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STRATEGIES FOR THE PROMOTION OF BROADBAND SERVICES AND INFRASTRUCTURE: A CASE STUDY ON SRI LANKA

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Strategies for the promotion of broadband services and infrastructure: a case study on Sri Lanka

September 2012

BROADBAND COMMISSION
FOR DIGITAL DEVELOPMENT

ITU

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It is part of a new series of ITU reports on broadband that are available online and free of charge at the Broadband Commission website: http://www.broadbandcommission.org/ and at the ITU Universe of Broadband portal: www.itu.int/broadband.

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Preface

The past twenty years have been an extraordinary time for the development of information and communication technologies (ICTs) – with the 'mobile miracle', we have brought the benefits of ICTs within reach of virtually all the world's people. Through its technical standardization and spectrum management work, ITU has been at the forefront of technological change and is today committed to continue to drive positive change in the ICT sector and beyond. It is now time to make the next step, and to ensure that everyone – wherever they live, and whatever their circumstances – has access to the benefits of broadband. This is not just about delivering connectivity for connectivity's sake, or even about giving people access to the undoubted benefits of social communications. It is about leveraging the power of broadband technologies, and especially mobile technologies, to make the world a better place.

In 2010, ITU, in conjunction with UNESCO, launched the Broadband Commission for Digital Development to boost the importance of broadband on the international policy agenda. The Commission believes that expanding broadband access in every country is key to accelerating progress towards these goals by the target date of 2015. The Commission is co-chaired by President Paul Kagame of Rwanda and Carlos Slim Helú, President of the Carlos Slim Foundation. Some 60 Broadband Commissioners representing governments, industry, academia and international agencies contribute the benefit of their insights and experience to the Commission's work. At the Broadband Leadership Summit held in October 2011 in Geneva, the Broadband Commission recognized broadband as a critical modern infrastructure contributing to economic growth and established four new targets for making broadband policy universal and for boosting affordability and broadband uptake. Innovative new models that promote competition, innovation and market growth are now needed to make the broadband opportunity reachable for all world citizens.

At ITU, the United Nations specialized agency for ICTs and telecommunications, we are committed to playing a leading role in the development of the digital economy through extending the benefits of advances in broadband and embracing the opportunities it unleashes. ITU's three Sectors – Radiocommunication, Standardization and Development – are working together to meet these challenges and our collective success will be a key factor in ensuring the provision of equitable broadband access throughout the world. This series of ITU Broadband Reports represent one tangible contribution towards this commitment.

Dr Hamadoun I.Touré

Secretary-General, ITU

Foreword

Broadband has become a key priority of the 21st Century, and I believe its transformative power as an enabler for economic and social growth makes it an essential tool for empowering people, creating an environment that nurtures the technological and service innovation, and triggering positive change in business processes as well as in society as a whole. Increased adoption and use of broadband in the next decade and beyond will be driven by the extent to which broadband-supported services and applications are not only made available to, but are also relevant and affordable for consumers. And while the benefits of broadband-enabled future are manifest, the broadband revolution has raised up new issues and challenges.

In light of these developments, ITU has launched a new series of ITU Broadband Reports in 2012. The first reports in the series focus on cutting edge policy, regulatory and economic aspects of broadband. Other related areas and themes will be covered by subsequent reports including market analysis, broadband infrastructure and implementation, and broadband-enabled applications. In addition, a series of case studies will complement the resources already made available by ITU to all its many different types of readers, but especially to ICT regulators and policy-makers.

This new series of reports is important for a number of reasons. First of all, the reports will focus on topical issues of special interest for developed and developing countries alike. Secondly, the various reports build on ITU's recognized expertise in the area augmented by regular feedback from its Membership. Last but not least, this series is important because it provides a meaningful contribution to the work of the Broadband Commission for Digital Development. The findings of the ITU Broadband Reports will trace paths towards the timely achievement of the ambitious but achievable goals set recently by the Commission as well as provide concrete guidelines. As broadband is a field that is growing very fast, we need to constantly build knowledge for our economies and societies to thrive and evolve into the future.

For these reasons, I am proud to inaugurate this first series of the ITU Broadband Reports and look forward to furthering ITU's work on the dynamic and exciting broadband ecosystem.

Brahima Sanou

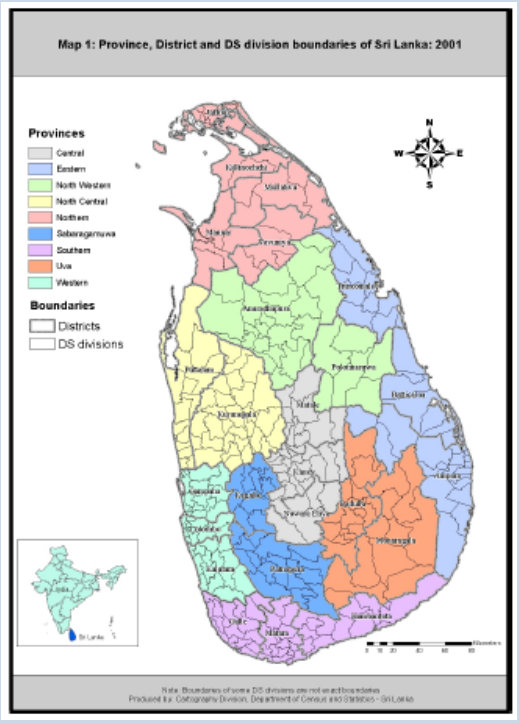
Director, ITU Telecommunication Development Bureau

1. Introduction

The Government recognized ICT and broadband as drivers and catalysts for economic growth and has taken many initiatives to boost ICT to fuel the local industry. This case study provides an insight to broadband development in Sri Lanka, examining the initiatives adopted and policies that are currently being developed. It also discusses the role of the agencies involved and regulatory measures taken by the regulator to foster broadband development in Sri Lanka.

The DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA is an island in the Indian Ocean situated off the southern tip of India, separated by a narrow strip of shallow water called the '*Palk Strait*'. Sri Lanka has a population of 20.28 million[1] spread over a land mass of approximately 65,600 square kms. For administrative purposes, Sri Lanka is divided into 9 Provinces and 25 Districts[2] (Figure 1).

Figure 1: Province, District and Divisional Secretariat division boundaries of Sri Lanka[3]



Source: Department of Census and Statistics.

Sri Lanka's major indices are described in Table 1 below.

[1] Provisional - as at 20th March, 2012 - Department of Census and Statistics - www.statistics.gov.lk
[2] http://www.statistics.gov.lk/GNcode/introduction.pdf
[3] http://www.statistics.gov.lk/misc/slmap.pdf

Table 1: Country Profile

Country Profile	
Area	65,610 sq km
Population (March, 2012)[4]	20,277,597
Urban Population (2002)	21.5%
GDP (2011)[5]	6,543 Rs. Billion (59.2 US $ Billion)
GDP per Capita (2011)[6]	Rs. 313,511 (2,836 US$)
Currency	Sri Lankan Rupee
Main Telephone Lines (March 2012)	
Fixed Line	3,616,411
Cellular Mobile	18,866,134
Public Payphones	6145
Tele-density (March 2012)	
Fixed Service	17.5
Mobile	91.3
Internet Subscribers (March 2012)	1,086,000
Broadband Internet Subscribers (Dec. 2011)	782,956

Source: Central Bank of Sri Lanka and TRCSL

Sri Lanka's Human Development Index (HDI) is 0.691 and is ranked 97[7] out of 187 countries with comparable data. The HDI values of South Asia as a region have increased from 0.356 in 1980 to 0.548 in 2012, placing Sri Lanka above the regional average.[8]

1.1. The ICT sector

The telecommunication sector in Sri Lanka was initially state-owned and run by the Department of Telecommunications. The Office of the Director General of Telecommunications (ODGT) was established as the regulatory body with the enactment of the Sri Lanka Telecommunications Act No. 25 of 1991[9]. Also in 1991 thereafter, the Department of Telecommunications was converted to a state-owned Corporation, the Sri Lanka Telecom Corporation. System Operator licences were also issued to several private operators to provide telecommunication facilities (such as data, mobile and payphone services), paving the way towards deregulation in Sri Lanka. The liberalization of the telecommunication industry was an important step towards developing the infrastructure to provide the country with a solid platform for economic and social growth. In 1996, the regulator - the Office of the Director General of Telecommunications, became the present Telecommunications Regulatory Commission of Sri Lanka

[4] www.statistics.gov.lk
[5] Annual Report 2011 - Central Bank of Sri Lanka
[6] Annual Report 2011 - Central Bank of Sri Lanka
[7] http://hdrstats.undp.org/en/countries/profiles/LKA.html
[8] http://hdrstats.undp.org/en/countries/profiles/LKA.html
[9] http://www.trc.gov.lk/images/pdf/ACT_25_1991.pdf

(TRCSL) under the Sri Lanka Telecommunications (Amendment) Act No 27 of 1996[10]. TRCSL is the organization responsible in regulating and monitoring the development of the telecommunications sector (including spectrum) and for ensuring market competition to be open, fair and effective. The Commission consists of five members: the Secretary of the Ministry (the Chairman), the Director General and three members who are distinguished persons in the field of law, finance and management. In 2005, the TRCSL was brought under the office of H. E. the President of Sri Lanka and hence the Secretary to H. E. the President functions as the Chairman.

In 1996, Sri Lanka Telecom was converted to a fully state-owned company, Sri Lanka Telecom Ltd (SLTL). SLTL's monopoly over fixed-line telephone service ended in 1996 with the issue of licences to two Wireless Local Loop (WLL) operators: namely, Suntel Ltd and Lanka Bell (Pvt) Ltd. In 2003 the exclusivity on international telephony ended with the issuance of External Gateway Operator (EGO) licences.

The Information and Communication Technology Agency (ICTA) was created by an Act of Parliament in 2003 as the ultimate body in charge of the implementation of ICT policy[11]. For example, the ICTA is responsible for implementation of the *e-Sri Lanka* initiative[12] which uses ICT to develop the economy, reduce poverty and improve the quality of life of all Sri Lanka's people. This vision will be realized through a strategy based on the following six programs:

- ICT Policy, Leadership, and Institutional Development;
- Information Infrastructure;
- Re-engineering Government;
- ICT Human Resource Development;
- ICT Investment and Private Sector Development; and
- E-Society.

The ICTA has activated projects such as the Government Information Centre (GIC), the Lanka Government Network (LGN), the Lanka Gate, the Lanka Government Cloud (LGC) and the e-Population Register some of which are discussed under policy initiatives. These ICT enabled development programs have created the need for broadband services.

1.2. The development of the telecommunication

Modern telecommunication infrastructure is a vital requirement for rapid economic and social development of the country. Sri Lanka is moving towards a fully liberalized telecommunications market environment. At present, there are three Fixed Access Operators[13], five Cellular Mobile Operators[14], six Data Communication Providers (Facility-based), nine Data and Internet Service Providers (Non-facility based) and 33 External Gateway Operators. The telecommunication sector consists of approximately 3.6 million fixed access subscribers, 18.9 million mobile cellular subscribers, 1.1 million Internet connections and 6145 public payphones spread across the country. The rapid expansion of cellular mobile services over the last ten years has contributed to a considerable growth in the telephone penetration.

[10] http://www.trc.gov.lk/images/pdf/ACT_27_1996.pdf
[11] www.icta.gov.lk
[12] http://www.icta.lk/en/e-sri-lanka.html
[13] Currently there are only three fixed operators. They are SLTL, Lankabell and Dialog Broadband. Suntel has merged with Dialog Broadband.
[14] Mobile Operators are Dialog, Mobitel, Etisalat, Hutch and Airtel.

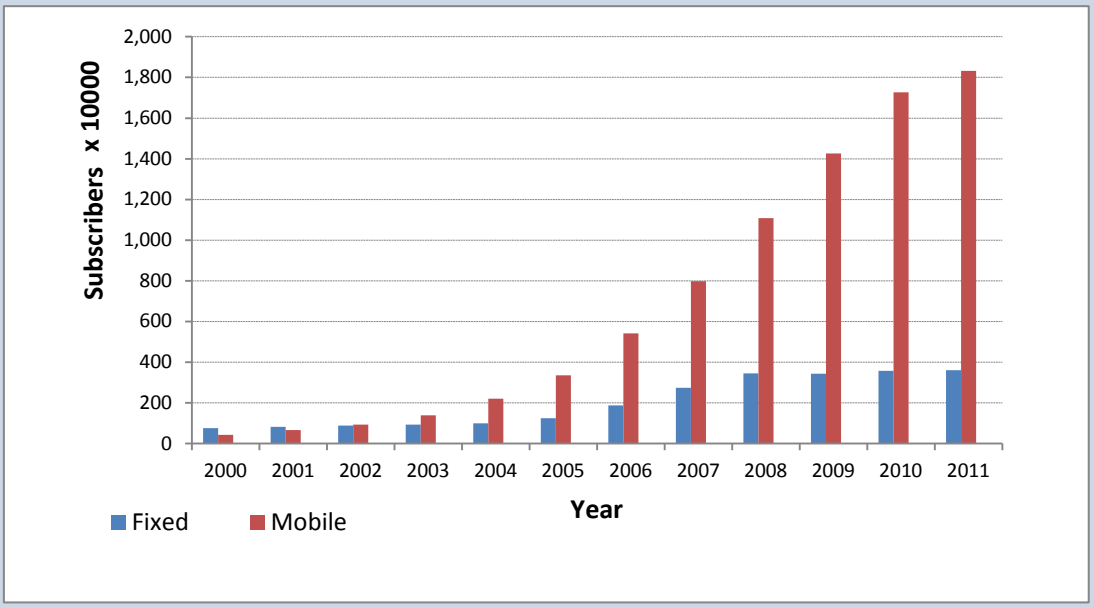
Considering the significant user benefits inherent to 3G systems, the Telecommunications Regulatory Commission of Sri Lanka (TRCSL) facilitated the introduction of the 3G mobile services on test frequencies for 3G in 2003 and on a commercial scale in 2006, becoming the first country in South Asia to offer 3G services. High-Speed Packet Access (HSPA) 3.5G systems were deployed on top of existing 3G networks, making Sri Lanka the first country in South Asia to offer 3.5G services.

In 2010 mobile operators have requested the 700MHz frequency band for Long-Term Evolution (LTE) technology, but it will not be available until TV broadcasting is digitalized. However, a 20MHz slot was allocated in the 2.6 GHz band to each operator for trial LTE Networks. According to the operators, tests were successful and some operators are testing further in the 1800MHz band already allocated to them. Free slots in the 1800MHz band are to be allocated by a closed bidding process to existing mobile operators.

In the technology continuum, Sri Lanka has been on par with the developed world embracing new and evolving technologies such as 3G, 3.5G HSPA, HSPA+ and now trial LTE networks, which are fast becoming relevant to the country.

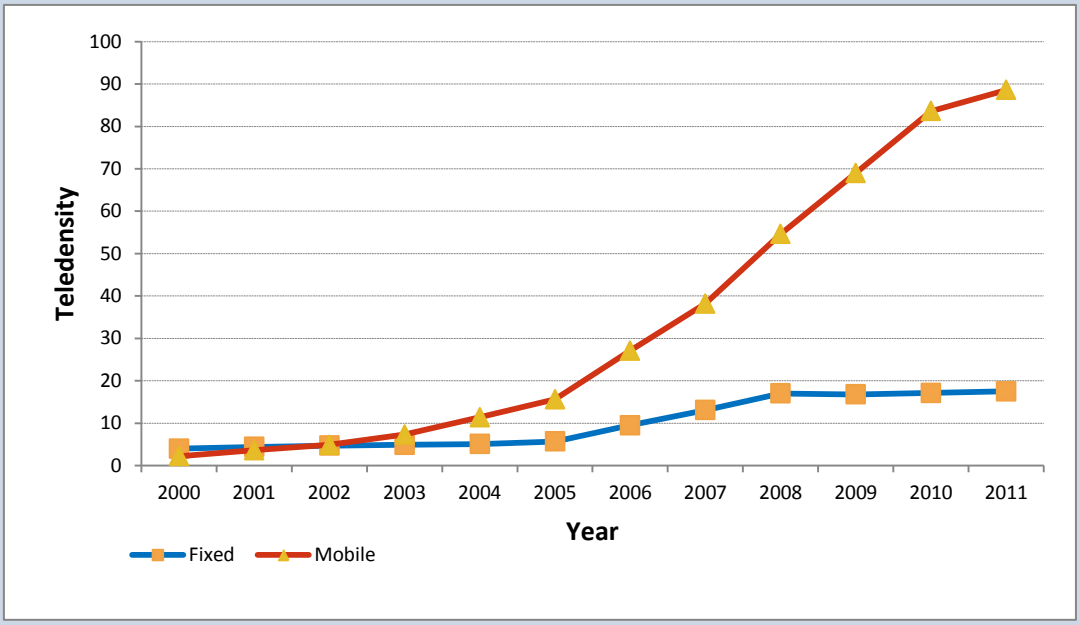
The growth of fixed and mobile cellular subscribers, teledensities and Internet subscribers are depicted in Figures 2, 3 and 4.

Figure 2: Performance of fixed and mobile access - telephone operators



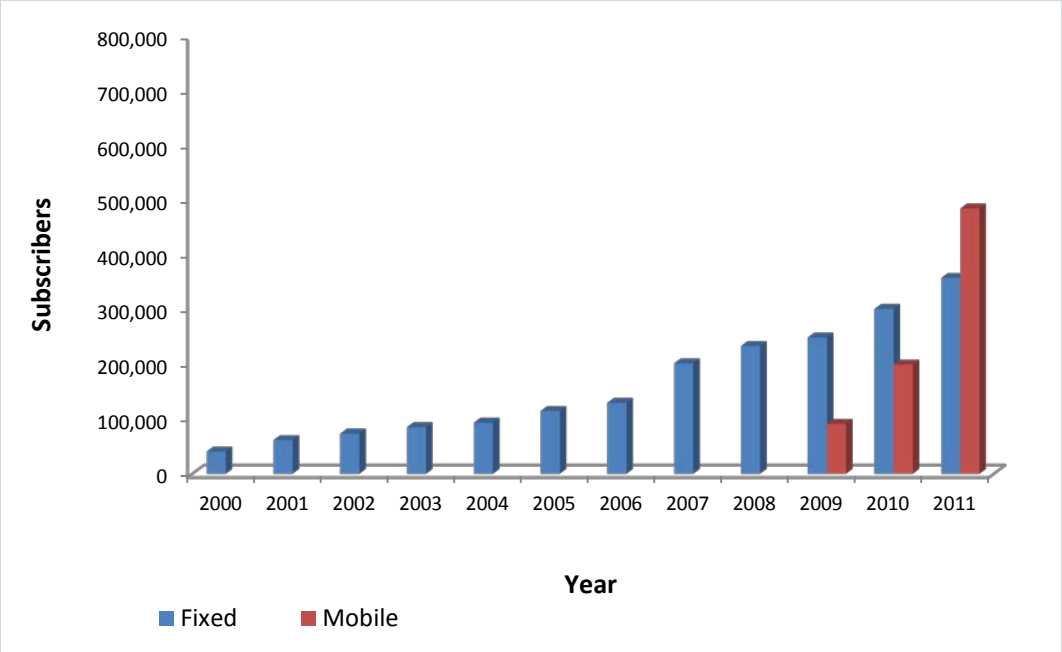
Source: TRCSL

Figure 3: Tele-density fixed and mobile



Source: TRCSL

Figure 4: Internet and Email Subscribers (Fixed and Mobile)



Source : TRCSL

Sri Lanka has international connectivity through two major submarine cable systems and there are three submarine cable landing stations. The major Submarine Cables are **S**outh-**E**ast **A**sia – **M**iddle **E**ast – **W**estern **E**urope (SEA-ME-WE) and the **F**iber-Optic **L**ink **A**round the **G**lobe (FLAG). Two landing stations are operated by SLT and the other by Lanka Bell. There is also connectivity through two regional submarine cables, Bharat Lanka and Dhiraagu.

Fiber has not been used widely in Sri Lanka and the majority of the fiber networks in the country are being used only for the purpose of transporting backhaul traffic. TRCSL has entrusted SLT to undertake the provision of broadband services for the implementation of a National fiber backbone network that can be shared by all operators. The first phase of this project is currently being implemented. No fiber to the home (FTTH) is available in the country to serve individual customers. Metro Ethernet services are available in the corporate sector and fiber to the building (FTTB) can be seen in areas where fiber is available.

2. Broadband Development in Sri Lanka

Broadband was introduced by the incumbent operator Sri Lanka Telecom (SLT) in 2003. In 2007, the second operator, Dialog Broadband Networks, joined the market. The new entrant chose wireless technology based on Worldwide Interoperability for Microwave Access (WiMAX) (IEEE 802.16d) to provide broadband services to subscribers, initially in urban areas.

In late 2007, mobile operators also joined the market to provide wireless broadband using 3G technology (HSPA). Mobile broadband services based on 3G HSPA have captured a significant share of the market within a short period of time. In 2012 Sri Lanka's mobile broadband (3G) market comprises five operators.

Table 2 below sets out the fixed and mobile operators providing broadband services and further information about the operators are set out in Annex 2.

Table 2: Broadband Operators and Technology

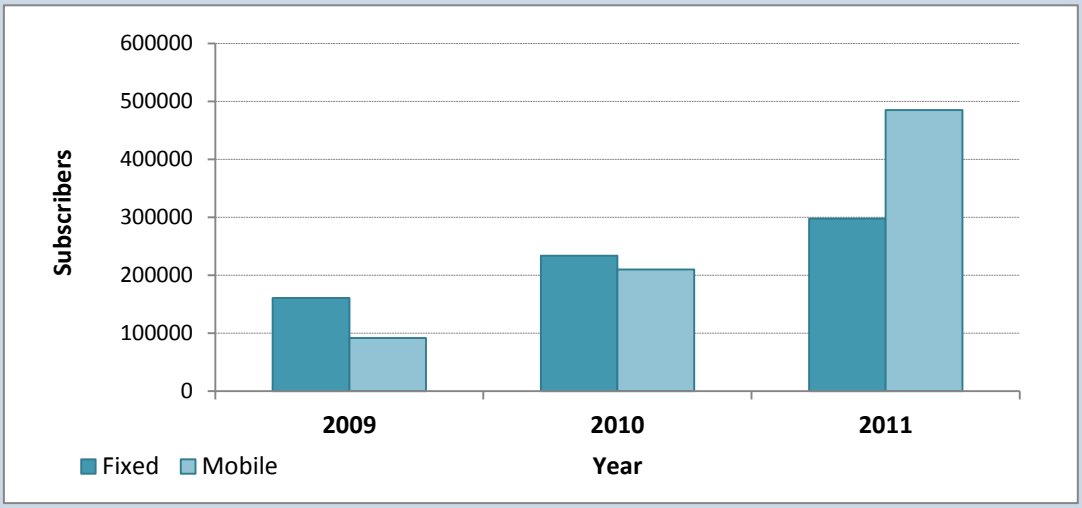
OPERATOR	TECHNOLOGY	MODE	MOBILE/FIXED
SLT	ADSL, ADSL2, ADSL2+	Wired	Fixed
LANKA BELL	CDMA2000/ WiMAX	Wireless	Fixed
DIALOG BROADBAND (DBN)	CDMA2000/ WiMAX	Wireless	Fixed
DIALOG MOBILE	GSM/W-CDMA		Mobile
MOBITEL	GSM/W-CDMA	Wireless	Mobile
ETISALAT	GSM/W-CDMA	Wireless	Mobile
AIRTEL	GSM/W-CDMA	Wireless	Mobile
SKY NETWORKS	WiMAX	Wireless	Fixed
HUTCHISON	GSM/W-CDMA	Wireless	Mobile

Note :
ADSL : Asymmetric digital subscriber line (ITU –T G.992.1)
ADSL2 : Asymmetric digital subscriber line 2 (ITU –T G.992.3 and ITU-T G.992.4)
ADSL2+: Asymmetric digital subscriber line 2 plus (ITU-T G.992.5)
CDMA2000: Code division multiple access 2000.
WiMAX: Worldwide Interoperability for Microwave Access (IEEE 802.16d)
GSM: Global system for mobile communications.
W-CDMA: Wideband code division multiple access.

Source: TRCSL.

WiMAX operators use the 2.365 – 2.4 GHz, 2.570 – 2.6 GHz and 3.4 – 3.6 GHz frequency bands. WiMAX (802.16d and 802.16e) technology has been used by operators to provide fixed wireless broadband. The growth of fixed and mobile broadband during the last three years is depicted in Figure 5 below.

Figure 5: Broadband Internet Subscribers: fixed and mobile subscribers

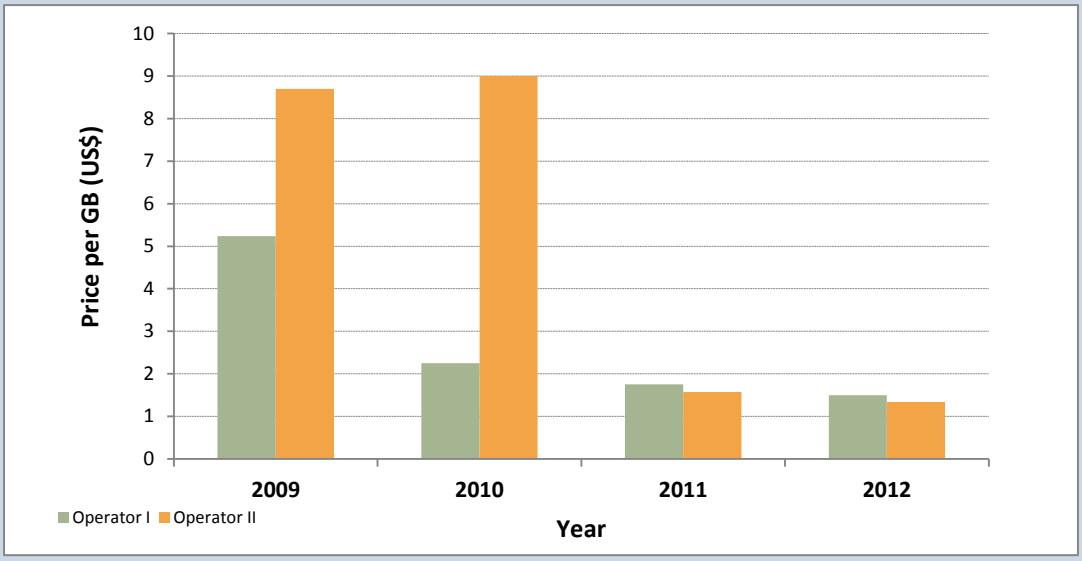


Source : TRCSL.

Since 2009, Sri Lanka experienced rapid mobile broadband growth, representing a fivefold increase to reach close to 500'000 mobile broadband subscribers at the end of 2011. Fixed broadband growth has been less impressive although the number of fixed broadband subscribers reached 300'000 subscriptions in 2011 up from more than 160'000 in 2009.

People previously on 512 kbps have been able to experience data speed up to 3.6 Mbps, with the introduction of HSPA service in 2007. Strong competition in 3G HSPA has driven the price per GB down drastically within a short period of time. These reductions in relation to two operators are depicted in the Figure 6 below:

Figure 6: Price reduction of mobile broadband



Source: TRCSL

As a result of stiff competition among mobile broadband operators price of mobile broadband had dropped drastically to a very low level and at present is as follows (Table 3).

Table 3: Price of mobile broadband services

Speed	Data Capacity	Price
7.2Mbps	**3GB**	**3 US$**

Source: TRCSL

Fixed broadband tariffs remained relatively unchanged for a long time period until 2010, due to poor competition and technical and cost differences in technologies. This could be observed in the data set out in Annex 3. Today, in ADSL speeds from 512kbps to 4Mbps can be obtained under different tariff plans as depicted in Table 4 below.

Table 4: Current Fixed broadband tariffs

512kbps	1Mbps	2Mbps	4Mbps
13 US$	**24 US$**	**44 US$**	**80 US$**
18GB	**22GB**	**35GB**	**60GB**

Source: TRCSL

3. Policy and regulatory Initiatives

The Government has recognized ICT and broadband as a drivers and catalyst for economic growth and has taken many initiatives to boost ICT to fuel the local industry. *e-Government* initiatives already in the pipeline, coupled with the growing take-up of general Internet usage, are expected to generate substantial demand for ICT infrastructure and connectivity. Another major objective of the Government is to elevate Sri Lanka to the level of a knowledge hub in the Asian region, the foundation of which is ICT and broadband connectivity.

Sri Lanka has been able to record a positive growth in key areas of ICT over recent years. During this period, the country's IT literacy rate has grown steadily, stimulating the development of ICT. This upward trend in ICT development in Sri Lanka is a clear indicator affirming the success of the plans and strategies adopted by the Government of Sri Lanka on its way to make Sri Lanka a digital wonder of Asia.

NGN is a reliable social infrastructure to deliver broadband applications. The development of NGNs and the regulatory and policy frameworks that enable their deployment are inextricably linked to a country's

national broadband policy[15]. Taking these factors in to consideration the TRCSL developed a NGN Policy and Regulatory framework and then a policy on broadband.

3.1. Development of a NGN Policy and Regulatory framework

The TRCSL published a public consultation paper on the "Policy and Regulatory Framework for Next Generation Networks (NGN)" on September 2010[16].

The objectives of this consultation paper were fourfold:

- To provide a general introduction to NGNs and the services that can be offered using these networks;
- To explain the potential benefits of the introduction of the NGNs and corresponding services in Sri Lanka.
- To provide some insight into the main technical, economic and regulatory issues that may need to be addressed in order to accommodate the migration to and adoption of NGN, while protecting the interest of Sri Lankan customers.
- To obtain the views and the comments of the stakeholders with a view to formulate the NGN policy and regulatory framework.

TRCSL sought the views and comments from all stakeholders on the issues raised by this consultation paper, and received eight responses.[17] The report incorporating a summary of all responses was published by the regulator on February 2011.[18]

The Policy and Regulatory Framework has been prepared taking into consideration the stakeholders' consultation. One of the key recommendations of this framework is to appoint an NGN advisory committee comprising key stakeholders including fixed, mobile and data service providers to advise the regulator on interconnection and standards, naming and addressing, security and universal service obligations.

The other recommendations include the issue of public consultation documents for the following topics:

- Asymmetric regulation and wholesale access
- Universal service obligations
- Addressing and numbering
- Mobile number portability

The TRCSL is also considering undertaking the following studies:

- Implementation of a not-for-profit Internet Exchange Point (IXP)
- Spectrum management reform, considering LTE spectrum requirements and digital dividend
- USO program in collaboration with consumer associations and the NGN advisory committee
- Consumer-protection framework in collaboration with consumer associations

Further in order to renew the current operator licences which are due to expire the TRCSL will:

- Validate the recommendations to be included in the new licences
- Decide what framework would be feasible to implement these new licences

[15] http://www.itu.int/net/pressoffice/backgrounders/general/pdf/5.pdf
[16] http://www.trc.gov.lk/images/pdf/NGN_Ppolicy_&_Regulatory_Framework.pdf
[17] http://www.trc.gov.lk/press-room/public-notice/199-public-consultation-.html
[18] http://www.trc.gov.lk/images/pdf/TRCSL_Repoet_on_Public_Consultation_on_NGN.pdf

- Implement the framework in a relatively short timescale (six months) which will be challenging and will require significant legal support

The NGN Policy and Regulatory framework will be submitted by the regulator as policy advice to the Government and once approved will be implemented in the 4th quarter of 2012.

3.2. Sri Lanka's National Broadband Policy

TRCSL is now ready to focus on policies, standardization and broadband deployment plans to boost broadband penetration in Sri Lanka, especially in underserved areas, while encouraging investments directly in broadband deployment.[19] Barriers to the development of broadband include the removal of red tape faced by the operators in the process of deploying broadband services.

In the next phase, priority will be given to deploy high-speed broadband services with greater bandwidth capacities. The TRCSL will provide guidance and encourage operators to deploy fiber networks right up to the customer premises using alternative and cost effective methods. The TRCSL is expecting Sri Lanka's first Fiber to the Home (FTTH) network to commence its operations in Sri Lanka in 2012, with speed up to 25Mbps.

Having identified the importance of high-speed broadband (HSBB) and impediments which hamper its growth, a draft National Broadband Policy has been prepared to overcome obstacles and stimulate broadband development. The Policy provides guidance to stakeholders including Government, industry operators and broadband users to develop broadband in key application areas where broadband is used to provide services to the public.

The main focus of the Policy is to develop Sri Lanka's telecommunication infrastructure facilities to support the delivery of high-speed broadband services. In this regard, a number of steps have been proposed in the Policy. The policy includes a national definition, and conditions to create a level playing field for the operators and technological standards. To encourage stakeholders to deploy high-speed broadband services in underserved areas where Returns on Investment (ROI) would be low, special subsidies and tax incentives are proposed in the Policy. It also has provision to promote broadband in schools and other educational institutions while encouraging distance learning program development. Alternative technologies to take broadband to the rural communities have also been considered.

The TRCSL anticipates filling the longstanding vacuum in the data communication sector in Sri Lanka through the National Broadband Policy. The Policy is expected to be released during the fourth quarter of 2012.

3.3. Regulatory initiatives

3.3.1 Quality of Service (QoS) Measurements[20]

Having realized the importance of high-speed broadband, TRCSL commenced its broadband initiative in 2010 to develop high-speed broadband services in Sri Lanka and to increase its usage. The Government of

[19] "TRCSL to gear up next phase of broadband development": Sanath Siriwardena - Consultant TRCSL http://www.dailynews.lk/2012/04/26/bus35.asp

[20] The information relating to the broadband initiative is available at : http://www.trc.gov.lk/broadband/broadband-initiative.html

Sri Lanka decided to formulate a National Policy for High-Speed Broadband (HSBB) Internet. However, prior to the drafting of the National Broadband Policy (NBP), the TRCSL has embarked on a study to evaluate the status of the broadband in Sri Lanka

Preliminary studies had revealed that the quality of service (QoS) and rates paid by the subscribers monthly for broadband services are the two major obstacles requiring the attention of the TRCSL. Fixed broadband services associated with low download speeds and high monthly rentals have been recognized as barriers to the development of broadband in Sri Lanka. From the perspective of fixed broadband, little or no competition and the lack of regulatory intervention have been the main reasons for limited take-up.

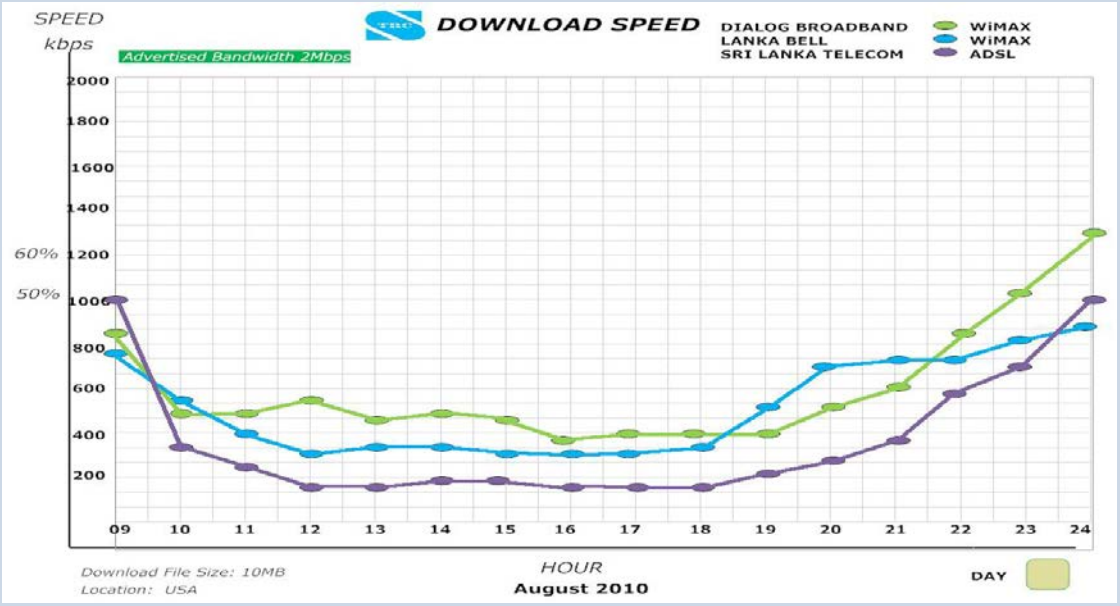
Speed is the undercurrent which driving broadband forward. Higher bandwidth capacities and support of multifunctional operations have contributed much to the spread of high-speed broadband services around the world. Therefore, speed is a priority for the telecom regulators. Inadequate or degraded broadband services would cause retardation in usage, due to loss of confidence among users about its potential.

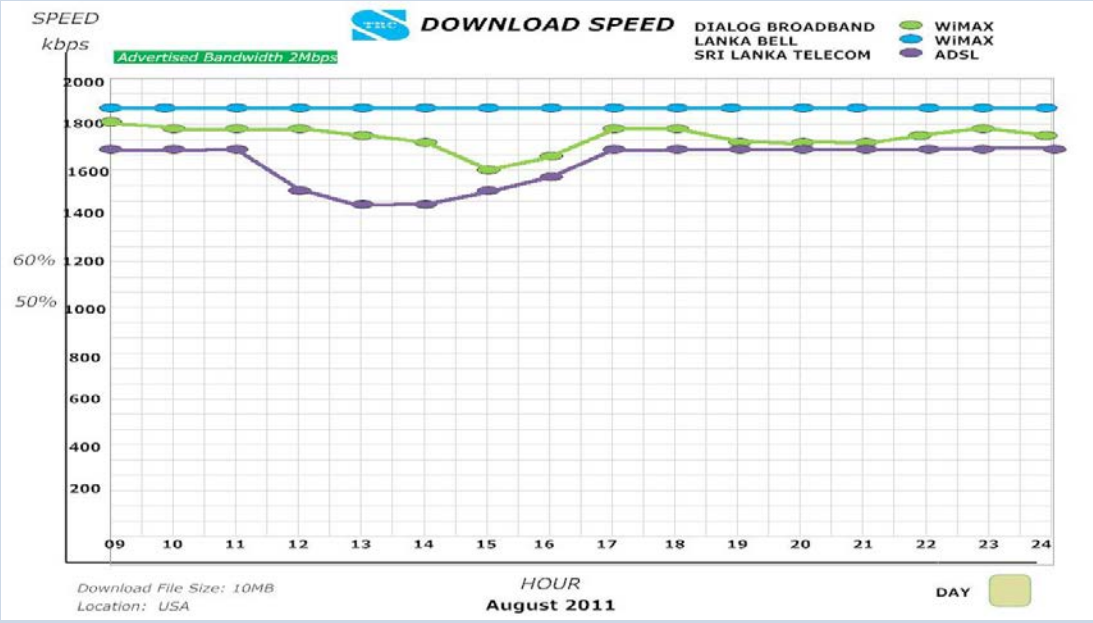
However, the availability of fixed broadband services is vital for the growth of broadband. To fulfill demands set up by certain applications - especially on the bandwidth - fixed services with acceptable QoS are needed at an affordable price. So TRCSL had to face three challenges: to increase competition, improve QoS and reduce prices in fixed broadband services.

As a strategic measure, TRCSL began monitoring broadband QoS in late 2010. A unit has been established especially for this purpose with sophisticated equipment to monitor the speeds of broadband services, which publishes its findings regularly to raise public awareness (Figure 7).

Subsequently, to allow other operators to improve their QoS, the incumbent's submarine cable landing station charges have also been reduced through discussions with operators. Figure 7 shows the QoS measurements carried out by the TRCSL broadband unit in August 2010 and August 2011 respectively – a significant improvement in quality of service is clearly visible.

Figure 7: QoS Measurements carried out by TRCSL



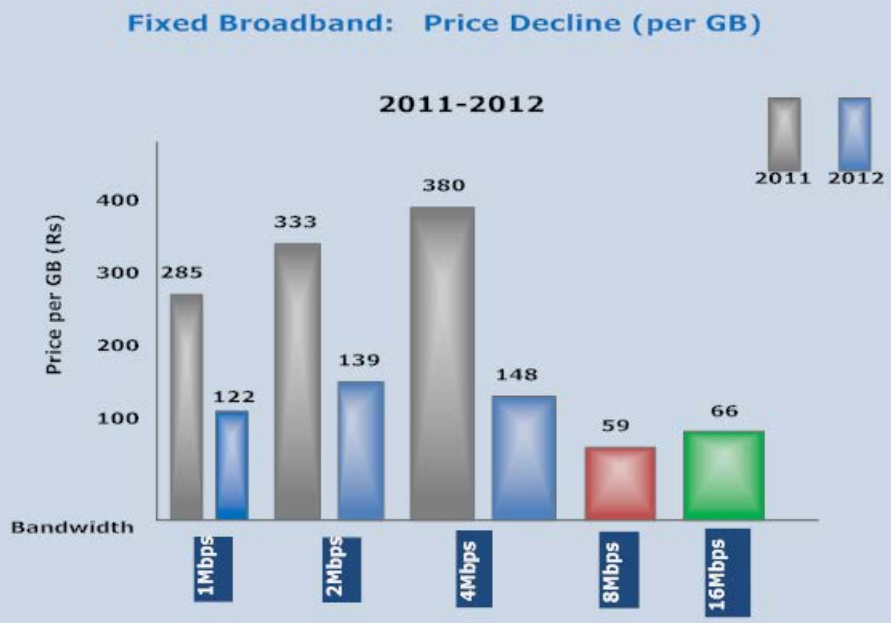


Source: TRCSL

Operators in Asia-Pacific would struggle to deliver an unlimited broadband service to customers with an acceptable QoS with limited network resources. Previously, service providers offered packages with the "unlimited" marketing tagline to attract customers, but they in fact provided very low speeds of data transfer. QoS improvements have influenced operators to adopt traffic policies and introduce new packages to the market with pre-allocated data volumes to manage their network resources, instead of continuing with so-called 'unlimited' packages capable of downloading any amount of data. The TRCSL has foreseen the importance of introducing such traffic policies (with pre-allocated data volumes) as vital for sustainable broadband operations. . As of 2012, the volume based packages has not only reduced the price per GB (Figure 8), but increased the bandwidth of fixed broadband services. Subsequently, the entry-level price has fallen to approximately 1500 rupees per month for speeds of up to 8 Mbps.

However, packages with greater data volume capacities cost more compared to other countries in the region. The TRCSL anticipates a price drop in packages with greater volume capacities as the market matures.

Figure 8: Price drop in fixed broadband service



Source: TRCSL

3.4. e-Sri Lanka Initiative

Some of the programs under the *e-Sri Lanka* initiative which has created the need for broadband are described below:

- The *Nenasala Project* [21] is one of the projects implemented under the above Initiative by ICTA. It aims to provide ICT facilities for rural primary schools throughout the country. Telecentres or knowledge centres have been established in all parts of Sri-Lanka to spread ICT services to rural and semi-urban populations. The project aims to provide infrastructure to address the ICT needs of rural areas through the establishment of telecenters for the provision of ICT-based services in all parts of the country. There are 676 Nenasala Centers spread throughout the country.
- The creation of an enabling environment through legislation and regulatory reform for e-government and e-commerce.
- The objective of the Lanka Government Network (LGN) [22] is to provide the necessary infrastructure to connect government organizations and local bodies. Some of the major benefits of this project are to enable a connected government and access to government services for

[21] . http://www.nanasala.lk/

[22] http://www.icta.lk/en/programmes/i-infrastructure/75-projects/programmes/re-engineering-government/131-main-projects/240-lanka-government-network-project-lgn.html

citizens. The Policy and Procedures for ICT usage in Governement (*e –Governement* Policy) was approved on December 2009.

- The objective of the *Lanka Gate* [23]is the provision of on line information and services relating to Sri Lanka. This will result in ease of access of information and services and reduced transaction costs for citizens.
- The development of human resources at different levels to support national development.

4. Financing of Broadband Deployment

4.1. Telecommunications Development Charges Fund (TDC)

Every International operator has to pay an international telecommunications operator levy (ITO Levy) to the TRCSL in respect of every incoming international call terminated within Sri Lanka with effect from 3rd March 2003. A defined percentage of this levy is considered as a Telecom Development Charge (TDC) which is paid by the operator directly to the TRCSL. Each operator may claim up to two thirds of the funds paid by him to the TDC within a period of three years for telecommunication network development in underserved and un-served areas as determined by the Commission. Guidelines for the disbursement of the TDC fund were formulated by the TRCSL to be utilized exclusively for meeting Universal Service Obligations.

Already financial support for infrastructure under the TDC fund has been provided as subsidy support for setting up of 9 hundred and 9 towers in 23 districts spread over 9 provinces for mobile and fixed wireless services in specified rural and remote areas where there were inadequate existing fixed wireless and mobile coverage. The infrastructure so created is shared by operators. The TRCSL has disbursed Rs million 3457 (approx. 31.42 US$ million) from March 2003 to March 2008. The Commission is in the process of finalizing the disbursement for the period 2008-2009 and is scheduled to disburse up to Rs 2326 million (approx. 21.14 US$ million). The infrastructure support under the TDC has resulted in the use of such infrastructure for the development of broadband services. For the installation of rural household telephone connections during March 2003 to March 2008 the Commission has disbursed a subsidy of Rs 2563 Million (approx. US$ 23.3Million) from this fund. The disbursements from the TDC fund for 2008/09 for fixed domestic PSTN operators are expected to be approx. Rs 177 million (US $ 1.6 million).

4.2. Connect a School, Connect a Community initiative

The International Telecommunication Union (ITU) and the Telecom Regulatory Commission of Sri Lanka (TRCSL) inaugurated a project to connect 25 schools in Akuressa in the Southern Province of Sri Lanka on May 2011. Under the *"Connect a School, Connect a Community"*[24] initiative, ICT tools such as computers and printers and Internet connectivity have been provided. Using a public-private-people's partnership (4Ps) model, telecommunication operators and NGOs have joined the project as partners to provide access to education through ICTs in rural schools, some of which are located in remote communities. This project aims to transform these schools into connected community ICT centres.

[23] http://www.icta.lk/index.php/en/programmes/re-engineering-government/131-main-projects/556-the-lanka-gate-initiative

[24] https://itunews.itu.int/En/1979-Connect-a-School-Connect-a-Community.note.aspx

Figure 9: Inauguration of the "Connect a School, Connect a Community" Program

Source: TRCSL

This project demonstrates that the challenges of funding, implementation and sustainability can be overcome by creating a broad and sustainable public-private-people's partnership.

The project is already attracting more investment in connecting schools within Sri Lanka. Its success has raised the awareness of the Ministry of Education about the importance of the use of ICT in schools. Recently, the Education Minister quadrupled investments in connecting project schools and the school principals have also sought ways to increase their ICT facilities. The successful implementation of this project encouraged ITU to select Sri Lanka as one the five beneficiary countries to receive assistance. Under this project in partnership with TRCSL, local telecommunication operators and NGOs, a computer laboratory and broadband connectivity will be provided to one identified school in each of the 21 Districts selected throughout the country.

4.3. Provision of ICT facilities to Disabled and Marginalized Groups

TRCSL started a project in 2005 called "*eNABLE*" to provide ICT facilities for the empowerment and development of disabled and marginalized groups in Sri Lanka.[25] [26] The major funding is by the TRCSL and telecommunication operators have provided support for free tariff packages for a limited time period, as well as dongles and connectivity as a part of their licence conditions and corporate social responsibility. This project has also received considerable assistance from the ITU, whereby much-needed equipment (such as Braille Printers, FM hearing systems, ICT equipment and broadband connectivity) has been provided to these communities.

Through the e-Nable project TRCSL has been able to introduce/ develop ICTs in ninety eight schools, thirty eight Vocational training institutes, three Universities for disabled persons and forty Ranaviru villages (disabled soldier communities).

[25] "Addressing the Special Needs of Citizens with Disabilities through ICTs: The Case of Sri Lanka"- A presentation made at the "ITU Asia-Pacific Regional Forum on Digital Inclusion for All" Conference 21 – 23 June, 2011 http://www.itu.int/ITU-D/asp/CMS/Events/2011/DigitalInclusion/S6_Mohan_Jayasekera.pdf

[26] Sri Lanka's eNABLE Programme, - A presentation made at the "Asia-Pacific Regional Forum on Mainstreaming ICT Accessibility for Persons with Disabilities" 25-27 August Thailand http://www.itu.int/ITU-D/asp/CMS/Events/2009/PwDs/docs/Session-9-Jagath.pdf

Figure 10: ITU/ TRC Project ICTs for Disempowered/ Marginalized Communities

Source: TRCSL

Under another initiative the ITU and the National Information Society Agency (NIA) of the Republic of Korea are implementing a joint program on Korean IT Volunteers (KIV) 2012. Under the KIV program, invaluable training and cultural exchange have been made possible to some of these centres coming under the eNable project. This is an ongoing program which has been appreciated and enjoyed by the staff and students in these centres.[27]

Figure 11: NIA/ITU/TRCSL Korea It Volunteers Program - 2012

Source: TRCSL

4.4. Provision of ICT facilities to primary schools in rural areas

This program is an initiative of the Presidential Secretariat. Under this initiative ICT facilities and connectivity are provided to primary schools in rural and remote areas with a relatively small number of students. The funds for this project are met by the TRCSL under USO funds and the other partners of this project are the Education Ministry, and Ministry of Local Government and Provincial Councils.

[27] http://www.trc.gov.lk/component/content/article/46/279-korean-volunteers-to-provide-ict-training-in-sri-lanka.html

5. Lessons learned

The lessons learnt from the initiatives undertaken by the regulator include the following.

1. Early allocation of 3G spectrum by TRCSL paved the way for operators to introduce mobile broadband services.
2. The successful implementation of the projects by the ICTA such as the Nenasala, Government Information Centre (GIC), the Lanka Government Network (LGN), the Lanka Gate, the Lanka Government Cloud(LGC) and the e-Population Register amongst others have developed the ICT sector while creating the need for broadband services.
3. Gradual but momentous QoS improvement was recorded in fixed broadband operations soon after the TRCSL's broadband benchmarking process. Operators started to compete for higher speeds and have taken all efforts to be at the top of the graphs published by the regulator regularly over its website. Sri Lankan subscribers have been able to enjoy higher-speed broadband as a result of this action.
4. The TRCSL has introduced a smart mechanism to the broadband market segment by creating competition among operators. Introducing competition has not only reduced the price per GB, but increased the bandwidth of fixed broadband services successfully to a capacity exceeding 15 Mbps in the downlink. Subsequently, the entry level price has fallen approximately to rupees 1500 per month for speeds of up to 8Mbps. However, packages with greater data volume capacities cost more compared to other countries in the region. The TRCSL anticipates a price drop in packages with greater volume capacities, as the market matures.
5. The Akuressa project, the initiative by the Presidential Secretariat and the *e-Nable Project* is not only about the hardware and software needed to connect schools, but also about human resource development more broadly. Providing computers and Internet connectivity to rural schools fosters ICT literacy among students and enhances the quality of teaching. Computers with broadband access can serve as an effective platform for digital educational content, and ICT can be used to reduce the administrative burden on teachers. The new ICT facilities will enable teachers to teach their students more efficiently and creatively.
6. Under the Actions adopted at the World Summit on Information Society (WSIS) in 2003 to ensure one of the WSIS targets (*To connect all educational institutions by the target date of 2015),* the ITU *Connect a School, Connect a Community* initiative is designed to promote broadband Internet connectivity for schools so that schools can serve as community ICT centers with a particular focus on disadvantaged and vulnerable groups such as women and girls, indigenous peoples, persons with disabilities, youth and children. The successful implementation of the Akuressa project based on the 4P (Public-Private-People Partnership) model could act as a role model in implementing similar programs throughout the country.

6. Conclusions

In 2012, Sri Lanka's broadband market is enriched with cutting-edge technologies capable of serving customers at speeds of up to 16 Mbps. Wireline technologies based on Asymmetric Digital Subscriber Line (ADSL) broadband provide maximum speeds, while wireless mobile broadband services such as 3G HSPA are confined to speeds up to 7.2 Mbps.

Early allocation of 3G spectrum and the availability of low-cost access devices, competitive rates and wide coverage are seen as the reasons for the success of mobile broadband services in Sri Lanka.

Broadband is expected to further drive future industry growth, as current penetration is still very low. The increased affordability of device prices and broadband services and rapid growth in smartphones are expected to drive Internet penetration significantly over the next years.

The Government of Sri Lanka recognizes that Information Communication Technology (ICT) plays a key role in economic development. ICT is laying the foundations to transform Sri Lanka to a supplier of digital goods and services to the global market. Broadband is a carrier in modern electronic economic regimes for delivering the benefits of ICT to the society. Boosting broadband development has become essential for total ICT development. Therefore the Government has successfully implemented a number of programs and is also in the process of finalizing policies on broadband and NGNs to enhance broadband development and to share the benefits with all citizens including marginalized, disabled and disadvantaged groups.

Annex 1

Table 5: Performance of Fixed and Mobile Access Telephone Operators

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011
Fixed	939,013	991,239	1,243,994	1,884,076	2,742,059	3,446,411	3,435,958	3,578,463	3,608,392
Mobile	1,393,403	2,211,158	3,361,775	5,412,496	7,983,489	11,082,454	14,264,442	17,267,407	18,319,447
Total	2,332,416	3,202,397	4,605,769	7,296,572	10,725,548	14,528,865	17,700,400	20,845,870	21,927,839

Source: TRCSL

Table 6: Teledensity fixed and mobile

Year	Fixed	Mobile	Total
2000	4	2.2	6.2
2001	4.4	3.6	8
2002	4.7	4.9	9.6
2003	4.9	7.3	12.2
2004	5.1	11.4	16.6
2005	5.7	15.6	19.3
2006	9.5	27.1	36.7
2007	13.1	38.2	51.4
2008	17	54.6	71.6
2009	16.8	69	85.9
2010	17.12	83.62	100.74
2011	17.5	88.6	106.1

Source: TRCSL

Table 7: Internet and email subscribers (fixed and mobile)

Year	Fixed	Mobile
2000	40,497	/
2001	61,532	/
2002	73,468	/
2003	85,500*	/
2004	93,444*	/
2005	115,000*	/
2006	130,000*	/
2007	202,348*	/
2008	234,000*	/
2009	249,756*	91,359*
2010	302,000*	200,000*
2011	359,000*	485,000*

Source: TRCSL

Table 8: Broadband Internet Subscribers (fixed and mobile)

Year	Fixed	Mobile
2009	160657	91357
2010	233541	209946
2011	297791	485165

Source: TRCSL

Annex 2

Overview of ICT Market players

Sri Lanka Telecom PLC[28]

Sri Lanka Telecom, the incumbent, has built a modern ICT broadband network infrastructure throughout the nation to provide communication services to all people in all parts of the country. SLT provides broadband facilities through ADSL technology via its copper and optical fibre-based network. The company is in the process of replacing the microwave infrastructure in the core network with optical fibre facilitating seamless connectivity and enabling IP-MPLS technology to support multi-service offerings and value-added services.

During September 2011, SLT launched its ultra-high-speed Broadband Network under its nation-wide network modernization project, "*i-Sri Lanka*" in Jaffna. SLT is seeking to expand broadband across the country, by upgrading the existing copper-based access network with fibre optics. This enables users to enjoy consistent high-speed Internet services at speeds as high as 20 Mbps and more, allowing for private and business networking, interactive entertainment, distance learning, online education, and e-health at a higher speed, high quality and high reliability.

By 2012, SLT has enhanced broadband speeds to give users an improved experience in Internet usage across the country. Speeds of up to 16 Mbps have been introduced for users, four times faster than the existing broadband speeds, along with four new broadband packages. Better offers have been launched to provide opportunities for connectivity, communication and knowledge gathering for SLT broadband users spread across the country.

SLT provides amongst others telephone services (international and local), data transmission, maritime mobile, INMARSAT services, and international television transmission.

Lanka Bell Ltd[29]

Lanka Bell has invested US$ 25m in extending the FLAG cable network to Sri Lanka, becoming one of the two operators which operate cable landing stations and provide international connectivity. Lanka Bell owns and operates the Colombo Landing Station for the Falcon segment of the FLAG network, with a cable design capacity of 1.2 Terra bits (TB) per second. Lanka Bell has a cable design capacity of 1.2 TB and activated Internet capacity in excess of 2GB. Lanka Bell uses state-of-the-art WiMAX 802.16d, Frequency Division Duplex (FDD) (3.5 GHZ) technology as the access network, along with microwave and domestic fiber to extend high-speed/high-capacity Internet services to the corporate sector.

Lanka bell provides amongst others fixed basic telephony, data transmission and payphone.

Mobitel (Pvt) Ltd[30]

Mobitel was the first network in South Asia to launch GSM and EDGE and was also the first network in the regions to launch 3.5G HSPA in 2007. Having successfully trialed HSPA+ Multiple- Input and Multiple-Output (MIMO) in 2009 - another first in the region - Mobitel also successful trialled LTE successfully in May 2011 again for the first time in South Asia, delivering speeds of up to 100 and 50 Mbps in downlink and uplink respectively. With LTE's ability to interconnect with other access technologies, Mobitel will be

[28] Extracted from the information provided by Sri Lanka Telecom Ltd. relating to their operations.
[29] Extracted from the information provided by LankaBell relating to their operations.
[30] Extracted from the information provided by Mobitel relating to their operations.

able to converge with other operators such as fixed line broadband networks, creating the opportunity to deliver subscribers seamless communications services.

Mobitel provides mobile telephony and ISP.

Dialog Axiata PLC[31]

Dialog Axiata PLC (Dialog) started providing commercial broadband solutions as early as 2006, when it launched South Asia's first 3G networks. In 2008, during the height of the conflict in the North and the East, Dialog moved to invest in conflict areas, providing much-needed high-speed Internet access by being the first operator to provide 3G HSPA service in the North. The Dialog Group has had a significant impact on the spread and growth of broadband in Sri Lanka by providing viable, economical and robust services to both the retail and corporate customer base via mobile, fixed and satellite based solutions. Dialog recently launched a trial LTE network, becoming one of the first operators in South Asia to touch exposition of LTE services. Its trial 4G network has demonstrated delivery of over 100Mbit/s in indoor demonstration mode and 40 – 50 Mbit/s under outdoor mobile conditions.

Dialog's international gateway has a large global footprint, with access to all four cable landing in Sri Lanka (i.e., SEA-ME-WE3, SEA-ME-WE4, Bharat Lanka Cable and FLAG/WARF) with connections at three different cable landing stations (i.e., Mount Lavinia, Colombo Fort and Vauxhall Street) and connectivity to multiple Tier -1 IP providers at diverse locations, in order to provide optimal latency to each region. Dialog provides mobile telephony and ISP.

Dialog Broadband Networks (Private) Limited (DBN)[32]

Dialog Broadband Networks Limited (DBN), the fully privately-owned subsidiary of Dialog, provides broadband Internet through WiMAX.

DBN is also in the process of expanding its Wireless Fidelity (Wi-Fi) network islandwide, which currently consists of more than 500 Wi-Fi outdoor hotspots. DBN is also in the process of rolling out a fixed LTE network, enabling it to meet the demands of business customers. Fixed wireless operator Suntel Limited was acquired by Dialog and subsequently amalgamated with DBN.

DBN provides voice telephony service, data communication service, public payphone service and leased line service.

Etisalat Lanka (Private) Limited [33]

Mobile operator Etisalat launched 3.75G broadband services in May 2011. The latest technology to be deployed in Sri Lanka consists of a fully Internet Protocol (IP)-based backbone and a HSPA network with a bandwidth capability of up to 21 Mbps targeting key commercial cities.

Etisalat provides mobile telephony and ISP.

Bharati Airtel Lanka (Private) Ltd[33]

Bharati Airtel has deployed a HSPA+ network which supports a combination of 14Mbps and 21 Mbps data speeds. Bharati Airtel's 3G network is connected to international bandwidth through a state of the art

[31] Extracted from the information provided by Dialog Axiata PLC relating to their operations.
[32] Extracted from the information provided by Dialog Axiata PLC relating to their operations.
[33] Extracted from the information provided by Etisalat relating to their operations.
[33] Extracted from the information provided by Bharati Airtel Lanka (Private) Ltd.

carrier grade ISP network. To date Bharati Airtel has already invested more than USD 15.5 Million on the deployment of its 3G network.

Within three years of launch of its operations, Bharati Airtel has covered all the major densely populated areas including all urban and commercial hubs.

Annex 3

Table 9: Broadband Tariff Trend

Year	Operator	SLT	Lanka Bell	DBN	Dialog	Mobitel
2008	Volume	Unlimited*	Unlimited	Unlimited	Unlimited	5 GB
	Downlink Speed	512 kbps	1 Mbps	1 Mbps	Not Applicable	3.6 Mbps
	Tariff per Month(Rs.)	2,250/-	3,000/-	3,000/-	4,500/-	5,000/-
2009	Volume	Unlimited	Unlimited	Unlimited	5 GB	5 GB
	Downlink Speed	512 kbps	512 kbps	1 Mbps	Not Applicable	3.6 Mbps
	Tariff per Month(Rs.)	1,600/-	2,000/-	1,750/-	2,990/-	5,000/-
2010	Volume	Unlimited	Unlimited	Unlimited	4 GB	5 GB
	Downlink Speed	512 kbps	512 kbps	1 Mbps	Not Applicable	3.6 Mbps
	Tariff per Month(Rs.)	1,600/-	2,000/-	1,750/-	990/-	5,000/-
2011	Volume	8 GB	10 GB	15 GB	5 GB	5 GB
	Downlink Speed	1 Mbps	512 kbps	512 kbps	1 Mbps	1 Mbps
	Tariff per Month(Rs.)	1,500/-	850/-	2,000/-	990/-	890/-
2012**	Volume	20 GB	10 GB	15 GB	5 GB	5 GB
	Downlink Speed	2 Mbps	1 Mbps	1 Mbps	1 Mbps	1 Mbps
	Tariff per Month(Rs.)	1,490/-	500/-	2,000/-	990/-	890/-

** Approved in 2003*

*** Up to July 2012*

Source: TRCSL

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