of Internet development in a country. By measuring Internet penetration against GDP for the 10 states similar patterns begin to emerge. For example, the countries generally follow a positive logarithmic trendline associating higher Internet usage with higher rates of economic development (Figure 1.3).

Figure 1.3: Internet Penetration vs GDP Per Capita (PPP) (2014)



Source: ITU (2015), "World Telecommunication/ICT Indicators Database"; World Development Indicators (2015), "GDP per Capita, PPP (current international $)", http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD

This approach suggests that the 10 countries fall into three distinct country clusters:

- **Cluster 1**, a majority of the population (>50%) with Internet access (Azerbaijan, Kazakhstan)
- **Cluster 2**, a significant minority (30%–50%) of the population with Internet access (Armenia, Georgia and Uzbekistan)
- **Cluster 3**, low population access (<30%) (Afghanistan, the Kyrgyz Republic, Pakistan, Tajikistan and Turkmenistan)

When Internet penetration, defined as the percentage of the total population that uses the Internet, is measured against economic development several outliers emerge. Most obvious is Turkmenistan with

[13] See ISOC (2013), "Lifting barriers to Internet development in Africa: suggestions for improving connectivity", and ISOC (2015), "Unleashing the Potential of the Internet for the ASEAN Economies"

only 12% Internet penetration despite being classified as an upper-middle-income country according to the World Bank. It is also notable that while Armenia, Georgia, the Kyrgyz Republic and Pakistan lie within the same lower-middle income grouping, the former two (Armenia, Georgia) belong to the higher Internet penetration cluster, Cluster 2 (46% and 49% respectively), while the latter two fall into Cluster 3 with penetration rates of 28% and 14%.

Table 1.1: Clusters According to Internet Penetration

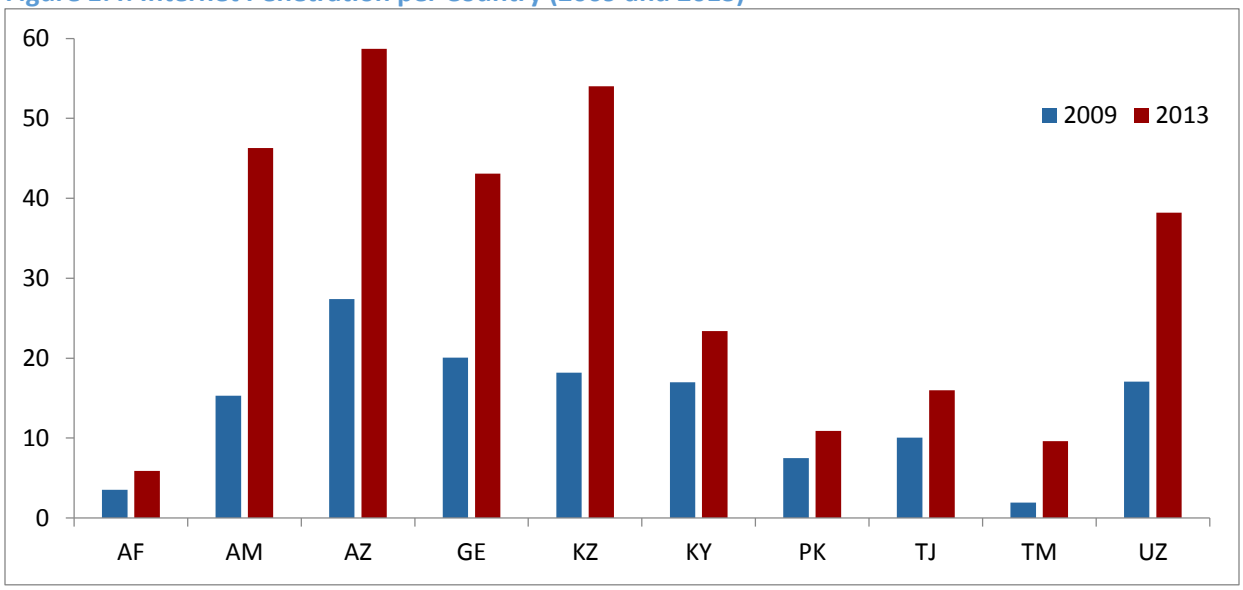
	Country	Country Income Classification* (2014)	% of Internet Users (2014)
Cluster 1: *Majority access (>50%)*	Azerbaijan (AZ)	Upper-mid (USD17,516)	61%
	Kazakhstan (KZ)	Upper-mid (USD24,205)	55%
Cluster 2: *Partial access (30%–50%)*	Georgia (GE)	Lower-mid (USD7,582)	49%
	Armenia (AM)	Lower-mid (USD8,138)	46%
	Uzbekistan (UZ)	Lower-mid (USD5,576)	44%
Cluster 3: *Low access (<30%)*	Kyrgyz Republic (KY)	Lower-mid (USD3,322)	28%
	Pakistan (PK)	Lower-mid (USD4,842)	14%
	Tajikistan (TJ)	Low-income (USD2,655)	17%
	Turkmenistan (TM)	Upper-mid (USD15,474)	12%
	Afghanistan (AF)	Low-income (USD1,976)	6%

Source: ITU (2015), "World Telecommunication/ICT Indicators Database"; World Development Indicators (2015)
* GDP per capita, PPP current international $"

Analysis by cluster group also illustrates the importance of rising above a certain level of penetration for accelerated growth to kick in. Cluster 2 economies all experienced compound annual growth rates (CAGR) of more than 15%, while Cluster 3 countries were all below 15%, with the exception of Turkmenistan, which had the strongest growth rates in the subregion at 47%, however it also started from the lowest base (Figure 1.4). The two Cluster 1 countries, Azerbaijan and Kazakhstan, experienced growth rates of 8% and 20% respectively, suggesting that the initial growth in Azerbaijan had been strong but was slowing, while Kazakhstan is still enjoying rapid expansion.

Strong growth rates in the Cluster 2 economies suggest that the demand for Internet access has been somewhat met by an increase in supply, which creates a virtuous cycle, further enabling growth. Countries in Cluster 3 all started off from a lower base, however with the exception of Turkmenistan, growth has been lackluster, which suggests that these countries still face heavy constraints in stimulating both demand and supply.

Figure 1.4: Internet Penetration per Country (2009 and 2013)



3 year CAGR	14%	23%	8%	17%	20%	8%	11%	11%	47%	24%

Source: ISOC (2014), "Internet Society Global Internet Report", http://www.internetsociety.org/map/global-internet-report/

Mobile Teledensity

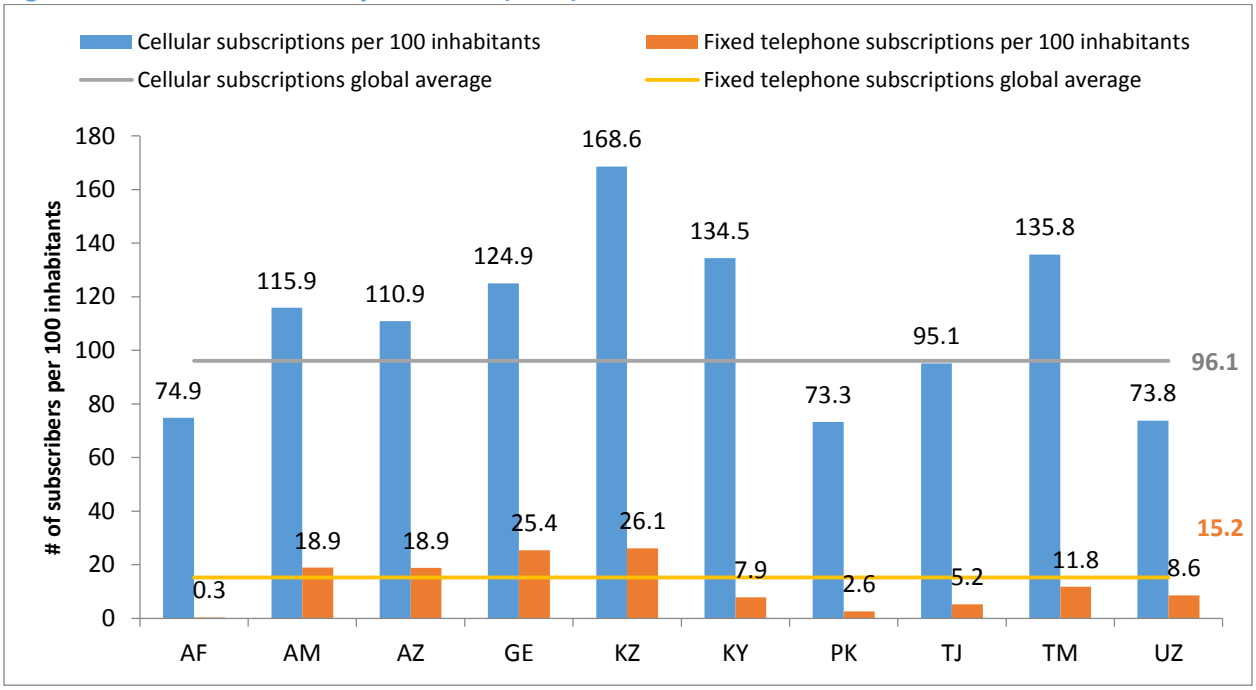
Teledensity, or the percentage of the population having access to a fixed telephone line, is no longer the bellwether of communication access (and economic development) that it once was. *Mobile* phone penetration or mobile teledensity, however, has become an increasingly important indicator as mobiles have become the access mechanism of choice for both voice and data communications and services.

Of the countries in this group, fully six—Armenia, Azerbaijan, Georgia, Kazakhstan, the Kyrgyz Republic and Turkmenistan—have mobile penetration rates in excess of 100%, all exceeding the global average of 96%, while Afghanistan, Pakistan, Tajikistan and Uzbekistan have mobile penetration rates of over 70% (Figure 1.5). Four economies (Armenia, Azerbaijan, Georgia and Kazakhstan) also have fixed line telephone penetration rates above the global average of 16%. The subregion as a whole has done comparatively well in telecommunications, especially mobile, largely due to improved coverage and affordable devices. The high mobile penetration in the subregion indicate that many already have the means to some form of Internet access, such as through General Packet Radio Service (GPRS) 2.5G.[14] As telcos upgrade their networks to 3G and 4G, existing users will often be automatically transitioned to the upgraded networks, and find themselves with the means for faster Internet access, and the capacity to do many more activities. As the price of smartphones continue to fall users will increasingly find

[14] 2.5G such as GPRS is a stepping-stone from 2G (i.e. Global System for Mobile - GSM) to 3G mobile by providing data applications in a channel separate from voice calls, in an "always-on" mode. GPRS is a packet-based wireless communication service with data rates from 56 up to 114 Kbps.

themselves armed with an access device for an ever broadening array of services.[15] The proliferation of mobiles is thus naturally becoming the driver of Internet adoption, and enabling the means of leapfrogging to increased Internet access.

Figure 1.5: Mobile Teledensity Overview (2014)



Source: ITU (2015), "World Telecommunication/ICT Indicators Database"

Broadband Penetration

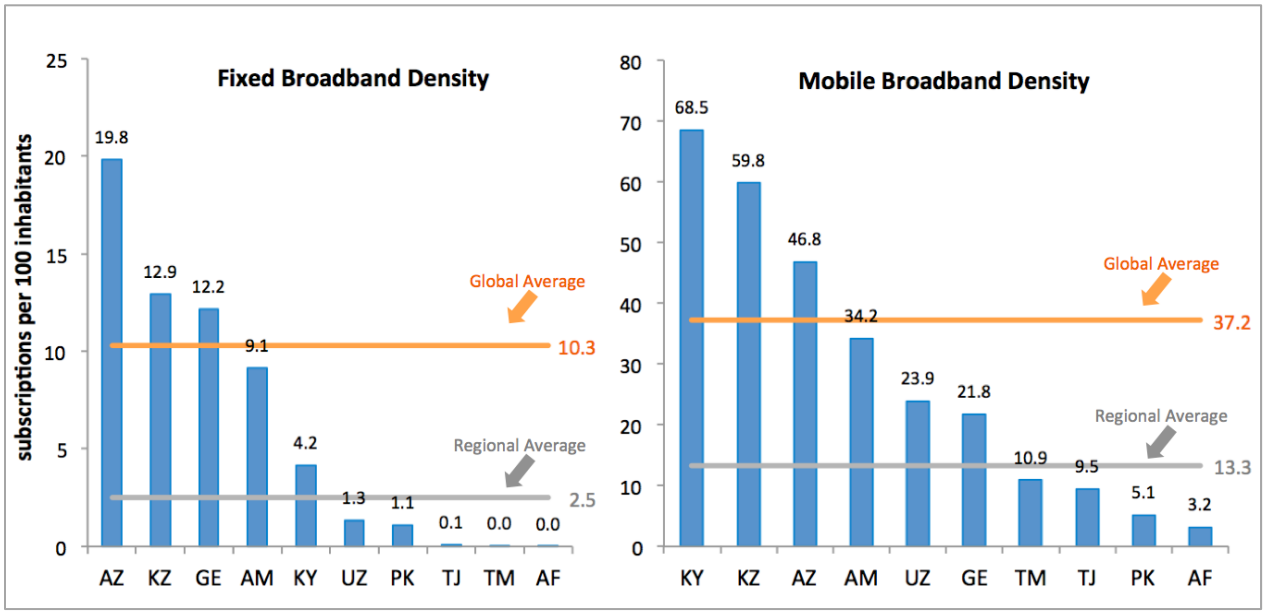
Broadband penetration, rather than mobile teledensity, is now more commonly used to measure communications infrastructure and Internet access. To date the focus has largely been on fixed broadband, but that too is changing, given the fall in smartphone prices on the one hand, and the rapid growth of mobile connectivity, particularly in emerging and less developed economies, on the other. Sustainable broadband mobile connectivity cannot emerge however, without a corresponding investment in certain aspects of fixed infrastructure. This highlights that policy makers need to focus on enabling widespread and inclusive mobile connectivity *in combination with* substantial fixed infrastructure to support the necessary capacity and backhaul requirements. These requirements are further explored below and in Chapter III.

We began by highlighting (Figure 1.1) how average Internet penetration for the Central Asia+5 lags the global average and that of other subregions. But averages mask *substantial* country variations, and these are shown in Figure 1.6 for both fixed and mobile broadband penetrations respectively.[16]

[15] 'Basic' phones too are increasingly having extra functionality added, including for Internet access. But as smartphone prices fall and smartphones proliferate, they are often becoming the first choice device even for new users in emerging economies.

While most countries in the subregion remain significantly below the global average (10%), Azerbaijan, Georgia and Kazakhstan all have fixed broadband penetration rates above this, with Armenia only slightly below. In mobile broadband, the Kyrgyz Republic, Kazakhstan, Azerbaijan and Armenia all perform well against the global average as well. In countries such as Armenia and Georgia mobile became the de- facto communication vehicle in the mid-2000s, a result of new competition spurring latent demand—issues that are explored in greater depth in Chapter III—and this has served these markets well. By contrast, markets such as Turkmenistan have been constrained by poor policy decisions and strong incumbents, issues that they are now more actively looking to address.

Figure 1.6: Broadband Penetration per 100 Inhabitants (2014)



Source: ITU (2015), "World Telecommunication/ICT Indicators Database"

Penetration of fixed broadband, measured in terms of number of subscribers, largely corresponds to the three clusters based on Internet penetration (Table 1.2). In mobile broadband, however, the picture looks rather different. In addition to the changing order, what has been noteworthy has been the speed of growth in mobile broadband in a number of these countries. After launching 3G and 4G services in 2014, Pakistan immediately saw growth in mobile broadband subscribers from a nonexistent base to 13.5 million by the end of 2014 and over 20 million by October 2015.[17] Even more dramatic has been the

[16] The regional average is calculated using a weighted average, which takes into account the total population for the region. It should be noted that estimating the number of users through fixed-line broadband subscription statistics remains complicated given that in many households and businesses a single subscription will be shared among multiple users through the use of a Wi-Fi router. This may translate to a four- or even five-fold increase in user numbers than the number of fixed broadband subscribers would suggest. The same argument can be made about mobile phones or telephone lines that are shared among family members or rented for a fee within a community.

[17] Pakistan Telecommunications Authority (2015), "Broadband Subscribers by Technology", http://www.pta.gov.pk/index.php?Itemid=599

growth in the Kyrgyz Republic and Uzbekistan, with the Kyrgyz Republic almost tripling its mobile broadband penetration rate in 2014 alone.

A possible explanation for the Kyrgyz Republic's dramatic growth is that Beeline, then known as Bitel, changed its mobile broadband definition to include smartphones, and reported 1.47 million subscriptions in Q4 2013, up from 30,713 in Q1 2012.[18] But the overall trends and changes also suggest some countries picking up on latent demand for Internet access, which has been quick to be realized once supply has been forthcoming and as prices for access and for devices fall. Moreover, the rapid growth in certain countries strongly suggests the potential for leapfrogging to mobile as the basis for broadband connectivity for the subregion as a whole and, as some states accelerate the development, there is a potential for dramatic change in the Internet cluster compositions. It also shows that Cluster 1 and 2 countries such as Kazakhstan, Azerbaijan, Georgia, Armenia and Uzbekistan have headroom in broadband to make up, compared to the Kyrgyz Republic.

Table 1.2: Internet and Mobile Broadband Penetration

	Country	Mobile penetration[1]	Internet Penetration[1]	Fixed Broadband Penetration[1]	Mobile Broadband Penetration[1]
Cluster 1	Kazakhstan	168.6	54.9	12.9	59.8
	Azerbaijan	110.9	61	19.8	46.8
Cluster 2	Georgia	124.9	48.9	12.2	21.8
	Armenia	115.9	46.3	9.1	34.2
	Uzbekistan	73.8	43.6	1.3	23.9
Cluster 3	Kyrgyz Republic	134.5	28.3	4.2	68.5
	Tajikistan	95.1	17.5	0.1	9.5
	Pakistan	73.3	13.8	1.1	5.1
	Turkmenistan	135.8	12.2	0	10.9
	Afghanistan	74.9	6.39	0	3.2
Average[2]		**83.4**	**21.1**	**2.5**	**13.3**

Source: ITU (2015), "World Telecommunications/ICT Indicators"; Broadband Commission (2015), "State of Broadband 2015"; (1) measured as the number of subscribers per 100 inhabitants, (2) weighted averages.

While both coverage and access appear to be better in mobile, the growth in demand has to be met with a corresponding growth in bandwidth to support wireless services, lest it hit capacity constraints. It is to this part of the supply chain that we turn in Chapter II.

[18] BMI Research (2015), "Kazakhstan and Central Asia Telecommunications Report Q1 2015"

II. International and Regional Internet Bandwidth

Most of the Central Asia+5 countries suffer from a lack of adequate international bandwidth—in many cases substantially so. Taking the 10 countries together as a singular subregion, it can further be said that the subregion as a whole lacks sufficient bandwidth (detailed further below)—and this is in stark contrast to other subregions such as ASEAN which, as the earlier ISOC report illustrated, had more than enough bandwidth supply *regionally*, even where certain countries were struggling to access it. This lack of supply coming into the subregion is an initial constraint that results in comparatively lower speeds and higher prices. Higher international (wholesale) prices are in turn passed on via domestic service providers to the end-user: businesses and consumers. This combination of high prices, low speeds and higher latencies, results in reduced demand for Internet access, and the lack of demand then discourages ISPs from investing in the necessary infrastructure network upgrades, leading to a suboptimal environment—at least for a period of time. It is this part of the Internet supply chain—the international bandwidth supply—that we look at in this section, with a view to identifying where the bottlenecks are, and what can be done to address them.

Several points are worth noting upfront, having come up in previous subregional studies.[19] First is the inverse relationship outlined above resulting from high costs of international bandwidth. Investing in international bandwidth is a high fixed cost resource. When there is little user demand, the access costs remain very high, but access is easy to expand once the infrastructure and bandwidth capacity exist. Thus the focus needs to be on *both* stimulating demand and enabling supply—one without the other results in the negative investment cycle that is shown to be a characteristic of the Central Asia+5 subregion. It is this dynamic that we seek to address in this chapter and the next.

Second, Internet content comes from three sources: local content produced by domestic websites, locally cached international content, and international Internet content accessed directly. Locating content locally or in the region tends to lower latency of access, as well as the international Internet transit costs.[20] According to web analytics companies Alexa.com and SimiliarWeb.com, international sites such as Google, Facebook and YouTube are typically among the top five websites in each Central Asia+5 country, suggesting that a substantial portion of Internet traffic continues to come from international sources (Table 2.1). If Internet costs remain high and quality is low, existing demand will continue to remain latent and unfulfilled and, correspondingly, costs will not come down until international bandwidth capacity is, at least, adequate.

[19] See ISOC (2013), "Lifting barriers to Internet development in Africa: suggestions for improving connectivity", http://www.internetsociety.org/doc/lifting-barriers-internet-development-africa-suggestions-improving-connectivity and ISOC (2015), "Unleashing the Potential of the Internet for the ASEAN Economies", http://www.internetsociety.org/doc/unleashing-potential-internet-asean-economies

[20] See ISOC (2015), "Promoting Local Content Hosting to Develop the Internet Ecosystem", http://www.internetsociety.org/sites/default/files/Promoting%20Local%20Content%20Hosting%20to%20Develop%20the%20Internet%20Ecosystem.pdf

Table 2.1: Top Websites per Country by Traffic

Country	Top 5 Websites by Traffic				
Afghanistan*	Facebook.com	Google.com	Google.com.af	Youtube.com	Yahoo.com
Armenia	Facebook.com	Google.com	Youtube.com	Google.am	Ok.ru
Azerbaijan	Google.az	Facebook.com	Youtube.com	Google.com	Mail.ru
Georgia	Facebook.com	Youtube.com	Google.com	Baidu.ge	Ok.ru
Kazakhstan	Mail.ru	Vk.com	Youtube.com	Google.com	Yandex.kz
Kyrgyz Republic*	Ok.ru	Mail.ru	Youtube.com	Google.com	Vk.com
Pakistan	Google.com.pk	Facebook.com	Google.com	Dailymotion.co	Yahoo.com
Tajikistan*	Mail.ru	Google.com.tj	Ok.ru	Google.com	Vk.com
Turkmenistan*	Ok.ru	Mail.ru	Google.com	Vk.com	Google.tm
Uzbekistan	Google.com	Mail.ru	Ok.ru	Facebook.com	Youtube.com

Source: Alexa (2015), "Top 500 sites in each country or territory", http://www.alexa.com/topsites/countries; SimilarWeb (2015), "Top 50 sites in each country", http://www.similarweb.com/country, * SimilarWeb

Subregional Internet Bandwidth

Lack of access to international bandwidth is a key constraint on Internet development across these 10 countries. According to ESCAP, a majority of the international connections in the subregion are "low capacity, transborder links, typically operating at no more than a few gigabits per second."[21]

The 10 countries are surrounded by their neighbors, the Russian Federation in the north, the People's Republic of China (PRC) in the east, Iran in the south west, and Turkey in the west. The geography of the 10 countries dictates that they are highly dependent on their neighbors for access to international bandwidth, with the exception of Pakistan and Georgia, which have access to coastal routes, and are less constrained. These neighbors with their access to coastal submarine markets are more readily able to join international submarine cable systems to gain access to international bandwidth. For the eight remaining landlocked countries, access to international bandwidth is only made possible through transborder terrestrial fiber-optic connections, which have to run through their neighbors.

By comparison, the PRC, and the Russian Federation had an international Internet bandwidth of 9 Tbps, and 6 Tbps, while Pakistan had 300 Gbps.[22] This demonstrates the potential of the available bandwidth from the neighboring countries (the Russian Federation and the PRC) which has yet to be tapped.

Bandwidth supply needs to continue to accelerate to meet domestic demands including from businesses who wish to use the Internet to generate growth, and from consumers who wish to use the Internet for

[21] ESCAP Committee on Information and Communication Technology (CICT) (2014), "Fourth Session: Asian Information Superhighway: seamless connectivity for sustainable development in Asia and the Pacific", http://www.unescap.org/sites/default/files/Committee%20Note%20on%20AP-IS.pdf

[22] 1 Gbps is equivalent to 0.0009765639 terabit per second. Estimates for available international capacities vary. Ministry of IT of Pakistan, for example, estimates the country's available international capacity to be 860 Gbps, TeleGeography (2015), "Global Internet Geography Country Bandwidth, ESCAP (2014), "An In-Depth Study of Broadband Infrastructure in South and West Asia, 2014." Hussain, Mudassar (2015), "Pakistan-OFC and Infrastructure Snapshot", presented at the *UN-ESCAP Open-Ended Working Group on Asia Pacific Information Super Highway* in Incheon, September 2015.

communication, social media, online videos and games, and so on. As Table 2.2 demonstrates, country capacity on a per capita or per Internet user basis, however, remains low for most countries in the subregion reinforcing the point that, even when there is access, in many cases the capacity of that connection will be starkly limited.

Table 2.2: Summary of International Internet Bandwidth by Cluster and Country

	Country	Intl Bandwidth (Gbps)	Intl Bandwidth per Capita (Kbps)[1]	Intl Bandwidth per Internet User (kbps)[2]
Cluster 1	**Azerbaijan**	205	22.4	39.6
	Kazakhstan	275	16.5	31.2
Cluster 2	**Georgia**	80.3	25.9	51.7
	Armenia	73.6	18.7	39.4
	Uzbekistan	7.8	0.3	0.9
Cluster 3	**Pakistan**	300	1.7	7.1
	Afghanistan	15	0.5	1.2
	Kyrgyz Republic	5	0.9	3.8
	Tajikistan	2.5	0.3	2.5
	Turkemenistan	0.6	0.1	1.0

Source: ESCAP (2014), "An In-Depth Study of Broadband Infrastructure in North and Central Asia"; ESCAP (2015), "An In-Depth Study of Broadband Infrastructure in Afghanistan and Mongolia"; ESCAP (2014), "An In-Depth Study of Broadband Infrastructure in South and West Asia"; World Bank (2014), "Little Data Book of ICT"; TRPC analysis. (1) Data from Terabit Consulting (2) Data from the World Bank Little Data Book on ICT 2014

Four points come through quite clearly from Table 2.2. First is the comparatively low level of international bandwidth per country (this is also shown in the left half of Figure 2.1). Only two countries—Pakistan, and Kazakhstan—have aggregate bandwidth of more than 250 Gbps. Compare this with, for example the ASEAN 10 countries, wherein Indonesia, Malaysia, the Philippines, Singapore, Thailand and Viet Nam all have International bandwidth of more than 250 Gbps.[23]

This illustrates the second point: the relative paucity of bandwidth coming into the subregion as a whole, and what this may mean for relations with neighboring countries for access to international bandwidth. As of 2014, neighboring giants the PRC and the Russian Federation had international Internet capacities of 9 Tbps and 6 Tbps respectively.[24] As discussed above, these countries bordering to the north and east of the subregion, along with Iran in the south west and, to a lesser extent, Turkey in the west, are important transit connections for the subregion. Subregional relationships with these powers, along with negotiating leverage for transit pricing could become increasingly strategic issues—for the subregion as a whole. The available bandwidth capacities leading into and from the PRC and the Russian Federation, in particular, also suggest the potential for capacity access that has yet to be fully exploited.

[23] ISOC and TRPC (2015), "Unleashing the Potential of the Internet for the ASEAN Economies", http://www.internetsociety.org/doc/unleashing-potential-internet-asean-economies

[24] TeleGeography (2015), "Global Internet Geography Country Bandwidth, and ESCAP (2014), "An In-Depth Study of Broadband Infrastructure in South and West Asia, 2014"

(The importance of building terrestrial connections from these points is further explored below with the Box 2.1. Asia-Pacific Information Superhighway [AP-IS].)

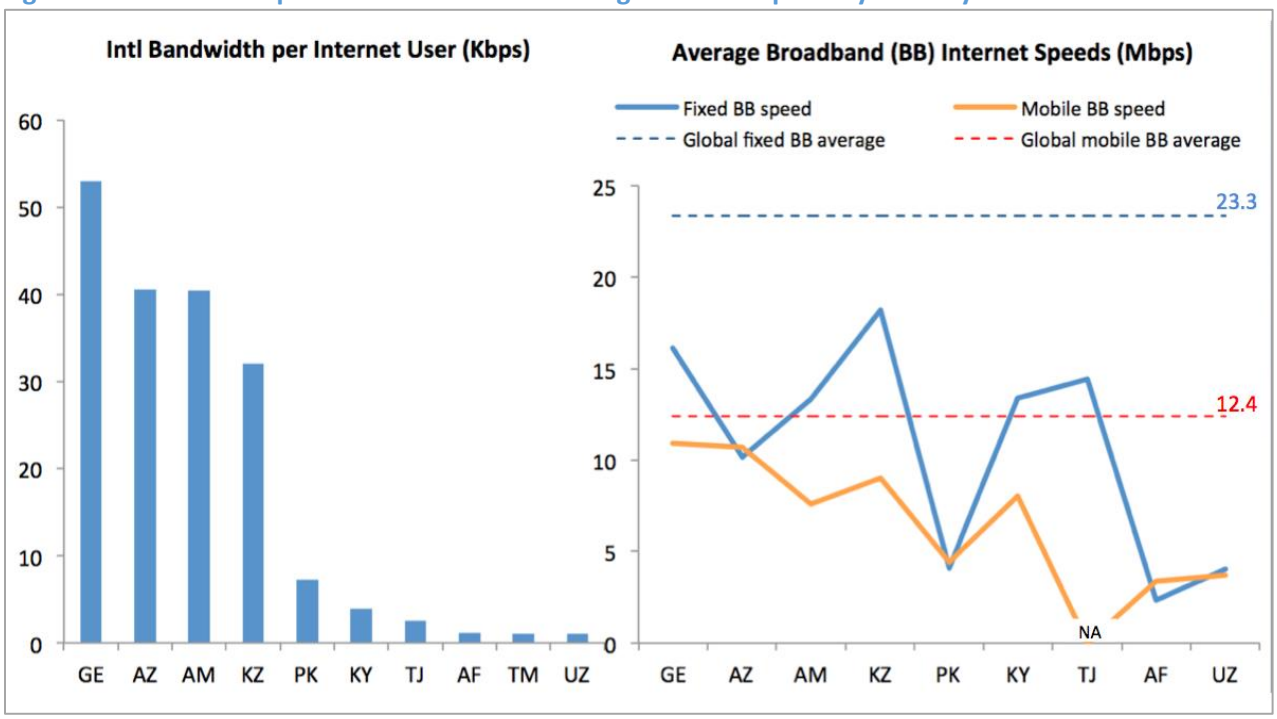
Third is the outlier nature of Pakistan. Pakistan easily has the highest international connectivity in the subregion at 300 Gbps, *but with a population that is also more than half the subregion's total.*[25] As such, Pakistan's connectivity translates to a lowly 7.1 Kbps per Internet user and a very low 1.7 Kbps per capita. This issue and Pakistan's role in subregional connectivity are explored further below.

Fourth, and perhaps most important is the apparent correlation between higher bandwidth and higher demand. The top four countries in bandwidth per Internet user—Azerbaijan, Kazakhstan, Armenia and Georgia—all belong to Clusters 1 and 2. While it may be hard to definitively determine the direction of causality—i.e., if it is higher bandwidth that attracts higher demand, or the other way around—the figures clearly show that bandwidth plays a role in driving Internet take up (as has equally been demonstrated in the earlier ISOC reports). While mobile broadband adoption grows, the concomitant increase in bandwidth has not yet been sufficiently forthcoming to support the emerging demand for mobile and Internet growth. There is a need to build more landline infrastructure both within and across nations to support the growth in demand for bandwidth lest the subregion continues to be held back by constraints on price, and capacity limitations (Other driving forces behind Internet penetration such as market and institutional factors are explored in Chapter III.)

Access speed is another key indicator of connectivity. Reliable and consistent speeds along with throughput are also bedrocks of Internet demand, which typically will further spur investment in connectivity. Figure 2.1 uses the statistics from Table 2.2 to show the theoretical bandwidth per Internet user based on the international bandwidth coming into the different Central Asia+5 economies. This provides a good reference for the lower-income countries looking to promote high growth in terms of the number of Internet users: unless investment into international and national connectivity is forthcoming, the Internet experience will increasingly be a poor one due to inadequate bandwidth.

[25] According to Pakistan's Ministry of IT of Pakistan, the country's available international capacity was 860 Gbps as of mid-2015. See Mudassar Hussain (2015) Pakistan-OFC and Infrastructure Snapshot, presented at the UN-ESCAP Open-Ended Working Group on Asia Pacific Information Super Highway in Incheon, September 2015.

Figure 2.1: Bandwidth per Internet User and Average Internet Speed by Country



Source: TeleGeography (2015), "Global Internet Geography Country Bandwidth; ESCAP (2014), "An In-Depth Study of Broadband Infrastructure in South and West Asia, 2014"; Broadband Commission (2015), "The State of Broadband 2015"

The right half of Figure 2.1 shows the results of Internet speed tests aggregated by Ookla, a global broadband and web diagnostics company, and provides an important illustration of the challenges for the subregion in providing attractive connectivity.[26] The Central Asia+5 countries as a whole fall well below the world average when it comes to Internet speed. The standout exception to the relationship between bandwidth and speed is apparently the Kyrgyz Republic and, as will be shown in Chapter III, this has resulted in a dramatic growth in the subscriber base recently—in other words the user experience, together with cost reduction, is encouraging further use. The corollary, however, is that without further investment in capacity this trend will be unsustainable. Internet speeds, along with affordability (covered in Chapter III) are one of the key selling points for Internet use and for ISPs. Faster speeds, through greater bandwidth, allow users to browse sites faster, stream and watch videos, reduce latency for gaming, etc. For businesses, greater Internet speeds provide business development opportunities for cloud computing, e-commerce, and new opportunities for innovation and expansion. And from the government's perspective, high-speed Internet enables a new user base and allows them to provide and deliver better e-services (see Chapter IV).

International Bandwidth Supply: Landline and Submarine Cables

The supply of international bandwidth is supported by the extent and quality of fiber and other broadband infrastructure. Table 2.3 summarizes the infrastructural connections of these 10 economies

[26] Ookla's speed tests are aggregated by users running tests and submitting data in their respective regions. These data points are used to provide an indicator only of the Internet speeds in these regions.

with the rest of the world, mostly comprised of terrestrial landline cables, but also submarine cables in the cases of Pakistan and Georgia.

Table 2.3: International Capacity Supply

Country	Landline Cables + Submarine	No. of Cables (Landlines + Submarine)	Intl Bandwidth per capita (Kbps)
Afghanistan	Afghanistan-Iran; Afghanistan-Pakistan (northern and southern links); Afghanistan-Turkmenistan (eastern and western links); Afghanistan-Uzbekistan	6+0	0.5
Armenia	TAE; Armenia-Georgia; Armenia-Iran	3+0	48.9
Azerbaijan	TAE; Rostelecom-Azertelecom; Synterra (MegaFon)-Azertelecom; TransTelekom-Azertelecom; Iran-Azerbaijan; Azerbaijan-Georgia; Azerbaijan-Turkey; Europe-Persian Express Gateway (EPEG); TASIM[1]	9+0	22.4
Georgia	Caucasus Cable system;[27] Georgia-Azerbaijan; Georgia-Russia; Georgia-Armenia; TASIM[1]	3+2	46.3
Kazakhstan	TAE; Kazakhstan-Kyrgyz Republic; Northern Kazakhstan-Russia; North-western Kazakhstan-Russia; Western Kazakhstan-Russia; Kazakhstan-Turkmenistan; Kazakhstan-Eastern Uzbekistan; Kazakhstan-Western Uzbekistan; TASIM[1]	9+0	16.5
Kyrgyz Republic	TAE; Kyrgyz Republic-Tajikistan; PRC-Kyrgyz Republic-Tajikistan; Kazakhstan-Kyrgyz Republic; Kyrgyz Republic-Uzbekistan	5+0	0.9
Pakistan	SE-ME-WE-3; SE-ME-WE-4; IMEWE; TW1; AAE-1;[1] SE-ME-WE-5,[1] Afghanistan-Pakistan (northern and southern links)	2+6	1.7
Tajikistan	Afghanistan-Tajikistan; Kyrgyz Republic-Tajikistan; Tajikistan-Uzbekistan	3+0	0.3
Turkmenistan	TAE; Kazakhstan-Turkmenistan; Afghanistan-Turkmenistan (eastern and western links)	4+0	0.1
Uzbekistan	TAE; Kazakhstan-Eastern Uzbekistan; Kazakhstan-Western Uzbekistan; Kyrgyz Republic-Uzbekistan; Tajikistan-Uzbekistan; Afghanistan-Uzbekistan	6+0	0.3

Source: ESCAP (2014), "An In-Depth Study of Broadband Infrastructure in North and Central Asia"; ESCAP (2015), "An In-Depth Study of Broadband Infrastructure in Afghanistan and Mongolia"; TRPC analysis. (1) Planned or under construction

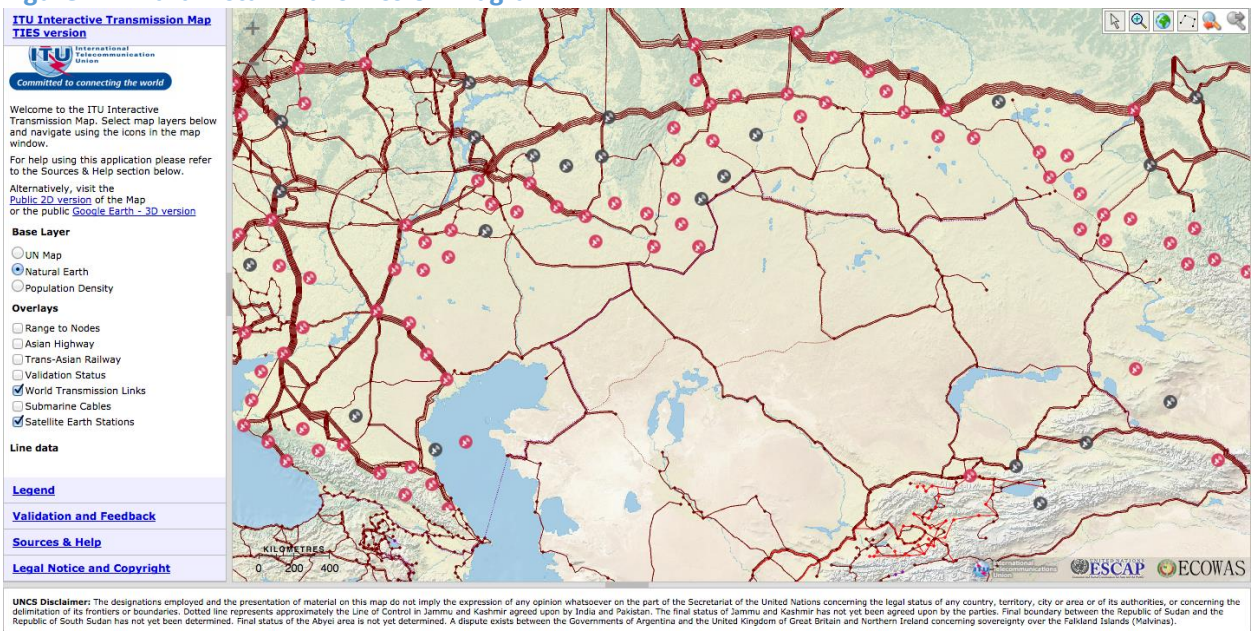
While both Georgia and Pakistan have 'coastal lines' and thus access to submarine cables, Georgia's undersea cables run through the Black Sea, and the Georgia-Russia cable, for example, has recently

[27] The Caucasus Cable System is a submarine communications cable linking Balchik, Bulgaria with Poti, Georgia since 2008 with a design capacity of 1.92TB/s.

experienced a cut,[28] reportedly due to a seismic activity that impacted providers in Georgia and Armenia.[29] This points to the important role that certain countries in the subregion play in terms of either submarine landing points or cable transit countries. The Russian Federation, for example, can be seen from Table 2.3 to be an important source of transit with Kazakhstan playing a key linkage role for countries such as the Kyrgyz Republic, Turkmenistan, and Uzbekistan (see also Figure 2.2).

Pakistan, along with Iran (lying outside the Central Asia+5 countries), has the potential to bridge access to international submarine cables and provide greater bandwidth to the subregion. Indeed, Pakistan could become the natural 'southern route' to connect the subregion to international networks. Iran may also step in to fill the role particularly given that it borders more Central Asia+5 countries than Pakistan does.

Figure 2.2: Kazakhstan Transmission Diagram



Source: ITU Interactive Terrestrial Transmission/ESCAP Asia-Pacific Information Superhighway Map; Black dots represent satellite stations while the red ones represent clusters of satellite stations.

Kazakhstan, sharing 'external' borders with the PRC and the Russian Federation, as well as 'internal' borders with the Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan, plays an important role in the subregion in providing access through its landmass.[30] As shown in Figure 2.2, the Russian Federation has a number of satellite stations dotted across the border with Kazakhstan and a number of transmission lines connecting Kazakhstan with the Russian Federation and other neighboring countries.

[28] Dyn Research (2013), "Faraway Fallout from Black Sea Cut," http://research.dyn.com/2013/02/faraway-fallout-from-black-sea/

[29] Trend News Agency (2013), "Underwater volcano damaged Poti-Novorossiysk-Sochi fiber-optic cable," http://en.trend.az/scaucasus/georgia/2105346.html

[30] By 'external' and 'internal' borders here, we mean to indicate borders that delineate the Central Asia+5 subregion under review and those that are interlinking between them.

For example, the Trans Asia Europe (TAE) line passes through Kazakhstan to provide direct international connectivity to the Kyrgyz Republic, and Uzbekistan.

What is very clear from the above analysis is the importance of the interconnected terrestrial cable networks running through the subregion. Examples include the TAE line, the Europe-Persian Express Gateway (EPEG), and the Trans-Eurasian Information Superhighway (TASIM):

- **The Trans Asia Europe (TAE) line** connects Azerbaijan, Armenia, Georgia, Kazakhstan, the Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan. The 27,000 km international cable runs from Frankfurt in Germany to Shanghai in the PRC. Designed with an initial capacity of 622 Mbps in 1998, the line was upgraded more recently to 200 Gbps by Rostelecom and China Telecom.[31]
- **The Europe-Persian Express Gateway (EPEG)**, launched in January 2013, links Frankfurt across Eastern Europe, the Russian Federation, Azerbaijan, Iran and the Persian Gulf to Barka, Oman. Delta Telecom organized the route via Azerbaijan. This new cable system has a designed capacity of up to 3.2 Tbps and a lit capacity of 540 Gbps. It has a total length of approximately 10,000 km, out of which 9,500 km is a terrestrial fiber cable. It is considered to be the "Internet's fastest path between the Gulf and Europe, shaving at least 10% off the best submarine cable round trip tie from Dubai to Frankfurt."[32]
- **The Trans-Eurasian Information Superhighway (TASIM)**, was proposed by the government of Azerbaijan in 2008, and adopted by the UN General Assembly in 2009 to connect the countries of Eurasia from Western Europe to Eastern Asia. Construction work is expected to begin by the end of 2015, and once finalized, will connect 20 countries from Frankfurt to Turkey, passing through the PRC, Kazakhstan, Azerbaijan, Georgia, Turkey, to Germany.[33]

Cable systems such as TAE, EPEG and TASIM are important developments for the subregion for at least two reasons. In the first instance, they present alternative and redundant routes to existing 'chokepoints' in the current undersea cable system. The EPEG, for example, provides an alternative to the congested Suez transit corridor while the TAE terrestrial cable network provides an alternative terrestrial route connecting Europe and Asia.[34] Second, they give rise to the possibility of creating high-capacity pan-subregional networks. Such a prospect is highlighted in the box below on the Asia-Pacific Information Superhighway (AP-IS) initiative.

[31] See ESCAP (2014), "An In-Depth Study of Broadband Infrastructure in North and Central Asia"; ESCAP (2015), "An In-Depth Study of Broadband Infrastructure in Afghanistan and Mongolia"; TeleGeography (2011), "Caucasus Online Inks Undersea Cable Upgrade Contract", https://www.telegeography.com/products/commsupdate/articles/2011/04/20/caucasus-online-inks-undersea-cable-upgrade-contract-with-subcom/

[32] Dyn Research (2013), "Will Iran Follow Sudan in Leaving the Internet?", http://research.dyn.com/2013/09/three-ways-irans-internet-can-show-heroic-flexibility/

[33] TASIM (2015), "Overview", http://www.tasim.net/overview.html

[34] Terabit Consulting (2014), "Submarine Telecoms Industry Report; Submarine Networks", http://submarinenetworks.com/systems/asia-europe-africa/tea/tea-cable-network

Box 2.1: The Asia-Pacific Information Superhighway (AP-IS)

The Asia-Pacific Information Superhighway is an on-going initiative, led by the ESCAP secretariat to improve regional broadband connectivity, through a dense web of open access cross-border connectivity. The network will connect cities and towns to house data centers and become points of presence. The Information Superhighway will piggyback on the 'Asian Highway', wherever appropriate, to provide both intra-regional and intercontinental access via a cohesive regional network of optic fiber.[35] This will help drive international bandwidth prices down, increasing resilience by offering redundancy to submarine cables, and decreasing latency across the region.

Figure 2.3: Transmission Diagram of the Central Asia+5 Subregion

Source: ESCAP-ITU Interactive Terrestrial Transmission[36]

The primary focus of the Information Superhighway is the development of international and regional backbones, but as they traverse many countries, they may open up secondary markets for shorter national or subregional backbone routes. The Information Superhighway aims to facilitate the provision of end-to-end dark fiber services and associated colocation facilities (passive services), and end-to-end capacity with end-point colocation (active services), based on the principle of open access, equivalence and transparency of pricing and market neutrality, for the ultimate purpose of increasing availability, reliability and affordability of broadband access for all across the region.

The first meeting of the Working Group of the Asia-Pacific Information Superhighway was organized in September 2015 in Incheon, Republic of Korea, to lay the foundation for development. Further meetings are scheduled in 2016.

Source: ESCAP (2015), "Asia-Pacific Information Superhighway", http://www.unescap.org/our-work/ict-disaster-risk-reduction/asia-pacific-information-superhighway/about

[35] Initiated in 1959, the Asia Highway is a road communication platform of 32 Asian governments spanning 141,000 km from Japan to Turkey, linking Asia with Europe. ESCAP and the ADB have been the primary instigators behind the transcontinental transport infrastructure project.

[36] One of the motivations behind the Information Superhighway is the lack of network redundancy for the subregions such as Central Asia (see Figure 2.3), where meshed networks of terrestrial links appears sparse compare to other regions such as Europe

It should be noted that in addition to fiber optic cables, satellite connectivity continues to play an important role in the subregion, although the emphasis has been more on broadcast use than broadband Internet access. Azerbaijan operates the AzerSat-1, which provides capacity for broadcast and Internet transmission. Afghanistan, Armenia, Azerbaijan, Georgia, Kazakhstan, the Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan are also part of the North Atlantic Treaty Organization (NATO) initiated Virtual Silk Highway Project to establish a subregional and education network using satellite technology. This initiative is now in the midst of transitioning to the primary use of fiber optic cables.[37] In general, satellite communications are reserved for broadcast communications, disaster relief scenarios, backing-up submarine cables or supplementing national backhaul networks. As an OECD report points out, "[a] fibre pair can carry as much traffic as all geosynchronous satellites combined together."[38]

IP Transit Pricing and IXPs

IP transit pricing is the price paid by one ISP to another for interconnection and the onward delivery of traffic, and, the higher it is – the higher the end-price charged to the user will be, which in turn will influence demand for Internet services. Although IP transit pricing has been falling globally, many countries in the Central Asia+5 subregion continue to pay high prices.[39]

This negative correlation can be shown by comparing the monthly Internet transit cost figures from Table 2.4 with the Internet penetration rates from Figure 1.2 (see Figure 2.4, left half): *countries with a lower cost of Internet transit traffic have higher Internet penetration rates, and vice versa*, with the exception of Afghanistan which still suffers from poor Internet penetration despite the comparatively cheaper IP transit costs. Again, the Kyrgyz Republic presents as an interesting outlier given the recent spurt in user growth. This is the result of domestic policies focused on promoting demand (explored further in Chapter III).

Comparing Table 2.4 with Table 2.2 demonstrates that countries with higher international bandwidth enjoy lower transit prices (Figure 2.4, right half), with Afghanistan once again proving to be the exception. For example, the monthly cost of Internet transit traffic in Kazakhstan is USD15 per Mbps, compared to over USD100 per Mbps in the Kyrgyz Republic, Pakistan, Tajikistan, Turkmenistan, and Uzbekistan. IP transit prices are often costed based on volume, and thus some countries (such as Pakistan in Table 2.4) will exhibit a range of costs from low to high. This is the often the result of competition opening the market, and it therefore takes a little while for prices to settle down to the

[37] Silk Project (2009), "The Silk Project", http://www.silkproject.org/
[38] OECD (2014), "International Cables, Gateways, Backhaul and Internet Exchange Points", pp. 4, http://oecdinsights.org/wp-content/uploads/2014/02/International-cables-gateways-IXPs.pdf
[39] In fact, the pace of IP transit price decline has slowed in the past two years such that, according to TeleGeography, the median price of a 10 Gbps Ethernet (10 GigE) port in Hong Kong, the PRC, London, New York, and São Paulo fell less than 15% annually. TeleGeography (2014), "IP Transit Price Declines Slow Globally", https://www.telegeography.com/press/marketing-emails/2014/09/24/ip-transit-price-declines-slow-globally/

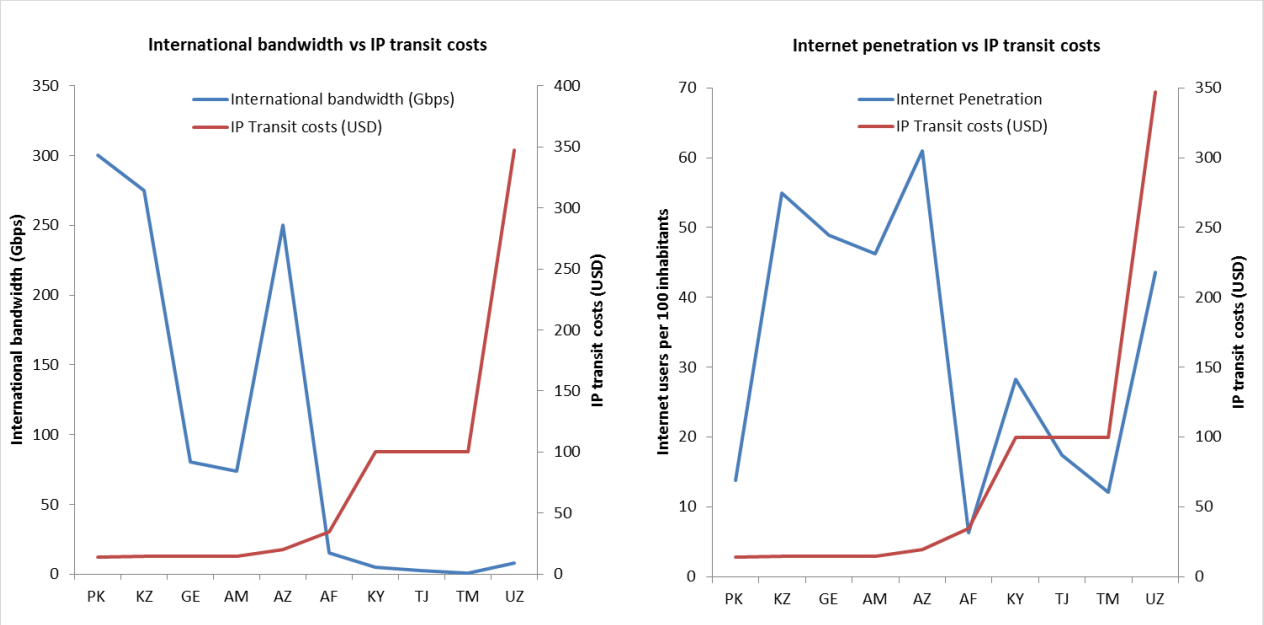
lower level.[40] By contrast, where the state has yet to liberalize telecommunication services, IP transit costs can often stay stubbornly high.

Table 2.4: Monthly Cost of Internet Transit Traffic

Country	Cost per Month (USD)	Country	Cost per Month (USD)
Afghanistan	USD35 per Mbps	**Kyrgyz Republic**	USD30–100 per Mbps
Armenia	USD15 per Mbps	**Pakistan**	> USD14–USD100 per Mbps depending on volume
Azerbaijan	USD20 per Mbps	**Tajikistan**	> USD100 per Mbps
Georgia	USD15 per Mbps	**Turkmenistan**	>USD100 per Mbps
Kazakhstan	USD15 per Mbps	**Uzbekistan**	USD347 per Mbps

Source: ESCAP (2014), "An In-Depth Study of Broadband Infrastructure in North and Central Asia"; ESCAP (2015), "An In-Depth Study of Broadband Infrastructure in Afghanistan and Mongolia"; Interview with ISOC staff

Figure 2.4: Internet Transit Traffic Costs versus Internet Penetration



Source: ESCAP (2014), "An In-Depth Study of Broadband Infrastructure in North and Central Asia"; ESCAP (2015), "An In-Depth Study of Broadband Infrastructure in Afghanistan and Mongolia"; ITU (2015), World Telecommunication/ICT Indicators Database; Interview with ISOC staff; For Pakistan, IP transit costs for high volume was used.

[40] Uzbekistan is an exception, insofar as it has the highest known IP transit costs, yet also has relatively high Internet penetration compared to its neighbors Turkmenistan and Tajikistan, both with IP transit costs upward of USD100. There are at least three factors at play here. First, Uzbekistan has a competitive wireless market with five operators (Beeline, Ucell, Perfectrum Mobile, MTS and Uzmobile). Notably, the first four are private operators backed by foreign investors. Second, IP transit prices have fallen significantly, from USD1510 in 2010 to USD312 in Nov 2013. Lastly, while access at the private household level still appears limited, the Uzbekistan government has extended Internet coverage to all state apparatus at the regional and city levels, increasing access to the Internet at workplaces for public sector workers. Internet cafés are also popular especially for young people, despite recent state restrictions. See Freedom House (2014), "Uzbekistan," https://freedomhouse.org/report/freedom-net/2014/uzbekistan

IXPs in the Central Asia+5 Subregion

The importance of Internet exchange points (IXPs) in helping to address the issue of high transit costs, particularly as domestic traffic begins to grow substantially, cannot be overstated. (For a review of the economics of IXPs, see ISOC [2015], "Unleashing the Potential of the Internet for ASEAN Economies, and ISOC [2015] IXP Toolkit.[41]) IXPs are essential in enhancing competitive opportunities, quality and affordability of Internet services. By providing physical points for ISPs to exchange traffic, IXPs centralize and economize the interconnection process. They improve the functioning of the ecosystem by enhancing the competitive environment for exchanging traffic, purchasing capacity, and offloading traffic from congested international links.

If interconnection *cannot* take place within the subregion where traffic originates and will be terminated, ISPs must resort to lengthy and circuitous routing of traffic, or "tromboning".[42] The further afield the traffic has to travel, the higher the latency rates and the more cost it will incur, as the Internet traffic transit costs are prohibitively high in some countries. This then points to a further limitation in the Internet infrastructure of the Central Asia+5 subregion: an almost complete absence of functioning *carrier neutral* IXPs. Looking at an Internet Society IXP diagram for 2015 (Figure 2.5) shows a subregion very sparsely covered for IXPs when compared to the rest of the world.

Figure 2.5: IXP Location Diagram

Source: ISOC (2015), "Internet Exchange Maps", http://www.ixptoolkit.org/ixps

On the positive side, the lack of IXPs suggests a significant opportunity to rapidly drive down access prices and aid connectivity through investments in IXPs. But it also suggests that there is a great amount of work to do. The actual number of IXPs across the Central Asia+5 countries is difficult to verify, not

[41] ISOC and TRPC (2015), "Unleashing the Potential of the Internet for the ASEAN Economies", http://www.internetsociety.org/doc/unleashing-potential-internet-asean-economies, and ISOC, "IXP Toolkit", http://www.ixptoolkit.org/ixps

[42] See "Lifting Barriers to the Internet" and "Unlocking the Potential of the Internet for ASEAN Economies" by ISOC for how the tromboning effect manifests in certain countries.

least because of the difficulty in distinguishing at times between incumbent ISPs offering clearing services or limited peering arrangements, and true carrier neutral IXPs.[43] The examples below provide an illustration of various recent developments and efforts related to IXPs:

- **Afghanistan** – The National Internet Exchange of Afghanistan (NIXA) was established in May 2011 by the Ministry of Communication and Information Technology. The IXP is dormant and the Ministry is in the process of "rebooting" the IXP. To this end, the Ministry issued an RFP for equipment and installation for NIXA in Jun 2014.[44]
- **Armenia** – The Armenian Internet Exchange (ARMIX) is a not-for-profit IXP that was established in November 2010 and is housed with the Armenian country-code top-level domain (ccTLD). There are nine networks peering at ARMIX.[45]
- **Azerbaijan** – Azerbaijan Internet Exchange was established in 2013 and is managed by Delta Telecoms. Other operational details are unknown.[46] The Ministry of Communications is in discussions with international experts to start another IXP.
- **Kazakhstan** – The Kazakhstan Internet Exchange was built in 2007 by national carrier Kazakhtelecom, and open to all ISPs, with free national traffic peering facilities.
- **Pakistan** – The Pakistan Internet Exchange (PIE) is not an IXP per se but rather a carrier-run exchange.[47] It was established in 2000 by the government, and is operated by the Pakistan Telecommunication Company Limited (PTCL). It is the main hub for the exchange of Internet traffic between ISPs within and outside of Pakistan. It has three main nodes in Islamabad, Karachi and Lahore, and 42 smaller nodes, and connects to two submarine cables (SEA-ME-WE-3 and SEA-ME-WE-4).[48]
    - Local Internet peering arrangements have also been made mainly in the cities of Islamabad, Karachi and Lahore by various operators. The regulator, the Pakistan Telecommunication Authority (PTA), has formed a multi-stakeholder group comprising PTA, PTCL, academia, ISPs and cellular mobile operators to work on the formation of IXPs in the country, and the first neutral IXP is expected to be online in 2016.

[43] Various sites show different information on IXPs. For further details, see Packet Clearing House (2015), "Internet Exchange Directory", https://prefix.pch.net/applications/ixpdir/summary/, and IXP map by ISOC (2015) http://www.ixptoolkit.org/ixps

[44] TeleGeography (2014), "MCIT launches tender for Afghan IXP", https://www.telegeography.com/products/commsupdate/articles/2014/06/19/mcit-launches-tender-for-afghan-ixp/ and interview with ISOC staff

[45] ARMIX website (2015), http://www.armix.am/eng/index.php

[46] Packet Clearing House (2015), "Internet Exchange Directory", https://prefix.pch.net/applications/ixpdir/detail.php?id=1710

[47] While not a local IXP, PIE still has the potential to benefit the local Internet economy by routing traffic through local switches instead of traversing through international transit.

[48] OpenNet Initiative (2012), "Pakistan", https://opennet.net/research/profiles/pakistan.

- **Tajikistan** – The Tajik Internet Exchange Point was established in 2005 by the Association of Tajik ISPs. However, of the 11 available ISPs only four are connected.
- **Uzbekistan** – The Tashkent Internet Exchange, established since 2004, boasts 37 ISPs who have signed an agreement to route data among their networks without having to rely solely on the Uztelecom network.[49]

The demand and supply sides of telecommunications markets, including for broadband and Internet, are usually understood to be, by their very nature 'virtuous', meaning that as supply increases *revealed* demand increases and that in turn is an incentive for incumbents and new entrants to increase supply further. In other words, the industry has become based around a 'build it and they will come' model. That has been the focus of this chapter. And, as has been previously noted, "The history of broadband and Internet usage demonstrates that users, especially in urban environments, will always find the means to use up the bandwidth available."[50]

Because of the increased strategic importance of broadband access there is inevitably a role for governments to play in creating conditions favorable to investment in networks and competitive markets, and to removing barriers to supply. In particular, in lower income countries, where demand is constrained by low incomes and high prices, policies will often be needed to encourage investment in supply to drive down both wholesale and retail prices to the point where latent demand can show itself. It is to this mix of access, affordability and institutional issues that we turn our attention in Chapter III.

[49] Freedom House (2012), "Uzbekistan," https://freedomhouse.org/report/freedom-net/2012/uzbekistan
[50] ISOC and TRPC (2015), "Unleashing the Potential of the Internet for ASEAN Economies," http://www.internetsociety.org/doc/unleashing-potential-internet-asean-economies

III. National Connectivity

National Internet connectivity is strongly influenced by economic factors, in particular the supply and pricing of international bandwidth, as detailed in previous chapters. This chapter assesses the next link in the Internet supply chain—national connectivity, and of particular interest are the **institutional factors** within the 10 countries impacting the diffusion of the Internet and the potential for the emergence of a digital economy. Moreover, as high-speed, affordable broadband connectivity is fast becoming the bedrock of a modern economy, this chapter uses the **reach** of broadband networks in each country and the **affordability** of fixed and mobile broadband access as benchmarks for the development of the Internet ecosystem.[51]

The factors limiting broadband adoption can be seen to fall into three categories: i) limited coverage or network penetration, ii) high prices, and iii) unfavorable market conditions (e.g. unfair advantage to incumbents or significant market players). This chapter therefore examines the availability of access highlighting the challenges faced among the 10 countries along each of these three parameters.

Broadband Penetration

As noted in Chapter I, both consumers and businesses across the 10 countries in the subregion are increasingly accessing the Internet through wireless broadband rather than fixed connections (Table 3.1).[52] This trend corresponds with the Broadband Commission's 2015 report, which found that there are now over four times as many mobile broadband connections as there are conventional fixed broadband subscriptions.[53]

While it is true that mobile broadband, and increasingly affordable smartphones, are becoming the de-facto means of bringing users online and driving usage, this does not minimize the importance of deploying fixed broadband infrastructure to support the growth of overall broadband use, especially the expanded use of Wi-Fi in urban areas. And this appears to be one of the key weaknesses in the current development trajectory throughout the Central Asia+5 countries—***having the necessary fixed backbone infrastructure to support the emerging demand for wireless communications.*** Thus, it is important that while investment is made to capture rapidly growing mobile demand, attention is also given to building out the fiber-optic networks necessary for long distance backhaul and traffic management.

[51] In 2015, the Federal Communications Commission (FCC) of the United States updated its broadband benchmarking speed to 25 Mbps for downloads and 3 Mbps for uploads. See FCC (2015), "2015 Broadband Progress Report", https://www.fcc.gov/reports/2015-broadband-progress-report

[52] Wireless broadband typically refers to 3G/4G mobile data plans for smartphones, tablets or other mobile devices

[53] Broadband Commission (2015), "The State of Broadband 2015", http://www.broadbandcommission.org/documents/reports/bb-annualreport2015.pdf

Table 3.1: Internet, Mobile and Broadband Mobile Penetration (2014)

	Country	Mobile penetration[1]	Internet Penetration[1]	Fixed Broadband Penetration[1]	Mobile Broadband Penetration[1]
Cluster 1	Kazakhstan	168.6	54.9	12.9	59.8
	Azerbaijan	110.9	61	19.8	46.8
Cluster 2	Georgia	124.9	48.9	12.2	21.8
	Armenia	115.9	46.3	9.1	34.2
	Uzbekistan	73.8	43.6	1.3	23.9
Cluster 3	Kyrgyz Republic	134.5	28.3	4.2	68.5
	Tajikistan	95.1	17.5	0.1	9.5
	Pakistan	73.3	13.8	1.1	5.1
	Turkmenistan	135.8	12.2	0	10.9
	Afghanistan	74.9	6.39	0	3.2
Average[2]		**83.4**	**21.1**	**2.5**	**13.3**

Source: ITU (2015), "World Telecommunications/ICT Indicators"; Broadband Commission (2015), "State of Broadband 2015"; (1) measured as the number of subscribers per 100 inhabitants, (2) weighted averages.

Broadband: Availability, Affordability and Accessibility

Affordability of access is one of the principal factors driving adoption by consumers and businesses. Table 3.2 provides a comparison of basic mobile and fixed broadband offerings from the leading service providers in the 10 countries, and what proportion of personal income in GNI per capita terms, it represents.

Table 3.2: Affordability of Fixed Broadband Services

Country	Monthly subscription for fixed BB (USD)[1]	Cost of fixed BB (% GNI/cap)	Cost of fixed BB (% GNI/cap PPP)	Evaluation
Afghanistan	69.00	123.6%	42.2%	Unaffordable
Armenia	8.77	2.8%	1.2%	Affordable
Azerbaijan	9.50	1.5%	0.7%	Affordable
Georgia	8.95 (2 Mbps no cap)	2.9%	1.4%	Affordable
Kazakhstan	20.60 (4 Mbps no cap)	2.1%	1.1%	Affordable
Kyrgyz Republic	5.83	5.6%	2.2%	Moderate
Pakistan	29.40 (4 Mbps no cap)	25.0%	6.9%	Expensive
Tajikistan	58.44	64.9%	26.4%	Unaffordable
Turkmenistan	171.40 (512 Kbps no cap)[54]	25.6%	14.2%	Expensive
Uzbekistan	37.50	21.5%	7.7%	Expensive

Source: TRPC research and analysis (1) all offerings are based on the speed of 1 Mbps of unlimited data, unless stated otherwise.

[54] Turkmenistan has a USD38 monthly subscription for a 1 Mbps plan, however it is capped at 400Mb monthly, and charges excess fees of USD0.03 per Mb.

In two of the 10 countries (Afghanistan and Tajikistan) the cost of fixed broadband represents over a quarter of personal income in purchasing power parity (PPP) terms, putting it out of the reach of the vast majority, while in three others (Turkmenistan, Uzbekistan and Pakistan) it is 'expensive' as defined by the Broadband Commission in that it is more than 5% of personal income in PPP terms.[55] Notably these countries are all in the lower cluster groups, corroborating that ***pricing of broadband is a significant limiting factor in the adoption of the Internet and broadband in particular***.

Table 3.3: Affordability of Mobile Broadband Services

Country	Monthly subscription for basic mobile cellular with data (USD)	Cost of mobile data packages (% GNI/cap)	Cost of mobile data packages (% GNI/cap, PPP)	Evaluation
Afghanistan	8.23 (4GB)	14.7%	5.0%	Expensive
Armenia	3.14 (1.5GB)	1.0%	0.4%	Affordable
Azerbaijan	5.70 (1GB)	0.9%	0.4%	Affordable
Georgia	4.00 (4GB)	1.3%	0.6%	Affordable
Kazakhstan	5.32 (1GB)	0.5%	0.3%	Affordable
Kyrgyz Republic	6.00 (1GB)	5.8%	2.2%	Moderate
Pakistan	3.92 (4GB)	3.3%	0.9%	Affordable
Tajikistan	10.87 (1GB)	12.1%	4.9%	Moderate
Turkmenistan	45.70 (4GB)	6.8%	3.8%	Moderate
Uzbekistan	10.00 (1GB)	5.7%	2.1%	Moderate

Source: TRPC research and analysis

Mobile broadband, on the other hand, proves to be more accessible and affordable (Table 3.3) with all 10 countries lining up as having 'moderate' priced access or better. For five of the countries, namely Armenia, Azerbaijan, Georgia, Kazakhstan and Pakistan, the cost of mobile subscriptions combined with data packages are 2% or less of personal income in GNI PPP terms, well below the target threshold that the Broadband Commission has set. Excluding Pakistan, it is also notable that these are all Cluster 1 and 2 countries**,** which underscores the **strong correlation between affordability of access and Internet take up**. Pakistan stands out clearly as a demonstration of affordability powering the rapid take up of wireless broadband in early 2015. This is explored further below.

Price can play a strong role in influencing adoption and usage, but other factors such as the availability and quality of service also matter. The readiness of the population to use and explore the possibilities that come with broadband access is another important factor (further explored in Chapter IV). A worthwhile exercise therefore is to understand the reasons for barriers to adoption in each country.

[55] The affordability evaluation used here builds upon the Broadband Commission's target of offering basic fixed broadband services at <5% of monthly GNI per capita. In this evaluation, we used the following criteria to evaluate the cost of broadband (calculated as a share of monthly GNI per capita, PPP): Unaffordable: >25%; Expensive: 5%–--25%; Moderate: 2%–--5%; Affordable: <2%. See also 2015 report of the Alliance for Affordable Internet (A4AI), which found that citizens of rich countries pay on average of 1%–--2% of their monthly income to connect to the Internet.

The following section assesses the state of national broadband coverage along with affordability and institutional factors according to the Internet penetration clusters. Institutional factors, arising from regulatory dynamics, play an important role in determining how well the supply chain works and ultimately impact the uptake and usage of the Internet. In particular, a regulatory framework, which provides a level playing-field among all the different players is critical to encourage investment and promote innovation throughout the digital value chain. The following section identifies how these factors interact and affect Internet take up in each of the countries.[56]

Cluster 1: Azerbaijan and Kazakhstan

A clearer, albeit unsurprising, pattern emerges when coverage, broadband affordability and institutional conditions are juxtaposed and analyzed according to the Internet penetration clusters: countries with higher Internet penetration tend to have competitive market conditions, which incentivizes operators to expand service coverage of mobile and/or fixed broadband, bringing down access prices to more affordable levels. This pattern appears particularly apparent in the case of mobile broadband.

Cluster 1 countries are illustrative of states with wide-reaching coverage of both fixed and wireless broadband services at affordable cost, and with a reasonably competitive market environment (Table 3.4). The situation around fixed broadband ownership and competitiveness can be rather more complex, particularly given the investments required to rollout necessary infrastructure. It is perhaps unsurprising that the majority of the Central Asia+5 countries have state incumbents dominating this aspect of the market. Government commitment therefore to fostering broadband development can become particularly important, and limitations on market power and promoting access and use are equally important.

Table 3.4: Broadband Coverage, Cost and Institutional Conditions[57]

Country	Coverage	Cost	Institutional Conditions
Azerbaijan	**Majority** coverage for mobile BB (80% of population, ~70% territory)	A**ffordable** for both fixed and mobile BB (0.7% and 0.4% GNI/capita, PPP)	Fixed BB dominated by **state incumbents** while mobile BB market is **competitive**
Kazakhstan	**Majority** coverage for mobile BB (70% of population)	**Affordable** for both fixed and mobile BB (1.1% and 0.3% GNI/cap, PPP)	Fixed BB dominated by a **majority-state-owned incumbent**[58] while mobile BB market is **competitive**

Source: TRPC analysis based on BMI (2015) "Kazakhstan and Central Asia Telecommunications Insights"; ESCAP (2014), "An In-Depth Study on Broadband Infrastructure in North and Central Asia"; TeleGeography GlobalComms Database (2015), http://www.telegeography.com; The World Bank (2014), "A Sector Assessment: Accelerating Growth of High-Speed Services in Azerbaijan"

[56] As many carriers are actively expanding coverage, specific references made here may change rapidly. Data found in this table is dated Dec 2014 unless a separate citation is made.
[57] Coverage is based on reported 3G-service coverage of leading carriers either in terms of proportion of population or territory covered. Cost is based on the affordability analysis from Table 3.2 and Table 3.3. Institutional factors are based on TRPC research and specific sources as cited below Tables 3.4 to 3.6.
[58] KT is 51% owned by a state-owned holding company and has a market share of 79% as of Dec 2014.

Azerbaijan. In mobile broadband development, Azerbaijan (along with Armenia) has achieved sizeable 3G take up (41% of the population).[59] In Azerbaijan's case, this was after a comparatively late start, as it took Azercell and Bakcell two years to be awarded licenses for 3G services (in Nov 2011, following the incumbent Azerfone's 3G service launch in Dec 2009).[60] However, with momentum now clearly established, the government also claims that it is ready to carry out the scheduled digital switchover (DSO) from analogue to digital TV, which will free up further spectrum for future LTE roll out and possible use of the unused radio spectrum or "TV white spaces".[61]

While Azerbaijan has introduced a series of successful market liberalization initiatives, lack of competition in the fixed-broadband market and low fixed-broadband network coverage can constrain future growth.[62] While there are over 40 private ISPs in operation, the "absence of a level-playing field" stemming from the duopoly of Baku Telecom Production Association (BTRIB or BakTelecom) and AzTelecom, both wholly owned by the Ministry of Communication and High Technology (MCHT, formerly MCIT), may have dis-incentivized ISPs from investing in and developing quality access networks, according to a report by the World Bank.[63] The same report also pointed to the regulatory bottleneck at the wholesale level as another challenge the country needs to overcome.

Given the continuing significant state presence in the fixed market, several state initiatives are worth calling out for having contributed to Azerbaijan's successes in broadband:

- *E-Azerbaijan 2010–2012* (formerly e-Azerbaijan 2005–2008) prioritized Internet development including e-governance and e-education and contributed to the liberalization of ISPs[64]
- *Concept on Development of Broadband Internet in 2011–2013* promoted broadband connections across the country and Wi-Fi services in the capital. AzTelecom and Huawei installed new

[59] Armenia had seen 45% take up of 3G by November 2015.The Kyrgyz Republic, despite having achieved over 68% of mobile broadband, has a reported 3G take up of 16%. See TeleGeography GlobalComms Database (2015), http://www.telegeography.com

[60] According to MCHT, the two operators had not submitted the relevant documents related to network deployment progress and coverage plans. Azercell subsequently launched 4G LTE services shortly thereafter in May 2012.

[61] The ITU has allocated the use of 694/698 MHz to 862 MHz bands for the licensing of mobile broadband services on a primary basis, while the use of TV white space will be able to operate across the full range of unassigned and unused frequencies between 470 MHz to 862 MHz on a secondary basis. Armenia, Azerbaijan, Georgia, Kazakhstan, the Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan belong to ITU Region 1 which agreed to maintain the ITU's primary allocation in alignment for Region 2 (the Americas) and Region 3 (Asia). Digital broadcasting allows for a greater number of channels to be broadcast, which frees up spectrum for wireless Internet services. TV white spaces uses unassigned and unused bands without causing interference to primary users to deliver broadband, and other forms of connectivity, such as Wi-Fi operating within these bands.

[62] Azerbaijan, for example, successfully deregulated the licensing requirement for ISPs in 2002, contributing to the sector's liberalization.

[63] World Bank (2014), "A Sector Assessment: Accelerating Growth of High-Speed Internet Services in Azerbaijan", http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2015/01/27/000470435_20150127140336/Rendered/PDF/AUS91950REVISED0Box385411B00PUBLIC0.pdf

[64] TeleGeography (2015), "GlobalComms Database, Armenia", http://www.telegeography.com

Advance Digital Sync Processing (ADSP)[65] ports in several cities across 25 subregions as part of the project[66]

- *Expansion of National Broadband Network 2015* is AzTelecom's project to expand broadband infrastructure, enhance public access to ICT resources and improve the quality of service.[67]

Kazakhstan. The country's high ranking amongst the Central Asia+5 countries in broadband penetration is not surprising given its comparatively well-developed fixed line infrastructure and 3G/4G mobile coverage. This includes the incumbent, Kazakhtelecom's, management of the National Information Superhighway (NISH) -- an 11,500 km fiber-based next-generation backbone network. KT has not only continued to expand its backbone networks, including the laying of an additional 1,800 km of fiber to connect all major cities in 2012, but it also has upgraded networks to improve transmission speeds, including the completion of a live trial of optical network equipment with 100 Gbps capacity in Nov 2014.[68]

Kazakhstan's newly established independent regulator, the Agency of Communication and Information (ACI), has had a dynamic history. Originally established in 2003, ACI was transformed as the Ministry of Communication and Information (MCI) in 2010, which was then dissolved in 2012 into the Ministry of Culture and Ministry for Transport and Information. ACI was subsequently re-constituted in 2014. It is not difficult to imagine how the frequent organizational change may have affected the continuity of vision, planning and even institutional capacity. For example, ACI still did not have a functioning website in October 2015.

One challenge Kazakhstan faces is its vast landmass and a decentralized decision-making structure when it comes to deployment of communications infrastructure. Given the growth trajectory, however, significant increases in demand as well as an ever-growing reliance on broadband can be expected.[69] Indicative of this trend is recent growth in social media use with over 900,000 Facebook users and two million VKontakte users as of 2015.[70]

[65] Advanced Digital Sync Processing (ADSP) is a proprietary Extron technology that addresses potential issues with sync in RGB computer-video signals that could compromise or prevent, proper video display.
[66] MobilityTechZone (2011), "Azerbaijan's broadband Internet development concept to be submitted to Cabinet of Ministers", http://www.mobilitytechzone.com/news/2011/08/12/5703089.htm; TeleGeography, (2015), "GlobalComms Database Armenia", http://www.telegeography.com
[67] TeleGeography (2015), "AzTelekom launches first phase of broadband expansion project", https://www.telegeography.com/products/commsupdate/articles/2015/02/05/aztelekom-launches-first-phase-of-broadband-expansion-project/
[68] KT subsequently announced plans to provide FTTH to all multi-story, multi-family residential units by 2015.
[69] BMI forecasts over 11% of CAGR in the broadband penetration in Kazakhstan between 2015-2019. See BMI (2015), "Kazakhstan and Central Asia Telecommunications Report Q3 2015"
[70] Interview with Vadim Lyu on 11 Jun 2015. Originally VKontakte, which means "in touch", VK is a Russian social network that was ranked 21st in Alexa's global Top 500 sites as of 19 Aug 2015.

Cluster 2: Armenia, Georgia and Uzbekistan

The three Cluster 2 countries are illustrative in particular of the strong efforts in expanding mobile broadband (Table 3.5). Enabling market conditions by fostering competition among mobile carriers therefore also appears to be a key factor in promoting successful adoption.

Table 3.5: Broadband Coverage, Cost and Institutional Conditions

Country	Coverage	Cost	Institutional Conditions
Armenia	**Majority coverage for both** mobile BB (94%–98% of territory) and fixed BB (all major cities)	**Affordable** for both fixed and mobile BB (1.2% and 0.4% GNI/cap PPP)	Both fixed and mobile BB markets are **competitive**
Georgia	**Majority** coverage for mobile BB (86% of population)	**Affordable** for both fixed and mobile BB (1.4% and 0.6% GNI/cap PPP)	Fixed BB dominated by a **state incumbent** but ISP and mobile BB markets are **competitive**
Uzbekistan	**Partial** coverage for mobile BB (39% of territory)	From **expensive** for fixed BB (7.7% GNI/cap PPP) to **moderate** for mobile BB (2.1% GNI/cap PPP)	Fixed BB dominated by a **state incumbent** ad mobile BB dominated by a **duopoly**

Source: TRPC analysis based on BMI (2015), "Kazakhstan and Central Asia Telecommunications Insights"; ESCAP (2014), "An In-Depth Study on Broadband Infrastructure in North and Central Asia"; TeleGeography GlobalComms Database (2015), http://www.telegeography.com

Armenia. Although categorized in Cluster 2 in terms of Internet penetration, Armenia stands out with near universal mobile broadband coverage, with some 45% of the population already subscribing to 3G services by 2015. There are at least three factors contributing to Armenia's relative success:

1. Armenia is market-friendly in both broadband and mobile services. Its top three operators all have parent companies abroad and the country has two international entrants.[71] In the fixed broadband market the picture is similar with new entrants, backed by foreign investment, expanding their market share through aggressive marketing and service offerings.[72]

2. Armenia had a comparatively early start in rolling out 3G. VivaCell and ArmenTel were both awarded 3G licenses in 2007, and Orange Armenia in 2008. The Public Services Regulatory Commission (PSRC), an independent regulator created in 2004, has been effective in welcoming new entrants and assigning additional frequencies as demand increases. In no small part due to

[71] VivaCell is majority owned by MTS of the Russian Federation, and ArmenTel is affiliated with Vimpelcom of the Russian Federation. The Orange Group (formerly France Telecom-Orange) became the third operator by winning an international tender. There is also now a fourth entrant, UCOM, whose priority is mobile Internet.

[72] For example, GNC-ALFA, a broadband service provider majority-owned by the Russian Federation's Rostelecom, invested over USD35 million into network expansion and interconnection with the region's major backbone and international gateway. The improved speed and bandwidth enabled the carrier to dominate the fixed broadband market in Yerevan. It now operates in 15 cities in Armenia and is broadening its service to other areas such as IPTV.

the strong competition among the trio, PSRC was able to report that 3G services already covered 98% of Armenia's territory, or all but 23 of the 1,001 towns and villages, by 2014.[73]

3. The growth of tech start-ups, an area enjoying strong state support, is increasing demand for data and data-related services. ICT software and services accounted for some 3.8% of GDP by 2013, with the number of ICT companies operating in Armenia, already in excess of 400, growing at 4% per year.[74]

There are still regulatory issues to be addressed to ensure a sustainable and competitive market. For example, enforcement of local loop unbundling (LLU) will help fuel investment which will further address the penetration of fixed networks.[75] Nevertheless, as an indicator of market development, one important, and indeed very positive, regulatory development in the mobile market was the launch of Mobile Number Portability in 2013/2014, with good cooperation by the operators which was a key component of its introduction.

Georgia. Somewhat similarly to Armenia, Georgia has progressed rapidly in rolling out broadband by promoting wireless access and competition. Again, a few factors stand out as drivers. First, Georgia has promoted an open and competitive mobile market, with foreign-backed operators, such as Mobitel, rapidly being able to expand their market share over the last decade, leading to a more dynamic wireless and broadband market.[76] Second, 3G roll out had an early start, with the first set of licenses awarded in 2006 to MagtiCom and GeoCell.

This has helped to promote a more vibrant and competitive ISP market. By 2015 there were more than 400 ISPs, with 17 licensed to operate Fiber to the x (FTTx) service.[77] And while the market is much smaller than Kazakhstan or Afghanistan in landmass, the provision of satellite service available to ISPs on a wholesale basis, allows for market gaps to be addressed on a commercial basis, which means nascent demand can be targeted by small providers if they see an opportunity.

Georgia's market is still facing a number of challenges. For one, LLU does not appear to be in effect with reported disputes between incumbent and dominant bandwidth resellers providing unbundled access. While the regulator, the Georgian National Communications Commission (GNCC), stepped in recently and mandated duct access to be reduced, the effectiveness of the intervention remains to be seen.[78]

---

[73] 4G licenses were issued in 2010. VivaCell, the only operator offering commercial LTE services by 2015, claims to cover more than 47% of the population. UCOM plans to launch LTE service in 2016.
[74] State support includes tax incentives of up to three years, and income tax exemption for tech start-ups.
[75] Local loop unbundling refers to the process of requiring incumbent operators to open, wholly or in part, the last mile of their telecommunications networks to competitors (ITU, 2003; OECD, 2003).
[76] Mobitel, despite being the only operator without a 3G license, progressed straight to 4G LTE, partnering with Chinese vendor Huawei. See TeleGeography (2015), "GlobalComms Database Georgia", http://www.telegeography.com
[77] 'Fiber to the x' is the collective term used to describe optical fiber delivery topologies, where the 'x' refers to where the fiber connection terminates, e.g. fiber to the node (FTTN), fiber to the building (FTTB), etc.
[78] Duct access was reduced to GEL370 from GEL900–1,400. See ESCAP (2014), "An In-Depth Study on Broadband Infrastructure in North and Central Asia".

Uzbekistan. With broadband penetration at only 7% Uzbekistan lags far behind the other Cluster 2 Internet countries, and is significantly behind some Cluster 3 countries, such as Pakistan (14%). In fact, some 4.4 million people were estimated to still be connecting to the Internet using dial-up by the end of 2013.[79] While the country's Internet market has seen growth over the last decade, actual subscriptions have remained limited for the majority of the country's population. As with most developing economies, the arrival of mobile broadband in Uzbekistan has given a major boost to the local Internet market. While there were only 400,000 fixed broadband subscribers in early 2015, there were more than seven million mobile broadband subscribers by that stage.[80] The principle barrier to growth has been the high cost of bandwidth, with international bandwidth costing over USD300 per Mbps according to the State Committee for Communications, Information and Telecommunication Technologies (CCITT).[81]

However, more can be done to improve the business environment in order for Uzbekistan to further develop its wireless broadband market. MTS Uzbekistan's temporary exit between 2012 and 2015 due to license issues, for example, illustrates the type of barriers that could discourage investment in the country and, as a result, limit growth.[82]

The state-owned national telecom operator, Uzbektelecom, has been responsible for the fixed-line network and services throughout the country. It was originally granted a monopoly on international voice services and VoIP until 2007. In the meantime, it controlled around 98% of local fixed-line telephony services and 96% of international fixed-line services. Little progress had been made in the government's plans to privatize Uzbektelecom despite several attempts over the last decade to sell off a sizable stake to a foreign investor.[83]

Another notable incident illustrating the challenges faced by operators was the introduction of a 'subscriber tax' in 2012, charging operators USD0.22 per month per number.[84] Although proceeds go to the state budget, such developments put pressure on operator margins, ultimately affecting the pricing of access.

Cluster 3: Afghanistan, the Kyrgyz Republic, Pakistan, Tajikistan and Turkmenistan

Most countries in Cluster 3 have experienced political instability or security issues in recent times, which has constrained development of broadband markets and in turn, domestic connectivity (Table 3.6). Many of them also began from a lower baseline, either due to a lack of investment under the Union, or

[79] TeleGeography (2015), "GlobalComms Database, Uzbekistan", http://www.telegeography.com
[80] It is noted that the various sources for statistics on Internet subscribers in Uzbekistan provide limited or contradictory information.
[81] The new Ministry of Development of Information Technologies and Communications (MDITC) was established in Feb 2015.
[82] In 2012, MTS Uzbekistan had its license revoked on various allegations. Faced with a USD600 million fine, MTS Uzbekistan filed for bankruptcy and all assets were seized by the government. MTS returned to the Uzbekistan market in 2015.
[83] See for example Budde Communications, "Uzbekistan Forecasts (2015)", http://www.budde.com.au/Research/Uzbekistan-Telecoms-Mobile-Broadband-and-Forecasts.html
[84] The tax was later increased to USD0.24. TeleGeography (2015), "GlobalComms Database Uzbekistan", http://www.telegeography.com.

the destruction of communication infrastructure from recent violence in the country. Despite the inherent shortcomings, many are making strategic and deliberate efforts to catch up and establish a competitive market.

Table 3.6: Broadband Coverage, Cost and Institutional Conditions

Country	Coverage	Cost	Institutional Constraints
Afghanistan	**Partial** coverage for mobile BB (major cities) and **very limited** coverage for fixed BB (ADSL and VSAT only)	From **unaffordable** for fixed BB (42.2% GNI/cap PPP) to **expensive** for mobile BB (5.0% GNI/cap PPP)	Fixed BB is the purview of **a state incumbent**, and is competitive at the ISP level. Mobile BB is **competitive**.
Kyrgyz Republic	**Partial** coverage for mobile BB (>60% of population) and **limited fixed BB** (Bishkek and larger cities only)	From **moderate** for fixed BB (2.2% GNI/cap PPP) to **moderate** for mobile BB (2.2% GNI/cap PPP)	Fixed BB is dominated by a **majority-state-owned incumbent** while mobile BB is **competitive**.
Pakistan	**Limited** coverage for mobile BB (30–66 cities) and **partial fixed BB** coverage (2000 cities for ADSL	From **expensive** for fixed BB (6.9% GNI/cap PPP) to **affordable** for mobile BB (0.9% GNI/cap PPP)	Fixed BB dominated by a **majority-state-owned incumbent** while mobile BB is **competitive**.
Tajikistan	**Majority** coverage for mobile BB (90% of population) and **limited** coverage for fixed BB (major cities only)	From **unaffordable** for fixed BB (26.4% GNI/cap PPP) to **moderate** for mobile BB (4.9% GNI/cap PPP)	Fixed BB dominated by a **state incumbent** while mobile BB is competitive.
Turkmenistan	**Partial** coverage for mobile BB (larger cities only) and **very limited** coverage for fixed BB (ADSL in Ashgabat only)	From **expensive** for fixed BB (14.2% GNI/cap PPP) to **affordable** for mobile BB (3.8% GNI/cap PPP)	Both fixed and mobile dominated by **state incumbents**

Source: TRPC analysis based on ESCAP (2014), "An In-Depth Study on Broadband Infrastructure in North and Central Asia"; TeleGeography GlobalComms Database (2015) http://www.telegeography.com

Afghanistan. Both Internet and broadband penetration have remained low throughout Afghanistan given political and security instability. Nevertheless, there have been a number of positive developments aimed at improving connectivity, including construction of the Afghan Fiber Optical Network, the national backbone built around the country's Highway 1. This network connects all major provinces, and links Afghanistan with neighboring countries.[85] By 2015, the telecoms networks covered almost 90% of the population, according to the Ministry of Communications and Information Technology (MCIT). The country's first satellite, Afghansat-1, was also launched in 2015 under a strategic partnership with Eutelsat, further helping with basic connectivity.

[85] The installation of an additional 1,060 km of fiber optic cables is expected to be completed by 2016. TeleGeography (2015), "GlobalComms Database Afghanistan", http://www.telegeography.com

The advent of 3G services in 2013 has also served to provide a significant boost to broadband numbers. Prior to this Internet access was heavily reliant on dial-up. Most importantly, the price of Internet access has been dropping as a result of 3G and the growing subscriber base.

There is a dearth of technical knowledge related to the telecommunications and Internet market regulations, which has led the Afghanistan Telecoms Regulator Authority (ATRA) to seek outside experts to design 3G spectrum allocation and licensing strategies. To date, ATRA has successfully awarded 3G licenses to five operators, and they have been rolling out mobile Internet services since 2012.[86]

The Kyrgyz Republic. Internet use has undergone a comparatively healthy expansion in recent years, with user penetration reported at about 23% in 2014. However, actual Internet subscriptions remain generally low. In 2012 only around 7% of households had a computer, and thus public access such as Internet cafes have become a popular means of accessing the Internet. Around 50% of all users were estimated to access the Internet in this way, with workplace and educational institutions also making up a significant proportion of access points.

It needs to be noted that national fixed-line teledensity was only at about 8% by 2013 – not much different from the figure a decade earlier. In other words, growth had effectively stalled. Moreover, in addition to the lack of growth, is an imbalance in the market place: teledensity in the capital was around 25%, but only 5% in the rest of the country.

Fixed-broadband Internet services are still small in number, a result of the poor infrastructure rollout and challenging geography.[87] Again, however, the advent of mobile broadband is impacting the shape of the market—both from an accessibility and cost perspective.

In late-2013, the government decided that it would not sell its majority shareholding in Kyrgyztelecom, for reasons that "[privatisation] could lead to an increase in retail fixed line tariffs in the country." This was seen as surprising as the telecom and Internet sectors in the Kyrgyz Republic have been generally characterized by an open market that welcomes both foreign and domestic investors.

With the advent of 3G services, private mobile operators, who function in the provision of Internet services, have been actively investing in the necessary infrastructure, giving positive indications that the market will continue to expand. As a result, there is a slow but growing interest in the development of mobile broadband and data services.[88]

Accession to the WTO has had a positive impact on many aspects of the business culture in the Kyrgyz Republic. The emergence of a digital economy through increasing connectivity, usage and service delivery will both be benefitted by this trajectory and will reinforce these developments, emphasizing the need for the government to focus on institutional drivers.

---

[86] Ibid.

[87] The conversion of the country's fixed network from analogue has continued to move slowly, with an estimated 85% digital by 2013, although this is well up from just 37% in 2004.

[88] On the regulatory front, while considered generally open and having completed all of the requirements stemming from its WTO accession, there does remain a culture of poor limited transparency in some aspects of corporate behavior which will need to be addressed if the market is to accelerate and reach its potential.

Pakistan. Pakistan's relative success among Cluster 3 countries in broadband can be attributed to a combination of market-led growth in mobile and mobile value-added services and the government's IT sectoral push. Since 2014, Pakistan has seen rapid growth in mobile broadband following the issuance of 3G and 4G licenses—a licensing process that had been delayed since 2006.[89]

Beginning in 2005, due to the licensing of various wireless and wireless local-loop carriers, Pakistan saw a phenomenal expansion in mobile services with the number of subscribers jumping from less than two million to 100 million in just eight years. By 2009, mobile networks covered in excess of 90% of the population. However, while mobile penetration was strong, Internet penetration remained at relatively low levels and broadband was of particular concern with slow growth for many years.

Between 2009 and 2014, fixed-wireless solutions, particularly utilizing CDMA2000 1x EV-DO and WiMax became the technologies of choice to address the access gap, with the annual growth rate of fixed-wireless broadband subscribers in excess of 30%. As soon as the government issued 3G licenses, four operators that had secured licenses followed by rapid network roll-out. The advent of 3G and 4G has forced the market to look to more competitive and advanced technologies, with many ISPs abandoning WiMax to launch LTE, for example.[90]

Despite challenges with the 3G licensing process, there is much to suggest that the government's approach to connectivity and IT overall has had a positive effect. The country has been pursuing an aggressive IT policy, aimed at boosting Pakistan's drive for economic modernization. To this end, the government has recently laid out its commitment with its 'Vision 2025' paper.[91] Of particular significance has been the administration's provisioning of e-government services (see Chapter IV). Nonetheless, there continue to be constraints. In 2012, for example, the Competition Commission of Pakistan (CCP) issued a notice to PTCL, the majority-stated owned incumbent in fixed broadband, for limiting competition from ISPs in the DSL market.[92] Control of Internet accessed content continues to be a topic of heated debate in Pakistan. The government has directed that the monitoring of websites for particular content be undertaken by the telecom regulator, the PTA.

Tajikistan. With one of the lowest fixed-line teledensities in the subregion, fixed Internet connections also remain extremely low. A recently expanding Internet user-population has again been helped by growth of mobile access and subscriptions, and the increasingly widespread presence of mobile Internet services. A total of seven mobile operators have been licensed, although there has been some rationalization of the market. More than 10 ISPs have been licensed. Nevertheless, the state-owned

[89] PTA has announced potential auctions of 3G and 4G spectrum since 2006.
[90] Ibid.
[91] The Pakistan government has identified ICT as an important driver for innovation and committed to accelerate development of digital literacy among youth and broadband infrastructure. It also identified use of the Internet and mobile telecommunications to improve efficiency and efficacy of e-government initiatives. See Planning Commission, Ministry of Planning, Development and Reform, Government of Pakistan (2015), "Pakistan 2015: One Nation–One Vision", http://www.ntb.gov.pk/gop/index.php?q=aHR0cDovLzE5Mi4xNjguNzAuMTM2L250Yi91c2VyZmlsZXMxL2ZpbGUvUGFraXN0YW4tVmlzaW9uLTIwMjUucGRm
[92] PTCL appealed and took the case to the Islamabad High Court, which eventually ruled in favor of CCP in 2014.

incumbent operator, Tajiktelecom, continues to maintain a major presence in the market, providing local, long-distance and international telephone services throughout the country. Significantly, the privatization of Tajiktelecom has been subject to a series of delays.

There is room for the government to play a more positive role in fostering the demand-side of Internet content in Tajikistan. A series of high-profile website blocks, including of news agency sites in 2012 and 2014 sent a sobering message to investors and potential entrepreneurs in the market. This can also dampen demand for locally sourced content. Improving access to information locally available encourages Internet take up and provides certainty for investment into the market.[93]

Turkmenistan. The state-owned Turkmen Telecom has been the primary provider of public telephone, email and Internet services. Through a subsidiary, TM Cell, Turkmen Telecom has been operating a GSM mobile network in competition with private mobile operator, MTS Turkmenistan, since 2005 a subsidiary of the Russian Federation-based MTS. Not surprisingly it has been the mobile services that have been dominating growth. In a busy two-year period, Turkmenistan, one of the smallest telecom markets in the Central Asia+5 subregion, saw its mobile penetration jump from 8% to 30%. Mobile penetration had reached 63% (3.2 million subscribers) by the end of 2010.

In general, however, Turkmenistan's mobile and broadband market is not considered to be transparent with some major players reporting that they have either been suspended or forced to cease operations in the past.[94] In 2007 the government re-opened Internet cafes in the capital Ashgabat and was set to follow this move in subregional centers. This is important development as an hour of computer time costs about USD4—a high price in a country where the average monthly income is less than USD100. At least partially due to such difficulties, Turkmenistan has not been able to effectively integrate the Internet into its socio-economic development.[95]

However, some progress is now being made. Following large-scale revisions in 2013, access tariffs have gone down substantially.[96] However, more can yet be done to bring the rate down to internationally recommended levels of affordability.[97]

With the slowing of commodity price growth, the Turkmenistan government has shown a growing appetite to rebalance and diversify its economy, so as to move away from a heavy reliance on natural

[93] One source estimates the total number of blocked sites to be over 200 in 2014. The affected sites included Amazon, Facebook, YouTube, and VKontakte. See http://thediplomat.com/2014/10/tajikistan-cracks-down-on-internet-again/

[94] For example, MTS's operation was suspended between 2010 and 2012 when its license was not renewed, leaving TM Cell as the sole provider of mobile broadband. Some ISPs had been forced to close down in 2000 and 2002, which made room for Turkmenistan Telecom to step in and dominate data services.

[95] For example, Reporters Without Borders (RSF) has classified Turkmenistan as one of the 12 countries in the world considered "Enemies of the Internet" since 2012.

[96] Turkmenistan was reported to have the highest tariff in the world in 2011 when the price for 2 Mbps access was reported to be USD6,821 per month. When Turkmentelecom started offering personal broadband subscriptions, it was still around USD323 per month when the average monthly salary stood at only USD620.

[97] The UN Broadband Commission has set the threshold target of 5% of personal income (GNI per capita) for basic broadband communication expenditure.

resources as it has done for the past two decades. Taking specific policy choices to improve its digital ecosystem by ensuring a level playing field for business and improving human capital would be very beneficial for Turkmenistan in this regard.

Conclusion

The first part of this study has shown the broad variation in Internet and broadband penetration rates across the Central Asia+5 subregion, with one cluster of countries below 30%, a second cluster between 30% to 50%, and a third cluster above 50%. And, while countries may generally find themselves in a cluster corresponding to their respective income level, there are exceptions such as Turkmenistan and Pakistan, demonstrating the importance of other key variables. In both cases they are found in a lower Internet cluster than might be expected. By investigating the levels of international Internet connectivity available to these countries, together with the national coverage of their domestic networks, it can be seen that in lower income countries the costs, and therefore prices, of providing Internet connectivity can be prohibitive for many citizens. At the same time, there is no reason to believe that latent demand is any less in these countries, and if policy makers can find ways to encourage the necessary investment in the infrastructure, especially at an initial development stage, to provide greater coverage at affordable prices, demand will be forthcoming. Another important enabler is the plentiful supply of access devices at affordable prices. This is beginning to happen with a new generation of low-end smartphones which are especially helpful in poorer countries. Wireless is now often the preferred choice over fixed-line access owing to the convenience of being able to carry the device (portability) and use it anywhere (mobility).

There are also significant gaps in national network coverage in a number of the Central Asia+5 countries, and this is certainly the case for both the Kyrgyz Republic and Tajikistan. The geographies, including mountainous ranges and extensive deserts through a number of the countries, pose a major challenge to full network coverage, and in the case of both Afghanistan and Pakistan well-populated areas remain seriously underserved due to security challenges.

The first three chapters of this report have also established that while broadband connectivity penetration rates are less skewed than basic Internet connectivity *at this stage*, broadband connectivity has remained extremely limited until very recently and is now showing indications of shifting subregional rankings potentially further changing the relationship between GDP per capita and connectivity. The latter has interesting ramifications for the potential to see broadband connectivity as *a means for driving GDP growth*, potentials that will be explored in a limited manner in Chapter IV.

Of greater significance in this development is the role of wireless broadband as the growing means of Internet access for low and middle-income citizens of the Central Asia+5 economies. This is fortuitous given that it is far easier and cheaper to construct mobile cellular networks than fixed-line networks, but, to achieve national coverage, comprehensive provision via fixed-line backhaul networks remains a necessity. *This is still yet to be achieved in most of the Cluster 2 and 3 countries.*

It has been shown that the capacity of international bandwidth coming into a country, and that of national backhaul bandwidth available within a country, are major constraints upon Internet development in the economies concerned. There is a chicken-and-egg problem here as the lack of

Internet development means traffic volumes and revenues are insufficient to attract private-sector investment in these networks, and insufficient network capacity chokes off access to the Internet, keeps prices high and the speed and quality of service low. The role of government in cases of market failure is to bridge the gap between supply and pent-up demand until a virtuous cycle of development can kick-in. For example, government can play a leadership role in creating a national backbone either by building it themselves, subsidizing it or working with private sector partners. In addition, if governments give preferential treatment to incumbent operators at the expense of opportunities for competitive entry then the benefits of additional investment are far less likely to arise, innovation in services and pricing bundles will not take place, and Internet development will be further slowed.

A glaring gap across the Central Asia+5 subregion is the general lack of carrier-neutral peering locations to minimize bandwidth and cost constraints. Without carrier-neutral peering, Internet traffic routing is often inefficient, adding to cost and latency. The lack of international bandwidth and the anticompetitive market conditions for IXPs and ISPs translate into unaffordable Internet access and poor speed in countries that are most in need of it. This leaves the Central Asia+5 subregion with not only a digital divide *within* countries between those served and those not served, and those who can afford and those who cannot afford, but also *between* countries for those with and without sufficient bandwidth and efficient traffic management. Given the landlocked nature of most of these countries, access to bandwidth via peering arrangements of one sort or another is vital. The digital divide between countries is therefore not confined to basic access and pricing but also includes areas of coverage and service speeds or the bitrates that are available to users.

The impetus to address these connectivity divides is clear. In today's global economy countries increasingly need to be strongly *digital* to compete, to link into business supply chains, to reach new markets, to respond to market information in a timely fashion and to innovate in digital goods and services. This is especially true for enabling SMEs to access subregional and global markets, to reinvigorating traditional industries to be competitive, and to enabling governments to cost-effectively and sustainably serve their citizens with social support. The lack of sufficient bandwidth and widely available access to the Internet in many Central Asia+5 countries can only undermine progress toward a digital economy and integrated society.[98] It is to the potential in using connectivity for driving a digital society that we turn our attention in Chapter IV.

[98] TRPC, for example identifies six essential building blocks to usher in the digital economy, namely 1) widespread penetration and use of mobile, 2) ubiquitous Internet access, 3) interoperable mobile and e-payment systems, 4) open online market places, 5) conducive business environment, and 6) transparent and enabling policies and regulations. See TRPC (2015),"Going Digital: The Status and Future Potential of Internet-Based Economies in Asia", http://trpc.biz/wp-content/uploads/TRPC_GoingDigital_Whitepaper20150605.pdf

IV. Digital Economy Opportunities and Constraints

The previous chapters looked at the status of the Internet ecosystem using the framework of the Internet supply chain to follow the bandwidth from international capacity to local access. This chapter moves away from the linear supply side focus to further develop the complementary premise running through the report: the prospects for the transition from an Internet economy, based primarily on connectivity, to a digital economy. A digital economy is used to describe the transition in which a broad range of non-IT goods and services begin to utilize the Internet in their design, production, distribution and consumption. In other words, how well positioned these economies are or may be depends on the level of access to and the use of the Internet which will play a developmental and potentially transformational role in more traditional industry.

As we have already noted and examined, crucial to this development is the widespread existence of and access to public and private communications networks that utilize IP for interconnection and interoperability. Using this conceptual framework is particularly pertinent for lower-income countries going through rapid network, and especially *rapid mobile network*, development.

Previously we have noted that the foundations for a shift from a nascent Internet economy toward a fully developed digital economy and society can be established when lower income economies can achieve comprehensive levels of national coverage, interconnectivity and interoperability. But what comes through in parts of this review of the Central Asia+5 subregion is that for the approach to be effective, demand too must be stimulated and nurtured. The subregion consists of very diverse countries with, at times, a very challenging set of geographical and developmental conditions. People will consume connectivity when it provides access to a good or service which makes a material difference to their current condition. If the benefit coming from such a fixed or wireless broadband connection is not made obvious—be it for the delivery of education, healthcare, or even simply entertainment services—then the demand may not emerge, no matter what the price may be. At least not for some time.

The evidence appears to suggest, however, that when utilized in the delivery of value-added services, demand throughout the subregion can be substantial. In this chapter we therefore focus on a selection of key sectors which increasingly are able to be delivered digitally. The focus here is on how Internet connectivity, rather than being a vertical sector—communications—in its own right, has become a horizontal enabler of almost all other sectors, enabling access to a greater range of resources, and in turn facilitating how businesses operate and expand, and how society develops. This section provides a snapshot of how various countries are using the Internet to promote sectoral developments such as finance, e-government and electronic welfare services, and education. In turn, these ICT applications are critical for boosting the demand for Internet access and services, which is vital for developing the necessary virtuous cycle by which investment is targeted to provide further supply to meet unrealized demand. The success factors and constraints of the various initiatives are examined, and the opportunities for scale up and replication in the subregion are briefly identified. All the examples are chosen from within the past 5-year period, and the issues they highlight, for example, the need for interoperable systems across the finance sector, will remain relevant into the foreseeable future.

Finance

The financial system as a whole depends upon the interconnectivity of payments systems, and increasingly these reside upon IP-based networks at points along the lines of transactions processing. As mobile platforms become ever more ubiquitous, payments networks have begun to integrate with mobile networks and are transforming the financial services landscape.

Creating interconnected payments networks and interoperable payments systems is thus a particularly good example of how the provision of basic connectivity for Internet access becomes the platform for higher-value economic and social networking. Moreover, broadband mobile networks, coupled with smart mobile devices, have become the basis for a new generation of digital content distribution and the digital consumption of media and information products and services, and this too requires payment services, usually needing to be integrated with the digital product or service delivery. In this manner, digitally integrated payment platforms stimulate a range of entrepreneurial activities and innovations, positively impacting the private sector by spurring innovation and investment.

When set up properly, mobile money services can provide cheaper, faster, and safer means of transferring or storing funds, compared to traditional alternatives in many countries. This has important potential repercussions for extending financial inclusion, particularly to populations without access to the instruments of the formal financial system. Moreover, related financial services such as insurance are increasingly being offered over mobile money platforms. Traditional banking systems tend to have limited geographical coverage and charge high transaction fees. Money saved from lower transaction fees, or being able to avoid having to travel to a bank, means more funds in the hands of people and businesses. Since mobile money transfer is also instantaneous, time savings become an increasingly important benefit, particularly for small or remote businesses. Examples are provided here from recent developments—and challenges—in Afghanistan, Pakistan and Tajikistan.

Afghanistan

Afghanistan shows quite clearly the potential for mobile payments and mobile money as well as the challenges. M-Paisa, a joint venture payments service provider between Afghanistan's biggest telco Roshan, and British multinational Vodafone, was introduced in the country in 2009 as a trial to pay the Afghan national police with mobile money instead of cash.[99] Direct electronic payments meant that middlemen were no longer able to skim cash from legitimate salaries.[100] Mobile payments also resolved the security risk of transporting large amounts of cash.

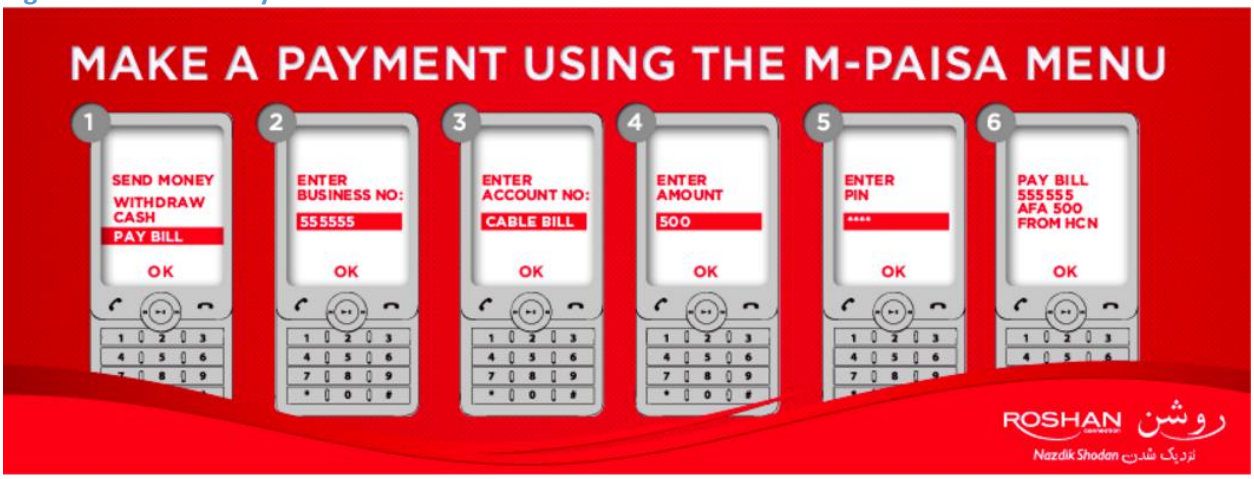
[99] Police staff reported what they thought to be a 30% increase in their salary when they first received payment through mobile money. In fact, they were receiving their actual salary for the first time. This is an illustration of how effectively mobile money can potentially prevent leaks in public funds.

[100] Better Than Cash Alliance (2015), "Transparency", http://betterthancash.org/why-e-payments/transparency/; S. Jalote (2013), "Using Mobile Technology for Development in USAID", http://www.futuregov.in/articles/2013/may/09/using-mobile-technology-development-usaid/; R. Bryce (2014), "How Digital Currency could End Corruption in Afghanistan", http://www.wired.com/2014/05/how-digital-currency-could-end-corruption-in-afghanistan/

By 2013, M-Paisa had more than 1.2 million subscribers, according to the Afghan Mobile Money Operators Association, and was growing its registered base of users at double-digit rates. This may not be surprising as less than 7% of Afghanis have a bank account, but more than 75% own mobile phones. The service's functionality had also grown beyond direct-payroll deposits in the public sector to include mobile person-to-person transfers, point-of-sale merchant payments and microfinance loan disbursements and repayments.[101] Western Union has also signed an agreement with Roshan to enable international money transfers to be sent directly to M-Paisa mobile subscribers in Afghanistan.

Such developments, as have been seen in other countries, can fundamentally change development models. To use the M-Paisa service doesn't require a bank account; in place of ATMs Roshan uses a network of agents, mostly small retail outlets that not only accept M-Paisa payments for groceries and supplies ('money-in'), but also dispense money to M-Paisa subscribers ('money-out'). In this way, mobile money brings people into the formal economy and "they suddenly become able to borrow money to buy fertilizer, pay for health care or save money for education."[102] M-Paisa has also created the opportunity for government and NGOs to distribute aid directly to Afghanis. By 2013 Roshan was working to integrate banks into the system by rolling out new services including e-payment of monthly utility bills. This, however, is where problems began to become apparent.

Figure 4.1: M-Paisa by Roshan



Source: Roshan website (2013), "Another First for Roshan— Convenient Bill Payments for Herat Cable Customers with M-Paisa", http://www.roshan.af/roshan/Media_Relations/News/News_Details/13-07-06/Another_First_for_Roshan%E2%80%94_Convenient_Bill_Payments_For_Herat_Cable_Customers_with_M-Paisa.aspx

In 2012, Roshan's three main competitors, Afghan Wireless, Etisalat and MTN, had all launched their own mobile-money offerings with no interoperability enabled between the services. The lack of interoperability has only served to fragment the still nascent market opportunity. Etisalat, for example, partnered with the power company to enable users to pay electricity bills through their m-pay system,

[101] Roshan (2013), "M-Paisa Services", http://www.roshan.af/roshan/m-paisa.aspx

[102] Laurence Chandy from the Brookings Institute, cited in E. Heinrich, (2013), "How Afghanistan is on the Leading Edge of a Tech Revolution," *Time*, http://world.time.com/2013/03/02/how-afghanistan-is-on-the-leading-edge-of-a-tech-revolution/

but only Etisalat subscribers could do so.[103] In June 2015, the first four mobile applications were launched on the Ministry's mobile government platform, HOSA (see below for further information on HOSA), and were only available to citizens using SIM cards from the Salaam Mobile Network.[104] This lack of interoperability has resulted in a market still too nascent and too fragmented to create the necessary critical mass for sustainable growth. As a result user activity has dropped significantly, suggesting that without some coordination or intervention, what is an otherwise worthwhile and exciting approach may fail to gain traction.[105]

Pakistan

In comparison with Afghanistan, mobile money initiatives in Pakistan have grown even more aggressively, but display some of the same emergent challenges. By 2014 there were eight mobile money providers operating in Pakistan with agent networks significantly outnumbering traditional banking channels.[106] Within five years of the introduction of mobile money services in Pakistan, the value of mobile money transactions had reached 3.5% of the country's total GDP.[107]

The dominant service provider, EasyPaisa, in this case championed by Norwegian telco Telenor (in partnership with Tameer Microfinance Bank), launched the services in 2009 and became the third largest mobile money provider *in the world* in 2015 *by registered users*, with some 7.4 million unique users, and with a network of 65,000 outlets serving an average of six million users per month.[108]

EasyPaisa's main differentiating factor has been that customers do not require a mobile phone or account with Telenor to pay their bills or to send/receive money: transactions can be done at any of the provider's more than 20,000 EasyPaisa shops around the country by the merchant on his/her mobile phone. Mobile subscribers use their own phones for a transaction and then go to an EasyPaisa shop to deposit or withdraw cash from their mobile account. As other providers have done elsewhere, as EasyPaisa has grown it has added various value-added services. For example:

- **G2P/ bulk payments:** The Sindh Education Reform Programme (SERP) signed an agreement with EasyPaisa in Jun 2014 which allowed the Sindh government to disburse educational stipends through the service. The program provides educational stipends to families in rural areas in the province of Sindh and has enabled the Sindh government to provide stipends to 400,000 girls through the service.

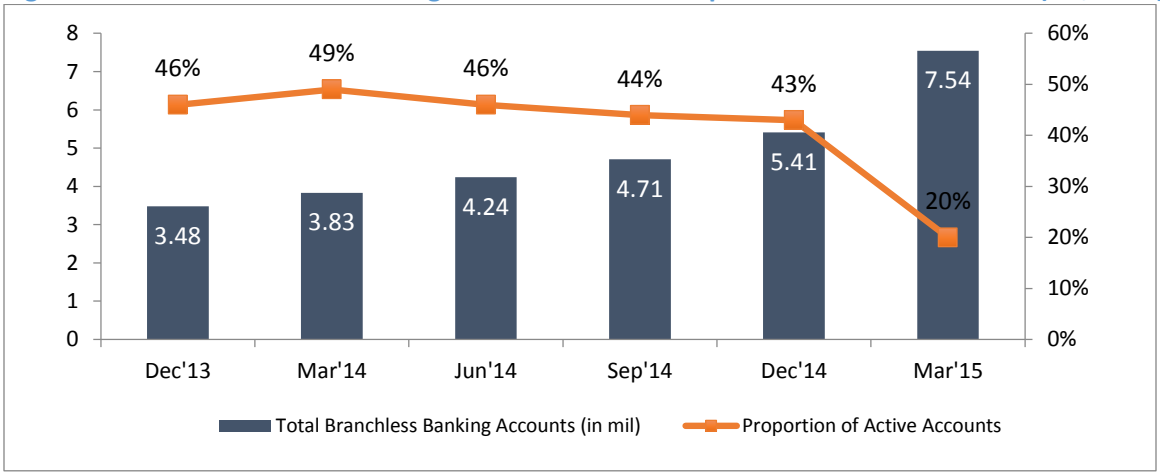
[103] Office of Inspector General, USAID (2014), "Audit of USAID/Afghanistan's Financial Access for Investing in the Development of Afghanistan Report", https://oig.usaid.gov/sites/default/files/audit-reports/f-306-14-002-p.pdf
[104] Mobile Public Services Afghanistan (2015), "HOSA launches 3 applications", http://hosa.mcit.gov.af/en/news/hosa-launches-3-applications
[105] C. Scherer (2014), "Mobile Money in Afghanistan: An Uphill Battle", http://www.ypfp.org/mobile_money_in_afghanistan_an_uphill_battle
[106] EasyPaisa, HBL Express, MCB Lite, Mobicash, Mobile Paisa, TimePay, UBL Omni, Upaisa
[107] I. Khan and N. Rashid (2015), "Using Mobile Money to Promote Financial Inclusion in Pakistan, Karandaaz", http://karandaaz.com.pk/sites/default/files/downloads/UsingMobileMoneyt-PromoteFinancialInclusion.pdf
[108] Regulations in Pakistan mandated a bank-led model and hence the license for branchless banking rests with Tameer Microfinance Bank; Telenor Pakistan acquired 51% ownership in Tameer for better governance of the new business.

- **Savings:** In 2013, EasyPaisa introduced a mobile savings service, Khushaal Munafa, giving customers returns of up to 9% for using their account for savings.
- **Insurance:** Life and Accidental Death Insurance of up to PKR1 million is offered to customers who use Khushaal Munafa savings service and maintain a minimum balance of PKR2,000.[109]

The reasons for growth in Pakistan are again compelling: a young and rapidly growing population, with some 87% of the adult population unbanked, and increasingly ubiquitous mobile phone coverage and usage. However, for EasyPaisa and its competitors, the growth numbers have been by and large restricted to user registrations, over-the-counter (OTC) top-ups (i.e., limited remote transaction usage), and person-to-person domestic remittance. Other value-added services to date, despite being successful in limited areas, have failed to show substantial sustained usage.

Branchless banking is a particular case in point. Having initially shown rapid growth in the number of accounts, the growth rate for *transaction volume* has dramatically tapered off and the proportion of active accounts has fallen (Figure 4.2).

Figure 4.2: Total Branchless Banking Accounts and the Proportion of Active Accounts (Q1, 2015)



Source: State Bank of Pakistan (2015), "Quarterly Branchless Banking Newsletter Jan-Mar 2015", http://www.sbp.org.pk/publications/acd/BranchlessBanking-Jan-Mar-2015.pdf

Pakistan, like Afghanistan, has shown huge early promise in an area that can have significant economic and social benefits, but is then having trouble maintaining customer engagement. A key cause remains the lack of interoperability.

Recent public and private sector initiatives may help advance mobile money adoption in Pakistan. The State Bank of Pakistan (SBP) developed branchless banking regulations in 2008, with revisions in 2011. The regulations were explicitly intended to promote financial inclusion and have proved to be successful in inspiring market participation. More recently, the country's National Financial Inclusion Strategy

[109] The coverage varies ranging from PKR100,000 to PKR1 million, depending on the customers' monthly balance.

(NFIS) has helped to provide further clarity and market impetus.[110] For example, a re-verification initiative for SIM cards was mandated by the government. This initiative incentivized mobile network operators to promote mobile money account registrations due to the fact that the biometric re-verification process is more extensive than the identification requirements needed to register a mobile money account.[111] On the private-sector side a number of service providers eliminated the fees related to money transfers between account customers and cash-out transactions.[112] For EasyPaisa this led to an increase in the number of P2P money transfers of around 2500% between September 2014 and April 2015.[113] Again, however, one of the single biggest blockers to growth has been the lack of interoperability between services with, for example, EasyPaisa mobile wallet accounts only able to exchange funds with other Telenor SIM subscribers.[114]

There are two other digital payments areas of great promise for the subregion that are only touched on lightly in the above: e-commerce and remittance. The biggest beneficiaries of an expanding e-commerce market are SMEs, and this is particularly true for emerging economies, as they are provided with access to a global market of suppliers and customers previously beyond reach. Given the demographic and market composition of the Central Asia+5 countries, enabling payment solutions for SMEs, particularly payment solutions that enable cross-border transactions and don't require multiple different solutions or accounts, will prove a boon to trade and development.

Tajikistan

Remittances are a significant financial component of the accounts of a number of Central Asia+5 economies. Tajikistan is the world's most remittance-dependent country, accounting for nearly half of the country's GDP.[115] Such large remittance flows are not only beneficial to individual recipients but can

[110] State Bank of Pakistan (SBP) engaged the World Bank to provide technical assistance for development of NFIS in 2014 and finally announced the launch in May 2015. The strategy forms the basis for coherent and sequential reforms needed to address both demand and supply side issues to help tackle financial exclusion. The focus of the initial phase will include digitization of payments, including G2P bulk payments. SBP (2015), "Finance Minister launches National Financial Inclusion Strategy for Pakistan", http://www.sbp.org.pk/press/2015/FM-22-May-2015.pdf

[111] See R. Lewis, J. Villasenor and D. M. West (2015)), "Advancing financial inclusion in Southeast Asia, Central Asia, and the Middle East," TechTank, Brookings Institute, http://www.brookings.edu/blogs/techtank/posts/2015/09/16-fdip-results-asia

[112] Ostensibly the elimination of fee transfers was to be for a set period only.

[113] CGAP (2015), "EasyPaisa: Incentivizing Mobile Wallet Usage in Pakistan", http://www.cgap.org/blog/easypaisa-incentivizing-mobile-wallet-usage-pakistan

[114] Other issues include OTC users feeling no need to register for accounts because they could access all necessary services through their agent. An insufficient understanding of the services is therefore proving to be a significant barrier to usage growth. At the individual level, gender has proven to be a strong predictor of m-money use with 95% of m-money users being males and only 5% female. Individuals aged 55+ and those with less than a secondary education are the next least likely to be using m-money. Intermedia (2015)), "Pakistan: Driving Financial Inclusion," http://finclusion.org/wp-content/uploads/2014/04/InterMedia-FII-Pakistan-Wave-2-Wave-Report1.pdf

[115] Remittances to Tajikistan are almost entirely from Tajik migrant workers working in the Russia Federation and the level of flow has fluctuated in recent years mainly due to exogenous factors. The level was around 50% of GDP in 2008 before the global financial crisis, then tapered to 40% in 2010 and was reportedly back at 52% level as of

be important for businesses and banks as well.[116] However, even though formal remittances do mostly flow through the banking system, customers really only interact with banks when they deposit or withdraw funds for remittance. Because of the inconvenience and cost, most Tajik remittance senders and receivers do not have any other kind of account in the formal financial sector. Yet they still need to go to a branch to be served. The potential is therefore substantial to make use of a promising mix of (i) people on both ends of the remittance corridor being in regular contact with banks; (ii) most of the senders and receivers still being unbanked; (iii) the banks having detailed records of remittance clients' financial flows; and (iv) intense and growing competition among banks, leading to declining fees for customers to remit money. Throughout the region, this is an acute issue. In most cases the individual markets are deemed to be too small for global financial providers to make the investment and absorb the risk costs associated with these markets. However, the subregion when taking into account the emerging needs of small-scale entrepreneurs and traders in a commodity rich environment against the backdrop of fast growing mobile connectivity, the conditions are already in place for increased use of mobile and other technologies for remittances.

E-government

Table 4.1 shows the rankings of the Central Asia+5 countries in the 2014 *E-Government Development Index* (EGDI) by the United Nations. According to the survey, only one country from the subregion made the top quartile (above 0.75) -- Kazakhstan—a vastly improved performer in recent years, and ready to make it into the global top 20, as well as the top quartile. Georgia, Armenia and Azerbaijan all placed in the second quartile, while the rest of the sub-countries in the region, with the exception of Afghanistan, ranked in the third quartile.

The majority of the countries topping the EGDI are distinguished by high income and economic stability. Income level has a strong influence on national e-government systems. But once again, it is not a sole, or causal explanation. The breakdown of the scores, particularly within the context of the preceding Internet infrastructure analysis, is rather telling. Importance is given to qualitative measurements of the online environment, the telecommunication infrastructure, and human capital. The one parameter in which almost all countries in the subregion do poorly on is telecom infrastructure. By comparison, the subregion is distinguished by high levels of education of the population.

2013. The Russian Federation's recent currency devaluation also is expected to have a significant effect on the remittance flow to Tajikistan. The World Bank's 2015 recent report predicts the remittance level to plunge 40% in the next two years. See Eurasianet.org (2014), "Tajikistan: Migrant Remittances Now Exceed Half of GDP", http://www.eurasianet.org/node/73591 and Eurasianet.org; Eurasianet.org (2015), "Tajikistan: Remittance to Plunge 40% - World Bank", http://www.eurasianet.org/node/68272

[116] In the case of one Tajiki bank, the revenues from commissions corresponded to 46% of net interest income in 2009. See CGAP (2013), "Remittances in Russia and Tajikistan", http://www.cgap.org/blog/remittances-russia-and-tajikistan

Table 4.1: The Ranking of the Central Asia+5 Countries in the United Nations EGDI (2014)

Country	Ranking	EGDI	Online Service Component	Telecom Infra Component	Human Capital Component
Kazakhstan	28	0.7283	0.7480	0.5749	0.8619
Georgia	56	0.6047	0.5984	0.4261	0.7895
Armenia	61	0.5897	0.6142	0.3889	0.7660
Azerbaijan	68	0.5472	0.4331	0.4605	0.7480
Uzbekistan	100	0.4695	0.4488	0.2333	0.7264
Kyrgyz Republic	101	0.4657	0.2756	0.3801	0.7413
Turkmenistan	128	0.3511	0.0866	0.2189	0.7478
Tajikistan	129	0.3395	0.0630	0.2306	0.7249
Pakistan	158	0.2580	0.3228	0.1174	0.3337
Afghanistan	173	0.1900	0.1811	0.1472	0.2418

Source: UN Public Administration Country Studies (2014), "UN E-Government Survey 2014", http://unpan3.un.org/egovkb/en-us/Reports/UN-E-Government-Survey-2014

All of the Central Asia+5 countries reviewed have some kind of e-government policy, strategy, plan or program. And all, except Turkmenistan, have created a portal where users can find information about government services. These countries all do comparatively well in this parameter. However, well-developed webpages and e-services will be less effective in environments where the population cannot use them because of a lack of access to the Internet or a lack of skills or awareness. In this regard, e-government initiatives can be one of the most effective ways for digital economy demand stimulation to be undertaken as such initiatives are focused on delivery of services, rather than mere connectivity.

In the more advanced economies such as Armenia, Azerbaijan and Kazakhstan, citizens can also carry out transactional services on the government's web portal, highlighting such interconnections and reinforcing the benefits to be gained across many emerging digital economy services. E-government can be a prime driver of mobile money and digital finance uptake in a country, with typical online services including applying for and paying for certificates, purchasing licenses and permits, and paying for utilities.

Governments themselves are also major users of Internet technologies, from simple mail services through to highly advanced cloud computing and Big Data analytics in areas such as environmental management, health services, and public service access and distribution.

A variety of initiatives have been undertaken across the Central Asia+5 countries, but in their diversity they also highlight the different stages of connectivity and *interconnectivity* development of these countries. Rather than run through examples of the ten countries surveyed, three instances of e-government development have been selected across different income groups to illustrate the different stages of advancement. The three examples selected are Afghanistan to highlight the opportunity offered by the leap to mobile access and mobile services delivery, Azerbaijan, to show the importance of interconnectivity and interoperability in developing and delivering a 'one-stop shop' approach to e-government, and Kazakhstan which is moving toward a multichannel service delivery model and illustrates the importance of top-down political will and political support for holistic success.

Afghanistan

In 2011, the MCIT developed an E-government Strategy outlining key priorities for the subsequent five year period.[117] These included:

- **National Data Repository Center**: a data repository center for storage of data related to e-government programs.
- **E-Tazkira:** an Electronic National ID Card System, which is a chip-based smart card, to serve as an identification system and a platform through which citizens could have access to e-services (Figure 4.3).
- **Design of Websites and E-Service Applications for Ministries**: including a G2G financial management application. Additionally, police and army payroll was to be managed online by transferring salaries directly to personal bank accounts.

Figure 4.3: E-Tazkira National ID Card System

Source: G.R. Fariwar (2014), "E-Government in Afghanistan", http://gov20class.blogspot.sg/2014/03/e-governmentin-afghanistan-e-government.html

However, given the comparatively weak infrastructure in Afghanistan, it was subsequently decided that mobile communications would be the ideal solution for reaching out to citizens and to strengthening e-government in the country. With 75% of the population having access to a mobile phone it is a far more direct channel for service delivery. Moreover the transition to digital service delivery had the added compelling benefit of addressing corruption and improving security.[118]

Thus, MCIT, in partnership with the private sector and international development agencies such as the World Bank and USAID, began implementing a number of initiatives to leverage the mobile infrastructure, based around the creation of a mobile services delivery platform, HOSA, so as to increase citizen access to government services.[119] Services available on HOSA include information (and news) from government agencies, weather and health alerts, exam results, notification of salary payment, and

[117] G.R. Fariwar (2014), "E-Government in Afghanistan", http://gov20class.blogspot.sg/2014/03/e-governmentin-afghanistan-e-government.html

[118] N. Isaczai (2013), "Achieving E-Governance a case study of Afghanistan and South Korea", http://www.academia.edu/4811424/Achieving_E-Governance_a_case_study_of_Afghanistan_and_South_Korea

[119] Paywast, a private company, is managing HOSA and working with different government ministries to roll out some 30 e-government applications/ services. Mobile Public Services Afghanistan (2015), "HOSA overview", http://hosa.mcit.gov.af/en/page/about-hosa/overview

so on. Government initiatives *also* include grants to support application innovations and the roll out of the mobile service delivery platform.

Figure 4.4: HOSA Website

Source: HOSA (2015), "Mobile Government Services for Afghanistan", http://hosa.mcit.gov.af/en

Under the initiative, electricity bill and payment of police and national army personnel salaries are being conducted via the mobile platform. Roshan, the incumbent telecom provider, has empowered M-Paisa to provide services for G2G (salaries of security forces) and C2G (payment of electricity bills). M-Paisa also provides for citizen-to-citizen remittances across the country. In addition, the E-Government Department has developed mobile applications for the health, finance, and education sectors. To date, 10 applications have been developed, including in the agriculture sector; a mobile phone application enables farmers to access information about current market prices and other agricultural issues to improve their income.[120]

Azerbaijan

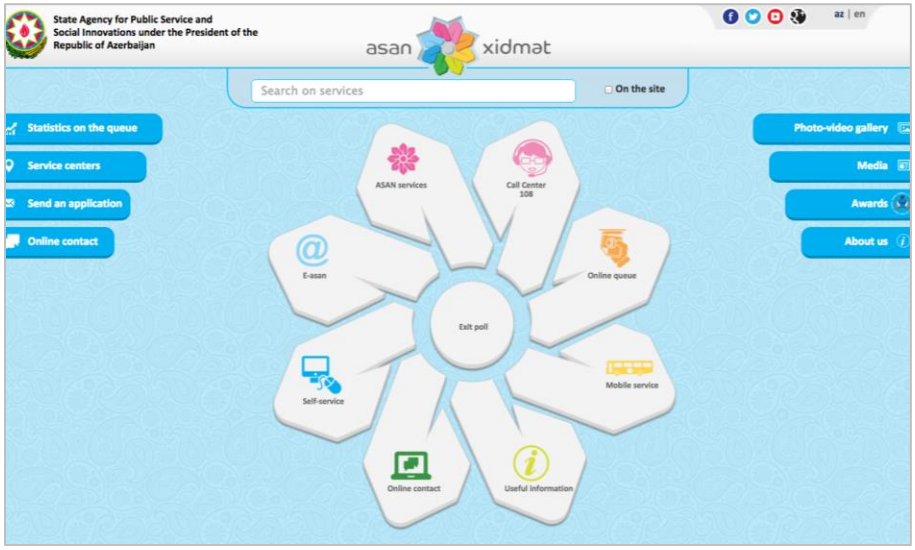
Although Azerbaijan has focused on the development of e-government services for some time—the creation of an e-government portal was a central part of the 10-year ICT National Strategy beginning in 2003, and included the E-Government Project—there had been a recognized lack of interconnection and service interoperability in the overall program design. To address this, the Azerbaijani Service and Assessment Network (ASAN) launched in early 2013 with the aim of making Azerbaijani state bureaucracy simpler and more accessible. ASAN is an e-government-based 'one-stop shop' for anyone who needs to access public services.[121]

Its central principle has been *to bring representatives from all government departments under one roof*, including those from the Ministry of Justice, Ministry of the Interior, Ministry of Taxes, the State Committee for Property Affairs, and the State Customs Committee. Many administrative tasks, ranging

[120] World Bank (2015), "Afghanistan Shows the Way in E-Government", http://www.worldbank.org/en/news/feature/2015/09/24/afghanistan-shows-way-e-government
[121] State Agency for Public Services and Social Innovations (2015), "ASAN" , http://www.asan.gov.az

from tax registration to driving license renewal, can be performed at ASAN service centers or via the ASAN website (Figure 4.5).

Figure 4.5: Azerbaijan's ASAN Website, http://www.asan.gov.az



Source: State Agency for Public Services and Social Innovations (2015), "ASAN", http://www.asan.gov.az

Another key challenge in delivering effective e-government had been found to be the lack of interaction and coordination among state ministries and agencies, with inadequate services interoperability between state agencies and ministries. ASAN offers 22 services, including: issuing residence permits; notarial document certification; registration of births, deaths, marriages and divorces; driving license renewal; identity card services; land registry applications and real estate services; state pension services; tax registration; and customs declarations. Moreover, *from the outset, ASAN was designed so that all payments are transacted online*. All ASAN centers are thus 'cash-free'. The Azerbaijani Taxation Ministry and ASAN have also collaborated to develop the ASAN Imza (simple signature). This enables entrepreneurs to use mobile phone technology to securely digitally sign documents. It is unnecessary to use a special card reader, and the system has been optimized for use globally, operating across various mobile platforms.[122]

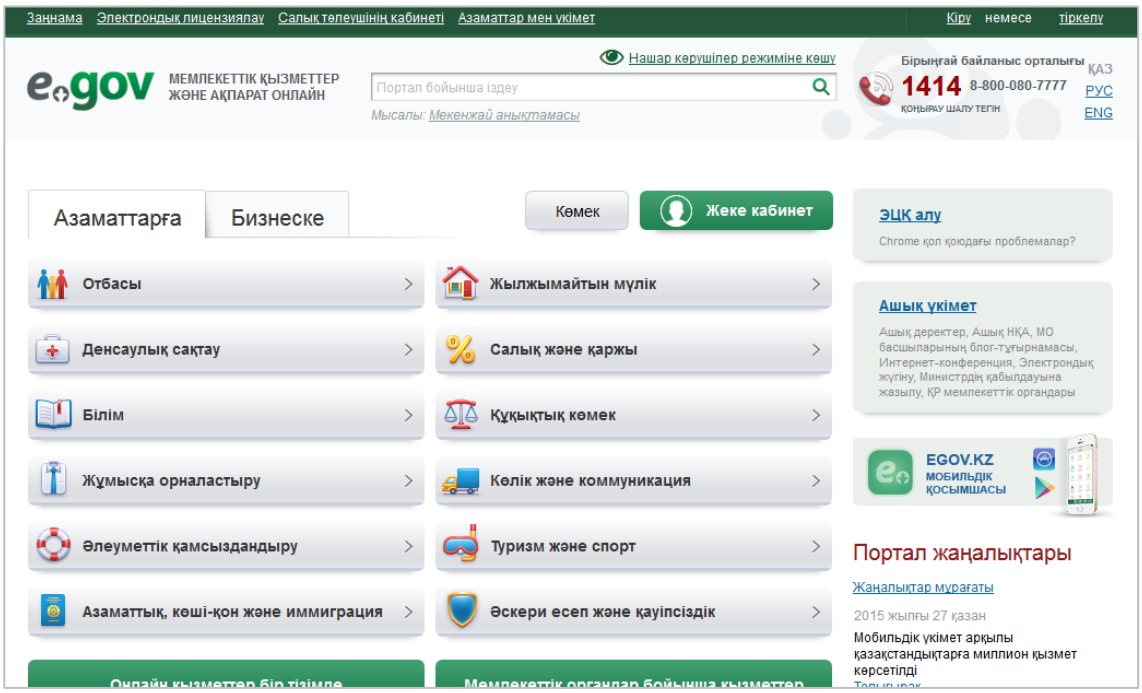
Expectations for "successful" e-government in Azerbaijan encompass a range of benefits for both citizens and the government: citizens will gain more effective access to information and services provided by government, while government will enjoy a reduction in costs—and particularly in ongoing per-unit costs—in providing those services. Thus, e-government will decrease budgetary expenses and establish a centralized data storage space for state agencies following full integration.

[122] ASAN Imza utilizes an 'X-Road system'. Estonia is currently the only other country using this technology in the public sector.

Kazakhstan

In the 2014 edition of the United Nations E-Government development index (Table 4.1), Kazakhstan improved its ranking by 10 positions, jumping from 38th to 28th place among the 193 countries. It was also the top-placing country within the subregion. Even though the country has already been developing e-government service delivery for more than nine years, the success, and rapid improvement of Kazakhstan's e-government ranking still strikes many in the subregion and internationally as a surprise. The foundation of the country's success has been the e-government national web-portal (Figure 4.6)

Figure 4.6: Kazakhstan' E-government Web Portal, www.e-gov.kz



Source: Kazakhstan's E-government Web Portal, http://egov.kz/

The Kazakh e-government portal offers Kazakh citizens access to more than 570 services, the most popular of which include the issuance of address references authenticating a person's living location and providing references for property ownership, pension savings and business ownership. The portal was visited on average by 43,000 users daily in 2014, and serviced some 38 million requests.[123] Additional services include applying for scholarships, authorization for driving permits, payment for utility services, paying fines and, taxes, changing ID to electronic digital signatures (EDS) and so on. All such services can be done from practically any locality in the country.

The success of the portal demonstrates the benefits of a holistic approach to interconnectivity and interoperability with almost all government agencies required to be connected into the central site, with one notable exception of the National Bank of Kazakhstan (NBK). Thus everyone has access to all government resources and information services through a one-stop shop approach, as well as having

[123] Astana Times (2014), "Foreign Ministry Diplomatic Corps Discuss Kazakh E-government", http://astanatimes.com/2014/06/foreign-ministry-diplomatic-corps-discuss-kazakh-e-government/

access to video and educational programs for children, online discussions and consultations, and so on. The Prime Minister and all members of the Cabinet of Ministers also have their own blogs where questions can be asked to officials and answers are expected to be provided.

As opposed to Afghanistan's focus on mobile delivery as the primary platform from the outset, Kazakhstan's e-government service initially began for the desktop, and its *next* area slated for development in e-government is to introduce *mobile* government services and to develop the mobile delivery platform, with some 50 services to be launched for access through mobile devices, including being compatible for 'traditional handsets', in 2015.[124]

To further promote the openness of government, the Kazakhstan Open Data portal was launched in 2014 with over 200 datasets.[125] This portal aims to increase people's access to government data, thus enhancing the transparency of public administration. It also aims to promote the innovative use of the data to create new services, and thus stimulate economic growth. To enable an open government, a number of regulatory changes had to be made, including an amendment to the information law mandating all government agencies to publish data in machine-readable format.[126] The opening up of government data allows citizens and businesses to use the data for research, to develop web and smart phone applications and solutions based on the data.

Education

Among the challenges facing many of the lower income Central Asia+5 countries are issues of basic connectivity for schools, the cost of connection, the bandwidth available, the costs of maintenance and the human resources required to explore the opportunities for e-learning in schools. With the spread of smartphones a new challenge is also arising: using multi-device connectivity for educational applications that combine audio-visual and interactive elements over the Internet using wireless and mobile networks in the classroom and outside for homework. This is a two-sided challenge in that not only do the students need to be trained in their usage of the devices for such functions, so do the teachers in many cases.

In addition to prioritizing Internet connectivity roll-outs to schools, and placing ICT studies in school curricula, it is equally important to build interoperable platforms and applications for collaborative e-learning between schools within the country and across the subregion. The Central Asia Research and Education Network (CAREN) network identified below, does this to a degree, but such initiatives need to be broadened and replicated.

At the tertiary education level, universities across the subregion are beginning to offer online courses as broadband Internet becomes more widely accessible. Examples include:

---

[124] Astana Times (2014),"Kazakhstan Going Mobile, Announced During E-government Forum" http://astanatimes.com/2014/10/ukazakhstan-going-mobile-announces-official-e-government-forum/

[125] Kazakhstan Open Data Portal website, http://data.egov.kz

[126] The government faced significant challenges opening up the 200 datasets, partly because they were in different format that required reformatting, editing and conversion before it could be made 'open'—e.g. accessible to all, including those with disabilities, and machine processable.

- Yerevan Haybusak University in Armenia;
- Khazar University in Azerbaijan;
- Kyrgyz Turkish Manas University;
- Kyrgyz Russian Slavic University; and
- University of Central Asia in Kazakhstan and Tajikistan.

The Internet stands to increase access to, and improve the quality of, higher and continuing education but to sustain such trends in an efficient and effective manner, the Central Asia+5 economies need to invest in both the development of content and in promoting digital enablers such as e-learning to address the growing demands for education and training, the deficiency of qualified teachers and trainers, and the re-skilling of the workforce in the transition to a digital economy.

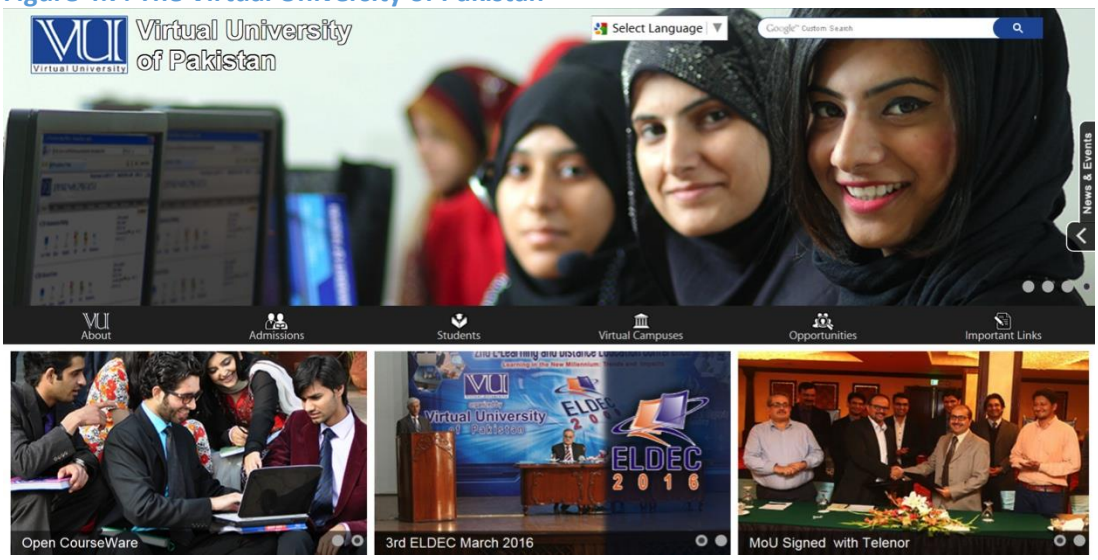
Pakistan and Armenia: Virtual Universities

The Virtual University of Pakistan was originally established very early, in 2002, as a public sector, not-for-profit university to provide affordable higher education to all regardless of location.[127] The Virtual University commissions professors from different universities to develop specific courses and then uses its full-time tutors to manage and deliver these courses, increasingly now over the Internet. The interactions between students and professors, and amongst students, including question and answer sessions, quizzes and assignments, take place through a learning management (software platform) system. Examinations are held at designated centers throughout Pakistan.[128]

As the cost of computers and Internet are still relatively high in Pakistan, the Virtual University of Pakistan has established a chain of 'virtual' campuses throughout the country in collaboration with the private sector. These campuses are basically infrastructure provision centers and are equipped with the necessary hardware and Internet connectivity that are required to pursue an educational program at the University. No additional costs are associated with students using the centers, thereby maintaining affordability. By 2015 the University had a presence in more than 100 cities and towns with a network of about 170 such centers.[129]

[127] There are many variations of virtual universities and colleges from individual institutions with or without campuses, to a network of institutions that offer courses online.
[128] e-DIRAP(2013), "Google+ Hangout#1: ICT in Education", https://plus.google.com/events/cpbqee5ee69162gqh7s5v74t9ms
[129] Virtual University of Pakistan (2015), "Mode of Education", http://www.vu.edu.pk/pages/HowVuWorks.aspx

Figure 4.7: The Virtual University of Pakistan



Source: Virtual University of Pakistan (2015), http://www.vu.edu.pk/Default.aspx

This Internet-based model subverts the usual education approach and limitations by providing access to top professors in different universities (addressing the supply constraint), and reducing the cost of access (by aggregating demand). In the process the University has made nearly 6,000 hours of quality courses publicly available on YouTube.[130] That online education in Pakistan is growing in popularity, is evidenced by the rapid increase in annual intake at the Virtual University of Pakistan from less than 5,000 students in 2005 to more than 30,000 in 2014.[131]

In Armenia, the Armenian Virtual College was launched in 2009 providing accredited courses in Armenian studies online through the Moodle learning management system. The Armenian Virtual College is also developing a series of multimedia e-books to promote the Armenian history and culture.[132] The College is primarily targeting the 5 to 10 million Armenian diaspora.[133]

Tajikistan: E-learning and MOOCs

In 2014, the World Bank piloted a series of ICT-based solutions aimed at tackling challenges identified in Tajikistan's National Education Development Strategy. The pilots involved three universities and two NGOs including:

- Teacher training on course creation using open-source learning management systems;[134]

[130] N. A. Malik, (2013), "Pakistan", in UN-APCICT, Open and Distance Learning in Asia and the Pacific, 2013
[131] Email exchange with Dr. Naveed A. Malik, Advisor, Virtual University of Pakistan, on 11 September 2015.
[132] AGBU (2015), "Armenian Virtual College", http://agbu.org/education/armenian-virtual-college/; Armenian Virtual College (2015), "Armenian Virtual College", https://www.avc-agbu.org
[133] Wikipedia (2015), "Armenian diaspora", https://en.wikipedia.org/wiki/Armenian_diaspora
[134] Moodle and ATutor

- The use of existing courses from different massive open online course (MOOC) platforms such as Coursera, Code Academy, Lingualeo and Intuit.ru for teacher training, life-long learning and supplementary learning materials;
- A survey aimed at the private sector on joint course creation with universities; and
- Workshops to raise awareness and conduct knowledge exchanges with open universities from Malaysia, Indonesia, South Africa and the United States on distance education and the use of learning management systems.

An evaluation of the pilot project showed the potential for the Tajik Academician Research and Educational Networks Association (TARENA—a member of CAREN), to provide far more research- and education-related services to higher education institutions. TARENA provides various ICT-related services for Tajikistan's higher education and research institutions, and connects them to each other and with those outside the country, including access to electronic information resources maintained by libraries, research facilities, publishers, and affiliated organizations. However, TARENA only provides service in the capital, Dushanbe, while higher educational institutions *outside* Dushanbe have no option but to use commercial ISP services, which significantly increases the cost.

Access to bandwidth will continue to be an issue. While the majority of higher education institutions connected have met the minimum bandwidth requirement for offering and using online courses (1 Mbps), students continue to complain about the speed of Internet access.[135] This is one area that will require further and ongoing attention (and investment) as content and traffic increase. Another is that under the current arrangement, and despite the interest, the service will continue to be limited to Dushanbe: *more access points are needed to address student demand and to further stimulate demand*. Further constraints include language requirements and the lack of localized software.[136]

Given the initial success and the widespread potential, this is an area in which other subregional economies could look to coordinate and build on the work done. Subregional-level programs to replicate the successes, as well as to promote collaborative e-learning could be considered, both in their own right, but also to bring development costs down rapidly and to open to the platform to a much broader audience base.

[135] World Bank (2014), "Tajikistan: Higher Education Sector Study", http://documents.worldbank.org/curated/en/2014/10/23089705/tajikistan-higher-education-sector-study

[136] Language is a barrier for using existing online courses; therefore, students and teachers prefer Russian-based online course materials such as Intuit.ru, which is run by the National Open University in the Russian Federation...

Box 4.1: Georgia: The Deer Leap Project

The Deer Leap Project is a government initiative that aims to connect every town or village in Georgia to an online school network. The project developed a web portal for teachers, giving teachers nationwide a platform for exchanging lessons and experiences. The project was developed in partnership with the Government of Estonia and local experts. In 2006, Georgia became a partner of the Global Gateway, a global network of schools that are using ICT for education. This has allowed Georgian schools to learn from other schools in the network on the use of ICT for education, including good practices on the creation of digital educational resources and conducting classes using ICTs.

In the second phase of the Deer Leap Project, the ICT infrastructure was improved with fiber optic cables. Local networks for educational institutions and resource centers were created. Hotline and online support were established, and an education information system was connected to the server. All schools now have broadband Internet connection.

The Government of Georgia has started to equip teachers and students with notebooks or tablets under the One Laptop per Child initiative. However, current educational offerings are weakened by teachers not having the competencies to educate in e-Skills.

As stated in the e-Georgia Strategy and Action Plan 2014–2018, the action plan for education is as follows:

- Facilitate ICT direction and its delivery in national educational plan;
- Intensify teachers' training in ICT;
- Adapt educational content into Georgian local needs and add local content;
- Establish a web portal for sharing learning resources online;
- Provide certificates of ICT skills for students;
- Establish help desk for IT support and IT coaches;
- Introduce e-learning and blended learning;
- Incorporate ICT into the curricula of teachers; and
- Ensure basic computer equipment for teachers.

Source**:** Asian Development Bank (2012), "ICT in Education in Central and West Asia: A Work in Progress", http://www.adb.org/sites/default/files/publication/29964/ict-education-central-and-west-asia-exec-summary.pdf; and A Digital Georgia: e-Georgia Strategy and Action Plan 2014–2018.

CAREN and Telemedicine

The Central Asia Research and Education Network (CAREN) is a subregional research and education network interconnecting over 500 research centers and educational institutions in Kazakhstan, the Kyrgyz Republic, Tajikistan and Turkmenistan via their national research and education networks. CAREN also provides links to the research communities in Europe and other countries. Operational since July 2010, CAREN is jointly funded by the European Commission and the Central Asian national research and education networks, and is currently in its third phase. Originally deploying satellite technology, CAREN has now transitioned to a primary reliance on fiber optics. In addition, CAREN supports the development of applications over improved connectivity, one of which is telemedicine.[137]

In addition to enhancing the management and exchange of health information, the Internet has also enabled online exchanges between patient and doctors, and among health specialists, benefiting those with limited access to health services and medical expertise. Recognizing this trend, CAREN has been collaborating with national research and education networks to link doctors, patients and hospitals via high-quality, real-time video, thus enabling remote diagnoses and consultations, and access to interactive medical training. In one example of this development, in March 2014 cardiologists from Kazakhstan, Tajikistan and Turkmenistan participated virtually in a subregional cardiology and internal medicine conference in the Kyrgyz Republic using CAREN's broadband connection.

Prior to the establishment of CAREN, the Kyrgyz Republic and Turkmenistan piloted telemedicine projects to explore the use of ICTs to increase access to healthcare services. In Turkmenistan, the Turkmen Research and Education Network Association (TuRENA) piloted a project in 2008 that made use of the satellite network at that time to organize eye surgery demonstrations, and pre- and postsurgery consultations.[138]

In the Kyrgyz Republic, the project was piloted in Batken, a remote and rural area, with funding support from the United Nations Development Programme (UNDP). It linked Batken Hospital with two leading medical institutions—the National Centre of Cardiology and Therapy, and the National Centre for Maternity and Child's Health Care—as heart diseases and complications during pregnancy and childbirth were the leading cause of death in the Kyrgyz Republic. Medical equipment for diagnosis and a communication system using the mobile network were set up at the three participating medical institutions. Medical staff were also trained to use the equipment.[139]

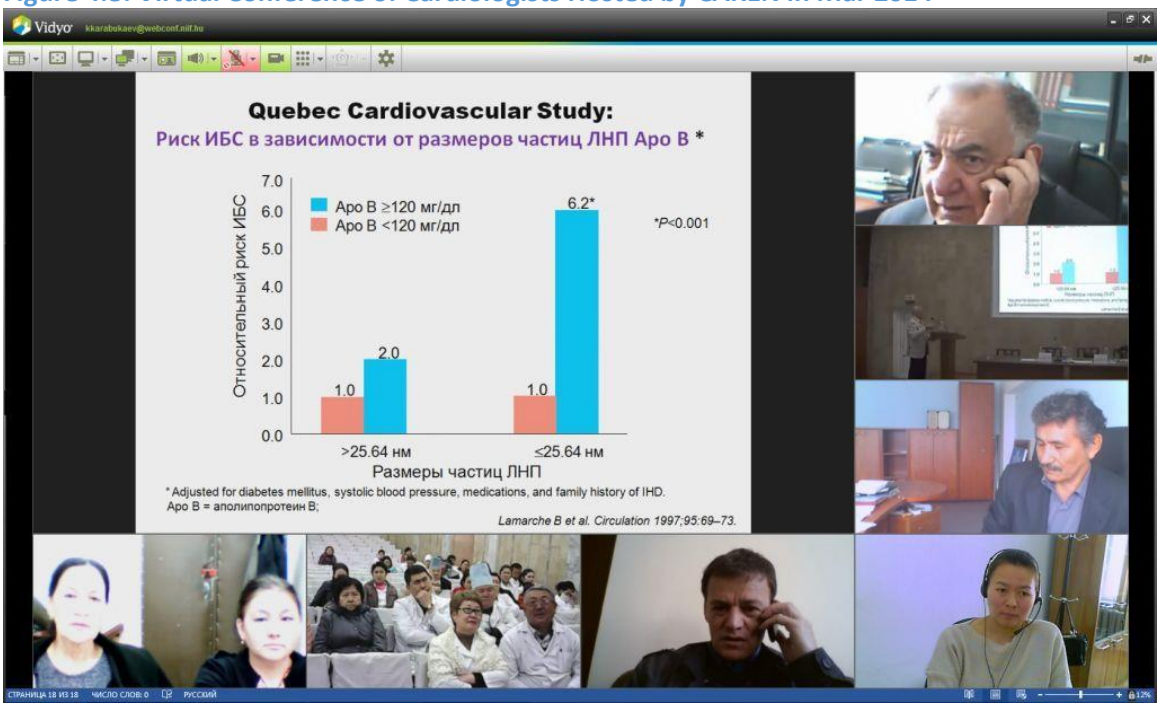
---

[137] UN APCICT (2013), "APCICT Case Study Series: Open and Distance Learning (ODL)", http://www.unapcict.org/ecohub/apcict-case-study-series-open-and-distance-learning-odl. See also CAREN (2015), "CAREN website", http://caren.geant.org/

[138] A. Charyyar, (2012), "Telemedicine Pilot Project in Turkmenistan", http://icaren.org/files/TURKEMENISTAN_Telemedicine%20Pilot%20Project_ENGLISH.pdf

[139] C. Suyunbaeva, (2012), "First Interactive e-Health Services in Kyrgyz Republic", http://icaren.org/files/KYRGYZSTAN_eHealth%20Project_ENGLISH.pdf

Figure 4.8: Virtual Conference of Cardiologists Hosted by CAREN in Mar 2014



Source: CAREN (2014), "Central Asian cardiologists stage first major international conference without leaving home", http://icaren.org/en/component/content/article/1/184

More recently, the Kyrgyz Research and Education Network (KRENA) hosted a videoconference on telemedicine that was attended by doctors and representatives of the scientific and educational networks of Kazakhstan, Tajikistan and Turkmenistan, and the Telemedicine Development Centre of Asia Kyushu University Hospital, Japan. In July 2015, a videoconference was organized for cardiologists in Osh Regional Hospital in the Kyrgyz Republic to consult with specialists at the Apollo Telemedicine Centre in India on the treatment of heart diseases.

CAREN has focused on both the supply of national and international connectivity, a*nd the creation of demand for Internet-enabled services* through telemedicine and distance learning. It has initiated cross-learning among countries in the subregion, and sought the expertise and experience from other countries and entities. Due to the linguistic, geographic and cultural similarities of the economies, subregional initiatives and programs that increase both the supply of and demand for Internet-enabled services in various development sectors could be considered. Moreover, since Russian is widely understood in many of the Central Asia+5 economies, the development of relevant digital content in Russian could potentially increase demand. For example, CAREN partnered with the United Nations Asian and Pacific Training Centre for ICT for Development (UN-APCICT) to translate its training modules into Russian, which are available as online courses.[140]

[140] National research and education networks are also present in Afghanistan and Pakistan—there is the Afghanistan Research and Education Network (AfgREN) that is a member of the Trans Eurasia Information Network (TEIN), and the Pakistan Education and Research Network (PERN).

ICTs for Children with Special Needs and Disabilities

There are a number of pilot projects that explore the use of ICTs for children with special needs.[141]

In 2010, the Ministry of Education in Azerbaijan collaborated with Nobel-T, a local company, and AzEduNet to conduct a pilot that provides online education to children with special needs at their home using notebooks, interactive learning software, and connectivity through AzEduNet. It involved teachers using online videoconferencing tools to interact with the children.

A similar initiative was piloted in Kazakhstan in 2010 where 90 teachers were trained to provide online education to children with special needs at their homes, and e-course materials were developed with special needs education experts. The children were provided with notebooks and Internet connection through collaborations with NGOs and the private sector. For instance, a local coal mining company donated 273 computers to children with special needs in Pavlodar city, and a local NGO covered the Internet connection fees.

In Uzbekistan, the government conducted a number of pilot projects on the use of ICT for the education of children with hearing and visual problems. A pilot project in Bukhara city called the Internet School for Children with Special Education Needs, used online education tools to provide secondary education for children who could not attend regular schools.

It is increasingly recognized that schools alone cannot provide quality basic education for all. According to UNESCO, there were more than 57 million out-of-school children of primary school age worldwide in 2011. At least another 69 million young adolescents were not attending primary or secondary school, due to the multiple and often interconnected disadvantages they face, such as poverty, rural location, gender bias, disability and social discrimination.[142] The Internet could potentially widen their access to education.

More broadly, the Internet offers important ways to empower people who are marginalized due to gender or disability by offering the means of communication and inclusion, and also ICT skillsets whereby they can play a full and productive part in society. Policy makers are urged to involve women and people with special needs and disabilities directly in the consultation and planning processes, and give such policies a more prominent place in national priorities. Furthermore, focus on the distribution of resources and the capacity building that enables inclusive access and participation are imperative. The exclusion of so many from the social mainstream is a major loss to the economy.

Conclusion

The chapter provides a brief insight into how the Central Asia+5 countries are progressing in making the transition from basic connectivity and the Internet economy to a digital economy and society, and how

[141] Asian Development Bank (2012), "ICT in Education in Central and West Asia: A Work in Progress", http://www.adb.org/sites/default/files/publication/29964/ict-education-central-and-west-asia-exec-summary.pdf

[142] M. Yasunaga (2014), "Non-Formal Education as a Means to Meet Learning Needs of Out-Of-School Children and Adolescents", http://allinschool.org/wp-content/uploads/2015/01/OOSC-2014-Non-formal-education-for-OOSC-final.pdf

far they may have to go in certain cases. In theory the Internet is a means of interconnecting everything and everyone to every other thing and person; developments such as cloud computing and the Internet of Things are good examples. In practice, however, not all IP-enabled networks are interconnected. Some for very good security reasons, some because they are designed to serve a closed user group, but many public networks are not interconnected and the applications running over them are not interoperable for purely commercial reasons. It is always the role of governments to consider the balance of public interests between the free play of markets, in which investment is accompanied by risk, and the benefits of interconnection to the public.

Governments themselves have the opportunity to show a leadership role in the way digital services can be delivered, either through targeted initiatives or a holistic manner. This report identifies progress being made in e-government developments in the Central Asia+5 subregion, as well as in finance and education. In conclusion, there are clearly steps governments can take to encourage and accelerate the shift from basic connectivity for Internet access toward a more fully-interconnected and interoperable digital economy. The benefits of a shift from the economies of scale of an Internet economy to the economies of scope of a digital economy promise to be transformative. In the next chapter we provide a set of recommendations as to what some of these policy steps can be.

V. Policy Recommendations

1. Priorities and Enable Wireless Access

The Central Asia+5 countries are rapidly 'leapfrogging' to mobile first connectivity. Mobile access has become nearly ubiquitous, while mobile broadband appears to be following closely behind. This has three important policy ramifications:

(i) Connectivity growth increasingly needs to be defined in terms of mobile connectivity. This shouldn't be to the exclusion of fixed line connectivity, but rollout and connectivity policies and programs do need to recognize that mobile is the agent of change and most people coming online now are doing so via a mobile device;
(ii) Assumptions around 'uneconomic' subscribers need to be challenged—as points of social inclusion and potential economic demand, outlying or marginalized individuals and communities should be proactively targeted for mobile connectivity; and
(iii) Internet access and national digital economy plans need to be adjusted to recognize the increasing mobile centricity of the population. In turn, applications and processes need to be designed and made natively for mobile platforms.

2. Identify and Stimulate Nascent Demand

To justify the investment required to proactively promote—and in some cases rollout—mobile connectivity, measures to stimulate demand, much of which is latent, also need to be in place. Policy makers and industry need to work together on the two major determinants of demand: accessibility and affordability. In practical terms, for most citizens this means gaining access through wireless networks, and the most direct way to stimulate demand is to encourage the extension of wireless networks to unserved and under-served areas. Governments themselves have the opportunity to show leadership in the way digital services can be delivered, particularly through e-government, social protection, and inclusion (e.g., financial inclusion) programs.

3. Provide Principles for Network Interconnection and Systems Interoperability

Network interconnection is not only the cornerstone of the Internet but, along with interoperability, provides the necessary springboard into a digital economy. Interconnection is key to driving network effects, which give rise to economies of scale. Seamless and cost-effective interaction of different players over a network through interoperability of platforms and services gives rise to new services and innovation. All are vital components in transitioning an economy toward becoming digital.

Any barriers to interconnection, as have been detailed at various times in the report, act as barriers by raising the cost of operations. Governments and international development partners can consider the following key principles to promote interconnection in these markets:

(i) The terms must be based on transparent public domain procedures;
(ii) Where there are dominant or limited numbers of service providers, rates should be based on long run incremental costs;

(iii) Rates and practices should be monitored and enforced by an unbiased and independent regulator; and
(iv) In public sector services and applications, interoperability, especially across mobile networks, should be built into all future planning requirements, with the ultimate focus on enhancing end-user services.

4. Build Regional Terrestrial Backbone Infrastructure

The 10 countries under review trail much of the rest of the world in terms of broadband access and Internet take up. While most have achieved mobile penetrations on par with, or above, global averages, they still lag in broadband penetration. To support growing broadband use and data traffic, including—and perhaps particularly—over mobile and stimulate the development of online government services and business innovations, substantial fiber-based national backbones and backhaul infrastructure will be essential. Without it, broadband experiences will suffer and deteriorate, retail prices will increase (as usage lags) and the digital divide will increase. To support connectivity growth and usage, and to increase affordability, policy makers need to also promote upgraded backbone connectivity and interregional bandwidth supply.

This should include the building of regional fiber networks to boost bandwidth supply and strengthen network redundancy. The example of EPEG points to the potential and feasibility of transnational terrestrial fiber-optic networks. In this regard, international development partners, for example, can commission a detailed feasibility study to support the Asia-Pacific Information Superhighway (AP-IS) project, which promotes the development of fiber networks, more efficient and effective traffic and network management, e-resilience and digital inclusion in a comprehensive manner. Once the detailed study and master plan are developed, respective countries should do their best to ensure the successful rollout of plans, bearing in mind the multiple stakeholders involved.

5. Promote the Development of Carrier-Neutral IXPs

To ensure affordability of access, ISPs and other service providers who need to lease bandwidth need to be able to do so at competitive prices. But wholesale prices can only be brought down if there is a more plentiful supply of bandwidth available on an equal access basis. In the first instance, competitive and open access across all levels of access should be enabled. One of the most significant constraints to broadband access is a high price, and one of the prime contributors to high prices is the lack of competition at various levels of Internet access.

Where ownership of network infrastructure is monopolized, steps need to be taken to ensure it is available on fair commercial terms base on the principle of open access to maximize consumer welfare. One of the most effective ways to reduce the transit costs is to promote carrier-neutral IXPs. Different models exist for making this happen, such as regulations on the dominant carrier, an independent third party wholesale model, or targeted state-investment. The priority here is to achieve affordable network access. By removing the bandwidth bottleneck, the full economic and social benefits of the Internet economy can be achieved and the path toward a fully developed digital economy embarked upon.

6. Improve the Ease of Doing Business

Encouraging investment and market participation requires transparency and, even more importantly, regulatory clarity. This extends to regulations and policies toward imports of software and hardware (such as handsets) and equipment type approval procedures. To this end, the Central Asia+5 countries should look at developing and accelerating Mutual Recognition Arrangements (MRAs) that simplify and speed up certification of imports. Policy makers should also ensure that the device distribution and retail networks are fully competitive, and carefully review any tie-in arrangements imposed by carriers that might be considered discriminatory and therefore anticompetitive.

7. Promote Capacity Building

As countries transition toward the development of a digital economy, capacity building has become a dual-edged knife. On the one hand, empowerment of marginalized persons and communities has long been an objective of governments and development groups in using communications networks to spread the benefits of the Internet. On the other hand, bureaucrats and policy-makers increasingly have to adapt to the cross-sectoral impacts of the Internet. Financial inclusion, home-based and remote healthcare, distance education, cross border data transfers and data privacy, and sharing economy applications are all increasingly premised on Internet access, but challenge existing regulatory frameworks. Thus, to ensure effective policy making, capacity building needs to go beyond awareness raising of consumers and to include training:

(i) Training of policy makers and regulators. This training itself also needs to be cross-sectoral;
(ii) Development of policy-making and regulatory frameworks that promote multi-stakeholder participation and engagement; and
(iii) Creation of a Government Chief-Information-Officer (GCIO), or equivalent, with the mandate and capacity to coordinate amongst and across different stakeholders to ensure that government has a holistic approach to its digital economy efforts.

8. Develop Statistical Benchmarks

Data is the currency of the digital economy, and policy makers need to recognize that, to be able to plan and develop successfully, there needs to be both a framework and a process for the collection, accounting, and analysis of statistics and data. Moreover, just as the digital economy requires interoperability—the ability for communication applications to 'talk' to each other—so too, policy benchmarks require statistics and data to be comparable across platforms, sectors and countries—a rendering of 'apples to apples'.

In the case of the Central Asia+5, absence of data is a more acute issue. The lack of representation of these countries is especially pronounced across private sector indicators such as, for example, Cisco's Visual Networking Index (VNI) or Akamai's the "State of the Internet," which track and forecast Internet traffic patterns or Internet speed respectively.

While basic access data such as mobile penetration and broadband subscription indicators have become relatively common at this point, the countries of the Central Asia+5 subregion still tend to show missing data across many basic statistical categories. And, often where data is apparent it is

nationally defined and remains incomparable. For effective policy making across the various domain of the emerging digital economy, data needs to be accurate, consistent, and regularly updated to be best analyzed and should support policy and decision making in planning and developing ICT infrastructure or services.

Government should also be looking to proactively promote open data, particularly for public or government data, wherever possible. Benefits from this approach include empowered citizens and businesses, as well as improved efficiency in government decision making and operations.

9. Promote Infrastructure Sharing

Expanding broadband access is still a cost-intensive exercise. In rolling out broadband communication networks civil works such as ducting, excavation and physical infrastructure are the dominant cost items, typically representing 70% to 80% of the total cost. To counter this and to increase cost effectiveness and social welfare, governments should proactively support the sharing of scarce resources such as towers and ducts to maximize network competition; as well as the sharing of certain radio spectrum (or dynamic spectrum assignment) to utilize frequencies in bands of under-used or unused spectrum. Similarly there should be support for infrastructure deployment processes.

In conclusion, there are clearly steps governments can take to encourage and accelerate the shift from basic connectivity for Internet access toward a more fully-interconnected and interoperable digital economy. In so doing, the benefits of a shift from the economies of scale of an Internet economy to the economies of scope of a digital economy promise to be transformative.