BROADBAND IN SRI LANKA

GLASS HALF FULL OR HALF EMPTY?
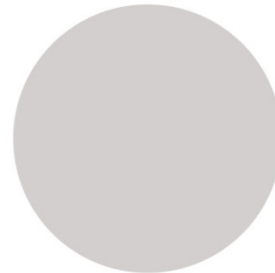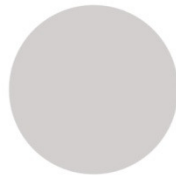
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AN *info*DEV PUBLICATION PREPARED BY:

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Table of Contents

List of Tables and Figures

Figures

Tables

List of Acronyms

3G	Third Generation
ADSL	Asymmetric Digital Subscriber Line
BPO	Business Process Outsourcing
CAGR	Compound Annual Growth Rate
CDMA	Code Division Multiple Access
DCS	Department of Census and Statistics, Sri Lanka
DS	Divisional Secretariat (a unit of government administration)
EBITDA	Earnings Before Interest, Tax, Depreciation and Amortization
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GPRS	General Packet Radio Service
GoSL	Government of Sri Lanka
HSPA	High Speed Packet Access
ICT	Information and Communication Technology
ICTA	Information and Communication Technology Agency of Sri Lanka
IT	Information Technology
ITeS	Information Technology Enabled Services
IX	Internet Exchange
Kbps	Kilo bits per second
LEARN	Lanka Education and Research Network
LKR	Sri Lankan Rupees (Rs.)
Mbps	Mega bits per second
NBN	National Broadband Network
NGN	Next Generation Network
SIM	Subscriber Identity Module
SLT	Sri Lanka Telecom
Tbps	Terra bits per second
TCO	Total Cost of Ownership
TRCSL	Telecom Regulatory Commission of Sri Lanka
USD	United States Dollars (US$)
WCDMA	Wideband Code Division Multiple Access
WiMAX	Worldwide Interoperability for Microwave Access

Acknowledgments

Sri Lanka, an island nation located in the Indian Ocean just south of India, has lately experienced an explosion in the use and availability of broadband services. The increase is primarily due to the high rate of adoption of third generation (3G) mobile technologies such as HSPA and HSPA+ dongles and associated SIM cards. This trend is typical of Sri Lanka and many other South Asian countries which do not have access to wide-spread copper last mile connectivity, and therefore are reliant on wireless networks to increase access, be it simple voice or broadband. Several factors have contributed to Sri Lanka's success in connecting it's citizenry to the internet via mobile broadband:

Innovative Business Models making services accessible to all: The increase in mobile broadband rides on the wave of extremely high mobile voice growth, enabled by successful innovations by the Sri Lankan (and Asian) operators. Faced with low ability to pay of many consumers in the region, the operators could have settled into serving the high-end, rich consumers. However, because the regulators and policy makers enabled new entry into the market, the intense competition forced operators to innovate in such a way as to be able to profitably serve even the poorest consumers. Network costs were reduced drastically by sharing passive and active infrastructure, by outsourcing key parts of the operation including even the management of the core network. Cost of billing was completely dispensed with and credit risk eliminated by moving to a pre-paid model. Distribution costs were minimized by enabling electronic reloading (e-reload), thereby eliminating cost of printing and distributing top-up cards for pre-paid users. Finally, even consumers with very low and very variable incomes were attracted to the market by enabling extremely small top-ups at any time (as low as USD 0.50 or less). This "budget telecom model"[1] based on low costs high volumes (high

minutes of use per user enabled operators to make positive EBITDA margins even though the Average Revenue per SIM was low, around USD 2 – 5.

This budget model of telecom that was first developed for the voice business is now being applied to mobile broadband in Sri Lanka. In particular, enabling pre-paid mobile broadband and allowing for very low value re-charges, the youth (who have highly variable incomes) have been brought into the mobile broadband market. The two first movers into the 3G space (Dialog Axiata and Mobitel) offered special promotional discount packages of up to 50% specifically for students. These early adopters created significant interest in mobile broadband. By 2008, the English and Sinhala blogosphere in Sri Lanka was barely mentioning fixed broadband; all the discussions and debates about quality and price was about mobile broadband.

Early availability of 3G spectrum: Of course all of the above was made possible because 3G spectrum was made available early to the operators in Sri Lanka. Here, the regulator deserves credit. As far back as 2003 test frequency was made available. By 2006, commercial 3G was launched. This is in sharp contrast to India which only managed to allocate 3G spectrum in 2010. Early access to spectrum enabled Sri Lanka to become the first Asian nation to offer 3G services.

Government's e-development agenda motivating investment: Apart from the regulator, the ICT Agency of Sri Lanka (ICTA) has had a major focus on broadband in the country. ICTA is the implementer of *e-Sri Lanka*, a cross-sectoral ICT-enabled development program for the whole country. ICTA set the ICT agenda through a series of comprehensive supply and demand side activities/projects (for example, setting up network of over 500 rural telecenters, announcing plans for a least-cost subsidy scheme to build and operate a fiber backbone in rural areas, development of e-

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[1] Samarajiva, R.(2010). Leveraging the Budget Telecom Network Business Model to Bring Broadband to People: how voice connectivity was achieved. Information Technologies and International Development, 6, Special Issue: 93-97. Also, The Economist (2009)."The mother of invention: Network Operators in the world are cutting costs and increasing access

in innovative ways". Sep 24 2009. Print Edition. Available at http://www.economist.com/node/14483880.

government applications, providing ICT skills to citizens from all walks of life, promoting investment in Business Process Outsourcing which in turn drives the demand for high speed connectivity) and helped create a significant buzz about the potential demand for BB in the country. All this helped increase awareness about opportunities afforded by ICTs. Operators were motivated to invest in the network infrastructure in light of upcoming demand.

However, having reached this stage, Sri Lanka needs to overcome several challenges if it is continue on its early success and make broadband a truly mass-market product instead of the niche popularity it still enjoys.

A key challenge is that of bringing a product of adequate quality to consumers. Budget broadband/budget telecom models mean low cost and therefore low prices. But they also mean low quality. This is indeed the case with Sri Lankan broadband. While the Sri Lankan mobile broadband performs better than Sri Lankan fixed broadband various quality of service measures, when compared with the developed world Sri Lankan consumers get less value for money on broadband. Part of the reason is bad advertising (promising broadband speeds that are possible theoretically, but not in reality). But a bigger part is the infrastructure – in particular, bottlenecks in international connectivity due to high prices.

The other challenge for operators is to keep up their investments necessary to move to the next technology cycle in face of declining margins. While at least two mobile operators have announced LTE network deployments, extending these upgrades beyond the population centers will prove challenging because of revenue and margin erosions due to intense competition.

2. Socioeconomic Overview

The Democratic Socialist Republic of Sri Lanka is an island nation of just over 65,000 square kilometers located in the Indian Ocean near the southern tip of India (Figure 1). Sri Lanka is a lower-middle-income economy emerging from years of conflict. With a GDP Per Capita of USD 2,053 [2] in 2009 (or about USD 4,715 [3] PPP adjusted), an adult literacy rate of 91%[4] among the 20.6 [5] million population and a Human Development Index of of 91, Sri Lanka is the most developed country in the South Asian region behind the Maldives. Primary and secondary education indicators are good, with only 4.4% of the population reported as having never attended school and 99.4% of the population aged 5 - 14 years currently attending school.[6]

Sri Lanka is a multi-ethnic society consisting of Sinhalese (82%), Tamils (9.4%), Moors (7.9%) and other groups. [7] Sinhala and Tamil are official languages while English is widely spoken (Sri Lanka is a member of the Commonwealth). After the government introduced English medium instruction into primary and secondary education, it has become an increasingly popular choice for students who could previously study only in Sinhalese and Tamil, with English only taught as a second language. Sri Lanka is also a multi-religious society with 77% of the population identifying themselves as Buddhists, 8% as Hindu, 8% as Islamic and 7% as Catholic and Christian.[8]

Sri Lanka is of late undergoing considerable economic growth. Year-over-year GDP growth for the first half of 2010 was 7.8%. [9] Though agriculture played a significant role in the Sri Lankan economy in the past, today the economy is driven by the services sector (Figure 2)

While the economy is on the upswing, until a few years ago Sri Lanka was in the middle of civil war that saw the country unable to capture the economic growth rates experienced by its emerging market peers. The war that went on for
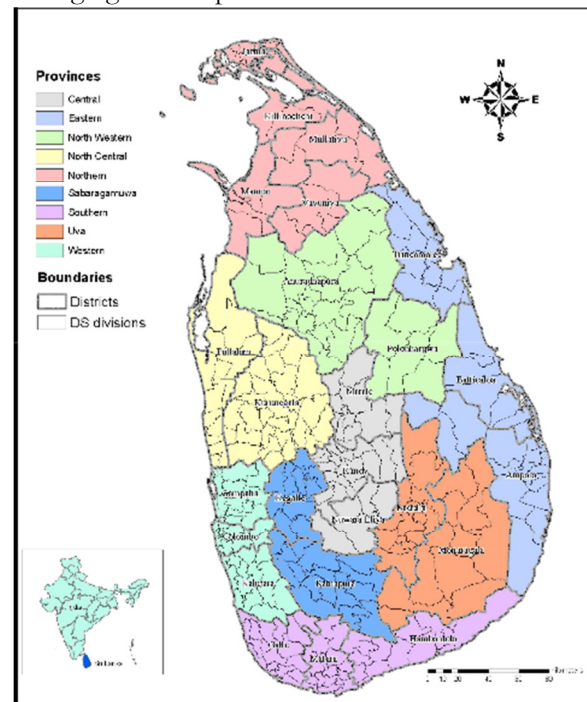
Figure 1: Province, District and Divisional Secretariat division boundaries of Sri Lanka (Source: Cartography Division, Department of Census and Statistics, Sri Lanka)

[2] The Central Bank of Sri Lanka. (2010). *Annual Report 2009*. http://www.cbsl.gov.lk/pics_n_docs/10_pub/_docs/efr/annual_report/ar2009e/ar09_content_2009_e.htm

[3] Using IMF PPP exchange rates available at: http://www.imf.org/external/pubs/ft/weo/2010/02/weodata/index.aspx

[4] Department of Census and Statistics. (2001). *Census of Population and Housing 2001: Literacy rates by district, sex and sector*. Retrieved 25 March 2011 from http://www.statistics.gov.lk/PopHouSat/PDF/Population/p9p10%20Literacy%20rates%20by%20district,%20sex%20and%20sector.pdf

[5] Department of Census and Statistics Sri Lanka. (2010). *Population and Housing*. http://www.statistics.gov.lk/page.asp?page=Population%20and%20Housing

[6] Department of Census and Statistics. (2010). *Household Income and Expenditure Survey 2009/10 Preliminary Results*. http://www.statistics.gov.lk/HIES/HIES2009Buletin.pdf

[7] Department of Census and Statistics. (2010). *Population and Housing*. http://www.statistics.gov.lk/PopHouSat/PDF/Population/p9p8%20Ethnicity.pdf

[8] Department of Census and Statistics (2010). *Statistical Abstract 2010*. http://www.statistics.gov.lk/abstract2010/Pages/index.htm

[9] Central Bank of Sri Lanka recent economic developments highlights of 2010 and prospects for 2011: http://www.cbsl.gov.lk/pics_n_docs/10_pub/_docs/efr/recent_economic_development/Red2010/Red2010e/red_2010e_index.htm

nearly 30 years was often limited to the North and North Eastern provinces of the country though Colombo and other major cities also came under intermittent terrorist attacks. Significant outward migration (to Canada, Australia and Europe) of the minority Tamil community took place during the years of the war. The conflict and the resulting under-investment saw the war-torn region declining in all socio-economic indicators. A ceasefire agreement in 2002 led to a resumption of economic activity in the region, only to be curtailed when fighting resumed in 2005.[10] In 2009, the conflict was ended through a major military operation by the government. Since then, the North-East region has been a focus of development activity and is expected be a major attractor of investment in Sri Lanka. Indications are that the overall country is already benefitting from the end of the war – arrival of tourists and foreign direct investment into the country has increased.
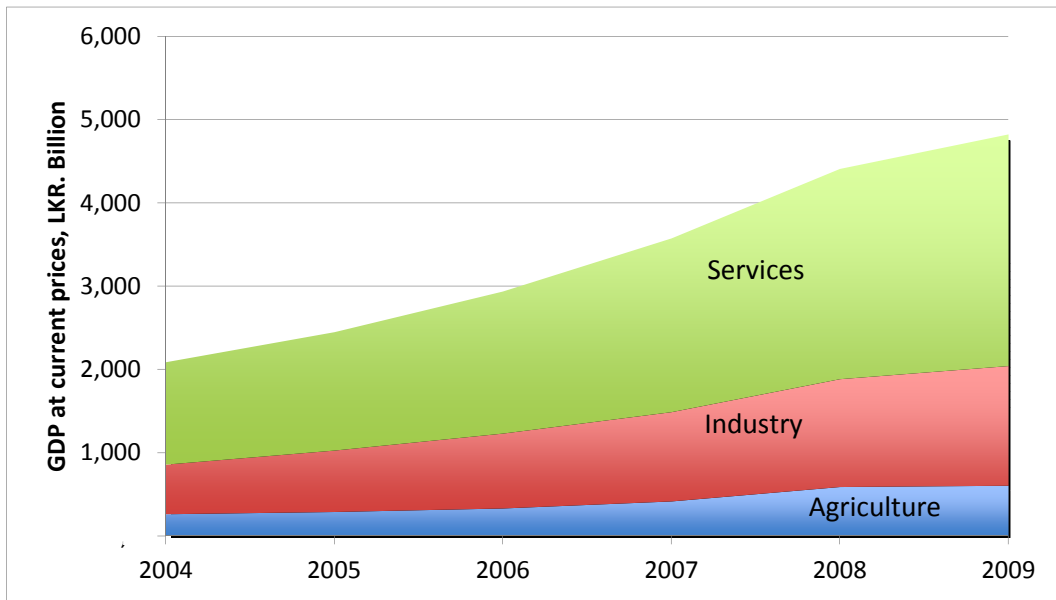
Figure 2: Sri Lanka GDP composition by sector, 2004-2009 (Source: Central Bank of Sri Lanka, 2010. Economic and Social Statistics of Sri Lanka**)**

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3.1 Regulatory and policy institutions and instruments

Up until 1991, fixed telephone services in Sri Lanka were provided by the Department of Telecommunication (DoT) of the Government of Sri Lanka. Corporatization of the incumbent was done under the Telecom Act of 1991, and a new, government owned, corporation called the Sri Lanka Telecom Corporation (SLT Corp) was formed by transferring to it DoT's assets. SLT Corp was partially privatized in 1997, creating Sri Lanka Telecom Limited (SLT), of which 35% was owned by NTT of Japan, 3.5% by SLT employees and 61.5% by the Government of Sri Lanka (GoSL). SLT continued to have the monopoly in fixed line services until 1996 (when WLL licenses were issued) and on international telephony until 2003 (when EGO licenses were issued).

The 1991 Act also created the regulatory agency. In 2003, the ICT Agency of Sri Lanka was created as the apex ICT policy implementing body in Sri Lanka.

3.1.1 ICT policy

ICT policy making in Sri Lanka has traditionally been carried out by a ministry (often the Ministry of Post and Telecommunications). However, In 2002, ICT was brought to the fore-front of the government's development strategy, away from any one ministry when the then government's primary policy document titled *Regaining Sri Lanka[11]* made particular mention of using ICTs to achieve its goal of pro-poor growth (closing the "information divide between poor communities and dynamics markets" was mentioned, as was "improving access to telecommunication facilities and bringing the Internet to the countryside"). *Regaining Sri Lanka* proposed "e-Sri Lanka", an initiative/project to "apply the benefits of modern technology to the workings of government and the private sector". E-Sri Lanka (further detailed in the *e-Sri Lanka Roadmap*) laid down a comprehensive plan for ICT-enabled

development for the country and covered multiple sectors (private, public, education etc.) and geographies (urban and rural). It also saw the creation of the ICT Agency of Sri Lanka (ICTA) as the implementation body for e-Sri Lanka, and therefore the de-factor policy-implementation (and in some specific areas, the policy making) organization (more on ICTA below). Though ICTA was under the Ministry of Economic Reform, Science and Technology at its creation in 2003, the year 2004 saw ICTA being taken under the office of the Prime Minister when a senior ICTA official was appointed Secretary to the Prime Minister. Since that moment ICTA and *e-Sri Lanka* gained prominence in the media and Prime Minister Mahinda Rajapaksa also leveraged it in the run-up to his presidential election campaign[12]. Prime Minister Rajapaksa's election manifesto *Mahinda Chintanaya[13]* had a section devoted to IT, which mentioned all areas that are targeted by the original *e-Sri Lanka* project, and specifically set a target of increasing IT literacy to 60% over 3 years. When he was elected President in 2005, ICTA was kept under his wing, and therefore moved under the office of the President. Moving ICTs away from a single ministry into the office of the Prime Minister and later the office of the President was justified based on the cross cutting nature of the e-Sri Lanka initiative, and the high level leadership demanded by certain e-Sri Lanka activities, specifically the reform of government processes using ICTs.

3.1.2 The regulator

The Telecommunications Regulatory Commission of Sri Lanka is the national regulatory agency. The Commissioners consist of the Director General of the TRCSL, the Secretary to the Minister of the relevant Ministry (policy maker) and three

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[11] World Bank. (2002). *Regaining Sri Lanka: Vision and Strategy for Accelerated Development*.
http://siteresources.worldbank.org/INTPRS1/Resources/Country-Papers-and-JSAs/Sri_Lanka_PRSP.pdf

[12] In fact the President's website mentions "re-energizing the ICT Agency" and "Taking IT and computer literacy to rural areas under the Nenasala [telecenter] project" as key development projects undertaken during his tenure as the Prime Minister. See
http://www.mahindarajapaksa.com/dev/index.php
[13] Available at
http://www.mahindarajapaksa.com/MahindaChinthanaEnglish.pdf (page 68)

members appointed by the Minister from the fields of law, finance and management, respectively. Since 2005, the TRCSL has been under the office of the President, therefore the policy maker (i.e. the "Ministry") is the office of the President of Sri Lanka and the Chairman of TRCSL is the Secretary to the President. In light

Telecommunications (Amendment) act of 1996[15]. It can regulate most aspects impacting on the sector including the allocation of spectrum (including broadcasting spectrum), tariffs, anti-competitive practices and quality of service. The only significant activity that the regulator cannot do is issue new licenses – this power lies with the
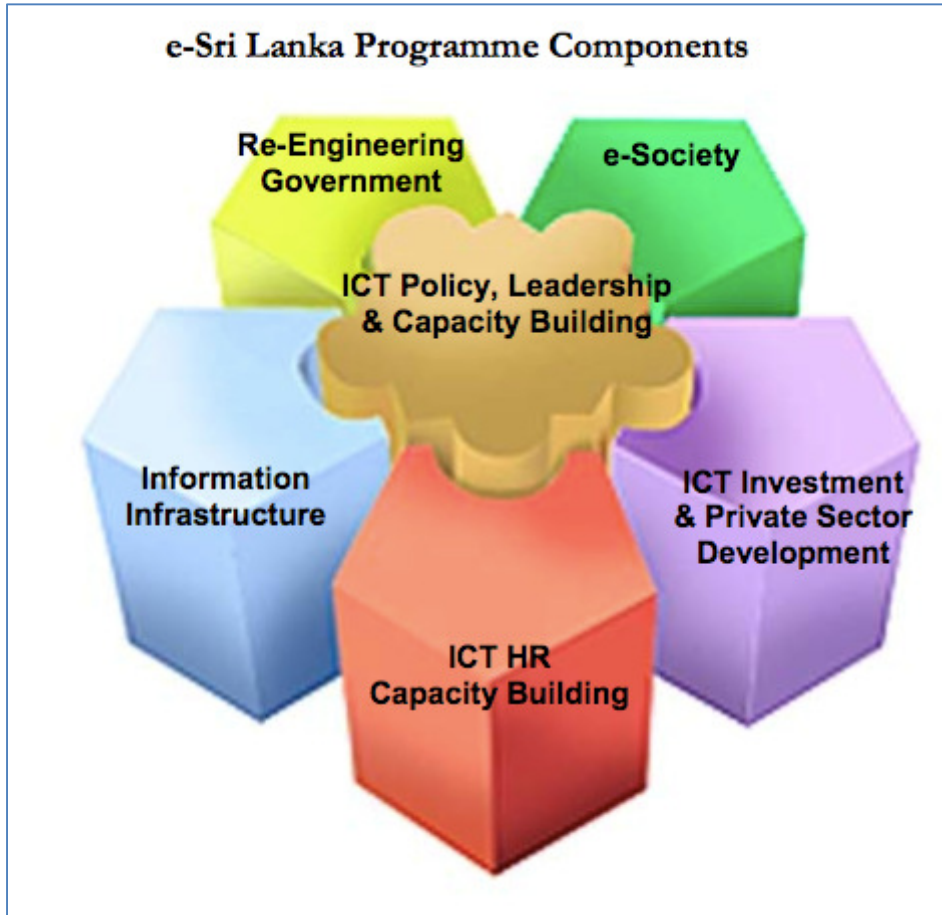
Figure 3: e-Sri Lanka program components (Source: ICTA)

of the (previously discussed) prominence given to ICTs in the national level, and the importance of TRCSL to achieve certain goals specified in e-Sri Lanka, it was perhaps a natural progression for the TRCSL to be taken under the office of the President, though it is unclear if this was the only motivation.

The TRCSL was established in 1991 under the Telecommunications Act of 1991[14], which was later amended by the Sri Lanka

Minister (i.e. the office of the President at present), though on the basis of the regulator's recommendations.

TRCSL is an independent regulator in that it is autonomous from the incumbent operator. However, as in many countries, there are times that the TRCSL is accused of acting in the interest of only the largest operators or it appears that at times the regulator's independence is compromised by the government itself.

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[14] See http://www.customs.gov.lk/docs/25386.pdf for the act.

[15] http://www.trc.gov.lk/about-us/legislation.html for consolidated act (1991 and 1996)

3.1.3 The ICT agency

The ICT Agency of Sri Lanka (ICTA) was created through an act of Parliament in 2003 and mandated to be the "apex ICT-policy making body" in Sri Lanka. Its primary mandate was the implementation of *e-Sri Lanka*, the comprehensive and cross-sectoral development program with ICT at the center. The e-Sri Lanka strategy, and therefore ICTA's activities focuses multiple facets of ICT-enabled development (Figure 3)[16]:

a) the supply of infrastructure for internet/ broadband connectivity (through the provision of backbone networks, the provision of a government-wide broadband network and the installation of a network of telecenters to enable access in primarily rural areas),

b) re-engineering of key government process and the introduction of ICT into these processes to increase efficiency and enable online access,

c) developing human capacity in ICTs by introducing ICT into all levels of education (primary, secondary, tertiary) and all sectors (government, citizens, students),

d) development of a vibrant, export oriented IT and IT enabled Service (ITeS) industry in the county,

e) taking ICTs to rural masses and traditionally disadvantaged groups through innovative applications under the e-Society program and

f) creating the environment for ICT-enabled development through the enactment of relevant laws (e.g. e-Transactions, Computer Crimes Law, intellectual property laws) and the development of technical standards (e.g. local language fonts, internet domain names and inter-operability frameworks).

The funding for ICTA is primarily from the World Bank and the Government of Sri Lanka (GoSL), with some funding also coming from the Korean Export Import Bank and several other countries and organizations. Some claimed results of the e-Sri Lanka Development project include the creation of 629 telecenters, an estimated

33,000 telecenter users, 112 on-line e-government services for the private sector in 2010 from zero in 2004, some 35,000 people trained in ICTs and the creation of Chief Information Officers in almost 600 government agencies.[17]

3.2 Size and importance of the ICT sector

Sri Lanka's growth is increasingly fueled by services (as opposed to manufacturing or agriculture) as seen in Figure 2, and the ICT sector is part of the services sector growth.

While the overall contribution to GDP made by the telecom sector is small at under 1.7 percent in 2009[18] (and was around 3.04 percent in 2007[19]), it is still the largest contributor to GDP *growth*. According to the Ministry of Finance and Planning, the post and telecommunications sector accounted for 11.7 percent of Sri Lanka's GDP growth in 2009 (down from 36% in 2005 and 21.5% in 2007[20]).

The regulator, TRCSL, is the organization that makes the single largest contribution to government revenue as a result of the fees and levies it collects from the sector. Today, contributions from the TRCSL account for 50% of total Government revenues from state owned enterprises (the number was higher in the past,

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[16] http://www.apdip.net/projects/e-government/capblg/casestudies/SriLanka-Rainford.pdf

[17] World Bank (2010). *Implementation Status and Results E-Lanka Development (P081771) (Rep. No. ISR2333).* http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/SAR/2010/12/25/0D9887F3F94C315385257804003D75E0/1_0/Rendered/PDF/P0817710ISR0Di022520101293275514930.pdf.

[18] The Central Bank of Sri Lanka. (2010). *Annual Report 2009.* http://www.cbsl.gov.lk/pics_n_docs/10_pub/_docs/efr/annual_report/ar2009e/ar09_content_2009_e.htm

[19] The Central Bank of Sri Lanka. (2007). *Annual Report 2007.* http://www.cbsl.gov.lk/pics_n_docs/10_pub/_docs/efr/annual_report/Ar2007/content.htm

[20] Ministry of Finance and Planning Sri Lanka. (2009). *Annual Report 2009.* http://www.treasury.gov.lk/FPPFM/fpd/pdfdocs/annualreports/annualreport2009-eng.pdf. Note that GDP growth contribution figures are reported for the post and telecommunication sector combined. However, given that the Department of Post has reported a net loss for each of these years (according to the Ministry of Finance and Planning 2009 Annual report, page 55), it's reasonable to attribute to all positive GDP growth contributions to the telecom sector

with TRCSL contributing more than all state-owned banks combined[21]).

The telecom sector continues to be a primary target for foreign direct investment (FDI) into the country. In 2008, the services sector attracted US$ 362 million worth of investment, with telecommunications leading the way with US$ 290 million[22] or 80%. According to the Board of Investment, telecoms and power usually account for over 60% of FDI into Sri Lanka[23] though this percentage is expected to decrease as a result of increasing investment into the tourism sector after the end of civil war.

Apart from the importance of the telecom sector in terms of revenue generation to the government, the broader ICT sector is also experiencing growth and gaining prominence. The ICT Agency and the industry associations engaged in a strategic initiative to promote Sri Lanka's export-oriented IT enabled Services (ITeS) sector (which includes Business Process Outsourcing (BPO) and IT). Developing human capacity in the IT/BPO industry (through financial assistance to IT professionals to achieve internationally recognized certifications and through the creation of educational standards for call-center operator training) and several years of industry promotion overseas have yielded positive results. Starting from USD 173 million in 2006[24], the export revenues from the IT/BPO industry grew to USD 392 million by 2010, a CAGR of 26%. Of this USD 294 million was from IT exports while USD 98 million were from BPO exports[25]. . According to the ICT Agency, in 2010, the sector was the fifth largest foreign exchange generator for the country[26].

A key enabler to the IT/BPO growth is the telecom sector itself, which makes it possible to engage in off-shoring to begin with.

3.3 Telecom Operators and services

Telecommunications services in Sri Lanka are competitive, with eight operators in the country making retail offerings at the time of writing. Sri Lanka Telecom (SLT) is the partially privatized incumbent (government owns 52%, Global Telecommunications Holdings N.V of Netherlands owns 44.9% and the general public owns the rest), and the only firm with a copper access network to reach homes and businesses. Of the five mobile operators, four (Dialog Axiata, Etisalat, Airtel and Hutch) are private companies that are part of large international or regional telecom operators, and one (Mobitel) is a fully owned subsidiary of the incumbent SLT. Two other operators (Suntel and Lanka Bell) primarily provide CDMA based (fixed-wireless) telecommunications services (Table 1).

The mobile market is highly competitive, with Sri Lanka having among the lowest prices in the world (Figure 4). Following an aggressive price war in anticipation of the arrival of new entrant Bharati Airtel, mobile operators saw margin erosion in late 2009: for example EBITDA margins which were over 50% fell to the 20-30% range with negative net profits[27]. Heavy lobbying by the operators then prompted the regulator to impose termination rates on all calls (eliminating the sender keeps all interconnection regime that existed previously), in effect imposing floor (minimum) prices in the sector.

[21] Author calculations, based on Ministry of Finance and Planning, Annual Report, 2009, table 3.1

[22] Trade Chakra. (n.d.). *FDI in Sri Lanka.* Retrieved 25 March 2011 from http://www.tradechakra.com/economy/sri-lanka/fdi-in-sri-lanka-337.php

[23] Lanka Business Online. (2010). *Investment Swing: Sri Lanka expects leisure to loom larger in FDI.* Retrieved 25 March 2011 from http://www.lbo.lk/fullstory.php?nid=1012423880

[24] Export Development Board. (2008). *Export Value Survey of the Sri Lankan IT/ITES Industry.* Retrieved 25 March 2011 from http://www.slasscom.lk/informationcenter

[25] www.slasscom.lk

[26] SundayTimes. (2011, January 30). Retrieved Arpil 2011, from Sunday Times: sundaytimes.lk/110130/It/it01.html

[27] Largest operator Dialog's EBITDA margin for the second half of 2007 was 50.3%. By Q3 2009 it was 29%. As reported on www.dialog.lk and by Wireless Intelligence/GSMA.

Operator	Markets	Comment
Sri Lanka Telecom (SLT)	Fixed, fixed wireless, fixed broadband, IPTV, mobile (through Mobitel), international connectivity	Incumbent operator. Partially privatized in 1997 through 35% sale to NTT, Japan. Mobitel started in 1993 as JV between SLT and Telstra, Australia. SLT bought out Telstra's share in 2002, for full ownership[28]
Suntel	Fixed wireless	Owned by a combination of foreign (Swedish, Hong Kong SAR) and local companies as well as the IFC
Lanka Bell	Fixed wireless	Formed in 1997. Bought by Milford Holdings Pvt. Limited, Sri Lanka
Dialog Axiata	Mobile, fixed wireless, broadcasting	Subsidiary of Axiata Group Berhad of Malaysia (formerly TM International).
Hutch	Mobile	Owned by Hutchinson Whampoa Limited, Hong Kong
Etisalat	Mobile	Owned by Etisalat, United Arab Emirates. Purchased from Millicom in 2009.
Airtel	Mobile	Owned by Bharti Airtel, India

Table 1: Major telecom operators in Sri Lanka
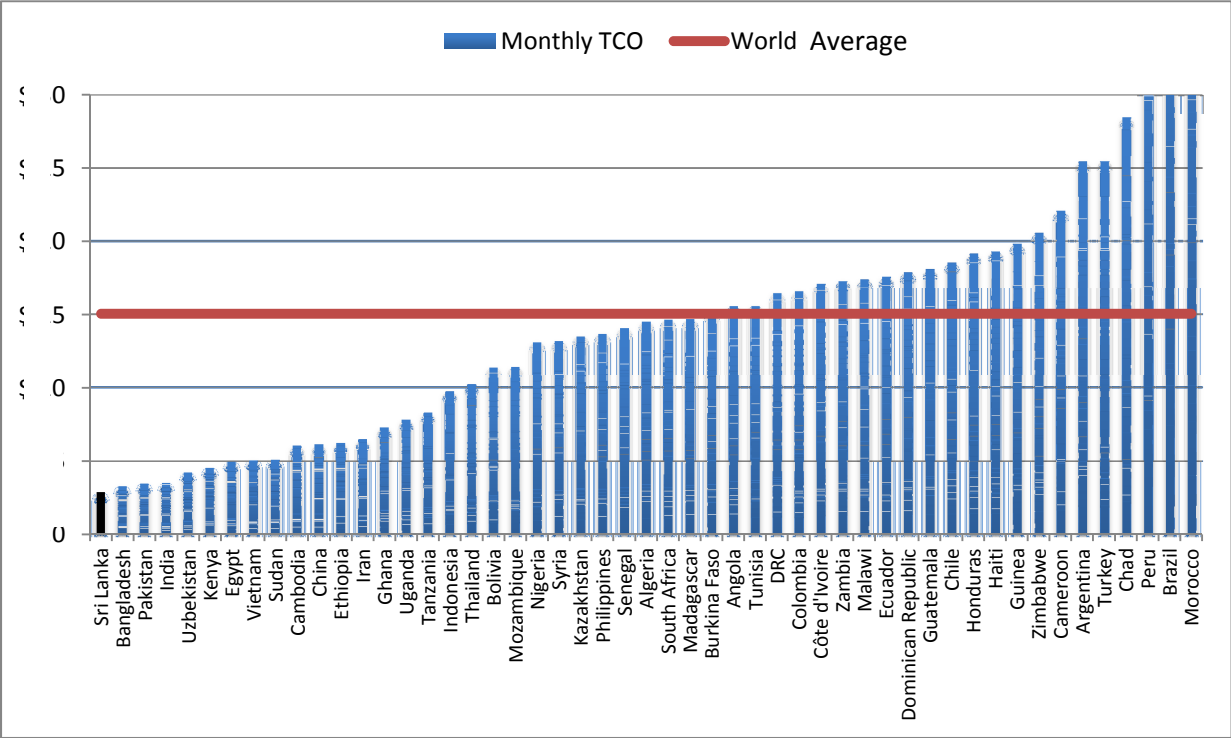
Figure 4: Total Cost of Ownership (in USD) for mobile services including data, 2010 (Source: Nokia, 2010)

Note: Basket covers prorated handset cost and consuming the equivalent of the OECD "low use" mobile basket of minutes and SMSs per month as well as 2 MB data allowance per month.

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[28] Sri Lanka Telecom, *Annual Report 2003*. Retrieved 25 March 2011 from http://www.slt.lk/data/investor/pdf/annu_2003/html_verti on/financial/reportdirectors.htm

4.1 Retail broadband

Sri Lankan retail users (consumers and businesses) have a choice of broadband technologies and service providers to choose from. The retail service offerings can be summarized as described in Table 2.

In addition to the retail offerings shown above, businesses that need dedicated, higher speed Internet connectivity can obtain leased lines from most of the operators shown in Table 2.

All mobile operators have nationwide coverage of basic voice and GPRS services. Dialog and Mobitel also provide 3G/3.5G coverage in the majority of the country including the formerly war torn North East (3G coverage is still not available in low density population areas). Etisalat is in the process of investing to increase its 3/3.5G footprint.[31] Airtel covers the major population centers of Colombo, Galle, and Kandy with 3G.

At the time of writing, both Dialog Axiata and Mobitel were engaged in LTE trials in Colombo. Mobitel had also signed agreements (on tax free concessions) with the board of investment to invest in its LTE network[32].

Type of broadband connectivity	Operators with retail-level services offerings
Fixed wired broadband	1. ADSL through Sri Lanka Telecom (incumbent fixed operator)
Fixed wireless (limited mobility) broadband	1. WiMAX through 3 operators: - Dialog Axiata (largest mobile operator) - Sky Networks (subsidiary of Sri Lanka Telecom) - LankaBell[29] (CDMA-based "fixed" phone operator) 2. Microwave based broadband through Suntel[30] (a CDMA based phone operator)
Mobile broadband	1. WCDMA based broadband from multiple operators: - Dialog Axiata (largest mobile operator) - Mobitel (mobile operator owned by fixed incumbent) - Airtel (new entrant, part of India's Bharati Airtel) - Etisalat (pre-paid only mobile operator), about to enter the 3G broadband market at the time of writing. 2. WiMAX (802.16e) based mobile broadband (with plug-and-play dongles) through Sky Networks (subsidiary of Sri Lanka Telecom). About the enter the market at the time of writing.

Table 2: Broadband market and operators in Sri Lanka, March 2011

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[29] http://www.lankabell.net/fixed-broadband.htm and http://www.lankabell.net/broadband-technology.htm
[30] http://www.suntel.lk/business/broadband.php

[31] Dialog had 673 3G base stations at the end of 2009 and 3/3.5G coverage map is available at http://www.dialog.lk/content/uploads/pdfs/annual_reports/2009_annual_report_en.pdf. Mobitel's 3G coverage map is available at http://www.mobitel.lk/coverage/. Airtel 3G maps for Colombo, Galle, Kandy are available at http://www.airtel.lk/AirtelSL/broadband/3g_coverage.html.
[32] Telecoms.com. (2011). *Sri Lanka hits the LTE with trials, rollouts.* http://www.telecoms.com/27530/sri-lanka-hits-the-lte-road-with-trials-rollouts/

4.2 Wholesale infrastructure

4.2.1 In-country backbone infrastructure

While the retail broadband market is competitive and characterized by competitive and reducing prices, a few players dominate the wholesale

broadband speeds of over 20 Mbps to almost all its fixed line subscribers.

Despite the significant market power over such as key facility as the optic fiber backbone, SLT is not legally required by the regulator to sell access to competitors. As a result, competing operators
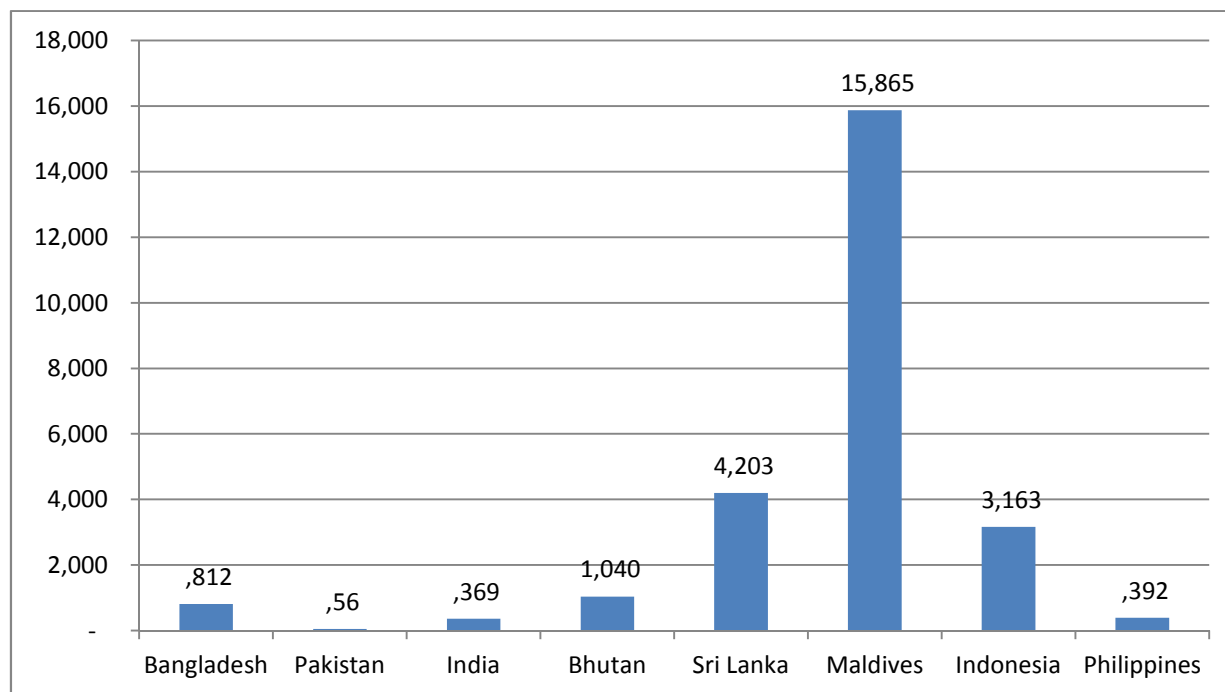
Figure 5: Tail-link cost (in USD) for 2Mbps backhaul in South Asia (Source: LIRNEasia, Broadband Benchmarks Emerging Asia, February 2010.)

market. At the time of writing, only two operators had an optic fiber based national backbone. Incumbent Sri Lanka Telecom (SLT) has the widest fiber coverage with some 8,000 kilometers of fiber connecting large areas of the country and another 4,000 kilometers planned by the end of 2011. SLT is also transitioning to a Next Generation Network (NGN) with around 20% of its customers served by this technology at the end of 2010. [33] NGNs are the subject of a recent consultation issued by the regulator. [34] SLT has also launched its "i-Sri Lanka" project placing fiber closer to the customer to reduce the length of copper loops. This will enable SLT to offer

were using microwave technology for backhaul where possible due to the high prices of SLT backhaul (for example, backhaul in Sri Lanka was the second most expensive in South Asia in 2010, surpassed only by the Maldives, an island nation that had many more geographical challenges to deal with than Sri Lanka - Figure 5). [35] Several years ago Dialog began installing fiber optic rings starting in the populated cities and offering wholesale access non-discriminately.

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[33] Sri Lanka Telecom. (2011). *Annual Report 2010*.
http://www.slt.lk/data/investor/pdf/annual_report_2010/annual_report_2010.pdf
[34]
http://www.trc.gov.lk/images/pdf/TRCSL_Repoet_on_Public_Consultation_on_NGN.pdf

[35] LIRNEasia (2010). *Broadband Benchmarks Emerging Asia*, February 2010. Retrieved 25 March 2011 from http://lirneasia.net/wp-content/uploads/2010/03/LIRNEasia-Broadband-prices-EmergingAsia-Feb-2010.pdf

The regulator and the Office of the President are currently planning for nationwide fiber backbone connectivity through a National Broadband Network (NBN). Initially planned by the ICT Agency under the e-Sri Lanka initiative, the procurement process was under way in 2008-2009 to competitively select a firm based on a least-cost-subsidy auction and to build and operate the network. The rights of-way were to be obtained via the Ceylon Electricity Board (CEB) and the Sri Lanka Government Railway (SLGR). Geographically, the new network was to cover the Deep South as well as the North Central and North Eastern regions where fiber did not extend to at the time of design (Figure 6). According to stakeholders, the design was problematic in that rights of way from CEB and SLGR were not guaranteed and the winner of the bid would have to negotiate with each of these entities and there was uncertainty about the price they would charge to lay cable along their facilities. In any case, the competitive procurement process was halted, and in early 2011 it was decided by the Cabinet that SLT would be asked to build the NBN, using government funds (instead of World Bank funds which were previously allocated for the least-cost
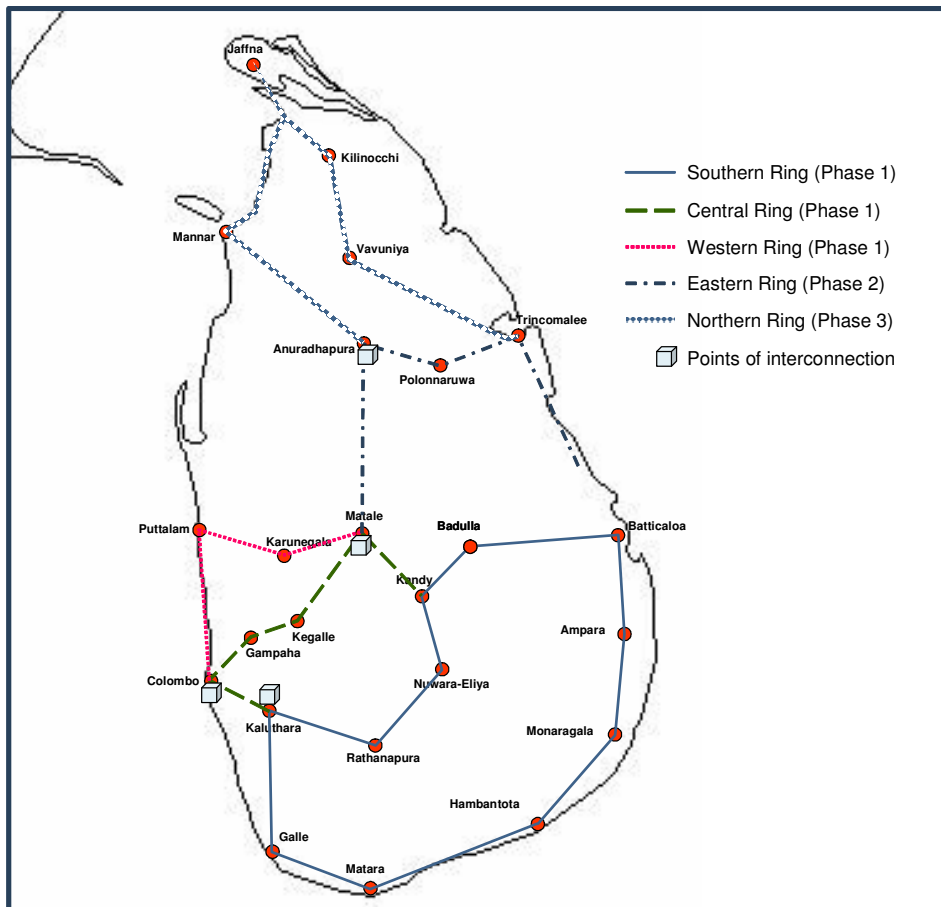
Figure 6: Proposed route for the NBN (*Source*: Spectrum Strategy Consultants & Value Partners. (2008), Consultation on Planning and Implementation of a National Fiber Backbone)

subsidy). According to the Director General of TRCSL, SLT would be given the contract to build the NBN, with the condition that they then give non-discriminatory re-sale to other operators.

4.2.2   International connectivity

 Sri Lanka has access to multiple international cables: SE-ME-WE 3 and 4, the SLT-Dhiraagu cable between Sri Lanka and the Maldives, the BSNL-SLT cable between Sri Lanka and India, and the FLAG cable (international cable system with over 16 countries). Landing stations for the first three are controlled by SLT while Lanka Bell owns the last. Although capacity on the SE-ME-WE cables is competitively priced, the landing point itself acts as bottleneck. For example, SLT does not allow operators to directly connect using their own fiber, forcing them instead to lease connectivity from SLT and charging high rates for this leased line.   Non-price barriers are also reported, such as delays in implementing requests for increased capacity. According to operators, until recently, the cost of

station. Operators still claim that if prices to connect to the landing station are cost-based, Internet connectivity prices could come down by 30%. This claim however has to be balanced by the fact that that only a low volume of traffic flows through the competing FLAG cable, primarily due to high prices (presumably prices higher than through SE-ME-WE, because otherwise the cheaper option would have the majority of traffic), even when no access problems or bottlenecks are reported at the FLAG landing stations. In any case, the FLAG cable does provide a useful point of redundancy in case of problems with the alternate.

SLT reported 8.3 Gbps of international backbone capacity in 2010. It appears that there may be insufficient international bandwidth in Sri Lanka that could be impacting quality. While Sri Lanka had the second highest international bandwidth per person in 2008 in South Asia (after Maldives), by 2010 it was ranked fourth in this metric (Table 3). Likewise, its average download speed (1.2 Mbps) only ranks fourth in the region and actually

	International Internet bandwidth				Average download speed	
	Gbps	Bits per person			Kbps	
	2010	2008	2009	2010	2009	2010
Bangladesh	15.4	12	…	93	485	739
Bhutan	0.3	66	230	482	…	…
India	535.0	125	212	440	1,202	1,411
Maldives	0.3†	783	…	…	1,821	1,819
Nepal	0.1†	6	…	…	387	417
Pakistan	9.0†	56	…	…	1,273	1,488
Sri Lanka	8.3	149	306	406	1,284	1,169

Table 3: International Internet connectivity, South Asia (Source: Adapted from World Bank and operator and regulator reports and OOKLA) Note: †2008

connecting to this international cable landing station was estimated to be over 10 times higher than on a reasonable cost-based basis and was even higher than Singapore. As a result, the regulator intervened and facilitated a 50% reduction in the fees to connect to the landing

declined between 2009 and 2010.

4.2.3 Internet Exchange

Sri Lanka has an Internet exchange (IX) that is operated and managed by Lanka Com (a subsidiary of Singapore Telecomm International) with all major operators having a link to the IX.[36] There is little locally hosted content, and email accounts used by a majority of users are international (Google mail, Yahoo, etc.). As such, the amount of traffic to be peered locally appears to be very little.

4.3 Penetration of broadband

There are acknowledged problems counting exact broadband subscriptions. First, TRCSL does not publish data on fixed broadband subscriptions and has only recently begun publishing data for mobile broadband subscriptions. Second, not all of the operators report the number of broadband subscriptions. Third, there are methodological issues related to the definition of mobile broadband. These include differences between the

through a breakdown between those using a mobile handset and those using a data card. There are also mobile broadband definitional and terminology issues with 3G often interchangeably used for different speeds and further nuances such as 3.5G. Some take a broad view—any network based on IMT-2000 standards (that would incorporate technologies such as EDGE and CDMA 2000 1x that operate at speeds less than 256 kbps). Others take a narrower view that the technology should be faster than 256 kbps such as High Speed Packet Access (HSPA) or EV-DO while others take a more restrictive view and consider only HSPA (sometimes referred to as 3.75G). There is a further complication of whether wireless technologies such as EV-DO or WiMAX can be used in both fixed and mobile modes. All of these issues apply to Sri Lanka that has a plethora of broadband technologies in use. As there is no internationally agreed upon solutions to these dilemmas, the context of the available broadband data is explained below.

Penetration of fixed broadband: In respect to

	2010	Per 100 people	Source	Comment
Population	20,653,000		Dept. of Census and Statistics	Mid-year
Internet & Email Subscribers – fixed	280,000[37]	1.4	TRCSL	Provisional including dial-up, ADSL and fixed wireless
ADSL subscriptions	213,816	1.0	SLT	
Mobile broadband subscribers	294,000	1.4	TRCSL	Provisional. Assumed to include only data cards and postpaid data subscribers.
HSPA connections	1,000,000	4.8	GSMA (Wireless Intelligence)	For Q4 2010

Table 4: Fixed and mobile broadband subscriptions, Sri Lanka, 2010 (Source: As noted in table)

theoretical capability to use a mobile broadband network (through ownership of a mobile broadband enabled handset) and *active* use (through access to the Internet in a recent period using the mobile broadband network). Active mobile broadband users can be further analyzed

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[36] http://www.robtex.com/as/as45338.html#peer has list of companies peering at the SL-IX.
[37] Includes ADSL, and fixed wireless (WiMAX) connections.

the overall market for Internet subscriptions, TRCSL reported 280,000 fixed Internet and email subscriptions in 2010 or 1.4% of the population. In terms of fixed wired broadband connections, SLT is the only mass-market retail provider with 213,816 ADSL subscriptions at the end of 2010. It offers packages with speeds ranging from 512 kbps to 4 Mbps (leased lines using SLT's Metro Ethernet are also available for corporate users with speeds of up to 2 Gbps). Since neither the

TRCSL nor the fixed wireless operators publish information about broadband subscriptions, the only certain fixed broadband subscription data is that of SLT. The resulting fixed broadband penetration is one percent of the population. ADSL accounts for 76% of the total Internet and email subscriptions. Almost one quarter of SLT's fixed (copper) lines are connected to ADSL (Table 4).

Penetration of mobile broadband: In December 2010 there were 17.4 million SIM cards

and this number had grown to 1 million connections for WCDMA HSPA by the end of 2010. The GSMA data is based on operator network software is capable of counting (at any given moment for any given location) the active data connections at various speeds.

The available statistics suggest that mobile broadband penetration in Sri Lanka was between 1.4% to 4.8% of the population in 2010 (Table 4). Therefore, while penetration is higher than in fixed, mobile broadband has a long way to grow.

	Q4 2009	Q1 2010	Q2 2010	Q3 2010	Q4 2010
Total Connections	28.86 %	25.94 %	22.93 %	17.74 %	15.88 %
All WCDMA connections	109.71 %	102.46 %	91.34 %	79.53 %	78.59 %
HSPA connections	212.16 %	199.65 %	179.03 %	153.45 %	142.45 %

Table 5: Year-over-year growth of mobile connections by speed (Source: Wireless Intelligence, Market Tracking Table - Sri Lanka, Q4 2010)

in Sri Lanka and the market penetration was 82% [38] . The number of reported mobile broadband subscriptions varies according to the source, reinforcing the methodological challenges discussed above. According to TRCSL there were 294,000 mobile broadband subscriptions in 2010.[39] However TRCSL data only captures the connections that are counted through a sale of a HSPA dongle and/or have subscription to a data plan, therefore leaving out users who are using a pre-paid connection or connecting at HSPA speeds through their mobile phones without a formal data plan. As a result, secondary sources report higher figures. According to published GSMA figures, there were 546,811 mobile broadband subscriptions in Sri Lanka at 2010 Q1[40]

But it is happening – while overall mobile connection growth has reached a plateau, WCDMA based broadband connections are growing faster and the fastest HSPA connections specifically for mobile broadband data is growing even faster (Table 5).

In mobile broadband, Sri Lanka compares well with its South Asian neighbors, coming only behind the Maldives (a much richer country with over 100% SIM penetration) (Figure 7, left). Sri Lanka ranks third in the region in fixed broadband subscriptions per 100 people (based only on SLT's ADSL connections) (Figure 7, right).

4.4 Retail broadband prices

There are a wide variety of pricing packages in Sri Lanka's dynamic broadband market. Table 6 lists prices compiled by TRCSL as part of its broadband quality monitoring for February 2011. Mobile broadband is generally cheaper on a monthly basis but packages are capped whereas fixed broadband packages are unlimited. On a

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[38] The penetration number is in itself problematic, because of multiple SIM use.
[39] Telecommunications Regulatory Commission of Sri Lanka. (2010). *Statistical Overview*. Retrieved 25 March 2011 from http://www.trc.gov.lk/information/statistics.html. Note that SLT reported 90,000 mobile 3.5G broadband subscriptions for its Mobitel subsidiary in 2010 while Dialog reported 28,000 mobile broadband subscriptions in 2009 (2010 data not published).
[40] GSM Association. (2010). *Mobile Broadband: Asia-Pacific Regional Fact Sheet*. Retrieved 25 March 2011 from

http://www.gsmamobilebroadband.com/upload/resources/files/16082010112500.pdf

Mobile broadband (per 100 people), 2010

Maldives	8.3
Sri Lanka	1.4
Bhutan	0.3
Pakistan	0.07
India	0.01
Nepal	0.002
Bangladesh	0

Fixed broadband (per 100 people), 2010

Maldives	3.7
Bhutan	1.2
Sri Lanka	1.1
India	0.9
Pakistan	0.5
Nepal	0.4
Bangladesh	0.003
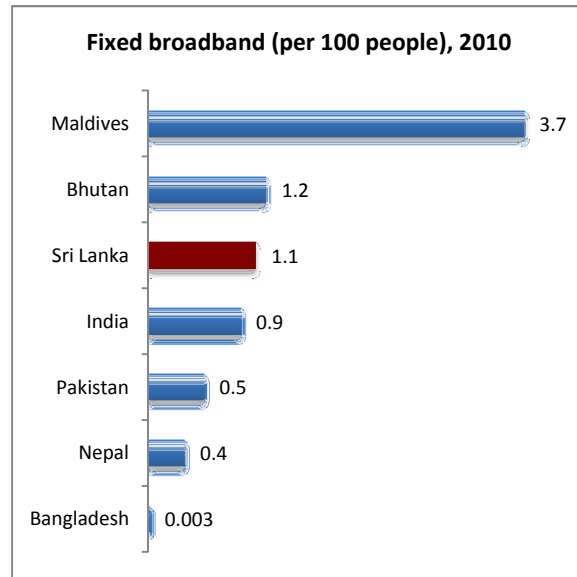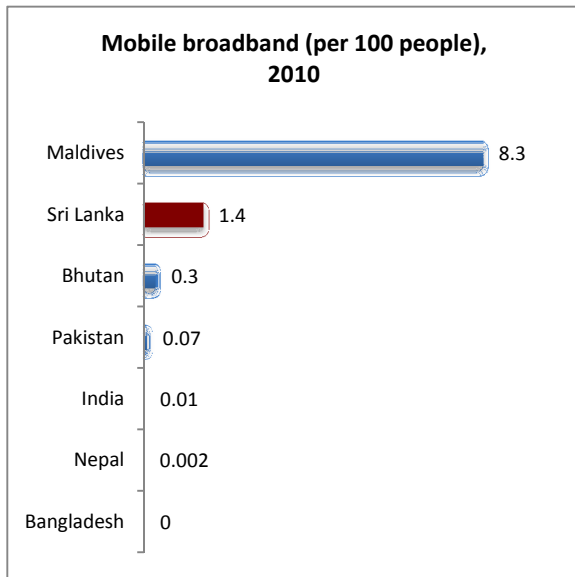
Figure 7: Mobile and fixed broadband subscriptions per 100 people, South Asia, 2010

Source: <u>Maldives</u> refers to "Mobile broadband" reported by the Communications Authority of the Maldives (CAM) in January 2011 (left chart) and "Broadband ADSL" reported by CAM for December 2010 (right chart). <u>Sri Lanka</u> refers to "Mobile broadband" reported by TRCSL for December 2010 (left chart) and "ADSL subscriptions" reported by SLT for December 2010 (right chart). <u>Bhutan</u> refers to "3G subscriber" (left chart) and "Broadband subscriber" (right chart) reported by Bhutan InfoComm and Media Authority for October 2010. <u>Pakistan</u> refers to EV-DO subscriptions (left) and "Broadband subscriptions" (right) reported by Pakistan Telecommunication Authority for June 2010. <u>India</u> refers to "Mobile Broadband Connections" reported by GSMA in 2010 Q1 and "Fixed Broadband Subscriptions" reported by Telecom Regulatory Authority of India for December 2010. <u>Nepal</u> refers to WCDMA subscriptions of Nepal Telecom in 2009. <u>Bangladesh</u> has not launched WCDMA; fixed broadband refers to "ADSL Connections" of Bangladesh Telecom Company Ltd. at November 2010.

price per Mbps, mobile broadband is theoretically a better buy. According to the plans tracked by TRCSL, the cheapest monthly rental is LKR 5.32 for mobile broadband. Pay per use packages for mobile broadband are available so that consumers can match usage to their purchasing power. For example Dialog Axiata provides time-based pay per use ranging from 30 minutes to 24 hours; a half hour of mobile broadband Internet access costs LKR 20 (USD 0.18).[41]

Sri Lanka has the cheapest 3G entry-level prices in South Asia (Table 7). Its prices are also the best value in terms of price per Mbps and price per GB of usage.

Low prices relative to other countries or downward movement of prices over time are both good indicators of competitiveness in a sector. Sri Lanka's broadband offerings have been doing both – particularly in mobile broadband. Nokia (2009) calculated the mobile data TCO for over 70 emerging economies in the world, and found Sri Lanka to be the 21st least expensive in absolute terms and 8th most affordable (affordability being defined as TCO as a share of GDP per capita, lower being better, with the best performing countries having TCOs less than 5% of GDP per capita). By 2010, Sri Lanka had become the least expensive in absolute terms (Nokia 2011).

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[41]
http://www.dialog.lk/personal/broadband/hspa/packages/prepaid-broadband/

reduced 27% while fixed broadband packages of

Operator	Technology	Speed (Mbps)	Monthly data volume (GB)	Monthly rental (USD)	Price per Mbps (USD)	Price per GB (USD)
DIALOG	WiMAX	0.512	unlimited	15.51	30.30	
LANKA BELL	WiMAX	0.512	unlimited	17.73	34.63	
SLT	ADSL	0.512	unlimited	14.18	27.70	
SUNTEL	WiMAX	0.512	unlimited	17.73	34.63	
DIALOG	WiMAX	2	unlimited	44.33	22.16	
LANKA BELL	WiMAX	2	unlimited	48.76	24.38	
SLT	ADSL	2	unlimited	48.76	24.38	
SUNTEL	WiMAX	2	unlimited	39.90	19.95	
AIRTEL	HSDPA	3.6	3	5.32	1.48	1.77
DIALOG	HSPA	7.2	15	26.51	3.68	1.77
MOBITEL	HSPA	3.6	8	11.44	3.18	1.43

Country	Operator	Technology	Speed (Mbps)	Monthly data volume (GB)	Monthly rental (USD)	Price per theoretical Mbps (USD)	Price per GB usage (USD)
Bangladesh	Grameen	EDGE	0.2368	1	4.39	18.54	4.39
Bhutan	BT	HSDPA	7.2	1.2	8.74	1.21	7.28
India	Airtel	HSDPA	7.2	1.25	14.77	2.05	11.81
Maldives	Dhiraagu	HSDPA	7.2	1	12.68	1.76	12.68
Nepal	NTC	WCDMA	0.384	1	69.51	181.01	69.51
Pakistan	Telenor	EDGE	0.2368	2	5.92	25.01	2.96
Sri Lanka	Dialog	HSDPA	7.2	2	4.34	0.60	2.17
SOUTH ASIA					**17.19**	**32.88**	**15.83**

256 kbps have reduced by 31%[42].

terms and 8th most affordable (affordability being

Table 6: Monthly broadband packages, Sri Lanka, US$, February 2011 (*Source*: TRCSL)
Note: Converted to US$ at 2010 annual average exchange rate.

defined as TCO as a share of GDP per capita, lower being better, with the best performing countries having TCOs less than 5% of GDP per capita). By 2010, Sri Lanka had become the least expensive in absolute terms (Nokia 2011). Further, from August 2007 to February 2010, fixed broadband packages of 2 Mbps have

[42] Calculated, based on Broadband Benchmarks Emerging Asia, Feb 2010 (http://lirneasia.net/wp-content/uploads/2010/03/LIRNEasia-Broadband-prices-EmergingAsia-Feb-2010.pdf) and Broadband Benchmarks South Asia, Aug 2007 (http://lirneasia.net/wp-content/uploads/2010/03/LIRNEasia-Broadband-prices-EmergingAsia-Feb-2010.pdf)

Table 7: Entry level 3G prices, South Asia, March 2011, US$ (*Source*: Adapted from tariff information on operator web sites)

Note: WCDMA networks in Bangladesh or Pakistan and HSDPA services in Nepal not available. Converted to US$ at 2010 annual average exchange rates.

Operator	Technology	Speed (Mbps)	Monthly data volume (GB)	Monthly rental (USD)	Price per Mbps (USD)	Price per GB (USD)
DIALOG	WiMAX	0.512	unlimited	15.51	30.30	
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SLT	ADSL	0.512	unlimited	14.18	27.70	
SUNTEL	WiMAX	0.512	unlimited	17.73	34.63	
DIALOG	WiMAX	2	unlimited	44.33	22.16	
LANKA BELL	WiMAX	2	unlimited	48.76	24.38	
SLT	ADSL	2	unlimited	48.76	24.38	
SUNTEL	WiMAX	2	unlimited	39.90	19.95	
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DIALOG	HSPA	7.2	15	26.51	3.68	1.77
MOBITEL	HSPA	3.6	8	11.44	3.18	1.43

Country	Operator	Technology	Speed (Mbps)	Monthly data volume (GB)	Monthly rental (USD)	Price per theoretical Mbps (USD)	Price per GB usage (USD)
Bangladesh	Grameen	EDGE	0.2368	1	4.39	18.54	4.39
Bhutan	BT	HSDPA	7.2	1.2	8.74	1.21	7.28
India	Airtel	HSDPA	7.2	1.25	14.77	2.05	11.81
Maldives	Dhiraagu	HSDPA	7.2	1	12.68	1.76	12.68
Nepal	NTC	WCDMA	0.384	1	69.51	181.01	69.51
Pakistan	Telenor	EDGE	0.2368	2	5.92	25.01	2.96
Sri Lanka	Dialog	HSDPA	7.2	2	4.34	0.60	2.17
SOUTH ASIA					**17.19**	**32.88**	**15.83**

5. Driving the Demand for Broadband

Sri Lanka has made extensive progress in introducing a competitive broadband market with a wide array of options and prices. Despite this advance, usage remains less than expected. For example the Network Readiness Index, which measures a country's ICT environment along three broad dimensions, finds that Sri Lanka lags in usage compared to other components (Figure 8).
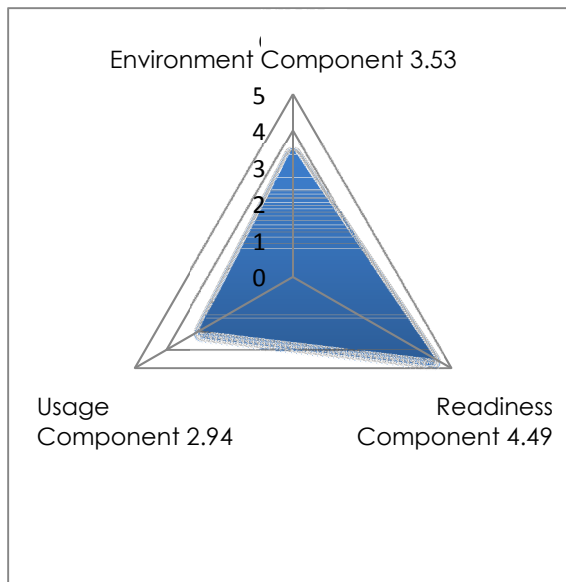
Figure 8: Sri Lanka's network readiness, 2009
(Source: The Global Information Technology Report 2009-2010)

According to the Sri Lanka Department of Census and Statistics Computer Literacy Survey, 13.1% of the population aged 5-69 used the Internet in 2009 or some 2.3 million people.[43] This is a significant improvement over the 3% reported in 2004 and there is noticeable rise since the previous survey carried out in 2007 (Figure 9, left). Nevertheless, current Internet penetration is insufficient particularly when compared to other lower middle-income nations that carry out similar surveys (Figure 9, right).

A number of demand stimulation policies are being pursued to raise Internet usage in Sri Lanka.

Some are spearheaded by the government, in partnership with the private sector and civil society. Others are classic competitive responses by operators who want to attract new customers and keep them.

5.1 Public access

Not everyone can afford home broadband access. Therefore it is critical to provide other options such as public facilities with broadband access. These can also serve as venues to provide training.

Nenasala program: Nenasala (or "knowledge center") is the name given to a series of telecenters that are being installed as a part of the *e-Sri Lanka* initiative and represents the government's primary public access initiative. According to http://www.nanasala.lk/, the 605th Nenasala opened in March 2011. The initial design for these telecenters was based on a business model that included a government subsidy (anything from 25 – 100% of costs) that would be scaled down to 0% over 4 years, which was the time estimated to reach financial self-sustainability. Later a new type of telecenter ("community model" based telecenters, as opposed to the "business model" based or entrepreneurial telecenters initially envisioned) was introduced, where financial sustainability was traded for other development objectives. Over-time, several other community access initiatives (such as e-libraries and distance-learning centers) have also been brought under the Nenasala project, and the program has deviated from the exclusive focus on rural areas, and currently includes telecenters even in areas that are well served by other alternatives such as commercial "communication shops" - for example, the Colombo district (the most urbanized district that is the financial hub of the country which has numerous commercial "internet cafes") reported 12 Nenasalas [44] . Irrespective of location or model, the expected benefits of the Nenasala program are to: increase ICT literacy, provide affordable access to citizen services, provide access to e-commerce and ICT services leading to job growth in rural areas and

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[43] Department of Census and Statistics Sri Lanka. (2009*). Computer Literacy Survey 2009*. Retrieved 25 March 2011 from http://www.statistics.gov.lk/CLS/BuletinComputerLiteracy 2009.pdf.

[44] According to http://www.nanasala.lk, 25 March 2011. Almost half of Nenasala users felt there were other locations in the vicinity providing similar services, according to a 2008 survey by the ICT Agency.

promote knowledge sharing. Provision of various training programs is a primary source of revenue for Nenasalas with only 9% reporting they do not engage in training.[45] Use of computers, use of Internet, and facilities to obtain print-outs were the other services offered across the board, while a smaller percentage of Nenasalas provided fax,

then the better solution is to provide a targeted subsidy to the desired user group. This was in fact the design of a pilot "voucher" scheme which was given to school children in rural areas so that they could get a specified number of hours at a telecenter. This scheme how was not scaled up.

Easy Seva centers: Starting in 2007, mobile
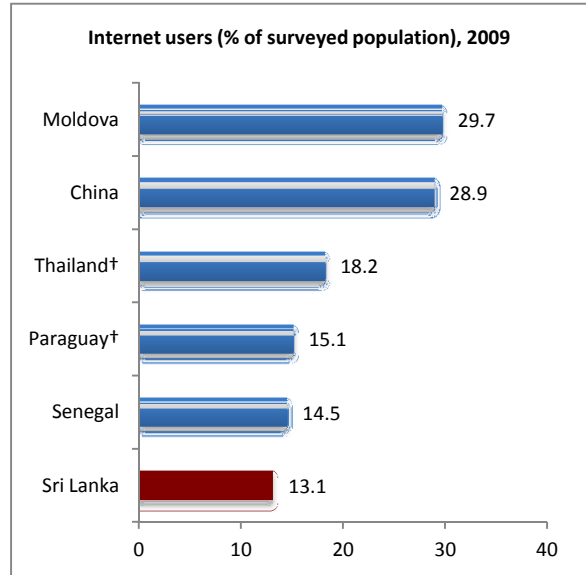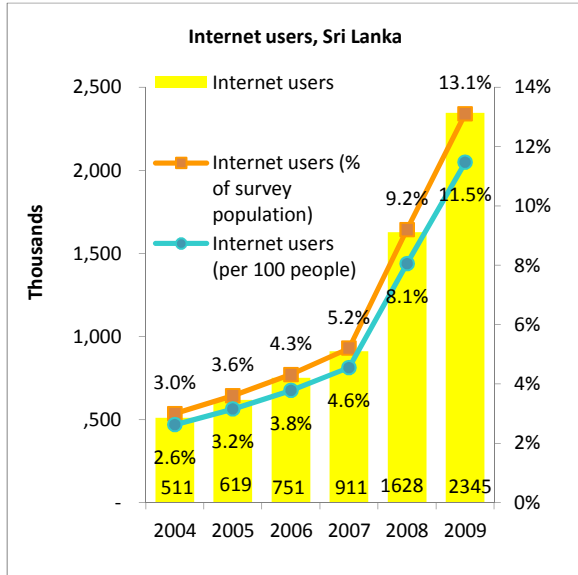
Figure 9: Internet users, Sri Lanka, 2004-2009 and selected lower middle-income economies, 2009.
Source: Adapted from national statistical offices except China (CNNIC) and Moldova (IPP).
Note: In the left chart, data for non-survey years have been estimated based on inter-survey growth. † = 2008 data. Methodology: Sri Lanka: Age 5-69 used in last year; Senegal: Age 12+; Paraguay: Age 10+; Thailand: Age 6+; China: Age 6+ used in last six months reported as % of total population; Moldova: Age 18+ using at least once in last three months.

and telephone (local and international call) services. Secondary school students represented the biggest user group (63%). "Basic learning", "gathering of information" and reading of "newspapers" were listed as the top purposes for which the Internet was accessed at the telecenters (the survey does not further define these categories). 88% of users claimed that Nenasala prices were lower than other centers in the neighborhood that offered similar services. This of course points to the market distortions created by the Nenasalas: government offering lower-priced services when the commercial providers may be already providing the service at a higher (market) price. If the government's aim is to encourage internet use by those who are otherwise unable to afford the commercial/market prices,

operator Dialog has been working with a number of development partners (e.g., USAid, Qualcomm) to establish 55 Easy Seva Centers based on a franchise model. Promoted as a "telecenter-in-a-box", the Easy Seva centers operate on a standardized model: four computers, headsets and a 3G modem and everything else (access to finance, training, technical support) needed for a local entrepreneur to set up an Internet café with ease is provided.[46] While rural implementations were planned, the initial 50+ Easy Seva centers were set up in town centers, even in semi-rural regions. Prices are around US$ 0.60 per hour of internet use. Internet and email were the services most used. According to Dialog Telekom, Easy

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[45] ICTA (2008). *Nenasala Interim Survey, Final Report.*
http://www.icta.lk/index.php/get/category/3-p

[46] USAID (n.d.). *Alliances in Action: Easy Seva Sri Lanka.*
Retrieved 25 March 2011 from
http://www.usaid.gov/our_work/global_partnerships/gda/r esources/Easy_Seva.pdf

Seva centers became the largest users of broadband outside the capital city of Colombo.[47] The program is being scaled up.

5.2 Digital literacy

According to the Sri Lanka Department of Census and Statistics, "… computer literacy has become the fourth pillar to the traditional three tenets of education: reading, writing, and arithmetic, and that a failure to acquire the now requisite technical knowledge will prevent large segments of population from realizing the fruits of the Information Age…"[48] In a 2009 survey, the DCS found that one fifth of the Sri Lankan population aged 5-69 was computer literate, defined as a person being able to use a computer on their own.[49] Although this is a 25% increase from the previous survey in 2006, more effort is needed to raise digital literacy if Sri Lanka is to develop wide participation in the information society. The computer illiterate fall along familiar socio-economic classes and tend to be disproportionally older, less educated and non-English speaking.

e-Sri Lanka has launched multiple activities aimed at increasing ICT literacy:

a) Targeting ordinary citizens, the *e-driving license* certification was launched, enabling people to receive low cost, basic ICT training through a network of pre-approved private sector training partners.

b) Targeting government employees, a comprehensive program to develop the ICT skills has been launched, covering basic computer literacy to highly technical skills. By Q1 2009 around 3,125 government employees were given the basic ICT Certification

training, with over 2,000 more in the pipeline.[50]

c) Targeting the private sector, over 5,000 non-ICT sector employees had received training by 2010.

d) The e-Sri Lanka PC program provided easy financing for citizens to purchase a computer

e) A weekly program broadcast on a popular television channel covered a broad range of topics related to basic computer literacy I including the use of simple software packages and simple hardware maintenance.

The Ministry of Education also worked in parallel to increase digital literacy through several initiatives starting with the launching of the National ICT Education drive in 2005.

f) Through various ICT-capacity building initiatives of the Ministry, it is estimated that at least 74,000 teachers had received one or more types of ICT-related training.[51]

g) ICT was introduced into the school curriculum and General Information Technology (GIT) as a subject was introduced for the G.C.E Advanced Level students. The first GIT exams were conducted in 2005.[52]

h) In 2006, SchoolNet[53], a wide area network connecting schools and other institutions that are engaged in education (such as zonal education offices, the Ministry of Education (MoE), the National Institute of Education (NIE), etc.) was launched with funding from the Asian Development Bank. Implemented in various stages (and still ongoing), schools were initially provided with a computer lab and an Internet connection under this program. Today, any school that has a

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[47] SSG Advisors, 2009. Best Practices and Lessons in Delivering Broadband to Rural Communities suing Micro-Franchising. http://www.ssg-advisors.com/files/SLLessonslearned.pdf

[48] Department of Census and Statistics Sri Lanka. (2009*). Census Department Measures ICT Penetration into Households*. http://www.statistics.gov.lk/special/index.htm

[49] Department of Census and Statistics Sri Lanka. (2009). *Computer Literacy Survey 2009*. http://www.statistics.gov.lk/CLS/BuletinComputerLiteracy_2009.pdf

[50] ICTA. http://www.icta.lk/en/programmes/hrc-building/117-government-training/510-ict-certification.html

[51] Dissanayake, A. (n.d.), *ICT Education in Sri Lanka*. Retrieved 15 March 2011 from http://info.worldbank.org/etools/docs/library/243154/day1Session%202_Sri%20Lanka.pdf

[52] Ministry of Education (2005). *Education for Economic Development and Prosperity*. http://planipolis.iiep.unesco.org/upload/Sri%20Lanka/Sri%20Lanka%20MOE_Profile_English.pdf

[53] http://www.schoolnet.lk/

computer lab with a LAN can apply for connectivity via SchoolNet. At present around 1,800 institutions (about 1,500 schools and 300 other institutions) are linked up via SchoolNet. Of these around 1,100 have ADSL Internet connectivity, about 400 have CDMA based connections and the rest are connected via WiMAX, though at present the majority are being converted to ADSL. Most have 128Kbps connectivity, while bigger or central schools have 256-512 Kbps. The MoE and the NIE have higher bandwidth of 6 Mbps and 4 Mbps respectively. Sri Lanka Telecom and Dialog Telekom are the primary providers of connectivity. Conversations with the Network Operations Center for SchoolNet revealed that the majority of traffic generated is for web browsing, though there is evidence of provincial level use of the various collaboration tools that are offered as part of the SchoolNet. Web hosting (of web pages for schools) and domain name assignment for schools are also widely requested services. Actual usage of facilities (the lab, or Internet) is governed by the policies of each individual school, and therefore highly variable: some allow relatively easy access while others have more restrictive opening hours and policies on which students can use the facilities.

While internet access at primary and secondary schools is still emerging, the universities and research institutions have traditionally had better access.

i) Internet connectivity for universities and research institutions is through the Lanka Education and Research Network (LEARN).**54** The majority of national and regional level universities and some private ones are connected to the Internet through LEARN. Operating funding comes from the government (via the University Grants Commission), while capital investment (e.g., for increased network capacity) has been funded through international donors in the past. International connectivity is through two paths: the incumbent SLT (120 Mbps) and also via the Trans-Eurasia Information Network (TIEN 3) which provides dedicated

high capacity Internet to research and education institutions in the Asia Pacific region (45 Mbps).**55** LEARN operates as a non -profit entity owned by the members and has a small staff operating the network operating center. The majority of traffic generated by the network is international.

5.3 Converged and bundled offerings

Operators are taking a classic approach of product bundling in order attract consumers, increase revenues and decrease churn. Some of these are helping drive the adoption of broadband. For example:

- Dialog's broadband and voice bundle products (SmartHome and BoxOffice) demonstrated significant growth in 2009 (with 162 and 64 percent customer growth for each product, respectively), despite broadband-only subscriptions growing only marginally.[56] Revenue contribution from customers of these two products grew from 35 to 41 percent between Q3 2009 to Q4 2009 whereas revenue contribution from broadband-only consumers fell from 65 to 59%.
- LankaBell offers free narrowband Internet services to its 1.2 million subscribers.[57] In July 2009, the company announced that its customer base for high-speed Internet had grown by over 300 percent in less than 18 months.[58]
- SLT launched its IP based television service PEO TV and reported over 26,000 subscriptions in 2010. While pricing for TV channels offered on PEO TV is less competitive than alternatives, it is an attractive option for consumers who have access to copper connectivity (within a short distance

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[54] www.ac.lk

[55] See http://www.tein3.net/upload/pdf/TEIN3_Topology_04.10_low_res.pdf for TEIN3
[56] Dialog. 2010. *Annual Report 2009*. http://www.dialog.lk/content/uploads/pdfs/annual_reports/2009_annual_report_en.pdf
[57] http://www.lankabell.net/lanka_bell_one_step.htm
[58] "Submarine Links." *Lanka Business Online*. July 9, 2009. http://www.lankabusinessonline.com/fullstory.php?nid=658627048

Rank	Name	Site	Comment
1	Google	google.lk	Search
2	Facebook	facebook.com	A social utility that connects people, to keep up with friends, upload photos, share links and videos
3	Google	google.com	Search
4	YouTube	youtube.com	YouTube is a way to get your videos to the people who matter to you. Upload, tag and share
5	Yahoo!	yahoo.com	A major internet portal and service provider offering search results, customizable content, etc.
6	Blogger	blogspot.com	Free, automated weblog publishing tool
7	ESPN cricinfo	espncricinfo.com	ESPN Cricket portal
8	Wikipedia	wikipedia.org	A free encyclopedia built collaboratively using wiki software
9	ElaKiri	elakiri.com	Largest Online Community and Media Portal for Sri Lanka
10	Gossip Lanka News	gossiplankanews.com	News from Sri Lanka
11	Ada Derana	adaderana.lk	A premier breaking news web site offering news from Sri Lanka in English, Sinhala and Tamil
12	Daily Mirror	dailymirror.lk	Sri Lanka 24 Hours Online Breaking News
13	Twitter	twitter.com	Social networking and micro blogging service utilizing instant messaging, SMS or a web interface.
14	Windows Live	live.com	Search engine from Microsoft
15	WordPress	wordpress.com	Free blogs
16	eBay	ebay.com	International person to person auction site
17	Lankaenews	lankaenews.com	English Sinhala & Tamil Latest news updates from Sri Lanka
18	Bing	bing.com	Search engine developed by Microsoft
19		bp.blogspot.com	
20	lankadeepa	www.lankadeepa.lk	Portal site of Wijeya Newspapers

Table 8: Top 20 web sites in Sri Lanka, March 2011 (Source: Alexa http://www.alexa.com/topsites/ countries/LK)

of the exchange, in order experience high quality) and do not want the hassle of maintaining a separate satellite TV subscription.

- At the time of writing, new broadband operator Sky Networks was in talks with one of the CDMA fixed line operators to offer a bundled voice+broadband offering to consumers.

5.4 Content and applications

Access to content that is relevant to users helps to drive broadband uptake. This includes access to popular global sites as well as the development of local content including e-government applications.

5.4.1 Browsing habits of users

A ranking of the top twenty web sites in Sri Lanka shows that global applications such as search portals (e.g., Google, Yahoo!, Bing) and social networking and peer to peer applications (e.g., Facebook, YouTube, Twitter, Blogger, eBay) are popular (Table 8). Local content, particularly news sites, rank in the top twenty as do sites of particular interest to many Sri Lankans such as cricket (ESPN cricinfo at #7). Like everywhere around the world, Sri Lanka has joined the social networking revolution with over 900,000 Facebook users in March 2011[59] or some 4.4% of the population and around 40% of Internet users (based on the DC&S Computer Literacy Survey). Elakiri.com is a popular website that allows users

forums on Elakiri.com claimed to have over 9 million posts under 874,000 different threads with over 348,000 users.[60]

5.4.2 E-government applications

Government can be a driver of increased broadband penetration through its own ICT activities including the development of online applications to facilitate citizen interaction. One of the main components of the e-Sri Lanka program was the development of e-government services. According to an evaluation of the program, Sri Lanka has progressed in e-government since 2004 when there were no Internet-enabled services and only a single central government portal providing static information.[61] By 2010, 290 agencies had a
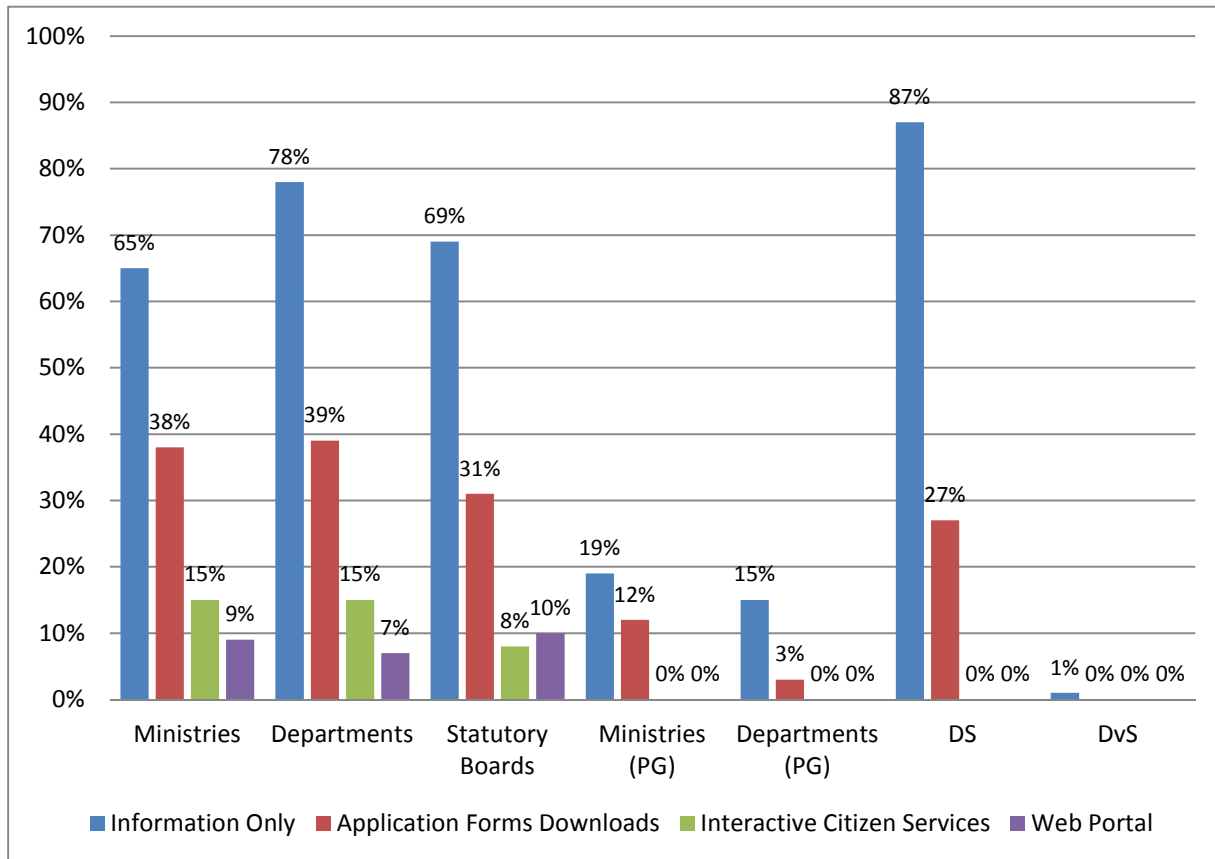
Figure 10: Services provided by various types of government organizations (Source: ICTA)

to upload (and download from other users) popular content such as music videos, pictures and mobile ring tones. It provides a facility for hosting blogs and contains several forums that are popular. At the time of writing, the various

[60] Statistics reported on http://www.elakiri.com/forum/
[61] The World Bank. (2010). *Implementation Status and Results E-Lanka Development (P081771) (Rep. No. ISR2333).* http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/SAR/2010/12/25/0D9887F3F94C315385257804003D75E0/1_0/Rendered/PDF/P0817710ISR0Di022520101293275514930.pdf

[59] www.ictDATA.org

web site and there were 112 online services for the private sector. More detailed analysis reveals that the even though many government offices had a web presence, only 10% provided some kind of interactive service. [62] The others provided information and at most allowed the download of forms (Figure 10). Yet the download of government forms should not to be under-estimated. Simply having information about how to access government services and providing the necessary application forms online provides a huge benefit to users who otherwise may have to travel several hours just to obtain these (and travel again to actually obtain the service).

A separate survey of citizens who walked into selected government offices revealed their most-used e-government service. Top ranked was obtaining information from government websites (47.3%), with making inquiries from the Government Information Center (GIC) ranking next (46.6%), making inquiries via e-mail from government organizations (7.5%) and online applications for government services (6.0%). [63] Indeed the availability of government information and forms appears to be a driver of Internet services, at least for those citizens that access the Internet at the Nenasalas (the government's telecenters). A 2008 surveys reveal that 70% of users of Nenasalas had accessed government websites for information and services and that 24% of them said access to government services through the Nenasala's had contributed positively towards their life.[64]

There is room for improvement. As noted, more government transactions enabled online (instead of simple information) could prompt more demand. Further, some of the most widely used e-government services implemented by ICTA are ones that use ICTs at the backend, but rely on citizens using simple old fashioned phones (in the case of the Government Information Center, which gives information about applying for various government services through a call center[65]), traditional counter-services (in the case of certified copies of birth, death and marriage certificates being available under 30 minutes by walking-into the relevant government office, achieved through a huge document digitization initiative) or "drive-through" services (in the case of the payment of motor vehicle road tax in a few minutes thanks to backend computerization of the process). According to the UN e-government survey, Sri Lanka ranks third in the Southern Asia region. However its rank dropped ten points between 2009 and 2010 and the country's overall e-government index has remained stagnant.

5.4.3 Content offerings from operators and emergence of "App Store" models

Private sector is also entering the mobile-application market. The models adopted by the operators vary. Some are creating educational content from scratch, hoping people will be willing to pay for useful content in a culture where education of children is the primary goal of most families, and majority of secondary schoolers (or their parents) pay for "private tuition" that helps with additional coaching on top of what they learn at school. Operators have also started online application stores, inspired by the iPhone App Store or Nokia's Ovi. However the difference is that the applications are within a walled garden of the operator, and operator-centric ((unlike the phone-centric models such as the iPhone app store which are accessible from any operator as long as the phone is an iPhone). At the time of writing Etisalat was offering application developers standardized contracts that provided them with a development environment (to develop and test the software), revenue share of 70% and non-exclusivity (i.e. the developer could make the app available to other operators, but had to do the marketing)). As with all user driven innovation, it is hoped that a large number of applications will be generated, with a few becoming extremely popular due to consumer demand. However, smart phones that can run these apps are still only a small percentage of the market. Therefore what is required are

[62] ICTA (2008). *Survey on ICT Usage in Government Sector.*
http://www.icta.lk/index.php/get/category/3-p)
[63] ICTA (2008). *Government Organizations Visitor Survey.*
http://www.icta.lk/index.php/get/category/3-p).
[64] ICTA (2008). *Nenasala Interim Survey.*
http://www.icta.lk/index.php/get/category/3-p).

[65] The GIC information is both available online at www.gic.gov.lk and via phone by dialing 1919. However the GIC 2009 Annual Report states that between 2007 – 2009 a total of 1.719 million calls were answered while the website only recorded a total of 635,928 visits as at March 2011.

applications that can run on basic (feature) phones and deliver utility to the masses.

5.4.4. Online Payments

As with many developing nations, the use and availability of credit cards is low. Therefore, online payments via credit card for the purchase of goods and services is only possible for a small percentage of the population. However, an alternate payment mechanism exists through mobile telecom companies – for example, citizens make appointments with doctors at various hospitals by dialing a 225 from their telephones and speaking to an operator. The doctors' charges (and hospital charges) plus a fee for the appointment booking service are added to the consumers bill at the end of the month (in the case of post-paid mobile users) or deducted immediately from the users available credit (in the case of pre-paid users, who are more than 90% of the market). Therefore, any vendor wanting to engage in "e-commerce" will have to tie-up with phone companies for the payment mechanism if they want to go mass-market.

5.5 Regulatory measures to protect the consumer

5.5.1 Online security

Proper security and other assurances are necessary to help some citizens overcome their resistance to use broadband services. This includes, for example, legislation that legitimizes electronic transactions and makes computer crimes illegal. It also includes initiatives to raise awareness about how users can limit access to sites they consider undesirable and how they can protect themselves against harmful content.

Several key pieces of legislation have been enacted:[66]

- Intellectual Property Act No. 36 of 2003: Under this law, computer programs are protected under the existing Copyright Regime
- The Electronic Transactions Act No. 19 of 2006: It aims to "recognize and

facilitate the formation of contracts, the creation and exchange of data messages and other communications in electronic form in Sri Lanka and to provide for the appointment of a certification authority and accreditation of certification service providers". The law was brought into operation in October 2007 and is based on the United Nations Commission on International Trade Law (UNCITRAL) Model Law on e-Commerce (1996) and Model Law on e-Signature (2001).
- Payment and Settlement Systems Act No. 28 of 2005: This legislation was introduced to enable transaction of checks and negotiable instruments in digital form.
- Computer Crimes Act No. 24 of 2007: This law covers two categories of offences: a) computer related crimes, and, b) hacking offences which affect integrity, availability and confidentiality of a computer system or network and deals both with unauthorized access and unauthorized modification and damage. This law was brought into operation in July 2008.

In addition to the above, other laws related to Data Protection (and approaches other than laws, such as self-regulation) are being considered.

Apart from the legal framework, simple awareness and perceptions with regards to security on the Internet has a direct impact on demand. In particular, access to unsuitable material by children can impact the parent's decision to purchase Internet access. Operators are addressing this. For example, at the time of writing, Etisalat was planning the sale of mobile broadband dongles that included pre-installed content filtering software. Dialog has also

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[66] Fernando, J. (n.d.). *Impact of Recent IT Related Legislation.* Retrieved 25 May 2011 from http://www.icta.lk/en/e-laws-project.html

launched a "Child Safe Internet" account that filters access to inappropriate web sites.[67]

The government's response to pornographic content online has been haphazard – with the topic gaining prominence at regular intervals, but then disappearing from the radar, without concrete policy or regulatory action in between.

were therefore ordered to monitor and filter such content. In July 2009 it was reported that based on a petition by the Inspector General of Police the courts had ordered TRCSL to ban twelve local Internet sites identified as containing pornographic material. In August 2009, it was reported that the TRCSL was about to force all Internet cafes to register and be monitored closely
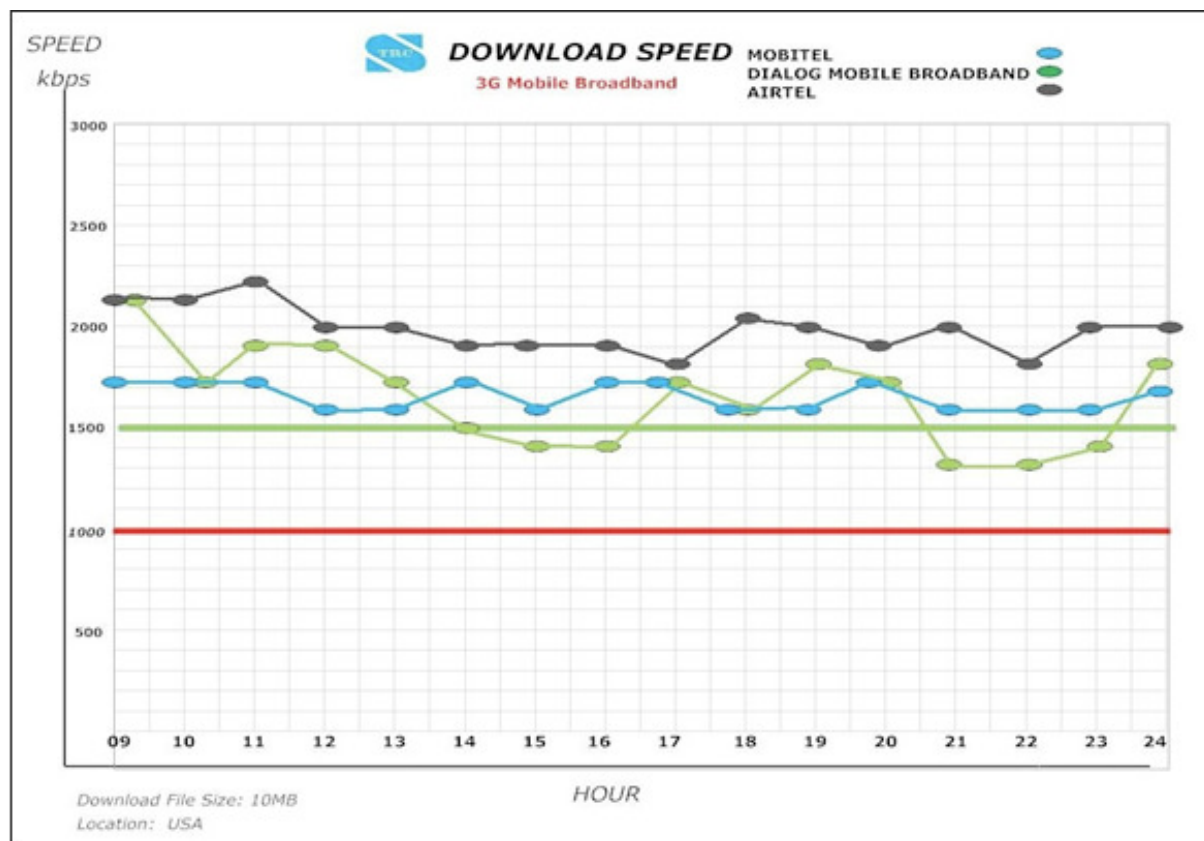
Figure 11: Mobile broadband speed tests, Sri Lanka, January 2011 (Source: TRCSL) *Note*: Measures download speeds of various mobile broadband operators over a 16 hour period in Colombo. Tests are based on download of 10Mb file from USA.

For example, in August 2008 it was reported in the press that the President had ordered the TRCSL to eliminate opportunities to watch pornographic movies and videos on the Internet[68] and that the National Child Protection Authority of Sri Lanka was considering banning the receiving of pornographic text messages.[69] ISPs

to ensure they do not provide access to pornographic content.[70] But as of today, how it is unclear how these rules/orders are being enforced.

5.5.2 Broadband quality
Consumer assurance can be enhanced through quality of service testing of broadband services. TRCSL has commenced carrying out broadband tests to measure advertised speeds against actual

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[67] Dialog. 2010. *Annual Report 2009.*
[68] "Unrestricted Web Access for Payment in Future, TRC.*" The Sunday Times*. August 2, 2008.
[69] Wattegama, Chanuka. "Sri Lanka: Now Internet porn banned, it is time to immobilise mobile porn." LIRNEasia, August 26, 2008. http://lirneasia.net/2008/08/sri-lanka-now-internet-porn-banned-it-is-time-to-immobilise-mobile-porn/.

[70] "No sex please, we're Sri Lankans". *The Sunday Times*. August 2, 2009.
http://www.sundaytimes.lk/090802/News/news_04.html

speeds.[71] It conducts tests for both fixed and mobile broadband, for all operators, for different advertised speeds. The tests are based on download results from servers in different countries. A January 2011 test for mobile broadband found that speeds were above the 1 Mbps threshold and generally above a 1.5 Mbps threshold (Figure 11).

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[71] Telecommunications Regulatory Commission of Sri Lanka. January 2011. *TRCSL Releases 3G Mobile Broadband Speed Test Results.* http://www.trc.gov.lk/broadband/184-trcsl-releases-3g-mobile-broadband-speed-test-results.html

6. Assessing Performance: Glass Half Full or Half Empty?

On one hand, Sri Lanka's fixed broadband penetration leaves much to be desired, with only a small portion households being served by fixed copper broadband, and an even smaller portion of the served households adopting ADSL. Whether fixed wireless (especially newly emerging 16.e WiMAX) will prove successful is unclear because these technologies/services are only just entering the market. However mobile broadband has stepped in to fill the void – Sri Lanka has the second highest level of mobile broadband penetration in South Asia (only behind Maldives, a much richer country) and it has the lowest prices. Though overall adoption is still low, mobile broadband is experiencing phenomenal growth. Many factors contributed to this success, as discussed below.

However, the path for *continued* growth for mobile broadband is far from certain, given the socio-economic conditions of the country and competitive dynamics between operators.

These factors are discussed in the following section.

6.1 What worked

6.1.1 Early availability of 3G spectrum
The Sri Lankan regulator was one of the first in the Asian region to make 3G spectrum available back in 2004 when it authorized its use for testing. By 2006, this spectrum was allocated for commercial use to all operators at a charge of around USD 5 million. Not only was 3G spectrum made available at the time, but was thereafter available to any operator who paid the same price. This eliminated "land-grab" type behavior that would have been otherwise created by a one-off spectrum auction and enabled operators to enter the 3G market when it made most sense to them – based on their assessment of trade-offs between early entry vs. waiting for the right time in their capital investment cycle. Though the government arguably lost potential income through this allocation method, it did make spectrum available on a non-discriminatory basis to all operators, and at a relatively low price. Once the primary barrier to mobile broadband investment was removed (i.e. spectrum was made

available), operators were quick to invest. Dialog launched South Asia's first commercial 3G network in 2006[72] and other Sri Lankan mobile operators have followed suit. Availability of 3G spectrum and 3G services is in sharp contrast to the situation in many of Sri Lanka's neighbors, most notably India which did not allocate it till until 2010.

Sri Lanka is keeping up this track record, and has made spectrum available for LTE networks, which are currently being tested by two operators.

6.1.2 Innovations by operators
The second key driver of mobile broadband stems from dynamics of an extremely competitive mobile industry in Sri Lanka. Market entry has been liberal with a relatively high number of operators. Once the market got beyond the duopoly situation, and disruptive third and fourth operators entered, serious competition set in, driving down prices. In order to maintain margins and grow the market, operators could not continue to "cream skim" (service the rich or those at the top of the socio-economic pyramid who have high ability to pay) but had instead to reach the masses and the poor. The operators innovated by moving towards a high volume, low cost network business model characterized by, a) outsourcing of network operations, leading to significant reduction in network costs, b) sharing of passive and active infrastructure, without regulatory obligation, further reducing operational costs, c) eliminating credit risk and cost of printing invoices by offering pre-paid service, d) catering to variable incomes of the poor by enabling extremely small re-charge amounts on pre-paid services (as low as USD 0.50 top-ups) and e) even eliminating scratch cards used for topping-up pre-paid services by moving to electronic re-charge, saving more costs. This business model is characterized by extremely high network utilization and low Average Revenue per User (ARPU) and has enabled those at the bottom of

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[72] "New Generation: Sri Lanka's Dialog Telekom launches first commercial 3G service in South Asia." Lanka Business Online. August, 15, 2006
http://www.lankabusinessonline.com/fullstory.php?newsID=628473154&no_view=1&SEARCH_TERM=5

the socio-economic pyramid to become mobile voice and SMS users.[73]

The same model is now being extended to mobile broadband. Faced with high competition in voice, operators are moving to other services, and data is the first target. While many rich or some middle classes households may have access to copper wire (and therefore ability to get ADSL connections), most other do households do not. Therefore wireless is the only option for many. Operators are meeting the demand with reasonably priced HSDPA dongles (at under USD 50 per dongle) and data plans (unlimited plans ranging from USD 4 to USD 27 per month). By enabling pre-paid top-ups, operators are eliminating the need for a monthly contract, further removing barriers to entry by those on low or irregular incomes. And by targeting students (e.g. Dialog offered them HSPA dongle and package discounts of up to 50% in the early days) they have managed to capture early adopters.

Sri Lanka has also traditionally been a leader in mobile telephony in South Asia and often the first to launch innovative new networks and applications. Dialog was the first 3G operator in South Asia and Mobitel the first 3.5G. This trend continues today – HSPA was first launched in South Asia by Dialog and Mobitel was first with HSDPA and HSUPA. At least 2 operators are running LTE trials at the time of writing, with plans to invest and launch LTE within 1 – 2 years. The mobile operators are on a constant innovative cycle, by matching each other's investments into faster, more cost-efficient technologies in each iteration.

6.1.3 Creating the ecosystem: e-Sri Lanka

We highlighted earlier the *e-Sri Lanka* initiative funded by the World Bank, Government of Sri Lanka and several other agencies. As an integrated, cross-sector ICT-enabled development program, *e-Sri Lanka* created extremely high expectations in the country. Seven years after it started, a number of the projects are still being implemented and others have been abandoned. However, most stakeholders agree that the impact

of *e-Sri Lanka* is not in the individual pieces, but rather the holistic eco-system it envisioned, and that even activities that are as-yet-completed contribute to that eco-system and general sense of "excitement" about ICTs created by the program.

6.1.4 Tax relief

Sri Lankan consumers have been plagued with high taxes on their telephone bills. Given the ease of collecting taxes through the telecom operators, it was common for the government to impose a variety of taxes, and sometimes taxes on taxes, on phone services, both mobile and fixed (besides VAT, a Nation Building Tax, an Environment Levy, etc.). As a result, Sri Lankan consumers were paying roughly 31% tax on their phone bills. This is in addition to the corporate taxes (and other levies such as spectrum fees) paid by the operators themselves. In November 2010[74], the government made drastic changes to the tax structure and, effective from 2011 imposed a reduced, flat tax of around 20% on phone consumers. This was a laudatory action – now instead of only getting browsing-time of 70 rupees on every 100 spent, consumers get 80 rupees of browsing-time (operators do not think the reduced taxes would result in the consumers reducing the total amount they spend each month). It is hoped that this will increase consumption of mobile services including mobile broadband.

6.2 Challenges

Though Sri Lanka has achieved much and looks poised to continue its growth, operators face major competitive challenges and there are several areas of regulatory concern.

6.2.1 Reaching the mass market

Compared to fixed, mobile broadband is enjoying high growth in Sri Lanka. However, unlike mobile voice (which enjoys 82% SIM penetration), mobile broadband reaches far less than 10% penetration (counting all types of terminal devices – phones ("small screens") to computers ("big screens")[75]). LIRNE*asia* (2008[76]) shows that over

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[73] Samarajiva, R. Leveraging the budget telecom network business model to bring broadband to the people, *Information Technology and International Development, 6, special issue*: 93-97. http://itidjournal.org/itid/article/viewFile/630/270

[74] 2011 budget speech at http://www.news.lk/category-table/16732-salient-features-of-the-budget-2011
[75] The distinction is important because big screen users generate higher revenue for operator through higher consumption.

88% of Sri Lanka's poorest citizens (those at the bottom of socio-economic Pyramid (BoP)) in both urban and rural areas are telephone users (primarily mobile phone). 73% of the BoP also owned a phone (again, primarily a mobile phone). However the same survey shows that only 3.2% of the BoP had used the Internet, that 74% had heard of the internet but never used it and worse yet that 23% had never heard of the internet.

Mobile broadband has a long way to become a mass-market technology in Sri Lanka. The industry claims that 10% – 15% penetration of big screen mobile broadband – i.e. a mobile internet dongle connected to a computer- is possible at current prices without too much effort. Up to that point the mobile operators are still serving mostly early adopters, or those who do not need much convincing about the utility of high speed Internet access (i.e., those that are already aware of the Internet, use it at the office, probably have the funds to even get an ADSL connection to their home, and need a mobile dongle for convenience or personal use). But after that market is saturated (which will happen soon), a truly "new" market, of users who are not convinced about the utility of broadband has to be reached. This will eventually include those at the BoP with low ability to pay. But with prices already relatively low ("unlimited" packages range from USD 4.50 – 27[77], depending on when the Fair Usage Policy (FUP) becomes active[78] with majority of users spending around USD 10 per month; or limited pre-paid broadband is about USD 3 per GB[79]), there is likely not too much room for prices to continue dropping. Operators worry that increased mobile broadband competition will result in behavior similar to that in the mobile voice space where price reductions

were so drastic that operators requested regulatory intervention (in the form of floor prices for interconnection), claiming that their viability was threatened. Even if this does not happen, EBITDA margins for mobile broadband is already low, making it harder to justify the investment needed to move to 4G island-wide.

Even if the operators can continue with these margins and invest, the bigger question of reaching untapped markets or having to "create" the market (of those as yet unconvinced about the utility of broadband) is the true challenge for the sector. According to some operators, not only is the utility something users need be educated about, but fear of the negative impacts of the Internet is also a barrier that has to be crossed.

It appears that operators are already acting. For example, the days of "unlimited" data packages are gone. Now the operators are clearly advertising FUPs or publishing the additional charges when the monthly data limit is reached. Others are offering "minute-based" plans – i.e., pre-paid plans where the users buy credit and are then able to use the Internet for a certain number of hours or minutes. This is because it has been shown that for an average pre-paid user, the minutes spent online is easier to keep track of and make more "sense" of than how much data was downloaded. Some operators are willing to engage in rural awareness building, and to offer mobile broadband dongles that come pre-loaded with content-screening software (with parental controls for what content is viewable, for example) and they think this will help bring some reluctant users into the market.

6.2.2 The language barrier
Sri Lanka uses three languages – Sinhalese, Tamil and English. The majority of Internet traffic is for content hosted overseas, in the English language. Except for government websites and several newspapers, there isn't sufficient local content in local languages; certainly not content that is dynamic and varied, in the way English content is. Tamil content (though not Sri Lanka specific content) is at least widely accessible on the Internet thanks to the presence of the large Tamil-speaking population in South India. There is of course a blossoming Sinhala language blogosphere in Sri Lanka – however the readers and bloggers

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[76] Published reference to LIRNEasia's T@BOP data that contains these data points, if possible. If not reference to slide-set online.

[77] February 2011 prices for Dialog Axiata, largest mobile operator (http://www.dialog.lk/personal/broadband/hspa/packages/unlimited-postpaid-broadband/)

[78] Unlimited packages have a Fair User Policy (FUP). Once a user reaches a certain download/upload limit per month, the service quality downgrades (speeds slows down), but no extra amount is changed. This is differentiated from packages that charge additional fees for additional downloading.

[79] LIRNE*asia* (20xx). *Broadband Benchmarks Emerging Asia, February 2010.* http://lirneasia.net/wp-content/uploads/2010/03/LIRNEasia-Broadband-prices-EmergingAsia-Feb-2010.pdf

International: Download speeds (kbps) per dollar

Legend:
- Sirius (256 kbps) Dhaka, BD
- Dialog (2 Mbps) Colombo, LK
- SLT (2 Mbps) Colombo, LK
- SLT (512 kbps) Colombo, LK
- Bell (6 Mbps) Ottawa, CA
- Rogers (10 Mbps) Ottawa, CA
- Verizon (3 Mbps) Buffalo, US
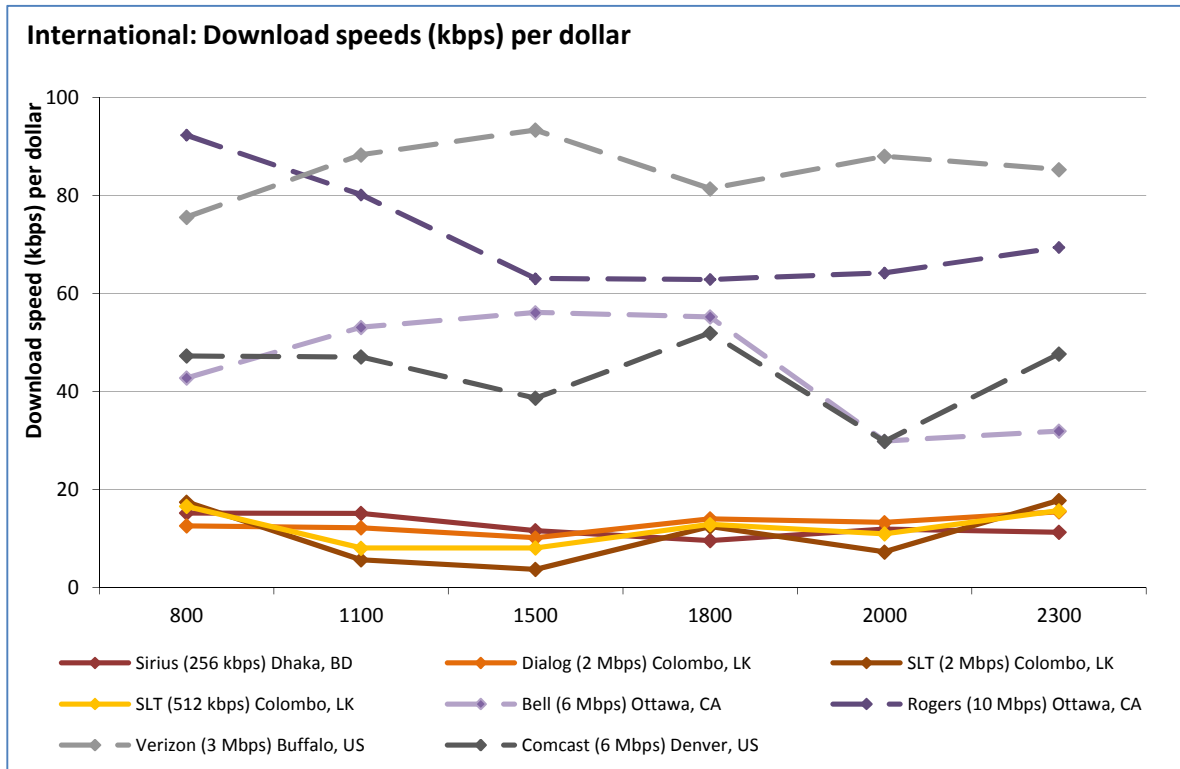- Comcast (6 Mbps) Denver, US

Figure 12: Actual download speeds (kbps) per US$, 2009 (Source: LIRNEasia)

are often the young and educated and many could read English content anyway. There are few websites other than newspaper sites for a Sinhala-only speaker, or a Tamil-only speaker who wants locally relevant content. As a result, the non-English-speaking citizenry appear to be kept out of the Internet.

This key challenge has to be addressed if the operators are to move beyond the low penetration levels they currently have in mobile broadband. The technical groundwork has been laid with the adoption Unicode Sinhala fonts.

On the other hand, one could argue that the language barrier is increasingly insignificant – even children of some non-English speaking parents are conducting their basic education in English as a result of the government introducing the option of English medium education. This is the generation that will drive Internet adoption (by convincing their parents to purchase Internet subscriptions). Therefore perhaps over time the importance of local language sites may become less important.

6.2.3 Regulating broadband quality

The budget telecom business model yields exactly what the name implies – low prices, but also low quality. Actual throughput delivered to the user is less than what is promised. Compared to users in North America, Sri Lankan broadband users receive less value for their money (as measured by actual experienced throughput per USD spent) as seen in Figure 12.

The quality of service issue has caught the attention of the TRCSL since 2010. It now carries out its own tests and is about to enact regulation regarding minimum quality standards. One form the regulation may take is setting a *minimum* speed that must be met at all times at all locations. This is technically possible on a mobile network – the operator has to add extra capacity so that the required speed is experienced at all times, irrespective of whether 1 user or 500 users are connected. However the result would be an expensive network that provides optimum performance. This is not feasible for networks that are run to optimize network load factors and keep costs to a minimum. Alternatives are needed. One possibility would be to require

average speeds (for the country or a particular geographic area) allowing operators to make the decisions on where to increase capacity to meet the average target. Light regulation could also be pursued where operators offer quality-differentiated pricing. There is sufficient competition in the market to encourage operators to differentiate themselves in such ways.

6.2.4 Special dispensation for the telecom sector

As noted, the government of Sri Lanka reduced the tax consumers pay on mobile services recently. At the same time, the government exempted the telecom operators from Value Added Tax (VAT). When this announcement was made suddenly, operators who had just ordered multi-million dollars worth of equipment were faced with a situation of not being able to claim back the VAT on their purchase. This is perhaps a one-time occurrence. However the broader question is why the telecom sector should be specially targeted (even in this "helpful" way, as deemed by the government). It seems that instead of giving the sector special favorable (or unfavorable) treatment in relation to other sectors, what's more appropriate is to provide a stable and predictable regulatory and policy regime. Given the high level of competition, most other issues would then be taken care of by the market.

6.3 Has Sri Lanka achieved enough, given favorable conditions?

Sri Lanka has an adult literacy rate of over 90%, and has benefitted from a strongly supported ICT4D program over the past seven years (*e-Sri Lanka*). Both Internet supply (through telecenters, national backbone networks, mobile broadband) and demand (through the development of e-government and other applications, creating awareness, capacity building) have been addressed as part of the *e-Sri Lanka* program. Therefore, it is reasonable to expect that Sri Lanka should achieve more in ICT connectivity and adoption than other developing countries that did not receive such targeted ICT funding and attention.

Vietnam provides a sharp contrast. In 2002, Sri Lanka and Vietnam had similar internet penetration rates. But between 2002 and 2009, Vietnam increased its Internet penetration by a factor of 14, while Sri Lanka only did so by 7. By 2009 Vietnam's intent penetration was more than twice as much as Sri Lanka's. In the World Economic Forum Network Readiness Index (NRI)[80], Vietnam's ranking was 17 spots below Sri Lanka in 2002; by 2009 Vietnam was 18 positions ahead. One would have also expected Sri Lanka to gain on its neighbors. But in 2009, Sri Lanka's NRI was behind India and just ahead of Pakistan.

Viewed in this light, it appears Sri Lanka should have been performing better, even with the toll of the 30-year ethnic war.

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[80] http://www.networkedreadiness.com

Sri Lanka has some ways to go to before it can be declared a broadband success story. It should be further ahead of the broadband adoption curve than it is today, given the favorable conditions it faced – a highly literate populace and a national level e-development program. However, it has made significant achievements, under less than ideal regulatory conditions and under less than stable socio-economic conditions including a prolonged ethnic conflict. And its mobile broadband has compensated for the somewhat lackluster fixed broadband performance - it is the best performer in mobile broadband compared to all its South Asian neighbors, many of who have more advantages in terms of larger markets (economies of scale) and better regulatory regimes. And the growth of mobile broadband doesn't appear to be slowing down anytime soon.

Best practice can be identified from Sri Lanka's successes and cautionary tales drawn from its failures. These are summarized as follows:

- **If nothing else, enable competition in the market by facilitating entry:** Sri Lanka is a poster child for what a competitive telecom market can achieve, even under less than ideal market-entry conditions. When enough players enter a country (certainly more than two, ideally more than three), disruptive competition takes place yielding business models that enable affordable mobile broadband, especially when voice revenues are declining.

- **Ensure that availability of spectrum is not a barrier:** Spectrum is the primary resource required for mobile broadband that is not within the control of the operators. The regulators should make this available early, and on a non-discriminatory basis, regardless of the allocation method. This is doubly important for developing nations, because most don't have wide-spread copper networks (or copper connections of sufficiently high quality to run xDSL).

- **Creating "the buzz" is as important as specific ICT4D projects**: *e-Sri Lanka*'s biggest contribution is arguably the enthusiasm and energy it created for ICT-

enabled development. This creates an eco-system of innovation and even energized the private sector into action (due to the threat of the government becoming a major player in the sector). Therefore if funds are limited, they are better spent on awareness building and promotion at the nationwide level, than on individual projects, which may or may not succeed.

- **The need for "Light touch regulation" in the early stages:** The approach to broadband QoS regulation that appears to be emerging in Sri Lanka is an example of the regulator attempting to do the right thing by the consumer (delivering good quality) at the expense of creating un-achievable targets for operators (regulation based on a guaranteed minimum speed per connection, instead of average speeds across the network or even average speeds for a local region. The former is achievable in the long term, of course. But in the in the immediate term, it's only achievable at great expense and the risk of not serving the poor).

- **Race to the bottom with prices, without growing the market is dangerous:** The natural response of Sri Lankan operators when faced with stagnant market-share has often been to slash prices. While this is good for consumers in the short term, lower prices that lead to lower profits that don't allow for investment hurts them in the long term. This is likely in the mobile broadband space, where penetration in the early adaptor and the top-of-the-pyramid consumer segments will reach saturation soon. Unless operators growth the market by breaking barriers and reaching the lower income groups (by creating local language content, addressing fears of safety on the Internet, providing more services through broadband connections and by increasing the perceived utility of a broadband connection), the industry could stagnate. The balance between lower prices and market growth has to be found by operators.

About *info*Dev

*info*Dev is a global development financing program among international development agencies, coordinated and served by an expert Secretariat housed at the World Bank Group, one of its key donors and founders. It acts as a neutral convener of dialogue—and as a coordinator of joint action among bilateral and multilateral donors—supporting global sharing of information on ICT for development (ICT4D), and helping to reduce duplication of efforts and investments. *info*Dev also forms partnerships with public and private sector organizations who are innovators in the field of ICT4D. *info*Dev is housed in the Financial and Private Sector Development (FPD) Vice Presidency of the World Bank Group.

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