IMPROVING REGIONAL DIGITAL CONNECTIVITY IN CENTRAL AND SOUTH ASIA INCLUDING MYANMAR

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EXECUTIVE SUMMARY

September 2023

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Countries in the Central and South Asia regions recognize that digital transformation is crucial for achieving green, resilient, and inclusive development. The COVID-19 pandemic—together with spillovers related to the return of Taliban rule in Afghanistan, Russia's invasion of Ukraine, and other regional geo-political tensions—have exacerbated socioeconomic vulnerabilities and resilience challenges in many of the countries.

Investing in broadband digital connectivity underpins socioeconomic resilience in the Central and South Asian regions. The geopolitical events underscore the need to accelerate digital inclusion in these regions. Investing in connectivity helps advance the goal that nobody should be left behind, particularly rural and poor households, while at the same time establishing the enabling environment for attracting investment and creating jobs for the rapidly growing youth population.

However, bottlenecks to universal broadband connectivity remain in many Central and South Asian countries. This is particularly true in relation to international connectivity (also known as first mile) as per capita international bandwidth is devastatingly low and international bandwidth prices are prohibitively expensive compared to major global markets. The bandwidth gap is particularly pronounced for landlocked countries in the region. International bandwidth is the "fuel" of the digital economy, and low international bandwidth speeds and high international bandwidth prices undermine a country's entire digital ecosystem and hinder overall social and economic development.

This Executive Summary outlines the key findings and recommendations of a World Bank study on options for improving regional digital connectivity in Central Asia and South Asia.[1] The study outlines the dynamics of digital markets and connectivity in the underserved regions of Central and South Asia and identifies feasible near-term and long-term initiatives to help close digital connectivity gaps.

1. The need to improve regional digital connectivity in Central and South Asia

Central and South Asian countries have benefited from significant telecommunications and broadband advancements facilitated by next-generation mobile network deployment. Over the last ten years, international bandwidth growth in these regions has averaged 45 percent annually, to reach approximately 53 terabits per second (Tbps) from only 1.3 Tbps in 2011.[2] To cope with this demand, several billions of dollars were invested in fiber and broadband wireless rollouts to increase bandwidth to the regions' coastlines, across its terrestrial borders, between cities, and in access networks.

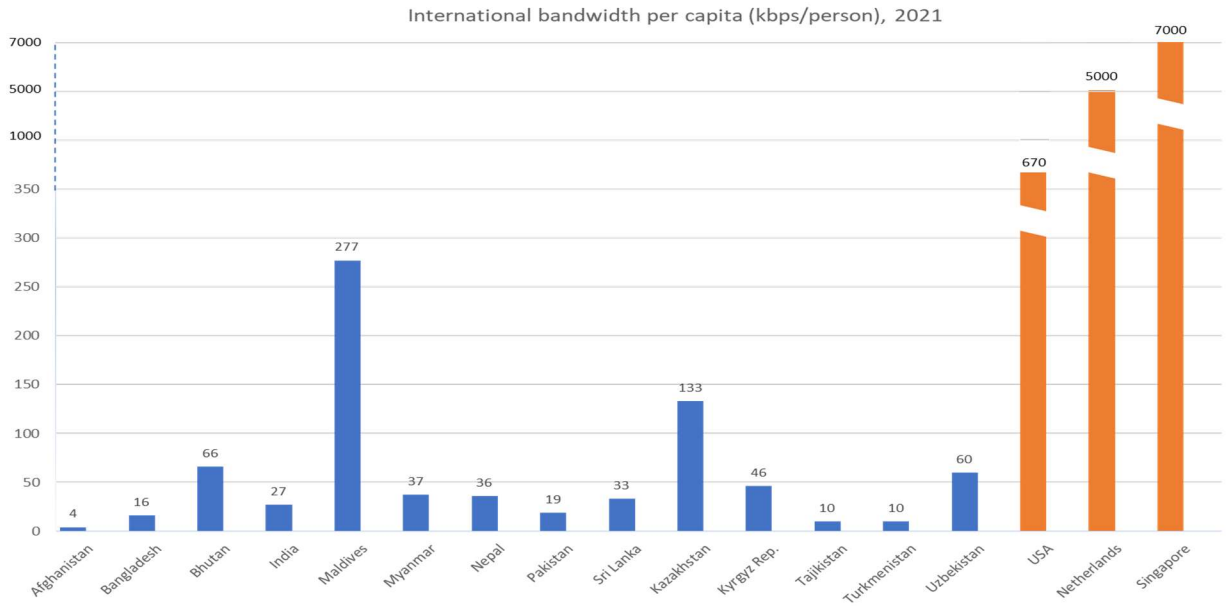
But development of digital economies in Central and South Asian regions remains constrained. They have some of the highest international bandwidth prices and lowest per capita international bandwidth anywhere in the world. Most of the 14 countries reviewed in the study still suffer from limited international fiber infrastructure connecting them to the global internet and low international internet bandwidth. This places Central and South Asia at a significant disadvantage compared to digital markets

[1] This study has received funding from the Program for Asia Connectivity and Trade (PACT) which is a World Bank South Asia regional trust fund supported by the UK's Foreign, Commonwealth and Development Office (FCDO). The study covers Afghanistan, Bangladesh, Bhutan, India, Kazakhstan, Kyrgyz Republic, Maldives, Myanmar, Nepal, Pakistan, Sri Lanka, Tajikistan, Turkmenistan and Uzbekistan.
[2] According to Terabit Consulting research and analysis.

in Europe and East Asia. The low international bandwidth in these regions has manifested most acutely in the form of higher consumer prices, lower internet usage, and delayed broadband technology adoption.

There is significant international bandwidth disparity between countries in the regions. The average international bandwidth per capita throughout the regions reached by year-end 2021 was 27 kilobits per second (Kbps), but the three landlocked countries— Afghanistan, Tajikistan, and Turkmenistan—each have 10 Kbps or less; this connectivity level renders the internet and most applications inoperative for most users. Meanwhile, Kazakhstan (a regional hub for Central Asian transit bandwidth) boasts per capita bandwidth of well over 100 Kbps, and the Maldives (well-served by submarine cable connectivity) has per capita bandwidth of 277 Kbps. However, even the most advanced Central and South Asian markets lag well behind East Asia, Europe, and the Americas (see Figure ES1).

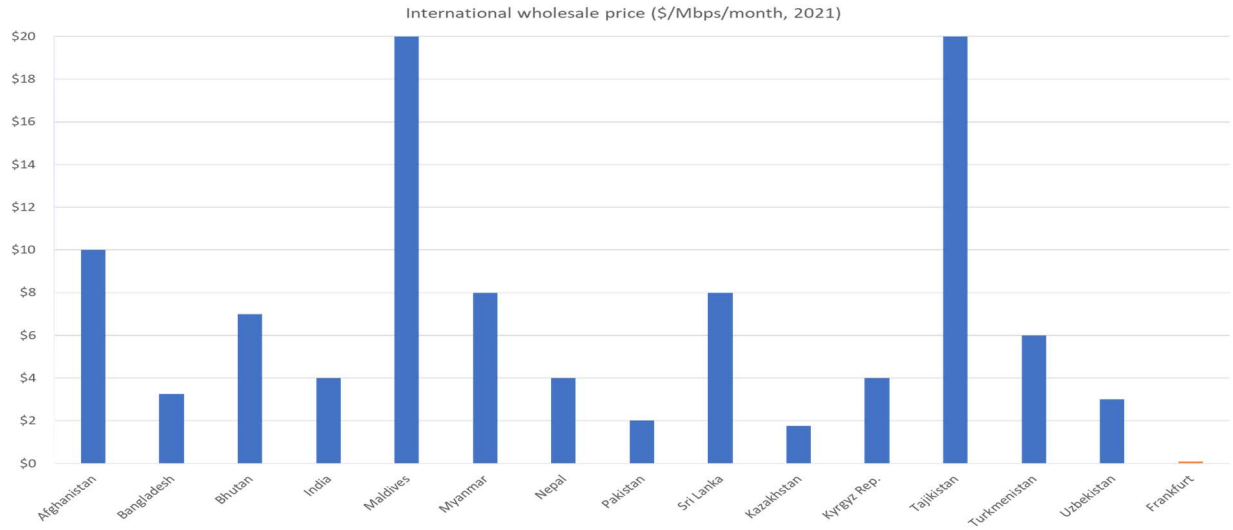
Figure ES1: International bandwidth per capita (Kbps/person, 2021)



Source: Terabit Consulting

International bandwidth pricing to operators (wholesale price) varies greatly across the study region. Prices range from as low as US$1.75 per megabit per second (Mbps) per month in Kazakhstan to as high as US$20 in Tajikistan; by comparison, IP transit in the so-called "FLAP" internet hubs—Frankfurt, London, Amsterdam, and Paris—is priced at as little as US$0.10 per Mbps per month (see Figure ES2). High international bandwidth prices represent a major obstacle to digital markets development because elevated bandwidth wholesale prices are passed along to consumers in the form of higher broadband retail prices and/or reduced network throughput, thereby decreasing affordability and impairing customers' internet usage experience.

Figure ES2: International bandwidth wholesale price (US$/Mbps/month, 2021)



Source: Terabit Consulting

2. Benefits of improving regional digital connectivity in Central and South Asia

Improved regional fiber-optic digital connectivity offers many socio-economic benefits. For customers, abundant and affordable international bandwidth drives lower prices, as well as improved quality and increased reliability of retail broadband internet services. This in turn is a key prerequisite for ICT sector development and accelerated government and business digitalization.

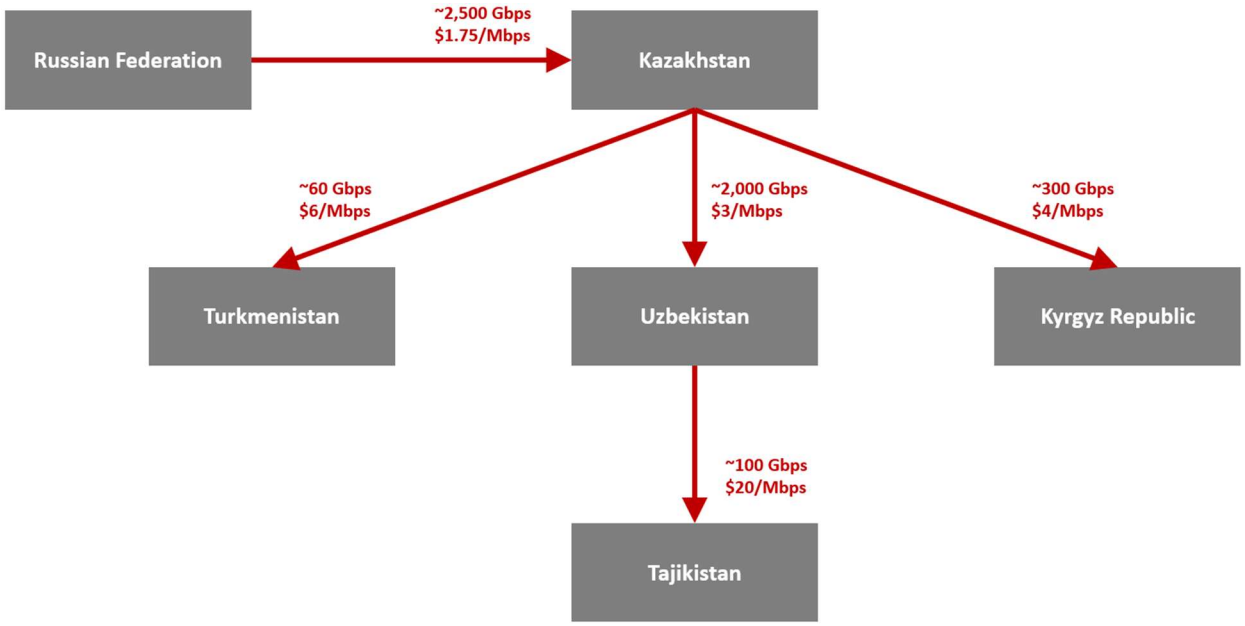
Improved international bandwidth also helps increase government revenues through greater tax intake from general economic, and ICT sector-specific, growth. Improving international bandwidth can drive increased ICT growth and employment in the sector. Various World Bank economic models, developed as part of project preparation in several countries, estimate that Central and South Asian economies could add between 0.8 and 1.2 percent to their Gross Domestic Products (GDPs) by increasing fixed broadband penetration by ten percentage points. Furthermore, broadband growth would contribute to ICT job growth at a rate 0.7 to 1 percent faster than would be the case otherwise, with a multiplier effect of between 2 and 4 in the broader services sector; that is, for every ICT job created, 2 to 4 new jobs would be created in the broader services sector.

Benefits of improving international bandwidth in Central Asia

Diversification of Central Asia's regional digital connectivity will benefit each Central Asian digital market in the form of increased international bandwidth reliability and capacity. Central Asia relies almost exclusively on international bandwidth that transits from Russia to Kazakhstan and then onward

to the region's other markets. Telecommunications operators and Internet Service Providers (ISPs) are particularly sensitive to the resilience of digital connectivity infrastructure; hence, they benefit from more capacity and reliability. Landlocked Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan would all logically be the greatest beneficiaries of improved regional digital connectivity. Finally, telecommunications operators, hyper-scalers,[3] and other "cloud" providers around the globe are desperately seeking to mitigate risks related to the concentration of Europe-to-Asia submarine cables in the Red Sea. These companies are likely to place significant volumes of traffic on any pan-Asian terrestrial fiber network that can provide cost-effective, low-latency, reliable transit.

Figure ES3: Bandwidth flows in Central Asia



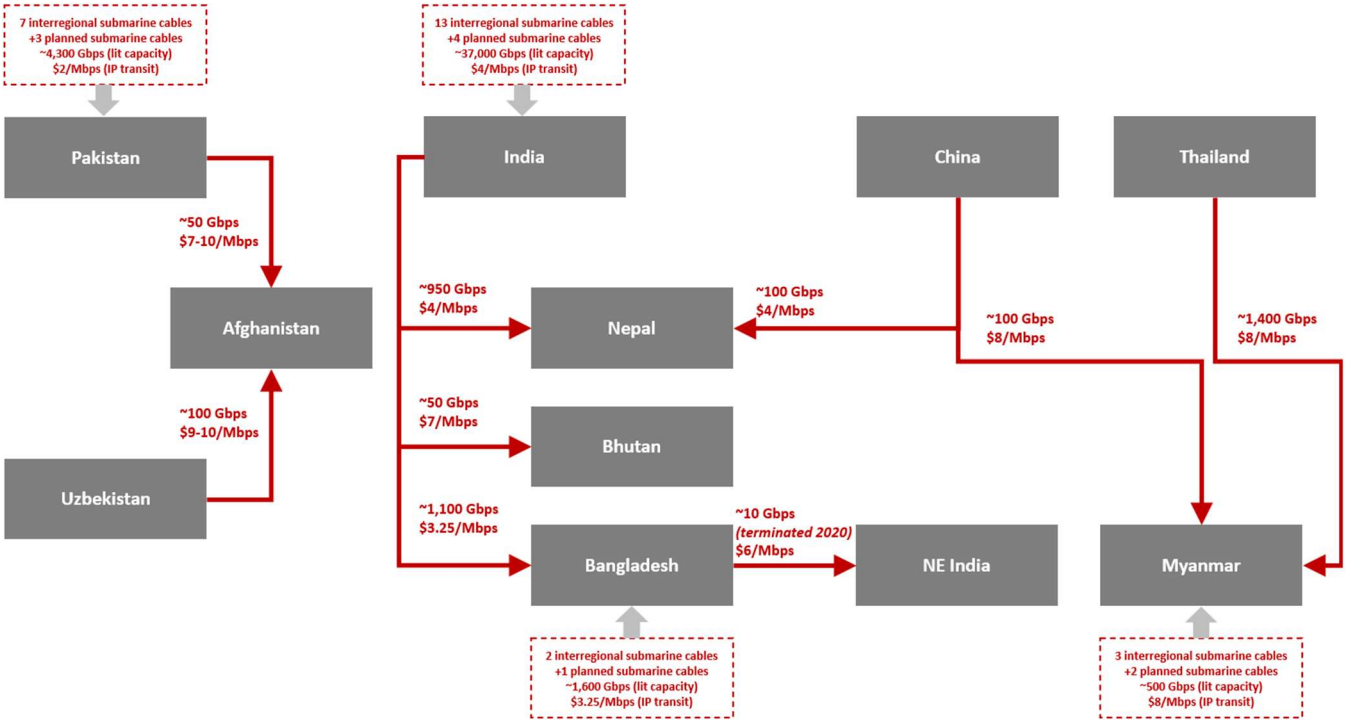
Source: Terabit Consulting

Benefits of improving international bandwidth in South Asia

Most South Asian economies would benefit significantly from improved regional digital connectivity. Across South Asia, coastal and island markets are mostly bandwidth-rich thanks to international bandwidth provided by multiple interregional submarine cables: India is served by thirteen submarine cables, Pakistan by seven, Sri Lanka by four, Myanmar and Maldives by three, and Bangladesh by two. The landlocked South Asian markets of Afghanistan, Bhutan, and Nepal would logically be the greatest beneficiaries of improved regional digital connectivity. Additionally, India and Pakistan have no active bandwidth connection across their land border, which limits diversity and resilience opportunities. The island nations of Maldives and Sri Lanka could benefit from tighter integration with competitive markets in the coastal nations. At the same time, they could position themselves as Indian Ocean hubs for submarine cable interconnection, thus attracting additional submarine connectivity infrastructure to increase diversity, resilience, and ability to export surplus capacity to their neighbors.

[3] Large cloud service providers that provide services such as computing and storage at enterprise scale (for example, Amazon Web Services, Google Cloud, Microsoft Azure, IBM Cloud, Alibaba Cloud).

Figure ES4 Bandwidth flows in South Asia



Source: Terabit Consulting

Taking advantage of increasing demand for international bandwidth between Europe and Asia

The compound annual growth rate (CAGR) of Europe-to-Asian traffic averaged 49 percent over the last decade, the second highest among all major intercontinental routes. Europe-to-Asia demand (aggregate bandwidth) totaled 212 Tbps as of year-end 2021. Fast growth was fueled by increasing deployment of fixed broadband technologies, faster download speeds, more data-intensive usage patterns, and data center-to-data center network traffic generated by hyper-scalers and other cloud providers. The Europe-to-Asia international bandwidth market is today valued at about US$650 million annually. This high value is due not only to the significant volume of traffic along the route but also the premium that Europe-to-Asia bandwidth commands over other intercontinental routes as a result of higher barriers to entry and historically limited competition.

A coherent pan-regional fiber network across the Central and South Asia regions, connecting East Asia to Europe through the Caspian Sea, represents a potentially lucrative market opportunity of well over one-half US billion dollars. Interconnecting that bandwidth to regional data center and cloud infrastructure would take advantage of affordable and renewable energy in the regions. Combined with potential transit demand from Southeast Asia., and diversity demand from South Asia's coastal countries,

regional collaboration between Central and South Asia to deploy coherent terrestrial international fiber infrastructure could capture a significant proportion of traffic.

3. Proposed priority investment initiatives for improved regional digital connectivity in Central and South Asia

We propose six priority investment initiatives. Investment in these areas will diversify regional connectivity paths and provide more uniformly affordable and reliable international bandwidth across the entire Central Asia and South Asia regions. Simultaneously, these investments would position the regions to meet increasing demand for international bandwidth between Europe and Asia. They are politically and economically feasible in the near to medium-term under current conditions.

1. **Trans-Caspian Submarine Cable Connectivity:** Implementation of trans-Caspian submarine fiber optic connectivity between Azerbaijan, Kazakhstan, and Turkmenistan (with onward connectivity to Europe through Georgia, the Black Sea, and Turkey) is critical for Central Asia's long-term digital competitiveness and represents key infrastructure to be positioned on the Europe-to-Asia route. While needed for decades, recent legal changes related to potential economic development of the Caspian Sea now allow for this kind of commercial activity, meaning a fiber-optic submarine cable could become a reality in coming years. While implementation could take multiple forms, the report proposes an open consortium combined with a multi-stakeholder special purpose vehicle (SPV) model to enable all interested stakeholders to participate in the initiative.

2. **Cross-Sectoral Leveraging of Electricity Infrastructure in Central Asia:** The region's electricity transmission lines are already equipped with optical ground wire (OPGW) or all-dielectric self-supporting (ADSS) cables for electricity companies' internal communications and monitoring. In some cases, these are already interconnected across borders, which could be commercialized for telecommunications operators and ISPs to use in a secure, reliable, and efficient way. The report proposes integration and expansion of these currently disperse regional links into a coherent regional network overseen by a multinational inter-governmental entity operated by a consortium.

3. **Cross-Sectoral Leveraging of Pipeline Infrastructure in Central Asia:** As with electricity transmission lines, oil and gas pipelines often include fiber-optic networks for Supervisory Control and Data Acquisition (SCADA) and internal communications. The report proposes a similar approach through a joint-venture model, whereby the pipeline operators commercialize their excess fiber-optic capacity, potentially in partnership with telecommunications operators and ISPs.

4. **Cross-Sectoral Leveraging of Transport Infrastructure in Central Asia:** Integration of fiber-optic into transport infrastructure, such as multinational rail and highway projects, offers transport infrastructure operators the opportunity to diversify their revenue stream while enabling value-added services such as intelligent transportation systems (ITS) on highways and fiber-optic acoustic detection (FOAD) on railways. The report proposes to leverage the ongoing United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) Asia-Pacific Information Superhighway (AP-IS) initiative to establish two interconnected regional Central Asian networks, one built on the existing railway fiber infrastructure and another leveraging the multiple highway networks across the region.

5. **Bangladesh-Bhutan-India-Nepal (BBIN) Cooperation/Integration in South Asia:** As landlocked countries sharing borders only with China and India, Bhutan and Nepal are greatly dependent on India

for international bandwidth. Likewise, India's northeastern region faces vulnerability due to the concentration of connectivity through the narrow Siliguri corridor. A long-term, mutually beneficial solution for the entire region would be to construct an integrated, open-access network linking Bangladesh, Bhutan, India, and Nepal (and Myanmar, if political conditions permit) leveraging the broader BBIN initiative. Since most electricity networks are already interconnected across the region (with the exception of the India-Pakistan border and India to Sri Lanka and Maldives), this report proposes commercialization of surplus fiber-optic infrastructure, starting with the BBIN countries, and potentially expanding further. While this initiative would target primarily two landlocked countries, it has long-term potential to benefit the broader South Asia region by enabling additional route diversity and eventually enabling the region's participation in the broader Europe-Asia transit market.

6. **Increased Submarine Connectivity to Maldives and Sri Lanka in South Asia**: While the Maldives and Sri Lanka already enjoy direct access to submarine fiber-optic cable infrastructure, it is important for these two island nations to maximize their strategic geographic position by continuing to attract next-generation submarine connectivity with the highest international bandwidth capacities and lowest unit costs. The report proposes a regional initiative for these two countries aimed at maximizing access to reliable, affordable, and abundant international bandwidth through facilitation of additional submarine cable projects, particularly power cables with embedded fiber infrastructure.

4. Policy and regulatory strategies to support priority investment initiatives for improved regional digital connectivity in Central and South Asia

A number of policy and regulatory strategies are needed to support implementation of the six priority investment initiatives.

At the Central and South Asia regional levels, it will be critical to:

1. **Raise awareness on the benefits of improved regional connectivity with key international, public sector, and private sector stakeholders.** These include international organizations, national regulatory authorities, incumbent operators, major international gateway providers, competitive telecommunications operators and ISPs. Stakeholders also include owners and overseers of complementary linear infrastructure with fiber-optic assets such as highway, rail, pipelines, and electricity.

2. **Encourage greater regional cooperation to harmonize the regional policy and regulatory environment for international connectivity**. Most immediately, regional cooperation could be fostered through creation of regional working groups to:
    - Ensure open access and non-discriminatory pricing for international connectivity.
    - Eliminate barriers to entry for international connectivity.
    - Reduce bandwidth price differences between coastal and landlocked countries.
    - Synchronize and cooperate on cross-border fiber-optic deployment projects.

At the country level, it will be important for governments to make progress on the following:

3. **Remove obstacles that limit the potential of improved international bandwidth**, in particular:
    - Limitations in international gateway competition and access.

- Limitations in backhaul, domestic, and inter-city connectivity.

4. **Promote growth of domestic and regional network assets,** such as data center and internet exchanges (IXPs) by providing participation incentives to private ISPs and by requiring that government (and possibly educational and research) networks be interconnected through IXPs.

5. **Encourage development of fiber networks along linear infrastructure assets**, such as energy and transport networks, by encouraging:
   - Streamlining of right-of-way procurement processes.
   - Determining market demand and operators' requirements to ensure a "dig-once" policy for new, future-proofed fiber networks.
   - Provisions for duct installation whenever major highway, railway, or electricity or pipeline infrastructure construction takes place.
   - Development of practices and legislation to ensure the protection of fiber infrastructure from external aggression including vandalism.

6. **Work with linear infrastructure owners and operators to promote their taking full advantage of fiber-optic communications networks** for intelligent transportation systems (ITS) and smart grid technologies.

7. **Address demand-side issues related to accelerating broadband adoption**, including programs to lower the cost of end-user devices and capacity building.

5. Proposed action plan to improve regional digital connectivity in Central and South Asia

We propose a series of recommendations to support improved regional digital connectivity in Central and South Asia (see Table ES1). These recommendations, designed for the short-to-medium term (about 1-3 years) and the medium-to-long term (about 3-5 years), are based on bottlenecks identified in this report. The main areas of recommendations include:

- Developing the international wholesale market.
- Leveraging infrastructure synergies with the energy and transport sector.
- Increasing domestic use of broadband.

The recommendations are primarily aimed at policymakers in all countries covered by this report. This includes digital development ministries and central ministries, such as ministries of finance and economic development. Some recommendations are also aimed at energy and transport ministries and their relevant structures. Furthermore, investment recommendations, including creation of SPVs, will require close collaboration with the private sector, which will be ultimately responsible for infrastructure deployment and operation.

Table ES1: Recommended policy and investment measures to facilitate implementation of priority projects.

Theme	Short-/Medium-term measures (1-3 years)	Medium-/Long-term measures (3-5 years)
Promote development of the	• Establish decentralized regional coordination structures to identify priority	• Define and implement regional institutional arrangements to establish multi-

international wholesale market.	projects for investment coordination and technical and regulatory harmonization. • Define potential sub-regional digital hubs and elaborate detailed action plan towards operationalization of collaborative projects in those hubs. • Initiate technical harmonization on sub-regional levels; for example, introduce regulation and model contracts to facilitate provision of connectivity on an Indefeasible Right of Use (IRU) basis. • Initiate regulatory harmonization on sub-regional levels; for example, pass regulations to support establishment of open landing stations and/or virtual landing stations. • Kazakhstan and Turkmenistan to consider acceding to the United Nations Convention on the Law of the Sea (UNCLOS).	stakeholder connectivity consortia/SPVs, including for submarine cables. • Establish platform for regional digital trade, with an initial focus on coordinating joint procurement of digital equipment and international wholesale connectivity services. • Advance technical and regulatory harmonization; for example, pass harmonized licensing, interconnection and infrastructure access regulations on an open access basis. • Support identified priority projects financing, including deployment of submarine cables and/or virtual landing stations, as well as complementary cross-border terrestrial connectivity.
Encourage deployment and commercialization of energy sector fiber infrastructure.	• Assess barriers and propose roadmap to facilitate commercializing fiber capacity on electricity and pipeline networks, including security and safety concerns. • Design a robust multinational entity to oversee deployment of seamless regional and/or sub-regional OPGW-based networks. • Assess options for creating regional or sub-regional networks on the basis of fiber assets owned by pipeline operators.	• Harmonize at the regional level and align energy and telecom sector legal frameworks and regulations to enable commercialization of fiber infrastructure owned by electricity network and pipeline operators. • Establish a regional, and/or sub-regional, inter-governmental entity (or entities) to oversee deployment of proposed regional energy sector-based networks. • Support creation of regional, and/or sub-regional, consortia/SPVs to deploy, expand, and operate proposed regional OPGW and pipeline-based networks, providing needed financing.
Encourage deployment and commercialization of transport sector fiber infrastructure.	• Assess barriers and propose a roadmap to facilitate commercializing fiber capacity on transport networks, including security and safety concerns. • Design a robust multinational entity (or entities) to oversee deployment of a seamless regional, and/or sub-regional, network based on railway operators' fiber networks. • Pass "dig-once" regulations mandating inclusion of ducts for fiber optic networks as part of any new road construction or road upgrades.	• Harmonize and align regional, and/or sub-regional, transport and telecom sector legal frameworks and regulations to enable commercialization of by road and rail operators' fiber infrastructure. • Establish a regional, and/or sub-regional, inter-governmental entity (or entities) to oversee deployment of proposed regional transport sector-based networks. • Support creation of regional, and/or sub-regional, consortia/SPVs to deploy, expand, and operate proposed regional railways-based and highway-based networks, providing needed financing.
Increase domestic use of broadband.	• Undertake a legal/regulatory gap analysis of broadband legislation to facilitate	• Regulate access to infrastructure of dominant networks, to stimulate competition in downstream markets.

	drafting a new regionally-harmonized telecom sector framework law. • Pass regulations to introduce transparency and non-discrimination in the dominant operators' wholesale offer of services. • Modernize licensing, authorization, and permitting regime, as well as access to spectrum. • Initiate knowledge exchange on the use of internet and digital skills programs to expand access to public services, through regional and/or sub-regional forums, workshops, and study visits.	• Award competitive subsidies or other forms of "state aid" and/or design public-private partnerships (PPPs) to attract private investment to cover rural areas with broadband networks. • Privatize remaining state shares in companies with state ownership to attract private investment. • Pass new telecom sector legislation, including creating an independent regulatory authority, where such agency does not currently exist. • Promote regional use-cases, including solutions for regional digital trade, education, health, migration, and others.

6. Long-term perspective for improving regional digital connectivity in Central and South Asia

The longer-term ideal would be to develop an integrated and fully coherent network linking Central and South Asia to the adjacent markets of Southeast Asia, China, Russia, and Europe. This could be achieved if certain geopolitical obstacles are overcome; the primary obstacles include instability and political risk in Afghanistan and Myanmar, as well as the militarized border between India and Pakistan.

Longer-term investment initiatives to create a pan-regional, protected ring-based network from Southeast Asia to Europe include:

1. Extend the OPGW fiber along the CASA-1000 right-of-way south from the Kyrgyz Republic and Tajikistan to Afghanistan and Pakistan.
2. Commercialize surplus fiber capacity along the planned Turkmenistan-Afghanistan-Pakistan-India (TAPI) Pipeline and/or the planned Turkmenistan-Afghanistan-Pakistan (TAP) 500-kilovolt (kV) electricity transmission line.
3. Improve South Asia-Myanmar connectivity through the planned Bangladesh-Myanmar Railway.
4. Activate and reinforce fiber optic links across the India-Pakistan border.