

An In-Depth Study on the Broadband Infrastructure in South and West Asia (Abridged Draft Version 1.0)

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Produced by:



Terabit Consulting
Riverview Center
245 First Street, 18th Floor
Cambridge, Massachusetts 02142 USA
Tel. +1 617 444 8605

www.terabitconsulting.com

Point of Contact: Michael Ruddy, Director of International Research
mruddy@terabitconsulting.com

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Please send questions or comments to:

Michael Ruddy

Director of International Research

Terabit Consulting, Inc.

First Street Center

245 1st St., 18th Floor

Cambridge, Massachusetts 02142 USA

Tel. +1 617 444 8605

Fax: +1 617 444 8405

Email: mruddy@terabitconsulting.com

Web: www.terabitconsulting.com

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Table 1: Overview of Broadband Status by Country

| | GDP per Capita, YE 2012 (PPP, USD) | Int'l. Bandwidth per Capita (Kbps) | Int'l. Connectivity | Domestic Connectivity | IP Transit Price | Competitiveness of Telecom Market | Fixed and Mobile Broadband Infrastructure | Annual 1 Mbps Broadband Subscription + Installation as % of Nominal GDP per Capita |
|---------------------------------|------------------------------------|------------------------------------|---------------------|-----------------------|------------------|-----------------------------------|---|--|
| Bangladesh | \$2,200 | 0.3 | Weak | Moderate | Expensive | Somewhat Competitive | Limited | Very Expensive |
| Bhutan | \$7,000 | 7.6 | Weak | Limited | Expensive | Less Competitive | Limited | Reasonable |
| India | \$4,000 | 1.0 | Excellent | Moderate | Moderate | Competitive | Limited | Reasonable |
| Islamic Republic of Iran | \$14,300 | 1.5 | Excellent | Limited | Expensive | Less Competitive | Limited | Somewhat Expensive |
| Maldives | \$10,200 | 24.0 | Sufficient | Moderate | Expensive | Less Competitive | Limited | Reasonable |
| Nepal | \$1,600 | 0.7 | Weak | Limited | Expensive | Less Competitive | Limited | Very Expensive |
| Pakistan | \$3,800 | 1.7 | Somewhat Weak | Moderate | Expensive | Somewhat Competitive | Limited | Somewhat Expensive |
| Sri Lanka | \$8,100 | 2.2 | Sufficient | Moderate | Expensive | Less Competitive | Limited | Affordable |
| Turkey | \$16,900 | 30.7 | Sufficient | Moderate | Very Reasonable | Less Competitive | Limited | Extremely Affordable |

Table 2: Summary and Analysis of International Internet Bandwidth by Country

| Country | International Internet Bandwidth (YE 2013) | 10-Year CAGR (2003-2013) | Int'l. Internet Band-width per Capita (Kbps) | Evaluation |
|---------------------------------|---|--------------------------|--|------------------|
| Bangladesh | 50 Gbps – As of March, 2014 Bangladesh’s total international bandwidth, including both Internet and voice, was reported to be 58 Gbps, with 25 Gbps provided by Bangladesh Submarine Cable Company Ltd. (BSCCL) via the Sea-Me-We-4 cable and 33 Gbps provided by the six international terrestrial cable (ITC) licensees. | 100% | 0.3 | Very Weak |
| Bhutan | 5.7 Gbps – In 2008 Bhutan Telecom established a DS-3 connection via the London Internet Exchange (LINX), which it supplemented with a DS-3 from Reliance Globalcom via the Hong Kong Internet Exchange (HKIX). However, utilization rates of the country’s international bandwidth were 98 percent, and both links were upgraded to STM-1 in 2010. In June of 2013 Bhutan Telecom’s subsidiary DrukNet increased its international bandwidth from 1.3 Gbps to 3.1 Gbps. As of 2014 DrukNet’s international bandwidth had been increased to 5.3 Gbps, with a peak utilization rate of approximately 50 percent, while Tashi Infocomm had 370 Mbps of international bandwidth and a utilization rate of approximately 60 percent. In addition to its POPs at LINX and HKIX, Bhutan Telecom intended to establish a third international POP in Singapore in 2014. | 98% | 7.6 | Moderate |
| India | 1.2 Tbps – As of year-end 2013, India’s total international Internet bandwidth was 1,209 Gbps. During the first quarter of 2014 bandwidth grew an additional 7 percent, to 1,294 Gbps. BSNL reported peak-hour utilization of 81 percent, Bharti Airtel 67 percent, and Tata 58 percent, and Reliance 53 percent. | 58% | 1.0 | Weak |
| Islamic Republic of Iran | 113 Gbps – Iran’s international bandwidth increased dramatically in 2013; in February of 2013 the Ministry of Communications announced an increase from 63 Gbps to 83 Gbps, and in October of 2013 the Telecommunication Infrastructure Company (TIC) announced a further increase to over 100 Gbps by year-end. | 60% | 1.5 | Weak |
| Maldives | 8 Gbps – Maldives’ international Internet bandwidth doubled in 2013, following the implementation of a 1,253-kilometer domestic submarine cable network the previous year. The country’s per-capita international bandwidth is among the highest for developing economies. | 88% | 24.0 | Strong |
| Nepal | 20 Gbps – As of year-end 2011 international bandwidth was 4.2 Gbps, with an upgrade to 10 Gbps planned for 2012. Sources in Nepal told Terabit Consulting that Nepal’s international bandwidth as of mid-2014 was approximately 25 Gbps. | 92% | 0.7 | Very Weak |

| Country | International Internet Bandwidth (YE 2013) | 10-Year CAGR (2003-2013) | Int'l. Internet Band-width per Capita (Kbps) | Evaluation |
|------------------|--|--------------------------|--|---------------|
| Pakistan | 300 Gbps – Sources in Pakistan told Terabit Consulting that bandwidth as of mid-2014 was between 300 Gbps and 500 Gbps, with approximately 60 percent of this capacity provided by PTCL via its three submarine cables (Sea-Me-We-3, Sea-Me-We-4, and I-Me-We), and the remaining 40 percent provided by the Transworld Associates' TW-1 submarine cable. | 95% | 1.7 | Weak |
| Sri Lanka | 45 Gbps – Sri Lanka Telecom's bandwidth in 2012 was reported to be 23 Gbps. In 2013 the Lanka Education And Research Network (LEARN) said that it purchased 1.5 Gbps of international capacity from SLT; the capacity represented approximately 1/30 th of the country's total international bandwidth. | 86% | 2.2 | Weak |
| Turkey | 2.3 Tbps – Turkey's international bandwidth is robust, and the country's position as a transit hub for other markets in the region is likely to assure the continued growth of its international connectivity. | 100% | 30.7 | Strong |

Table 3: Summary and Analysis of International Connectivity by Country

| Country | International Connectivity | Evaluation |
|-------------------|---|--|
| Bangladesh | <ol style="list-style-type: none"> 1. Bangladesh's primary international link is the Sea-Me-We-4 Europe-to-Asia cable, which was activated in Jhilingja, Cox's Bazar in May of 2006 (the cable was significantly delayed due to the construction of the Chittagong-Cox's Bazar fiber link; the Bangladeshi landing point entered service seven months after the rest of the cable's landing points and a year after Alcatel-Lucent completed installation of the Bangladeshi segment and construction of the cable landing station). The cable was upgraded in 2012, providing its Bangladeshi landing party, the Bangladesh Submarine Cable Company Ltd., with 200 Gbps, of which it reported a utilization rate of only 20 percent. BSCCL's largest customer is BTCL. 2. Six "International Terrestrial Cable" (ITC) operators were licensed in 2012: 1Asia-AHL Joint Venture, BD Link Communication, Fiber@Home, Mango Teleservices, Novocom, and Summit Communications. 3. The interconnection of BTCL's network with that of Indian operator BSNL was completed via a terrestrial cable that entered service in late-2010, connecting Chuadanga to Kolkata via a new 25-kilometer link between Darshana, Bangladesh and Krishna Nagar, India. 4. A cable linking Bangladesh to the Bharti Airtel network in India entered service in July of 2013, linking Benapole, Bangladesh and Petrapole, India. 5. Tata Communications is reportedly in the process of implementing an India-Bangladesh connection in partnership with Bangladeshi ITC operator BD Link, connecting Benapol, Bangladesh to Bangaon (West Bengal), India. 6. The Sea-Me-We-5 Europe-to-Asia cable, expected to enter service in 2016, will land at Kuakata in the southern district of Patuakhali. BSCCL invested BDT 560 crore (USD\$72 million) and will receive 1.4 Tbps of capacity. 7. Myanmar Posts and Telecommunications (MPT) and BSCCL are implementing a terrestrial link between Myanmar and Bangladesh in order to provide Bangladesh with connectivity to Sea-Me-We-3 and Myanmar with connectivity to Sea-Me-We-4. The Bangladesh Submarine Cable Company Ltd. (BSSCL) has reportedly budgeted \$2.75 million for their share of the project, which would include a 50-kilometer link between its Cox's Bazar landing station and the Myanmar border. | <p>Weak – With only one submarine cable and limited terrestrial connectivity to India, the country is extremely vulnerable to outages, particularly those caused by cable disruptions in Egypt.</p> |

| Country | International Connectivity | Evaluation |
|---------|--|--|
| Bhutan | <ol style="list-style-type: none"> 1. Bhutan has two international terrestrial fiber optic cables to India. The first, connecting Phuentsholing in southwestern Bhutan to Jaigaon, India, was activated in 2007 and the second, connecting the southern town of Galephu to Assam, India, entered service in 2011. However, both fiber paths converge at Siliguri, India, where they are then routed to the submarine cable gateway in Mumbai, raising concerns about the vulnerability of the country's international connectivity. 2. The South Asia Subregional Economic Cooperation (SASEC) program is in the process of implementing the SASEC Information Highway network connecting Bangladesh, India, Bhutan, and Nepal; the network will allow for the implementation of submarine cable connectivity via the Cox's Bazar, Bangladesh landing point of Sea-Me-We-4. As part of the SASEC project, in June of 2014 Railtel Corporation of India completed installation of a 10 Gbps link from Thimphu to Phuentsholing and Gelephu. | <p>Weak – Although the SASEC Information Highway will improve connectivity, Bhutan's international connectivity is fragile and dependent upon the vulnerable submarine connectivity of its neighbors.</p> |

| Country | International Connectivity | Evaluation |
|---------|--|---|
| India | <ol style="list-style-type: none"> 1. India is served by eleven interregional submarine cable systems. Three are traditional Europe-to-East Asia systems: FLAG Europe-Asia (FEA) (1997), Sea-Me-We-3 (1999), and Sea-Me-We-4 (2005). Two link India to Africa and then onward to Europe: SAFE (which entered service in 2002 and is interconnected with the SAT-3 cable in South Africa) and Seacom (2009). Two link India to Singapore: i2i (2002) and TGN-TIC (2004). The remaining four connect to the Mediterranean Sea via the Middle East and the Red Sea: Falcon (2006), I-Me-We (2010), Europe-India Gateway (2011), and the Gulf Bridge International /MENA network (2012). 2. Operators' share of international gateway traffic is as follows: Tata Communications 39 percent, Bharti Airtel 30 percent, Reliance Communications 26 percent, and Sify 5 percent. 3. Approximately 71 percent of the country's international traffic passes through the Mumbai gateway, while 25 percent is served by Chennai and 4 percent is served by Kochi. <p><i>Regional submarine cables include:</i></p> <ol style="list-style-type: none"> 4. Bharat-Lanka Cable, a bilateral cable which entered service in 2005 between Tuticorin, India and Mt. Lavinia, Sri Lanka, owned by BSNL and Sri Lanka Telecom. 5. India-Maldives, sometimes characterized as a Falcon segment, which entered service in 2007 between Thiruvananthapuram, India and Male, Maldives. <p><i>Terrestrial cables include:</i></p> <ol style="list-style-type: none"> 6. Reliance Communications and China Telecom China-India, which entered service in 2009 at a capacity of 20 Gbps, connecting Siliguri, India to Yadong, China. 7. China Telecom and Bharti Airtel China-India, a 40-Gbps terrestrial link inaugurated in late-2010 between Yadong, China and Siliguri, India via Nathula. 8. China Telecom and Tata Communications China-India, which was also inaugurated in 2010. 9. India-Myanmar, a 640-kilometer system initiated in December of 2006 and completed in 2010 at a cost of \$7 million, offering a capacity of STM-4 (622 Mbps), connecting Mandalay, Myanmar and Moreh, India via Tamu, Kampatwa, Kyi Gone, Shwebo, Monywa, and Sagaing. The cable is owned BSNL and Myanmar Post and Telecommunications (MPT), with the installation contract awarded to Telecommunications Consultants India Ltd. (TCIL). 10. BTCL and BSNL India-Bangladesh, a 25-kilometer link between Darshana, Bangladesh and Krishna Nagar, India that ultimately connects the cities of Chuadanga and Kolkata. 11. Tata Communications said in 2013 that it would construct a link in partnership with Bangladeshi international terrestrial cable licensee BD Link, between Benapol, Bangladesh and Bangaon (West Bengal), India. 12. Bharti Airtel activated a cable between Benapole, Bangladesh and Petrapole, India in 2013. 13. Two cables connect India to Bhutan, including one which entered service in 2007 between Jaigaon, India and Phuentsholing, Bhutan and another connecting Assam, India to Galephu, Bhutan, entering service in 2011. The links are considered somewhat vulnerable because they both converge at Siliguri, India. 14. Nepal Telecom is linked to the networks of three Indian operators, Reliance, BSNL, and Airtel, via fiber connectivity at the Birgunj-Raxaul and Birtatnagar-Jogbani border crossings; Indian operator Tata links to the network of UTL via links at the Birgunj-Raxaul crossing as well as a link between Bhairahwa and Sunauli. 15. A terrestrial link between India and Pakistan, linking the Indian network of Tata Communications in Amritsar to the Pakistani network of PTCL in Lahore, via Wagah, has been installed but is not yet activated. Sources told Terabit Consulting that as of 2014, Indian and Pakistani security agencies would only agree to allow voice transmission over the cable, but were refusing to allow data communications, rendering it commercially unviable. | <p>Excellent - Not only is India served by 11 major interregional submarine systems and multiple terrestrial links, but the world's two largest undersea fiber optic networks are owned by Indian investors after having been acquired separately by Indian operators Tata Communications and Reliance Communications in 2004. Furthermore, other Indian operators including the country's largest mobile operator, Bharti Airtel, also have significant investments in international telecommunications infrastructure. The Egyptian "choke point" still remains a critical vulnerability, however.</p> |

| Country | International Connectivity | Evaluation |
|--|---|--|
| <p>Islamic Republic of Iran</p> | <ol style="list-style-type: none"> Iran has terrestrial links with all of its neighbors, as well as six submarine cables. Government-owned Telecommunications Infrastructure Company (TIC), a sister company of the Telecommunications Company of Iran, and was created in 2005 to manage the country’s international bandwidth infrastructure. <i>Submarine cables include:</i> The 170-kilometer UAE-Iran bilateral cable, constructed in partnership with Etisalat, entered service in 1992. The Iran-Kuwait submarine system, a 330-kilometer branched network connecting Bandar Ganaveh, Iran to Kuwait City via two islands and an oil platform in the Persian Gulf. It was activated in 2006. Global Cloud Xchange’s Falcon cable. The system, which connects Egypt, the Middle East, and India, did not initially include landing points in Iran, but in 2008 the system was extended to Bandar Abbas, Iran, and in 2010 it was extended to Chabahar, Iran. The Gulf Bridge International (GBI) cable, connecting the Mediterranean, Middle East, and India. GBI signed a memorandum of understanding with TIC in 2010 to land the system in Bushehr, Iran. The spur connecting Bushehr to GBI’s Persian Gulf submarine cable ring entered service in 2012. The Pishgaman Oman-Iran (POI) submarine cable, which entered service in 2012. The system is owned by the Iranian conglomerate Pishgaman Kavir Yazd Group, which was awarded private access provider (PAP), ISP, and VoIP licenses by the Iranian Ministry of ICT. In 2009 Pishgaman reportedly submitted an offer for a 50-percent-plus-one-share stake in the Telecommunications Company of Iran (TCI) during the operator’s privatization. However, media reports said that Pishgaman “suddenly and ambiguously withdrew a few minutes before” the actual auction, which saw the company’s shares go to the Mobin Trust Consortium (Etemad-e-Mobin), reportedly affiliated with the country’s Revolutionary Guards, for approximately \$8 billion. It was subsequently revealed that Pishgaman had been disqualified from the auction on “security grounds,” and Pishgaman’s managing director said in November of 2009 that the company had filed a lawsuit against the Iranian Privatization Organization seeking \$15 million in damages. The Europe-Persia Express Gateway (EPEG) Iran-Oman submarine cable, which forms part of a 10,000-kilometer network from Germany to Oman and entered service in 2013. It is interconnected with the Europe-India Gateway (EIG) submarine cable in Al Madina A’Zarqa (Blue City). <i>Terrestrial connectivity includes:</i> In 2012 the Telecommunications Infrastructure Company (TIC) of Iran indicated that the capacities of its border gateways were as follows: Armenia 1.4 Gbps, Azerbaijan 1.2 Gbps, Turkey 600 Mbps, Turkmenistan 600 Mbps, Iraq 300 Mbps, and Afghanistan 200 Mbps. TIC confirmed that the only one of its neighboring countries to which it did not have a fiber link was Pakistan. Also in 2012, TIC forecasted that by 2017, its terrestrial links to neighboring countries would be increased to a total capacity of 8.9 Tbps, broken down as follows: Azerbaijan 4.3 Tbps, Iraq 1.2 Tbps, Turkey 1.1 Tbps, Armenia 930 Gbps, Turkmenistan 600 Gbps, Afghanistan 430 Gbps, and Pakistan 400 Gbps. In addition to its bilateral terrestrial fiber optic links with neighboring countries, Iran participates in two multinational terrestrial networks: Trans Asia Europe (TAE) and Europe-Persia Express Gateway (EPEG). The 27,000-kilometer Trans Asia-Europe (TAE) network, which entered service between 1998 and 2001, includes trans-border segments at Bajgiran, Iran (between Bonjurd, Iran and Ashgabat, Turkmenistan) in the east and between Aslanik, Iran and Albayrak, Turkey in the west. Its Iranian point of presence is in Tehran. All of the cable and transmission equipment used in the Iranian segments of the cable (as well as those in neighboring Turkmenistan) were manufactured in Iran by Iran Telecommunications Industries, Iran Telephone Planning and Development Company, and Shahid Ghandi Communication Cable Company. The 10,000-kilometer Europe-Persia Express Gateway (EPEG) fiber optic network, connecting Germany to Oman, was conceived in 2011, at least partly as a response to obstacles faced by the consortium-owned Europe-India Gateway submarine cable in activating connectivity across Egypt. EIG investors Omantel and Cable & Wireless Worldwide (now Vodafone) signed a memorandum of understanding with TIC and Rostelecom for the construction of the mostly-terrestrial EPEG network, which also includes the submarine cable between Iran and Oman. TIC was given responsibility for the segments within Iran from the Azerbaijan-Iran border to the Gulf of Oman. Testing of the network took place in 2012 and activation occurred in 2013. | <p>Excellent – Although Iran has not historically participated in major Europe-to-Asia cable projects such as the Sea-Me-We systems, the country has developed robust terrestrial links to its neighbors and has joined multiple regional submarine cable systems, giving it diverse access to global connectivity.</p> |

| Country | International Connectivity | Evaluation |
|-----------------|---|--|
| Maldives | <ol style="list-style-type: none"> 1. Maldives benefits from two diverse submarine cable systems. 2. The Dhiraagu Submarine Cable, constructed by Dhiraagu in partnership with Sri Lanka Telecom, links Hulhumale, Maldives to Colombo, Sri Lanka. It entered service in 2006. 3. The WARF Telecom India-Maldives cable was activated in 2007 by a consortium consisting of Maldivian operator Wataniya (now Ooredoo), Reliance Communications, and Focus Infocomm, a Maldivian ISP which operates under the brandname Raajje Online. The system was extended to Sri Lanka in 2008 in partnership with Lanka Bell. | <p>Sufficient – Although the country is served by only two international links, the systems provide diverse connectivity, and position the country as one of the few small island economies with more than one submarine cable.</p> |
| Nepal | <ol style="list-style-type: none"> 1. Nepal Telecom is linked to the networks of three Indian operators, Reliance, BSNL, and Airtel, via fiber connectivity at the Birgunj-Raxaul and Birtatnagar-Jogbani border crossings; Indian operator Tata links to the network of UTL via links at the Birgunj-Raxaul crossing as well as a link between Bhairahwa and Sunauli. 2. The South Asia Subregional Economic Cooperation (SASEC) program is in the process of implementing the SASEC Information Highway network connecting Bangladesh, India, Bhutan, and Nepal. 3. A link to China via Tatopani has been proposed since 2010 but as of 2014 the status of its development could not be confirmed. | <p>Weak – For its international connectivity, Nepal is almost entirely dependent upon fiber transiting India.</p> |

| Country | International Connectivity | Evaluation |
|----------|---|--|
| Pakistan | <ol style="list-style-type: none"> 1. Incumbent operator Pakistan Telecommunication Company Ltd. (PTCL) is the Pakistani signatory to the Sea-Me-We-3 (1999), Sea-Me-We-4 (2005), and I-Me-We (2010) submarine cables, which land in Karachi and link to Europe and India (as well as East Asia, in the case of the Sea-Me-We cables). As of 2014, sources told Terabit Consulting that PTCL handled approximately 60 percent of the country’s international bandwidth. 2. Private network operator Transworld Associates, which is 51 percent-owned by Orascom Telecom Media and Technology, activated the 1,274-kilometer TW-1 submarine cable to Oman and the United Arab Emirates in 2006. In 2014, TW-1 handled approximately 40 percent of the country’s international bandwidth. 3. In 2002, submarine cable operator FLAG Telecom (now Global Cloud Xchange) established a “virtual point-of-presence” in Karachi via the Sea-Me-We-3 cable. 4. A terrestrial link between Pakistan and Afghanistan’s Nangarhar Province was under development since at least 2009 and significantly delayed due to security issues; however, Afghan Telecom confirmed that the Nangarhar link and a second link at Spin Boldak in Kandahar Province are currently operational. Afghan Telecom had purchased 1 Gbps of IP transit from PTCL and another 1 Gbps from ISP Wateen. 5. In 2011, Pakistan’s Executive Committee of the National Economic Council (ECNEC) indicated its support for a 820-kilometer terrestrial cable connecting Pakistan to China via the Khunjerab Pass; in 2013 a contract for the cable’s construction was awarded to Chinese supplier Huawei, the total cost of the network, including connectivity to Karachi, was reported to be \$36 million. 6. A fiber link between Pakistan and Iran, linking the networks of the Telecommunications Infrastructure Company (TIC) of Iran and PTCL, is reportedly under development but its activation could not be confirmed by Terabit Consulting. 7. India and Pakistan have seriously pursued the implementation of a bilateral cable between the two countries since at least 2006; sources told Terabit Consulting that a terrestrial link between the Indian network of Tata Communications in Amritsar and the Pakistani network of PTCL in Lahore, via Wagah, had been installed at the manhole level, but Pakistani and Indian security agencies were refusing to allow its use for data transmission, only voice; the system is not considered to be viable as a voice-only cable and has thus not been activated. | <p>Somewhat Weak – Although Pakistan is connected to three major intercontinental submarine cable systems and a fourth regional submarine system, its terrestrial connectivity to neighbors is still under development.</p> |

| Country | International Connectivity | Evaluation |
|-----------|---|--|
| Sri Lanka | <ol style="list-style-type: none"> 1. Sri Lanka Telecom (SLT) is an investor in the Sea-Me-We-3 and Sea-Me-We-4 Europe-to-Asia submarine cables, which were inaugurated in Colombo in 1999 and 2005, respectively. 2. SLT and BSNL of India inaugurated the Bharat-Lanka Cable System (BLCS) between Colombo and Tuticorin, India in 2006. 3. The Dhuraagu Submarine Cable Network, funded by the eponymous Maldivian operator in partnership with SLT, linked Sri Lanka and the Maldives in 2006. 4. The India-Maldives submarine cable, which entered service in 2007, was extended to Sri Lanka via a branching unit in 2008. The system is owned by Lanka Bell, as well as Global Cloud Xchange (formerly Reliance Globalcom) and WARF Telecom (a consortium consisting of Maldivian operator Ooredoo, Reliance Communications, and Focus Infocomm). 5. SLT is an investor in the proposed Sea-Me-We-5 cable project, while Dialog Axiata is an investor in the proposed Bay of Bengal Gateway (BBG) system. Both networks are scheduled for completion in 2016. | <p>Sufficient – SLT’s participation in the Sea-Me-We cables, including both existing systems and the proposed Sea-Me-We-5, has given the country efficient access to intercontinental connectivity. This would be supplemented by the proposed BBG cable in which Dialog Axiata is an investor. Intercontinental connectivity is also supplemented by links to India and Maldives.</p> |
| Turkey | <ol style="list-style-type: none"> 1. Turkey’s primary path for international connectivity is the Telecom Italia-owned Med Nautilus system, which links to Italy, Greece, Cyprus, and Israel. The system was initially constructed in 2002 and expanded to Turkey in 2004 as the result of a \$40 million, 15-year capacity purchase commitment from Turk Telekom. Another Med Nautilus segment was constructed from Turkey to Greece in 2011. Turk Telekom operates the cable network’s Istanbul landing station. 2. In 2011 Turk Telekom purchased 250 Gbps of IP backbone capacity from the Greek operator OTE, with delivery of the bandwidth via the terrestrial Trans-Balkan Network (TBN). 3. Turk Telekom is also an investor in the Sea-Me-We-3 submarine cable, which entered service in 1999 and offers a significantly lower capacity than subsequent Europe-to-Asia systems. 4. Regional submarine cable systems include KAFOS in the Black Sea, linking to Bulgaria and Romania, and the Turcyos-1 and Turcyos-2 cables to the Turkish Republic of Northern Cyprus. 5. Turkey has strong terrestrial fiber connectivity to each of its neighbors, with the exception of Armenia. Both Turk Telekom and Turkcell-Superonline have fiber connectivity to Bulgaria, Greece, Syria, Iraq, Azerbaijan, and Georgia. Turk Telekom also has an interconnection with the network of Iran’s Telecommunications Infrastructure Company. 6. Turk Telekom is an investor in the terrestrial pan-regional Jeddah-Amman-Damascus-Istanbul (JADI Link) network, and Turkcell Superonline is an investor in the Regional Cable Network (RCN). However, because both networks pass through Syria, they are reportedly not in operation as of 2014 due to that country’s civil war. | <p>Sufficient – Turkey has sufficient access to European IP bandwidth, but lacks the diversity of submarine bandwidth infrastructure present in many other European markets. Terrestrial connectivity to neighboring countries is strong, but is designed primarily for the sale of transit capacity to foreign markets and not intended for the country’s own long-term bandwidth needs.</p> |

Table 4: Summary and Analysis of Domestic Connectivity by Country

| Country | Domestic Connectivity | Evaluation |
|-------------------|---|--|
| Bangladesh | <ol style="list-style-type: none"> 1. BTCL operates a nationwide transmission network that spanned 5,000 kilometers as of mid-2012, as well as a microwave network connecting 88 points. 2. In 2009 the BTRC awarded two licenses for Nationwide Telecommunication Transmission Network (NTTN), to Summit Communications Ltd. and Fiber@Home. 3. Summit Communications Ltd.'s domestic network spans 15,000 kilometers including its own fiber backbone, a fiber pair leased from Power Grid Company of Bangladesh (PGCB), and leased capacity from other operators. 4. Power Grid Company of Bangladesh operates an optical ground wire (OPGW)-based fiber network. 5. Bangladesh Railway leases capacity on its fiber network, which is more than 2,000 kilometers. 6. Mobile operators, including Grameenphone, Banglalink, Citycell, and Robi Axiata, also have fiber networks of between 600 and 2,000 kilometers in length. | <p>Moderate – although multiple operators provide several thousand kilometers of domestic fiber network connectivity, the transmission capacities of the networks are relatively low.</p> |
| Bhutan | <ol style="list-style-type: none"> 1. A fiber network connecting all 20 district headquarters, as well as 187 gewogs, via optical ground wire (OPGW) and all dielectric self-supporting (ADSS) fiber optic cable via the infrastructure of the Bhutan Power Corporation (BPC). 2. An additional 13 gewogs will be connected as part of the BPC's rural electrification project in 2014. 3. As part of the SASEC international cable project, in June of 2014 Railtel Corporation of India completed installation of a 10 Gbps link from Thimphu to Phuentsholing and Gelephu. | <p>Limited – Although Bhutan has made great strides in providing fiber connectivity throughout the country, the lack of competition in the domestic infrastructure space could hinder development. Furthermore, the network is a trunk-and-branch configuration and does not benefit from the protection of geographic ring topology would provide.</p> |

| Country | Domestic Connectivity | Evaluation |
|---------------------------------|--|--|
| India | <ol style="list-style-type: none"> 1. A special purpose vehicle, Bharat Broadband Network Limited, was established in 2012 to oversee the development of the National Optical Fibre Network (NOFN). Its participants are BSNL, Powergrid, and Railtel. The goal of the \$3.4 billion project is to connect 250,000 Gram Panchayats (villages and small towns) across India, and funding was drawn from the country's National Service Obligation Fund (NSOF). The project was reported to be significantly behind schedule, but in September of 2014 the Indian government mandated a deadline of March, 2016. 2. India's domestic fiber network is more than one million route kilometers. BSNL operates the country's largest fiber network, at 650,000 domestic route kilometers. Reliance Communications' network is 190,000 kilometers, Bharti's is 170,000, Tata Communications' is 42,000, Railtel's is 40,000, PowerGrid's is 25,000, and Gailtel's is 15,000. 3. State-owned BSNL, which operates the country's largest fiber network in terms of coverage, has a 70 percent responsibility for the implementation of the NOFN. In 2014 the company also issued a tender for the installation of an additional 57,000 kilometers of domestic fiber for use by the Indian military. | <p>Moderate – India's domestic fiber connectivity is relatively strong, with over 1 million kilometers operated by seven major network operators, but the country's existing fiber infrastructure is not considered to be capable of supporting the long-term bandwidth requirements due to weaknesses in reliability and low capacity.</p> |
| Islamic Republic of Iran | <ol style="list-style-type: none"> 1. As of 2012, the Telecommunications Infrastructure Company of Iran (TCI) reported that its national backbone network was 47,000 kilometers in length, and its metropolitan fiber deployment totaled an additional 83,473 kilometers, for a total of more than 130,000 kilometers. The operator reported continued investment in its network in 2013 and 2014, so that total deployment is now estimated at between 150,000 and 200,000 kilometers. 2. Domestic Internet bandwidth was reported to be 45 Gbps as of early-2013. | <p>Limited – Although the TCI network is relatively robust, the lack of any well-developed competing networks places the country at a disadvantage to peer markets.</p> |

| Country | Domestic Connectivity | Evaluation |
|----------|---|--|
| Maldives | <ol style="list-style-type: none"> 1. Dhiraagu's 1,253-kilometer domestic submarine cable network, installed by NEC at a cost of \$22 million, entered service in 2012 connecting Kulhudhuffushi, Haa Dhaalu Atoll; Eydhafushi, Baa Atoll; Hulhumale (a manmade islet approximately 1.5 kilometers north of Male and the landing point of the international segment of Dhiraagu's Submarine Cable Network to Sri Lanka); Dhangethi, Alif Dhaal Atoll; Gan, Laamu Atoll; Gaddhoo (Gadhdhoo), Gaafu Dhaalu Atoll; Hithadhoo, Seenu Atoll; and Fuvahmulah. 2. Both Dhiraagu and Ooredoo operate inter-island microwave networks. | <p>Moderate – Although the implementation of a domestic fiber network was a significant achievement for a country with Maldives' geographically-dispersed population, the development of the market is challenged by the lack of domestic fiber network competition as well as the point-to-point architecture of the domestic submarine network.</p> |
| Nepal | <ol style="list-style-type: none"> 1. Construction of Nepal's 12-fiber-pair domestic fiber network along the East-West (Mahendra) Highway was begun in 2002, using equipment supplied by Siemens. The project was overseen by Telecommunications Consultant India Ltd. (TCIL), with funding provided by the governments of both Nepal and India. Its total length between Bhadrapur and Nepalgunj, via Murchaiya, Godar, Pragatinagar, and Kawasoti, is 1,073 kilometers and features 79 nodes. A second phase of the buildout linked Lamahi, Kohalpur, Attaria, Mahendranagar, Birtamod, and Kakarbhitta. An optical ground wire (OPGW) link leased from the Nepal Electric Authority provided connectivity from Hetauda to the Kathmandu Valley; the OPGW network also linked Butwal, Kaligandaki, Pokhara, and Damauli. Connectivity to some areas north of the highway, particularly in the country's northwest, is primarily via microwave links. | <p>Limited – The country's network lacks a redundant mesh topology and its connectivity outside of the Mehendra Highway and the Kathmandu-Pokhara corridor is limited.</p> |
| Pakistan | <ol style="list-style-type: none"> 1. As of 2012, the country's domestic inter-city fiber network was approximately 20,000 kilometers, with backbones deployed and operated by Link Direct, Multinet, Pakistan Telecommunications Company Ltd. (PTCL), and Wateen. As of 2014, sources estimated total deployment to be approximately 25,000 kilometers. 2. In 2013 the country's Universal Service Fund was used to finance the deployment of 6,700 kilometers of new fiber deployment to 102 tehsils. | <p>Moderate – Although fiber networks are operated by four competing entities, the total length of network deployment is comparatively low. Also, the country is one of the largest without a domestic Internet exchange, making it extremely reliant upon international bandwidth.</p> |

| Country | Domestic Connectivity | Evaluation |
|-----------|---|--|
| Sri Lanka | <ol style="list-style-type: none"> 1. The Sri Lanka Telecom (SLT) domestic network was approximately 15,000 kilometers in length as of 2013. Historically, it has been strongest in the country's south-central region, connecting Colombo, Kalutara, Ratnapura, Awissawella, Nawalapitiya, Hatton, Nuwara Eliya, Kandy, Matale, Kegalle, Kurunegala, Chilaw, and Negombo. 2. The National Backbone Network, developed by the government in partnership with SLT, will ultimately comprise five rings (north, south, east, west, and central), with initial deployment focused on the country's south, including the area between Colombo, Puttalam, and Batticaloa, as well as less-developed areas on the country's south that were particularly hard-hit by the 2004 Indian Ocean tsunami. Phases II and III of the initiative aim to improve connectivity in the country's north. | <p>Moderate – The SLT network is being improved as part of the National Backbone Network initiative, but significant improvement is needed in the country's north and there is little viable competition, with SLT leasing its fiber capacity to other operators.</p> |
| Turkey | <ol style="list-style-type: none"> 1. As of year-end 2013, total fiber deployment was 227,000 kilometers. 2. Turk Telekom operates the country's largest fiber network, at 174,000 kilometers. 3. Turkcell Superonline's domestic network was 33,000 kilometers, but its fiber connectivity was increased following its 2014 purchase of Metronet. 4. In late-2013, Vodafone entered into a 15-year, \$62-million agreement to use the fiber network of the state-owned electrical transmission company, TEIAS, thereby increasing Vodafone's domestic fiber network from 6,000 to 16,000 kilometers. | <p>Moderate – Most of the country's fiber infrastructure is controlled by Turk Telekom, but competitors are developing their own fiber network through either new construction or procurement of third-party fiber.</p> |

Table 5: Summary and Analysis of International Capacity Pricing by Country

| Country | International Capacity Pricing (Volume Purchases of 1 Gbps or Greater) | Evaluation |
|---------------------------------|---|------------------|
| Bangladesh | In January 2011, the Bangladesh Telecommunication Regulatory Commission (BTRC) lowered the maximum price of capacity on the Sea-Me-We-4 system in Bangladesh to BDT 12,000 per Mbps, or \$170. The price represented a significant decline from January 2009, when the maximum price of capacity was set at BDT 28,000. As of year-end 2013, the Bangladesh Submarine Cable Company Ltd. (BSCCL) was reported to be selling IP transit bandwidth via Sea-Me-We-4 at a price of 4,800 BDT (USD\$62) per Mbps per month, while international terrestrial cable (ITC) licensees were charging only 2,000 BDT (USD\$26). In 2014 BSCCL reportedly proposed leasing 40 Gbps of international bandwidth to the Indian operator BSNL for use in some northeastern Indian states for 4.5 crore BDT (USD\$580,000, the equivalent of \$14.50 per Mbps per month); subsequent reports indicated that an MOU between the two parties ultimately called for the lease of 10 Gbps at a price of approximately \$10 per Mbps per month. | Expensive |
| Bhutan | There is no transparent market for wholesale IP transit in Bhutan, but managed bandwidth services in the country are uniformly expensive. Bhutan Telecom's Internet leased line price is \$154 per month for 1 Mbps or \$137 per Mbps for increments of 30 Mbps or more, and its IP VPN service is priced at \$438 for 1 Mbps or \$185 per Mbps for larger increments. Tashi Infocomm's leased line prices are approximately 50 percent higher. | Expensive |
| India | A 10 Gbps wavelength from Mumbai to London costs between \$100,000 and \$150,000 per month (\$10 to \$15 per Mbps), and IP transit in Mumbai is approximately the same price. Despite the fact that Indian bandwidth prices compare favorably to those in neighboring South Asian markets, several sources indicated that 10 Gbps wavelengths from London to Singapore, a distance that is approximately one-third longer by submarine cable, can be leased from some network operators at as little as half the price of London-Mumbai wavelengths. In 2014, Indian operator BSNL reportedly procured 10 Gbps of bandwidth from the Bangladesh Submarine Cable Company Ltd. for approximately \$10 per Mbps per month. | Moderate |
| Islamic Republic of Iran | In February of 2013, Iran's Communications Regulatory Authority (CRA) announced a 35 percent reduction in international bandwidth prices. The price of an STM-1 was reduced to \$9,000 per month, or \$58 per Mbps. | Expensive |
| Maldives | Bandwidth pricing in Maldives is extremely expensive; International private line circuits (IPLC) are priced at approximately \$1,400 per Mbps per month. | Expensive |
| Nepal | IP transit in Nepal is priced at between \$40 and \$60 per Mbps per month, depending on volume. Nepali operators spent 2.39 billion NPR (USD\$24.5 million) on international connectivity during fiscal year 2013-2014. | Expensive |

| Country | International Capacity Pricing (Volume Purchases of 1 Gbps or Greater) | Evaluation |
|------------------|--|------------------------|
| Pakistan | IP transit pricing can range as high as \$100 per Mbps per month for low-volume purchases, to as low as \$35,000 per month per STM-16, which is equivalent to \$14 per Mbps per month. | Expensive |
| Sri Lanka | In 2013 the Lanka Education And Research Network (LEARN) said that it had paid \$68 per Mbps for 1.5 Gbps of international capacity from Sri Lanka Telecom. LEARN representatives said that this was “the lowest in the country...because of huge bargaining power” (LEARN’s capacity was reported to represent approximately 1/30 th of the country’s total international bandwidth). | Expensive |
| Turkey | Turkish bandwidth prices are increasingly converging with the low bandwidth prices in the rest of Europe. IP transit in Istanbul costs approximately \$4 per Mbps per month for high-volume purchases, although pan-European network operator Interoute has reportedly offered a promotional rate of €20,000 per month for 10 Gbps of IP transit (USD\$2.60 per Mbps). A 10 Gbps wavelength from Istanbul to major European points-of-presence, including London, Amsterdam, Paris, Frankfurt, or Milan, costs €10,000 per month (USD\$1.30 per Mbps), while a protected 10 Gbps wavelength costs 50 percent more. | Very Reasonable |

Table 6: Summary and Analysis of Competitiveness of Telecommunications Markets by Country

| Country | Competiveness of Telecommunications Market | Evaluation |
|-------------------|--|-----------------------------|
| Bangladesh | <ol style="list-style-type: none"> 1. State-owned Bangladesh Telecommunications Company Ltd. (BTCL) was formed in 2008 when the Bangladesh Telephone and Telegraph Board (BTTB) was split into BTCL and the Bangladesh Submarine Cable Company Ltd. BTCL's recent losses have resulted in calls to partially privatize the company, but no credible plans have been put forth. BTCL dominates the fixed-line sector but government-owned mobile operator TeleTalk has an extremely small market share. There is significant foreign investment from the likes of Norwegian operator Telenor (the majority shareholder of Grameenphone), Malaysian operator Axiata, Singtel, Bharti Airtel, and Egyptian operator Orascom. 2. Fixed-line: BTCL controls most of the country's fixed-line infrastructure, and has a market share of 79%. Its only viable competitor is wireless local loop (WLL) operator RanksTel, with 20%; a third operator, BanglaPhone, has only a few thousand subscribers. Nine out of the country's 11 original private PSTN licensees had gone out of business as of 2014; five of these had their licenses revoked in 2010 following accusations of selling illegal voice-over-IP services. 3. Mobile: Grameenphone is the country's largest operator, with a 42% share; Banglalink has 26% and Robi Axiata has 21%. Smaller operators include AirTel with 7%, TeleTalk with 3%, and CityCell with 1%. 4. Internet/broadband: several dozen ISPs have been awarded operating licenses but the fixed-line broadband infrastructure is limited, with a relatively small number of FTTB and ADSL subscriptions. Approximately 96% of Internet users access the Internet via their mobile phones. LTE and WiMax operators including Banglalion, Ollo, and Qubee have so far catered mostly to corporate customers. | Somewhat competitive |
| Bhutan | <ol style="list-style-type: none"> 1. Bhutan's telecommunications market is effectively a duopoly served by Bhutan Telecom and TashiCell, although there are two additional ISPs: Drukcom and Samden Tech. 2. Fixed-line: government-owned Bhutan Telecom has a monopoly over the country's fixed-line market. 3. Mobile: The country's first competitive operator, Tashi Infocomm, was awarded a mobile license in 2006 and launched its network in 2008. Bhutan Telecom's B-mobile has a 75 percent share of the market while Tashi InfoComm Ltd. (TashiCell), which launched the country's first competitive network in 2008 (two years after having been awarded a license) has a 25 percent share. 4. Internet/broadband: There are four licensed ISPs. Bhutan Telecom's Druknet is the country's leading ISP, however Drukcom offers both ADSL and leased-line service, while Samden Tech offers only leased lines. Tashicell offers leased lines and wireless Internet service. | Less Competitive |

| Country | Competiveness of Telecommunications Market | Evaluation |
|---------|--|-------------|
| India | <ol style="list-style-type: none"> 1. Although India's international gateway market is dominated by only a handful of carriers (namely Tata, Bharti Airtel, and Reliance), domestic markets are very competitive, with 13 mobile operators and at least 10 major ISPs each serving one million or more customers in each sector. The fixed-line market, although dominated by incumbent operator BSNL, is served by seven other competitors. 2. Fixed-line: The fixed-line telephony market is relatively small, at only 29 million subscribers, for a penetration rate of 2.3 percent. Incumbent operator BSNL dominates the market, with a market share of two-thirds. Smaller operators include MTNL and Bharti, each with 12 percent market shares, as well as Tata (5 percent), Reliance (4 percent), Quadrant, Sistema, and Vodafone. Both BSNL and MTNL are owned by the Indian government; historically, MTNL held the concessions for Delhi and Mumbai while BSNL served the rest of the country. 3. Mobile: The mobile market continues to grow, with a 73 percent penetration rate as of 2014. The marketplace is extremely competitive and is served by 13 operators, eight of which have subscriber bases of 30 million or more. Major operators include Bharti, with a 23 percent market share; Vodafone, with 18 percent; Idea, with 15 percent; Reliance, with 12 percent; BSNL, with 10 percent; Aircel, with 8 percent; Tata, with 7 percent, and Telewings, with 4 percent. Sistema, Videocon, MTNL, Loop, and Quadrant each have market shares of 1 percent or less. 4. Internet/broadband: There are six Internet service providers with subscribership of 10 million or more: Bharti, with a market share of 24 percent; Vodafone with 21 percent; BSNL with 16 percent; Reliance with 15 percent; and Idea, with 10 percent. Additionally, Aircel, Telewings, Tata, Loop, and MTNL each reported more than one million subscribers. | Competitive |

| Country | Competiveness of Telecommunications Market | Evaluation |
|---------------------------------|--|-------------------------|
| Islamic Republic of Iran | <ol style="list-style-type: none"> 1. Competition in Iran's telecommunications markets is limited; with a monopoly in the fixed-line sector a near-duopoly in the mobile sector, although a new third operator has quickly seen its market share grow to almost 5 percent. The ISP market, while served by hundreds of licensees, is led by only a handful of broadband operators. 2. Iran's fixed-line market is served exclusively by the Telecommunications Company of Iran (TCI). In 2009 51 percent of TCI shares were sold to Mobin Trust Consortium (Etemad-e-Mobin), reportedly affiliated with the country's Revolutionary Guards, for approximately \$8 billion. 3. The Iranian mobile market is served by four operators, although two operators control 95 percent of the market. Mobile Company of Iran (MCI), the mobile arm of the Telecommunications Company of Iran (TCI), is the market leader with a 49 percent share. MTN Irancell has a 46 percent share; the company is only 49 percent owned by MTN Group, with the remaining shares held by local investor Iran Electronic Development Company due to local ownership requirements. A third operator, Tamin Telecom, offers mobile services under the Rightel brandname and was granted exclusivity in the 3G market until mid-2014; its subscriber base is estimated at approximately four million, while a prepaid operator, Taliya, is estimated to have one million subscribers. 4. There are several hundred Internet service providers. TCI launched ADSL service in 2004. Privately-owned Pars Online claims to be the country's largest private data network operator, handling 10 percent of the country's domestic data traffic. Another ISP, Iranian Net is reportedly in the process of implementing fiber-to-the-home (FTTH) networks in at least seven major cities. | Less Competitive |
| Maldives | <ol style="list-style-type: none"> 1. Maldives is served by only three operators: Dhivehi Raajjeyge Gulhun (Dhiraagu), Focus Infocomm. And Ooredoo. 2. Fixed-line: Although its exclusivity has been terminated, Dhiraagu remains the country's sole fixed-line operator, serving approximately 20,000 subscribers. In 2013, Dhiraagu's majority shareholder, CWC Islands Group, was purchased by Bahraini operator Batelco. 3. Mobile: Dhiraagu has a market share of 60 percent, while Ooredoo (formerly Wataniya) has a 40 percent share. 4. Internet/broadband: Focus Infocomm was licensed as an Internet service provider in 2003, and competes in the broadband sector against Dhiraagu. Ooredoo also offers mobile Internet service. | Less Competitive |

| Country | Competiveness of Telecommunications Market | Evaluation |
|-----------------|---|-----------------------------|
| Nepal | <ol style="list-style-type: none"> 1. The government of Nepal took steps toward the liberalization of the telecommunications market as early as 1995, although the monopoly of government-owned Nepal Telecom (then NTC) continued until 2003. The market is currently dominated by Nepal Telecom and Ncell, which is controlled by Swedish operator TeliaSonera. 2. Fixed-line: Nepal Telecom, which operates both PTSN and WLL networks, has a market share of 91 percent. The remaining 9 percent share of the market is served by United Telecom Ltd. (UTL), which became the country's first competitive operator in 2003; its network exclusively uses CDMA wireless local loop (WLL) technology. 3. Mobile: Spice Nepal Private Ltd. launched the country's first private mobile network in 2005 under the Metro Mobile brandname; in 2008 TeliaSonera acquired a majority stake in the company and in 2010 it was rebranded as Ncell. Ncell has a market share of 55 percent while Nepal Telecom serves the remaining 45 percent. 4. Internet/broadband: As of the beginning of 2014 there were 45 Internet service providers, although market share was concentrated between Nepal Telecom and Ncell. Nepal Telecom was the only provider of fixed-broadband ADSL service (120,000 subscribers) and it split the mobile Internet market with Ncell (each operator served approximately 3.7 million GPRS, EDGE, and WCDMA subscribers). UTL served 100,000 fixed-wireless CDMA subscribers. Smaller ISPs include Broadlink, WorldLink, Subisu Cablenet, Mercantile Communications, and Web Surfer Nepal, although the ISPs other than Nepal Telecom and UTL collectively served fewer than 100,000 subscribers as of the beginning of 2014. | Less Competitive |
| Pakistan | <ol style="list-style-type: none"> 1. Pakistan's incumbent operator, Pakistan Telecommunication Company Ltd. (PTCL), is majority-owned by the Pakistani government; Etisalat is a strategic minority investor. The company has majority shares of both the fixed-line and broadband markets. The mobile sector is significantly more competitive, with the market shared between five relatively strong operators. 2. Fixed-line: PTCL has retained a 95 percent share of PSTN fixed line subscribership, wireless local loop (WLL) operators have captured a significant share of the overall fixed market, reducing PTCL's overall market share in the fixed sector to 65 percent. Major WLL operators include Wateen, Wi-Tribe, and Telecard. The license of another WLL operator, Worldcall, was reportedly suspended in mid-2014 in a dispute over spectrum payment fees, but parent company Omantel indicated that the company would continue business as usual. 3. Mobile: The industry leader in terms of market share is Mobilink, a subsidiary of Orascom, with a 29 percent market share (although Mobilink controlled a majority of the mobile market prior to deregulation in 2004). Telenor was ranked second, with 26 percent. PTCL's Ufone subsidiary has a 19 percent share, China Mobile's Zong has 16 percent, and Warid has 10 percent. 4. Internet/broadband: PTCL's share of the broadband market rose by ten percentage points in 2013, to 71 percent or 1.9 million subscribers, with much of the growth attributed to its wireless EvDO connections. Second-place Wateen had 10 percent of the broadband market, while WorldCall and WiTribe each had 7 percent. WiMax operator Qubee had a 2 percent share. | Somewhat Competitive |

| Country | Competiveness of Telecommunications Market | Evaluation |
|------------------|---|-------------------------|
| Sri Lanka | <ol style="list-style-type: none"> 1. Competition in the Sri Lankan telecommunications market is relatively weak, with only a few major operators. 2. Fixed-line: Incumbent operator Sri Lanka Telecom (SLT) dominates the fixed-line sector but Dialog Axiata, a subsidiary of Malaysian telecom investor Axiata Group, has a market share of approximately one-sixth following its 2012 acquisition of wireless local loop (WLL) operator Suntel. Lanka Bell is also present in the WLL space (and has expanded into the 4G space). 3. Mobile: Dialog Axiata leads the mobile market with a 40 percent market share. Sri Lanka Telecom's Mobitel and Etisalat each have shares of approximately 20 percent, while Bharti's Airtel Lanka subsidiary and Hutchison Lanka each had shares of approximately 10 percent. As of late-2013 Airtel was reportedly in advanced discussions to sell its Sri Lanka operations to Etisalat. 4. Internet/broadband: Fixed broadband penetration is relatively low and is mostly limited to SLT's ADSL service, but greater investment in fiber infrastructure may increase competitors' market shares, particularly that of Dialog Axiata. Increasingly, Internet growth is expected to center around 4G services from | Less Competitive |
| Turkey | <ol style="list-style-type: none"> 1. Turkey is served by multiple fixed-line operators, although the incumbent controls 90 percent of the fixed telephony market and 78 percent of the Internet market. The mobile market is served by three operators. 2. Fixed-line: The market share of Incumbent Turk Telekom is approximately 90 percent. Competitors include TTNNet, Superonline, Turknet, Is Net, Millenicom, and Vodafone Net. 3. Mobile: There are three mobile operators present in the Turkish market; Turkcell's market share is 49 percent, Vodafone's is 29 percent, and the share of Turk Telekom's mobile subsidiary Avea is 22 percent. 4. Internet/broadband: Turk Telekom's TTNNet Subsidiary has a 78 percent share of the Internet market. Superonline has 13 percent, and an additional four ISPs each have market shares of between 1 and 5 percent. | Less Competitive |

Table 7: Summary and Analysis of Fixed and Mobile Broadband Infrastructure by Country

| Country | Fixed Broadband Infrastructure | Mobile Broadband Infrastructure | Evaluation |
|-------------------|---|--|----------------|
| Bangladesh | <p>Some sources indicate as many as one million fixed broadband subscribers in Bangladesh, however Terabit Consulting's analysis was unable to corroborate that figure. As of year-end 2013 there were 316,000 fixed WiMax subscribers, according to the BTRC. The WiMax market was served by Banglalion, Ollo, and Qubee (Augere), until mid-2014 when Grameenphone, Agni Systems, and ADN Telecom also entered the market. WiMax operators reported a decrease in subscribers as users migrated toward 3G providers. In addition to the WiMax market, there were reported to be as many as 350,000 fiber-to-the-building subscribers as well as 15,000 DSL subscribers, although neither figure could be independently confirmed.</p> | <p>There were a total of 34 million mobile Internet subscribers as of year-end 2013, according to the BTRC. 3G subscribership was estimated to be approximately 6 million as of mid-2014. A 3G spectrum auction was held in 2013 which resulted in the awarding of 10 MHz to Grameenphone at a price of \$210 million, while Robi Axiata, Airtel Bangladesh and Banglalink Digital Communications each received 5 MHz at a price of \$105 million. Grameenphone launched 3G service in Dhaka and Chittagong in late-2013 and as of mid-2014 it had covered all 64 district headquarters, giving it a 3G market share of approximately one-third. Five LTE licenses were awarded to BTCL, Bangladesh Internet Exchange Limited (BIEL), Banglalion, Mango, and Qubee in 2013, and the operators are expected to launch the service in late-2014.</p> | Limited |
| Bhutan | <p>As of 2013 Bhutan had 20,481 fixed broadband subscribers served through a combination of ADSL and fiber-to-the-building.</p> | <p>Bhutan Telecom's B-mobile and Tashi InfoComm's TashiCell served a combined 117,659 subscribers as of 2013, representing a sixfold increase over 2012. 3G service was launched in 2009 and as of 2014 B-mobile offered 3G in 15 dzongkhags, while TashiCell offered it in four. Due to a large increase in the number of users, B-mobile representatives conceded in August of 2014 that the operator's 3G network was suffering from congestion problems during peak hours. B-mobile also launched a 4G LTE network in selected neighborhoods of Thumphu in October of 2013.</p> | Limited |

| Country | Fixed Broadband Infrastructure | Mobile Broadband Infrastructure | Evaluation |
|---------------------------------|---|---|----------------|
| India | The Telecommunications Regulatory Authority of India (TRAI) reported approximately 20 million fixed-broadband subscribers as of year-end 2013. The majority of these subscribe to ADSL, but the country's weak fixed-line infrastructure means that most growth in broadband Internet subscribership will be in the fixed-wireless and mobile sectors, although there have been an increased number of fiber-to-the-home deployments. | TRAI reported 220 million total mobile Internet subscribers as of year-end 2013; 40 million of these were classified as broadband, and as of mid-2014 initial figures from carriers indicated that 3G subscribership had grown to almost 50 million. The 3G Internet market in India had struggled due to the perceived high cost of service, but as of 2014 it was considered to have gained momentum. Although 4G service is available in a few cities, most observers do not expect any substantive 4G penetration until 2016. | Limited |
| Islamic Republic of Iran | As of late-2012 there were approximately 2.3 million ADSL subscribers and 600,000 WiMax subscribers in Iran. | The development of the mobile broadband market in Iran is considered by many observers to have been delayed due to the exclusivity over the 3G market that was accorded to Tamin Telecom, which offers mobile services under the Rightel brandname; its total mobile subscriber base was estimated to be approximately four million as of 2014. The company's 3G exclusivity ended in mid-2014, at which point the country's two major mobile operators, MCI and MTN Irancell, announced that they would launch both 3G and 4G service. | Limited |
| Nepal | The fixed broadband market was limited to well under 200,000 subscribers as of the beginning of 2014, including 120,000 ADSL subscribers served by Nepal Telecom. | Nepal Telecom and Ncell each serve 3.7 million GPRS, EDGE, and WCDMA customers. By 2011 both offered 3G data services in major cities. Both operators are hoping to expand their 3G networks to provide nationwide coverage in 2014, and 4G LTE service is expected to be launched in 2015. | Limited |
| Maldives | As of mid-2014 there were 20,000 fixed-broadband subscribers. Approximately 75 percent were DSL subscribers, with the remainder served mostly by cable modems, although there were a few hundred fiber-to-the-home subscribers. | As of mid-2014 there were 145,000 mobile broadband subscribers. Dhiraagu said that its 3G network covered 82 percent of the population, while Ooredoo targeted 95 percent coverage for its HSPA+ service by September of 2014. In mid-2014 both Dhiraagu and Ooredoo announced limited implementation of 4G service. | Limited |

| Country | Fixed Broadband Infrastructure | Mobile Broadband Infrastructure | Evaluation |
|------------------|--|---|----------------|
| Pakistan | DSL subscribership slightly exceeded one million in 2013, as did EvDO connections. WiMax subscribership was approximately 600,000, while cable modem subscribership was only 33,000. | Zong, Ufone, Telenor, and Mobilink were each awarded 3G spectrum during an auction in April of 2014, and 3G service was launched the following month. Additionally, Zong was the sole winner of 4G spectrum at a price of \$210 million (a second 4G license will be auctioned at a later date). Zong announced in September of 2014 that it had launched 4G service in seven major cities. | Limited |
| Sri Lanka | There were approximately 500,000 fixed broadband subscribers in Sri Lanka as of mid-2014, with the vast majority served by Sri Lanka Telecom's ADSL services. Deployment of broadband fiber networks is increasing, on the part of both SLT and Dialog Axiata. | As of mid-2014 there were almost two million mobile broadband subscribers. 3G services were launched relatively early, in 2007, and in 2013, 4G LTE was launched by both Mobitel and Dialog Axiata. WLL operator Lanka Bell has also begun offering 4G service. | Limited |
| Turkey | There were 8.4 million fixed broadband subscriptions in Turkey as of year-end 2013. More than three-fourths, or 6.6 million, were DSL. Fiber-to-the-building grew by 85 percent to 1.2 million; Turkcell Superonline offers 1 Gbps FTTH service in the cities of Istanbul, Izmir, Ankara, Gaziantep, Bursa, Kocaeli, Mersin, Antalya, Adana, Samsun, Trabzon, Kayseri, Konya, and Diyarbakir. Cable modem subscribership has remained steady at approximately 500,000. | There were a total of 24 million handset-based 3G mobile Internet subscribers in Turkey as of year-end 2013, plus an additional 1.5 million 3G mobile computer-based users (e.g. USB dongle subscribers). The development of 4G networks has been somewhat restrained due to the comparatively high speeds of existing 3G connectivity. | Limited |

Table 8: Summary and Analysis of Typical Monthly Broadband Subscription Pricing by Country

| Country | Typical Monthly Broadband Subscription Pricing | Base Package Price per Mbps (USD\$) | Annual 1 Mbps Subscription + Installation as a % of Nominal GDP per Capita | Evaluation |
|---------------------------------|--|-------------------------------------|--|---------------------------|
| Bangladesh | <ol style="list-style-type: none"> USD\$15 per month + USD\$5 installation fee for 1 Mbps ADSL with unlimited download (<i>BTCL BCube Infinity 1000</i>) USD\$19 per month + required 4G modem for 1 Mbps WiMax with 30GB download limit (<i>Qubee</i>) | \$15 | $\$185 / \$830 = 22.3\%$ | Very Expensive |
| Bhutan | <ol style="list-style-type: none"> USD\$6.50 per month + USD\$22 installation for 2 Mbps ADSL with 4 GB monthly download limit (<i>Druknet Home</i>) USD\$41 per month + USD\$22 installation for 2 Mbps ADSL with 27 GB monthly download limit (<i>Druknet Enterprise</i>) | \$3.25 | $\$61 / \$2,600 = 2.3\%$ | Reasonable |
| India | <ol style="list-style-type: none"> USD\$13 per month for 1 Mbps ADSL with 6 GB monthly download limit and 512 Kbps speeds thereafter (<i>BSNL BB Home</i>) USD\$17 per month for 10 Mbps FTTH with 25 GB monthly download limit and 1 Mbps speeds thereafter (<i>MTNL Fibre Thrill 1050</i>) | \$1.70 | $\$20 / \$1,200 = 1.7\%$ | Reasonable |
| Islamic Republic of Iran | <ol style="list-style-type: none"> USD\$7.50 per month + USD\$3.50 installation for 1 Mbps ADSL with 4 GB monthly download limit (<i>Pars Online ADSL2+</i>) USD\$82 per month + USD\$3.50 installation for 1 Mbps ADSL with unlimited download (<i>Pars Online ADSL2+</i>) | \$7.50 | $\$93.50 / \$5,000 = 7.8\%$ | Somewhat Expensive |
| Maldives | <ol style="list-style-type: none"> USD\$13 per month+ USD\$16 installation for 2 Mbps ADSL with 5 GB monthly download limit (<i>Dhiraagu Home Plus</i>) | \$6.50 | $\$94 / \$4,000 = 2.4\%$ | Reasonable |

| Country | Typical Monthly Broadband Subscription Pricing | Base Package Price per Mbps (USD\$) | Annual 1 Mbps Subscription + Installation as a % of Nominal GDP per Capita | Evaluation |
|------------------|---|-------------------------------------|--|-----------------------------|
| Nepal | <ol style="list-style-type: none"> 1. USD\$15 per month + USD\$5 installation for 384 Kbps ADSL with unlimited download (<i>Nepal Telecom ADSL</i>) 2. USD\$6 per month + USD\$5 installation for 512 Kbps ADSL with 6 GB download limit (<i>Nepal Telecom ADSL</i>) | \$12 | $\$149 / \$700 = 21.3\%$ | Very Expensive |
| Pakistan | <ol style="list-style-type: none"> 1. USD\$9 per month + USD\$19.50 installation for 1 Mbps WiFi with 10 GB download limit (<i>Wareen WiFi</i>) 2. USD\$4 per month + USD\$15 installation for 1 Mbps ADSL with 10 GB download limit (<i>PTCL ADSL</i>) | \$4 | $\$63 / \$1,100 = 5.7\%$ | Somewhat Expensive |
| Sri Lanka | <ol style="list-style-type: none"> 1. USD\$4 per month + USD\$4 installation for 2 Mbps ADSL with 1 GB download limit (<i>SLT ADSL</i>) 2. USD\$11.50 per month + USD\$8 installation for 8 Mbps ADSL with 25 GB download limit (<i>SLT ADSL</i>) | \$1.40 | $\$25 / \$2,200 = 1.1\%$ | Affordable |
| Turkey | <ol style="list-style-type: none"> 1. USD\$27 per month + free installation for 25 Mbps FTTH with unlimited download (<i>Turkcell Superonline FTTH</i>) 2. USD\$62 per month + USD\$16 installation fee for 100 Mbps FTTH with unlimited download (<i>TTNet FTTH</i>) | \$1 | $\$12 / \$9,000 = 0.1\%$ | Extremely Affordable |

Table 9: Presence of Fiber Optic Connectivity Across Borders of the Countries Analyzed in This Study

| | Bangladesh | Bhutan | India | Islamic Rep of Iran | Maldives | Nepal | Pakistan | Sri Lanka | Turkey | Other Borders |
|--------------------------|--------------------------------------|-------------------------------------|---|--|---------------------------------|---------------------------------------|---|--|-------------------------------------|--|
| Bangladesh | | | 4,053km border: Multiple fiber links (& SMW4) | | No direct submarine cable links | | Sea-Me-We-4 submarine cable | Sea-Me-We-4 (& planned Sea-Me-We-5) | | Myanmar (193km) – fiber under implementation |
| Bhutan | | | 605 km border: multiple fiber links | | | | | | | China (470km) – no fiber |
| India | 4,053km border: multiple fiber links | 605 km border: multiple fiber links | | Falcon & GBI submarine cables | WARF Telecom submarine cable | 1,690 km border: multiple fiber links | 2,912 km border: unlit cable (SMW/IMW cables) | Sea-Me-We-3, Sea-Me-We-4, BLCS | | China (3,380km) – multiple fiber links Myanmar (1,463km) – fiber present |
| Islamic Republic of Iran | | | | | No direct submarine cable links | | 909 km border: fiber under development | No direct submarine cable links | 499 km border: multiple fiber links | Afghanistan. (936km) - yes Armenia (35km) - yes Azerbaijan (432km) - yes Iraq (1,458km) - yes Turkmen. (992km) - yes |
| Maldives | No direct submarine cable links | | WARF Telecom submarine cable | No direct submarine cable links | | | No direct submarine cable links | Dhiraagu Submarine Cable, WARF Subm. Cable | | N/A |
| Nepal | | | 1,690 km border: multiple fiber links | | | | | | | China (1,236km) – proposed fiber; could not be confirmed |
| Pakistan | Sea-Me-We-4 submarine cable | | 2,912 km border: unlit cable (SMW/IMW cables) | 909 km border: fiber under development | No direct submarine cable links | | | Sea-Me-We-3, Sea-Me-We-4 | | Afghanistan (2,430km) – yes China (523km) – fiber under implementation |
| Sri Lanka | Sea-Me-We-4 (& planned Sea-Me-We-5) | | Sea-Me-We-3, Sea-Me-We-4, BLCS | No direct submarine cable links | Dhiraagu & WARF subm. cables | | Sea-Me-We-3, Sea-Me-We-4 | | | N/A |
| Turkey | | | | 499 km border – multiple fiber links | | | | | | Armenia (268 km): No Azerbaijan (9km): Yes Bulgaria (240km): Yes Georgia (252km): Yes Greece (206km): Yes Iran (499km) : Yes Iraq (352km): Yes Syria (822km): Yes |

A total of six bilateral terrestrial borders exist between the subject countries. Terabit Consulting identified trans-border terrestrial fiber optic connectivity across five borders within the analyzed region, while a fifth border (India-Pakistan) has a fiber link that has so far remained unlit due to security concerns), and a sixth (Islamic Republic of Iran-Pakistan) was reported to have a completed fiber link but the operation of the system could not be confirmed.

An additional eleven country-pairs were candidates for direct submarine cable connectivity, and among these, eight country-pairs had existing submarine cables linking the two countries, while three country-pairs (Bangladesh-Maldives, Islamic Republic of Iran-Maldives, and Islamic Republic of Iran-Sri Lanka) did not have any direct submarine cable links.

1. **Bangladesh-India:** Multiple terrestrial fiber links; submarine cable connectivity via Sea-Me-We-4
2. **Bangladesh-Maldives (submarine route):** No direct submarine cables
3. **Bangladesh-Pakistan (submarine route):** Sea-Me-We-4 submarine cable
4. **Bangladesh-Sri Lanka (submarine route):** Sea-Me-We-4 submarine cable (and planned Sea-Me-We-5)
5. **Bhutan-India:** Multiple fiber links
6. **India-Islamic Republic of Iran (submarine route):** Falcon and Gulf Bridge International submarine cables
7. **India-Maldives (submarine route):** WARF Telecom Submarine Cable
8. **India-Nepal:** Multiple fiber links
9. **India-Pakistan:** Terrestrial fiber link constructed but unlit; submarine connectivity via Sea-Me-We-3, Sea-Me-We-4, and I-Me-We cables
10. **India-Sri Lanka (submarine route):** Sea-Me-We-3, Sea-Me-We-4, and Bharat-Lanka submarine cables
11. **Islamic Republic of Iran-Maldives (submarine route):** No direct submarine cables
12. **Islamic Republic of Iran-Pakistan:** Fiber reported to be under development, but completion and activation of the system could not be confirmed.
13. **Islamic Republic of Iran-Sri Lanka (submarine route):** No direct submarine cables
14. **Islamic Republic of Iran-Turkey:** Multiple fiber links
15. **Maldives-Pakistan (submarine route):** No direct submarine cables
16. **Maldives-Sri Lanka (submarine route):** Dhiraagu Submarine Cable and WARF Telecom Submarine Cable.
17. **Pakistan-Sri Lanka (submarine route):** Sea-Me-We-3 and Sea-Me-We-4 submarine cables

Table 10: Analysis of Cross-Border Connectivity and Identification of Priority Trans-Border Projects

| International Border (and border length) | Analysis | Recommendation |
|---|---|---|
| <p>Bangladesh / India (4,053 kilometers)</p> <p><i>Low Priority</i></p> | <p>The border between Bangladesh and India is served by one existing terrestrial fiber link, as well as an additional terrestrial fiber link currently under implementation. The two countries are also linked by the Sea-Me-We-4 submarine cable and will be linked by the proposed Sea-Me-We-5 submarine cable.</p> | <p>Given that Indian operators BSNL and Bharti Airtel have activated terrestrial fiber connectivity between the two countries (with additional terrestrial link under implementation by Tata), and given existing and planned submarine connectivity between the two countries, there is no strong requirement for additional terrestrial fiber between Bangladesh and India.</p> |
| <p>Bangladesh / Myanmar (193 kilometers)</p> <p><i>High Priority</i></p> | <p>Myanmar Posts and Telecommunications (MPT) and the Bangladesh Submarine Cable Company Ltd. (BSCCL) are in the process of implementing a terrestrial fiber link between the two countries.</p> | <p>Additional fiber links are needed in order to ensure that Bangladesh has redundant bilateral connectivity with more than one country.</p> |
| <p>Bhutan / India (605 kilometers)</p> <p><i>High Priority</i></p> | <p>Although Bhutan has two terrestrial links to India, with the first completed in 2007 and the second in 2011, both fiber paths converge in Siliguri, raising concerns about the vulnerability of Bhutan's international connectivity.</p> | <p>Diversification of Bhutan's fiber links to India is urgently needed in order to ensure the robustness of the country's international connectivity.</p> |
| <p>India / China (3,880 kilometers)</p> <p><i>Medium Priority</i></p> | <p>There are three fiber links between China and India, linking China to the Indian networks of Bharti, Reliance, and Tata.</p> | <p>The ability of the Chinese terrestrial route to provide an outlet for Indian international demand, coupled with the relative fragility of existing fiber links, indicates a need for more robust fiber links between the two countries.</p> |
| <p>India / Nepal (1,690 kilometers)</p> <p><i>Medium Priority</i></p> | <p>Nepal Telecom is linked to the Indian networks of Reliance, BSNL, and Bharti Airtel via multiple border crossings.</p> | <p>Despite multiple fiber links, the importance of India's connections with Nepal requires mesh-like connectivity across the countries' border.</p> |

| International Border (and border length) | Analysis | Recommendation |
|--|--|--|
| India / Myanmar (1,463 kilometers) | A 640-kilometer terrestrial fiber link was completed in 2010 at a cost of \$7 million and is operated by BSNL and Myanmar Post and Telecommunications (MPT). | The India-Myanmar border is a critical corridor for connectivity between India and Southeast Asia, requiring multiple fiber links. |
| India / Pakistan (2,912 kilometers) <i>High Priority</i> | A terrestrial fiber link has been constructed between India and Pakistan, but security agencies on both sides of the border have refused to allow its use for non-voice traffic. The cable remains dormant as of mid-2014. | Deploying more robust connectivity between India and Pakistan could be an important step to ensure regional stability, although there is currently little political momentum to do so. |
| Nepal / China (1,236 kilometers) <i>High Priority</i> | A link between China and Nepal via Tatopani was proposed in 2010 but as of 2014 the status of its development could not be confirmed. | Given Nepal's almost exclusive reliance upon terrestrial connectivity with India, the country is in urgent need of diversified connectivity via China. |
| Islamic Republic of Iran / Pakistan (909 kilometers) <i>Medium Priority</i> | Although Iran has strong fiber connectivity with each of its neighbors, the Iran-Pakistan border has historically lacked fiber and the implementation of a trans-border link could not be confirmed as of mid-2014. | Improved connectivity between Iran and Pakistan would provide both countries with improved interregional access, i.e. from Iran to South Asia and from Pakistan to northwestern destinations. |
| Islamic Republic of Iran / Turkey (499 kilometers) <i>Low Priority</i> | There are multiple fiber links between Iran and Turkey, and Telecommunications Infrastructure Company of Iran has set a target of 1.1 Tbps of bandwidth across the countries' border by 2017. | There is no urgent requirement for improved connectivity between Iran and Turkey. |
| Pakistan / China (523 kilometers) <i>High Priority</i> | A fiber link between Pakistan and China is currently under construction in the Khunjerab Pass. | Both Pakistan and China would benefit from improved fiber connectivity, as the single fiber link under implementation is not considered to be a definitive, long-term solution for linking the two countries with robust connectivity. |

| International Border (and border length) | Analysis | Recommendation |
|--|--|---|
| Turkey/ Armenia (268 kilometers) <i>High Priority</i> | Terabit Consulting did not identify any activated fiber capacity between Turkey and Armenia. | Given the gradual improvement of relations between the two countries, as well as increasing opportunities for closer social and economic cooperation, better fiber connectivity between Turkey and Armenia would be a boon to regional stability. |

High Priority Trans-Border Projects

1. **Bangladesh / Myanmar**
2. **Bhutan / India**
3. **India / Myanmar**
4. **India / Pakistan**
5. **Nepal / China**
6. **Pakistan / China**
7. **Turkey / Armenia**

➤ Medium Priority Trans-Border Projects

1. **India / China**
2. **India / Nepal**
3. **Islamic Republic of Iran / Pakistan**