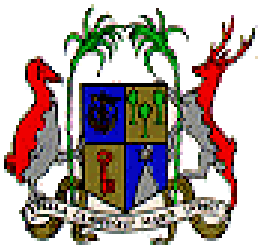

Republic of Mauritius

National Broadband Policy 2012 - 2020 (NBP2012)

Ministry of Information and Communication Technology

January 2012

MINISTRY OF INFORMATION and COMMUNICATION TECHNOLOGY

NATIONAL BROADBAND POLICY (NBP2012)

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1. EXECUTIVE SUMMARY

The National Broadband Policy 2012 – 2020 (**NBP2012**) sets out a strategic vision for a broadband Intelligent Mauritius, branded as **"Towards i-Mauritius",** and establishes national goals regarding broadband while elaborating specific policies to achieve those goals within the overarching National ICT Strategic Plan (NICTSP) 2011-2014 context.

Presently, the Information and Communication Technologies Authority (ICTA) treats broadband transmission as a telecommunication service subject to the statutory requirements set forth under section 24 of the ICT Act 2001, as amended[1]. Internet Service Providers licensed by the ICTA are able to provide "enhanced" or "information" services classified in most cases as broadband Internet access services. As from the beginning of 2010, the concept of broadband worldwide has evolved from the realm of being a purely technology and service issue to the extent that it significantly affects how people live and work. It is now viewed as a key driver of economic growth and national competitiveness[2] since it can contribute to social and cultural development. Countries, communities and individuals that lack easy access to broadband are believed to be in an unfavourable situation that they may miss economic and social opportunities. Broadband cities for example are reputed to attract more services firms and thus create more jobs than their narrowband counterparts[3].

Recent studies have revealed that broadband is becoming more and more an important economic actor and is therefore becoming more of a national policy issue. The World Bank[4] has found that in low and middle income countries, every 10 percentage point increase in broadband penetration accelerates economic growth by 1.38 percentage points. In a similar study, McKinsey[5] estimates that a 10 percent increase in broadband household penetration delivers a boost to a country's GDP that ranges from 0.1 percent to 1.4 percent. Booz[6] found that 10 percent higher broadband penetration in a specific year is correlated to 1.5 percent greater labour productivity growth over the following five years. Booz also suggests that countries in the top tier of broadband penetration have exhibited 2 percent higher GDP growth than countries in the bottom tier. These studies are the latest in the already extensive work estimating broadband's economic impact[7].

Against this backdrop, and further recognising the potential of the ICT sector to have significant positive spill-over effects on the other sectors of the economy, the Government of Mauritius sets out to elaborate the present NBP2012. Government is fully aware that the National Broadband Policy formulation must take into consideration the short- and long-term national objectives within a context of ever-changing social, economic, political, and technological conditions.

A current state assessment of broadband in Mauritius has initially been made in order to be in a better position to make the NBP2012 more responsive to the new opportunities and challenges facing the electronic communications sector in becoming an important vector for economic growth.

This document thereafter outlines the overall policy objectives and targets for a Broadband i-Mauritius and spells out the strategies to be adopted. It also sets out the methodology to ensure adherence to a logical sequence, viz. **promotion, oversight, and universalisation** which is so far the accepted and proven roadmap to successful broadband development[8].

The salient features of this Policy Paper comprise the following:

- Defining the broadband ecosystem for Mauritius.
- Creating a conducive environment to attract new investments and players in the new ecosystem.
- Establishing and promoting the National Broadband Infrastructure.
- Consolidating the regulatory and legislative frameworks to allow the emergence of Broadband I-Mauritius.
- Ensuring the quality of service of broadband services from 'best effort' to 'minimum guaranteed' levels.
- Linking the commercialising of broadband services to cost oriented elements.
- Developing a broadband handling culture for adequate usage.
- Developing a content production culture to stimulate sufficient supply and demand mixes.
- Developing efficient management strategies in the use of scarce resources for broadband deployment and monitoring thereof.
- Providing adequate broadband services within accessibility, availability and affordability ranges.
- Promoting research, innovation and competition for sustaining the broadband ecosystem.
- Introducing adequate regulatory safety-nets to ensure broadband universalisation.
- Defining institutional framework and responsibilities to achieve objectives set.

The major pillars of the NBP2012 include implementing and fostering a broadband ecosystem in the ICT services market, within the required regulatory framework, and thus paving the way for the adoption of the said concept within the overall economic activities of the country.

The Ministry of Information and Communication Technology, hereinafter referred to as **The Ministry**, being responsible for the elaboration of policies to circumvent challenges facing ICT businesses as a whole, has taken the lead in elaborating the NBP2012. This is in line with the Government's recognition of the importance to continuously monitoring policies and the value of the national ICT assets in linking to the sector reform programmes as clearly enshrined in the Government Programme 2010-2015 and emphasized in the NICTSP 2011-2014.

PART I:

BACKGROUND

2. INTRODUCTION

2.1 The Broadband Concept

Twenty-five years ago the term "Broadband" was coined as the opposite of a base-band signal to differentiate between narrowband and wideband signals in communication transmission systems[9]. As time marched on, the term gathered some more concrete definition in relation to the minimum upstream and/or downstream transmission speeds, or, according to the technology used or the type of service that it can deliver; the initial transfer speed of 384 kbps was used as the benchmark to define broadband services. However, countries differ in their definitions of broadband inasmuch as technological advances lead to redefining the minimum speeds which are likely to keep on increasing rapidly, being given that the quality of experience of the user is becoming more and more the focus of consideration.

Broadband is now considered to be the great infrastructure challenge of the early 21st century. According to the International Telecommunication Union (**ITU**)[10], in the 21st century, affordable and ubiquitous broadband networks will be as critical to social and economic prosperity as those for transport, water and power and can thus be viewed as a foundation for economic growth, job creation, global competitiveness and a better way of life. Indeed, broadband will serve as tomorrow's fountain of innovation, as in itself, it represents the maturing of the digital revolution which started in the mid nineties, the fruits of which have yet to be invented or even imagined.

Although it is true that most of the world still lacks basic Internet access, yet broadband is to be regarded as much more than just surfing the web. As we move towards machine-to-machine communications – what we call '***The Internet of Things***'[11] – these networks will underpin a vast number of services in areas like healthcare, education, energy management, transport systems, emergency services and much more. It is strongly believed that once we build broadband networks, everything else will follow, such as:-

- the ability to control and use energy more efficiently;
- the ability to manage healthcare in poor, ageing or isolated populations;
- the ability to deliver the best possible education to future generations;
- the ability to take better care of the environment;
- the ability to streamline transport networks; and
- crucially, the ability to accelerate progress towards the Millennium Development Goals (MDGs).

With this new orientation, it has now been proposed that broadband be defined beyond the traditional notion of a specific type of network connectivity or minimum transmission speed. Accordingly, broadband can be viewed as an ecosystem[8] that includes its networks, the services that the networks carry, the applications they deliver, and users as depicted in the graphical model in Figure 2.1. Each of these components has been transformed by technological, business and market developments.

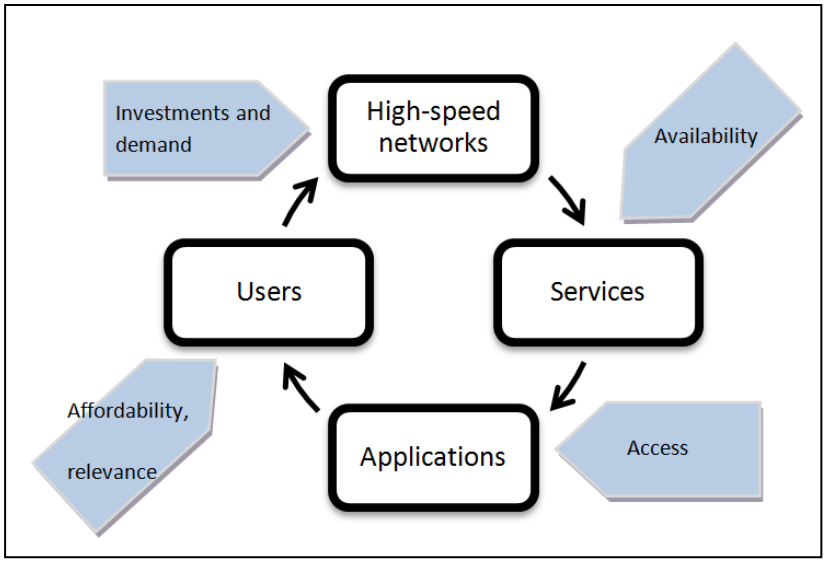

Figure 2.1: The broadband ecosystem model
Source: World Bank[8]

Broadband can now be thought of as an interconnected multilayered ecosystem of high-capacity communications networks, services, applications and users. The ecosystem includes the networks that support high-speed data communication and the services these networks provide. It also includes the applications provided by these services and the users who are increasingly creating applications and contents. Investments by public and private investors or agencies, and user-demands expand the reach of high-speed networks. These networks increase the availability of high-quality services to both users and application providers. Applications access these services to reach users, who respond to the affordability of the services and relevance of the applications. Users then grow in number and sophistication, demanding and driving greater investments in networks, creating the virtuous circle for broadband.

This virtuous circle can be interpreted as a '*wheel of value addition continuum*' that keeps on revolving iteratively and adding value to the ecosystem on each of the iterations. Accordingly, an alternative way to model the broadband ecosystem is depicted in Figure 2.2.

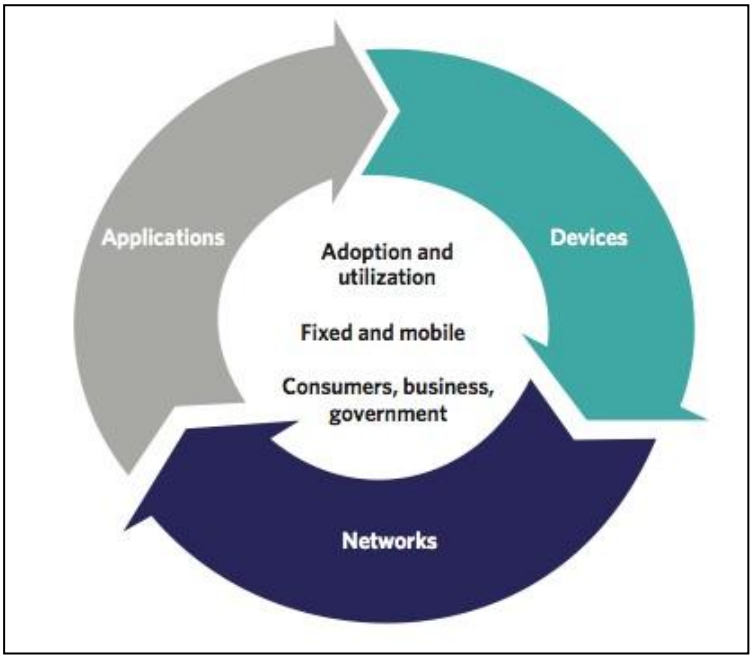

Figure 2.2: The broadband ecosystem modelled in the virtuous circle format

By defining broadband in this way to include both the supply and demand sides of the market, this also leads to a rethinking of approaches to spur broadband access and use. It is, therefore, critical to create both an enabling environment for supply-side growth in terms of access to networks and services and to facilitate demand for and adoption of broadband.

2.2 The Broadband Commission for Digital Development

Conscious of the potential of the broadband ecosystem, leaders from the private and public sectors had been called upon, through an initiative coordinated by the ITU, to address the importance of universal access to broadband networks. In this regard, with the support of the UN Secretary-General, the "**Broadband Commission for Digital Development"** was launched on 10 May 2010 by the ITU and UNESCO. This Commission has been tasked with not only identifying and publicizing the importance of **broadband for development**, but also hypothesising the necessary market structures needed to promote the widespread deployment of broadband infrastructure.

The establishment of the Broadband Commission in fact came five years after the World Summit on the Information Society (WSIS), and ten years after the launch of the MDGs. It is chaired jointly by President Paul

Kagame of Rwanda and Carlos Slim Hélu, Honorary Lifetime Chairman of Grupo Carso, with ITU Secretary-General Dr Hamadoun I. Touré and UNESCO Director-General Irina Bokova as vice chairs. They are joined by top-level figures from government, industry and international agencies, as well as those concerned with the content that will be delivered through broadband networks, from education to entertainment.

Activities within the Broadband Commission have, so far, highlighted the positive effects that broadband deployment can have on the realization of all MDG's, and the need to promote fair and competitive markets, which will be conducive to the provision of broadband services by private sector telecommunication companies. The activities have culminated in the release of two reports. The first report, entitled "***Broadband: A 2010 Leadership Imperative***", communicates the strategic vision of the Commission, based on extensive Commissioners' inputs. It also includes a Declaration that was signed by all Commissioners at a meeting of the Commission in New York on 19 September 2010, and a set of Recommendations designed to help drive broadband rollout in countries worldwide, regardless of their level of social and economic development. The second report, entitled "***Broadband: A Platform for Progress***", is a longer and more technical document which looks at the economic metrics of installing and generating Return on Investment (ROI) on broadband networks, the impact of savings across key social and industry sectors, and successful case studies of broadband deployment strategies from around the world. The reports were presented to the UN Secretary-General, Ban Ki-Moon at an official side event to the 2010 MDGs Summit in New York.

One of the key points highlighted in the second report is that it has now been decided to focus on considering broadband as based on a set of core concepts, such as an **always-on service** (i.e. not requiring the user to make a new connection to a server each time) and **high-capacity** which is capable to carry lots of data per second, rather than at a particular speed. The focus is more on the practical result, which is, that broadband enables the combined provision of voice, data and video at the same time.

2.3 Broadband Strategies Continuum

Strategies normally set the stage for policies, programs, projects and regulatory measures that implement any defined vision. As such, they play a significant role in sending the right signal to investors about long-term investments opportunity and provide insight about how the legislative and regulatory environment might evolve over time. Yet, as broadband markets grow, these strategies will also have to be revised and different policies enacted. In the same breath, the role of government evolves from market **promotion** to **oversight** to **universalisation** of service.

The initial focus is on the supply-side promotion combined with a constant focus on competition regulation to ensure that markets remain efficient. In the later stages, however, strategies will have to focus more on universalisation, ensuring that broadband is both accessible and used widely. Broadband strategies may also evolve:

(i) as markets undergo qualitative evolution in the level of broadband services;

(ii) as the range of applications increases; and

(iii) as the types of contents available increase.

With such qualitative transformations, so too must the approach of the government in promoting, overseeing, and universalising broadband adapt. Hence, even though first-generation broadband services might be universalised, higher-quality services might be the focus of promotion policies; this approach ensures that there is a constant value-addition continuum being established in the policy-making process by the Government. It is indeed this approach that has been adopted in the formulation of the NBP2012.

2.3.1 The Promotion Stage

In the initial promotion stage, strategies are focussed on either developing or reinforcing a national broadband backbone network, creating demand, and establishing an enabling environment for competition and investment by facilitating market entry. Promotion strategies and their supporting policies allow government to intervene in market creation and facilitation. Supply-side policies enable the development of access to broadband thereby enabling network operators and service providers to enter the market easily, operate on a level-playing-field, and, where necessary, provide financial support to reach high-cost areas through mechanism such as the Universal Service Funding. Such policies provide incentives to generate demand and reduce risks for network investors at the initial stage of broadband adoption.

The demand-side focus has been found to promote broadband adoption and use. It also enables wider inclusion of otherwise underserved or un-served communities because government is making broadband access and services more attractive and available to potential subscribers and users, by making policies that help to lower prices, by promoting Government-to-Citizen (G2C) services online, and by encouraging the diffusion of access devices such as computers through community and public access points. Improving digital literacy is another important aspect of demand facilitation, especially among communities and the vulnerable groups that might otherwise lag in broadband and the general ICT use.

2.3.2 The Oversight Stage

When broadband reaches mass-market status, oversight supports growth in access by ensuring sustained competition among facilities-based and service providers. Oversight includes policies and regulations to facilitate competition, guard against monopolistic and unfair practices, and regulate essential and/or bottleneck facilities. Hence, the focus of supply-side policies shifts to overseeing the market to ensure vigorous competition in facilities, services, or both. On the demand-side, government‘s role moves into creating an online environment that is safe for businesses, households and children. Government, in this phase, very often needs to review its legislations regarding ICT, electronic transactions, online safety, data protection and competition to adapt to the new business paradigm.

2.3.3 The Universalisation Stage

Universalising policies are meant to address economic goals but also should contain social elements based on equity, modernity and empowerment. As broadband market matures, governments seek to cover access gaps through service policies that drive broadband networks into rural and remote areas. On the supply side, governments often seek to help reduce the costs of reaching underserved areas. These policies aim at providing broadband to underserved areas and groups that lack access to it. On the demand side, the shift toward universalisation brings an increased focus on underserved communities and groups, while access to broadband is positioned towards becoming one of the fundamental rights. This final challenge has been put forward to global leaders by the ITU Secretary-General Dr Hamadoun I. Touré to ensure that more than half of the world’s people have access to broadband networks by 2015, and to make access to high speed networks a basic human right[12].

2.4 The Institutional Framework Requirement for Policy Implementation

Broadband policies and strategies very often also define the required institutional framework that is needed to implement the various programs and policies either in a prescriptive or descriptive manner. Some of these institutions might be obvious, such as ICT industry regulators, while new agencies may need to be established to implement specific programs. But there are also other existing agencies that could have a role in implementing the strategy. For instance, competition commissioners, trade ministries, and finance departments might support broadband development by ensuring adequate competitive safeguards, easing equipment import

restrictions, or providing tax breaks. On the other hand, line ministries such as health, agriculture, education, and public administration may play a role in supporting content development, bringing their services online, or using broadband to streamline their functioning.

A range of institutional structures has been attempted across countries. Some successful broadband markets have one agency that spearheads policy development and implementation. Japan[13] and Korea[14] offer one model, where a single organisation took the entire responsibility for implementing policy, ensuring consistent and efficient promotion of broadband. Establishing legal systems for broadband vision and policies can also contribute to consistent policy implementation.

It is also acknowledged that political circumstances may at times hold back governments from reforming organisational structures. Many countries, including Mauritius, have legacy administrative systems. In such cases some mechanism for collaboration should be in place to coordinate policies and implementation among government bodies. For instance, the United States[15] and some European countries[16] have regulators that take full responsibility for regulatory policies, while promotional and universalisation policies are handled by ministries and departments. Despite such separated management of policies, these organisations have maintained efficiency through their capacity for policy coordination.

2.5 Current State Assessment for Broadband in Mauritius

The sustained growth of the ICT sector relies heavily on the provision of high-bandwidth and secured service applications, geared towards meeting both the mainstream and specialised demands of ICT consumers. Such demand covers the basic essentials such as access to high quality telecommunications (voice services, Internet access services, etc…) to more specialised applications such as E-payment, online banking, online tax returns, and so forth. To ensure the reliability in the supply of such ICT services, as well as a qualitatively gratifying experience from the end user's perspective, telecommunication networks are called upon to continuously evolve and become increasingly resilient in the face of bandwidth-hungry applications. Simultaneously, such high-tech applications would only be able to yield spill-over effects to the entire economy only if they are accessible to the end user. This is directly linked to the cost structure and pricing adopted by Network Access & Service Providers in offering their various telecommunication services.

The technological booms that have permeated the global economy feature a common theme i.e. a shift towards Internet Protocol (IP)-based solutions and a demand for access to high quality information on the go, in short, the 'data-centric' and 'mobility' dimensions that ensure ubiquitous communications. Consequently, the

availability of bandwidth and the deployment of both high capacity and wireless networks in particular remain at the forefront of the agenda, for a developing country like Mauritius that has earmarked the ICT sector as a growth engine and catalyst for the complementary sectors of its economy.

To understand how the transformation towards a broadband ecosystem will evolve, it is important to understand the forces shaping the broadband ecosystem in Mauritius today. This ecosystem includes applications and content, such as email, search, news, maps, sales and marketing applications used by businesses, user-generated video and hundreds of thousands of more specialized uses. Ultimately, the value of broadband is realized when it delivers useful applications and desirable contents to end-users.

Applications run on devices that attach to the network and allow users to communicate: computers, smart-phones, set-top-boxes, e-book readers, sensors, private branch exchanges, local area network routers, modems and an ever-growing list of other devices. New devices mean new opportunities for applications and content. Finally, broadband networks can take multiple forms: wired or wireless, fixed or mobile, terrestrial or satellite. Different types of networks have different capabilities, benefits and costs. The value of being connected to the network increases as more people and businesses choose to adopt broadband and use applications and devices that the network supports, commonly referred to as the 'positive externality' dimension.

Several factors contribute to the consumers' decisions. These include whether they can afford a connection, whether they are comfortable with digital technology and whether they believe broadband is useful. Networks, devices and applications drive each other in a virtuous cycle. If networks are fast, reliable, secure and widely available, companies produce more powerful, more capable devices to connect to those networks. These devices, in turn, encourage innovators and entrepreneurs to develop exciting applications and contents. These new applications draw interest among end-users, bring new users online and increase use among those who already subscribe to broadband services. This growth in the broadband ecosystem reinforces the cycle, encouraging service providers to boost the speed, functionality and reach of their networks. An analysis of what the Mauritian ICT landscape presently offers is made and this will culminate in developing the **Mauritian Broadband Ecosystem**.

2.5.1 Access Networks & Service Provision

Network access providers are generally required to deploy a 'core' network, where the network intelligence and management functions are focalised, on one hand, and an 'access' network, which provides a direct connection

to the end-user for the provision of final services. To continually improve the resilience of the overall network, Government has reinforced the investment climate through the open access policy which is typically required at both the core and access levels, with the bottom-line being the provision of increasingly better, faster and more secure services for businesses and the public at large.

Currently, several of the major access providers have already earmarked a development plan for their networks to ensure that they can continue offering the latest services on a competitive basis. Among the front-runners are Mauritius Telecom Ltd and Emtel Ltd, with the former having already embarked on its NGN (next generation network) upgrade in its core network, while the latter has already deployed a fibre optic cable network in several parts of the island.

As regards the actual capacity available in terms of outgoing international Internet bandwidth, the latter stands at some 4.34 Gbps as at Quarter 2 of 2011, having experienced more than forty-fold increase over the period 2005 to 2011, as compared to 116 Mbps in 2005.

In terms of total international bandwidth capacity which currently stands at nearly 10 Gbps in 2011, there has again been a forty-fold increase compared to its initial level in 2005. This increase in international bandwidth usage has served as a boost to the various ICT related activities such as ITES-BPO, call centres, international voice traffic, and Internet access among others. Government's intention is to maintain this trend of bandwidth capacity growth.

In this context, Government formulated the **Open Access Policy**[17] in October 2010 with a view to setting the propitious environment to catalyse this trend. Further, Government welcomes the coming into operation of various other regional undersea cable projects (such as LION Phase 2, EASSy, etc…) in the near future, which will have the ultimate effect of significantly increasing the international bandwidth capacity and improving on route diversity by the end of 2012.

2.5.2 Tariffs for International Bandwidth

Much has been accomplished in terms of falling prices for international connectivity, especially over the period 2002 to 2012, as gathered from Table 2.1, facilitated through various determinations made by the ICTA pursuant to applications made by Mauritius Telecom Ltd (MT) in accordance with section 31 of the ICT Act. A similar picture is applicable in terms of bilateral half circuits over an identical period, with an average reduction of up to 77% over the selected routes as shown in Table 2.2.

Table 2.1 – Reduction in the price of full circuit International Private Leased Circuits

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Jan-12	2002 to Jan 2012 % change
Mauritius to France (MT POP Telehouse Paris)												
IPLC Full Circuit on SAFE (2Mbps E1) in USD:	22,339	12,600	12,600	12,600	7,900	6,300	6,300	4,900	4,900	4,100	3,500	84

Source: ICTA 2012

Table 2.2 – Reduction in the price of half circuit International Private Leased Circuits

Tariffs for Bilateral Half Circuits on SAFE	2005	2006	2007	2008	2009	2010	2011	Jan-12	2005 to Jan 2012 % change
IPLC Half Circuit on SAFE (2Mbps) in USD:									
South Africa	7,112	4,753	3,802	3,802	2,484	2,484	2,156	1,954	73
Portugal	9,169	6,128	4,902	4,902	3,031	3,031	2,479	2,110	77
India	6,836	4,568	3,654	3,654	2,378	2,378	2,168	1,960	71
Malaysia	7,726	5,163	4,130	4,130	2,522	2,522	2,237	1,993	74
Reunion	5,741	3,836	3,836	3,836	2,200	2,200	2,000	1,828	68
								Avg	73

Source: ICTA 2012

2.5.3 Domestic Connectivity

Network Access Providers are under pressure to continuously improve both the capacity and efficiency of their national networks, with the objective of achieving sustained revenue growth, through customer retention and the supply of innovative solutions, in line with global trends. Therefore, physical network upgrades to ensure spare capacity and future service deployment, together with investment in new technologies, are the pre-requisites to maintaining their competitive positions in the various telecommunications markets.

2.5.4 Wholesale ADSL

Wholesale ADSL lines represent one of the core components for the supply of retail internet services in Mauritius, on top of the requirement for international internet bandwidth. This particular component, specifically provided as part of the domestic copper based fixed line network of the incumbent operator, Mauritius Telecom

Ltd, has benefited from several tariff reductions over the past 5 years. The latest determination by the ICTA in December 2011 has resulted in a substantial decrease ranging from 30% to 50% from the prevailing price levels, depending on the selected speed and committed number of lines.

2.5.5 IP over Frame Relay / SHDSL

Internet Protocol (IP) over Frame Relay services generally consist of business oriented solutions, which provide a dedicated access to the Internet and allows a business to link up several of its domestic branches to one another, thereby creating a private network. Such services are again offered on the domestic copper wire network of Mauritius Telecom Ltd, and are gradually being upgraded to IP over SHDSL services, which use more contemporary compression standards, thereby enabling additional capacity to be extracted from the same line.

A decrease in the tariffs of such services was witnessed in 2011, with a reduction ranging from 5% to 41% becoming applicable, depending on the selected speeds. As an indication, a 2 Mbps package is presently commercialised at Rs 98,900/- per month as compared to Rs 130,000 per month (VAT exclusive) in 2010.

2.5.6 Point to Point Internet Connection

In contrast to the wired solutions discussed above, Point to Point Internet connection services represent the wireless substitute to the above. Such services have been deployed by Emtel Ltd so far, through its investment into a Wimax network, which makes use of radio frequencies to operate, hence bypassing the need to install underground wired infrastructure. In comparison to the above-mentioned wired services, a 2 Mbps connection with guaranteed bandwidth is presently commercialised at Rs 51,199 per month, almost 60% cheaper compared to an identical wired connection.

2.5.7 Domestic Leased Circuits

Mauritius Telecom Ltd is presently the sole provider of domestic leased circuits, commercialised as digital leased lines, across the island. Prices have been mostly unchanged, with a 2 Mbps connection fetching a minimum of Rs 7,000 to a maximum of Rs 58,500 per month (VAT exclusive), depending on the distance

between the two end points of the said circuit. Yet again, this service is offered as part of the copper wire based backbone of Mauritius Telecom Ltd.

It is to be highlighted, however, that in 2010, the ICTA received numerous expressions of interest, and eventually applications for Network Services Provider (National) licences to deploy fibre backbones and Wimax-based backbones. A new Network Service Provider licence has been issued in 2011 by the ICTA and it is anticipated that the eventual deployment of the said infrastructures in the future will generate the necessary competitive reactions in this market segment, such that the prices of domestic connectivity will be far more affordable than the present levels.

2.5.8 Internet Subscribers

The number of Internet subscribers in September 2011 was 287,339 representing some 23 subscribers per 100 inhabitants. Out of the 287,339 subscribers, 43% were mobile Internet users.

2.5.9 Type of Internet Access

Broadband Internet, defined as Internet connectivity at speed of at least 256 Kbps, was introduced in 2002. In September 2011, the number of broadband Internet subscribers was 232,611. The said subscribers had access to the service through Digital Subscriber Line (DSL) connection, mobile cellular telephone, using General Packet Radio Service (GPRS) including the Wireless Application Protocol (WAP), and the third Generation of Mobile telephony (3G).

2.5.10 ICT Access and Use by Households

Data on ICT access and use by households and individuals has been collected through the Continuous Multi-Purpose Household Survey (CMPHS) conducted in 2008 and 2010 by the Statistics Mauritius (SM). It is reported that the percentage of households with mobile cellular telephone increased from 82.8% in 2008 to 87.5% in 2010. Households with television increased slightly to 96.9% in 2010 from 96.4% two years back.

Some 11.9% of households had more than one television set in 2010 compared to 9.7% in 2008. Around 22.2% of households reported having paid TV channels (other than MBC) in 2010 against 16.9% in 2008. Households

owning computer increased to 37.7% and those having Internet access increased to 29.0% in 2010 compared to 29.9% and 20.2% respectively in 2008

Further, it is accounted that in 2010 some 62.1% of households with no computer at home reported that a computer was not necessary, while a further 33.6% considered the cost of a computer to be too expensive for not buying one. Around 62.1% of households with no computer did not have the intention to buy one; 6.2% intended to buy one in the next twelve months and 24% to buy one after a year.

In 2010, among households with computer, 71.5% had access to Internet. More than half (51.2%) of those with internet used ADSL. Among households not having internet connection, 7.6% intended to obtain access within the next twelve months and another 20.8% after one year.

2.5.11 ICT Access and Use by Individuals

In 2010, around 51.3% of persons aged five years and above reported that they could use a computer. The percentage was 69.2% of those aged 5 to 11 years, 91.3% for those aged 12 to 19 years and 9.2% among those aged 60 years and above. In 2010, 41.7% of persons aged 12 years and above reported using a computer compared to 35.4% two years ago.

Figures from the SM further indicate that in both 2010 and 2008 the use of computer and internet was highest among the young age groups and lowest among the higher age groups. Thus, in 2010, 85.2% of persons aged 12 to 19 were using a computer and 58.3% the internet, and 61.6% of persons aged 20 to 29 were using a computer and 50.7% the internet. Among those aged 50 to 59 years, 23.6% and 17.6% were using a computer and the internet respectively.

2.5.12 ICT Usage in Education

Primary schools: At the end of March 2010, it is reported by the SM that the percentage of primary schools providing Internet access to students for study purposes increased to 56% from 20% in 2009. The number of students per computer improved to 27 in 2010 compared to 25 in 2009.

Secondary schools: At the end of March 2010, the percentage of secondary schools reported to be providing Internet access to students went down to 94.7% from 95.7% in 2009. The number of students per computer

worked out to 22, same as in 2009. The number of students examined in ICT at School Certificate (SC) level increased by 13% to 5,241 in 2010 from 4,636 in 2009. However, the percentage of students examined in ICT at SC level decreased slightly to 26.0% in 2010 from 27.0% in 2009. The number of students examined in ICT at Higher School Certificate (HSC) level in 2010 was 977 representing 10.0% of all students examined at HSC level compared to 952 in 2009, giving an increase of 2.6%.

Tertiary education level: The number of students enrolled in ICT or an ICT-dominated field at tertiary level was 3,694 in 2010/2011 compared to 3,475 in 2009/2010. As a percentage of total number of students enrolled at tertiary level, ICT courses enrolment represented 8.3% in 2010/2011 and 8.5% in 2009/2010.

2.5.13 ICT Usage in Business

Data collected and reported by the SM, through the Survey of Employment and Earnings among 'large establishments' i.e. those employing 10 or more persons in 2009, showed that there has been a general increase in ICT usage. In 2009, 97.9% of large establishments had computers against 96.6% in 2008. The percentage of establishments having website was 48.3% in 2009 compared to 43.9% in 2008. Establishments using Internet/Email reached 92.0% in 2009 compared to 90.4% in 2008. Some 40.6% had intranet, 34.9% were receiving orders over the Internet and 34.7% placed orders over the Internet against the corresponding figures of 37.7%, 34.1% and 33.5% respectively in 2008. The results also showed that ICT usage was highest among establishments in the tertiary sector comprising trade, hotels & restaurants, transport and all the other service industries, and lowest in the primary sector which covers agriculture, hunting, forestry & fishing and mining & quarrying.

2.5.14 The ICT Sector as an Engine of Growth

Latest statistics pertaining to the ICT sector suggests that for the year 2010, the value added of the ICT sector as a percentage of GDP stood at 6.4%. Based on the trend, SM has estimated the contribution to GDP to be 6.5% for the year ending 2011, highlighting the resilience of the sector in spite of the economic uncertainty prevalent on the global arena. This is a very conservative figure. Available estimates for the ITES-BPO sector, when linked with the cost of international connectivity, would suggest that for every USD 100 average decrease in the cost of international bandwidth connectivity, nearly 2 new start ups are created within the IT-BPO industry. This definitely helps to reinforce the notion of an even more significant contribution by the ICT sector to the GDP. Furthermore, the reductions in the prices of telecom services that took place in December 2011 will

have spill over effect, be it in terms of the consumption for the ICT sector itself or for other sectors that will adopt ICTs. More importantly, the Public Key Infrastructure being put in place will give a new dimension to the way business is conducted, as this will ensure the confidentiality, non-repudiation and authenticity features that are required in the virtual world. Taking all the above factors together, a contribution which will largely exceeds the very conservative estimate is expected.

It should further be noted that over the period 2005 to 2010, the growth rate of the ICT sector has been maintained in double digit figures; there are reasons to believe that this trend should persist. In light of this observation, it is anticipated that the sector's contribution to overall GDP will maintain a better ascendancy. The World Bank Report[4] already demonstrated this fact; however, certain pre-conditions must be in place to ensure the sustainability of the above tendency.

Firstly, the requirement for continued investment in broadband networks is fundamental, to the extent that many developed countries earmarked infrastructure investment into broadband networks as part of their economic stimulus packages, during the not so distant worldwide recession. This is because such networks bring both direct results in terms of financial outlays and employment at the onset, and in addition, they generate positive spill-over effects across other sectors, since ICTs remain the lynchpin of a plurality of activities in today's economy. At the same time, this ensures that actual and spare capacities are both continuously improved to accommodate increasingly bandwidth hungry services and applications.

Secondly, service providers must be encouraged towards boosting the value-chain, by making optimum use of the available capacity to come up with innovative and efficient end user solutions, which can facilitate both private sector and government interactions, in terms of Business to Business transactions, or Customer to Business transactions respectively.

Thirdly, while the supply of additional capacity and the generation of new ICT services must be driven forward, it is imperative that the demand for such services is allowed to grow seamlessly. The pre-requisite for this to happen is ensuring access by the masses, which is conditional on the affordability of ICTs in general.

It is opportune, therefore, that the ICT sector in Mauritius finds itself in the midst of such critical developments, with the Government fully backing this sector as the 3rd pillar, and streamlining the growth path ahead through its various initiatives over the past years. This has been heavily translated into concerted efforts towards telecommunication network development, which will place Mauritius on equal standing with many advanced economies, in terms of offering and benefiting from the next generation of ICT services. As it was highlighted previously that:

(i) network access providers have already embarked on plans to upgrade their network capacity and efficiency;

(ii) new infrastructure deployments are in the pipeline – especially fibre & WiMax;

(iii) the international and national bandwidth capacities available to the country have been singled out for additional and significant increases; and

(iv) the cost of international and national capacity has been on the decline for the past 5 years, with further reduction earmarked for 2012 and beyond.

The overall impact of the above factors, working together on the various fronts, is sure to result in a vibrant and competitive sector, and a fully digital- and ICT-conversant economy, which will strengthen the regional and global position of Mauritius as one of the high-flyers on the ICT scene.

3. TURNING EXISTING CONSTRAINTS INTO FUTURE OPPORTUNITIES

3.1 Identifying Key Constraints

The current state assessment has tracked where the strengths of the ICT sector reside, and at the same time, also highlight where further progress could be achieved. While most indicators are showing improvements, the pace of such progress must be constantly assessed, and policies must be geared at addressing critical constraints that may be holding back more rapid and sustained expansion.

Two such bottleneck constraints in the context of the transition to a broadband networked society have to do with affordability and coverage, in other words, the prices being charged for accessing broadband services, as well as the infrastructure and equipment options being supplied to end users and other Internet Service Providers and/or competitors.

Policy direction must be clear and concise in regard to these constraints, and must be translated into pre-determined undertakings to make broadband more affordable, while committing resources towards broadband infrastructure development and sharing. The Open Access Policy being pioneered by the Government is an illustration of the latter.

3.2 Foundations of the Mauritius Broadband Ecosystem Blueprint

Therefore, the key foundation of the NBP2012 must be seen as addressing the issues of affordability of broadband services and the requirement to drive forward broadband infrastructure deployment, as well as ensuring the associated user equipment supply.

In consideration of the above, clear recognition must be given to the 'promotion' phase of the NBP 2012 in the short term, which will be earmarked as the critical success factor to implement the 'oversight' and 'universalisation' phases in the medium and longer term.

The policies involved in building the Mauritian broadband ecosystem may therefore be formulated and evaluated on the following components:

4. BUILDING THE MAURITIAN BROADBAND ECOSYSTEM

4.1 Applications

Users benefit directly from the applications and content they access through broadband networks. Applications help people purchase products, interact with government agencies and find information of their interests. Home Internet broadband use has increased over the years as consumers find more valuable applications and content online. Increased hours of use are correlated with increased actual speeds of broadband connections to the home. Broadband applications can also help businesses improve internal productivity and reach customers. These productivity gains benefit the entire economy.

Both consumers and businesses may also turn to applications and content that use video. User-generated video and entertainment - from sites such as YouTube - are a large portion of the total video traffic over broadband connections. Increasingly, video is embedded in traditional websites, such as news sites, and in applications such as teleconferencing.

Cloud computing, i.e. accessing applications from the Internet instead of on one's own computer, is also growing as more companies migrate to hosted solutions. Software based in the cloud may allow more small businesses and consumers to access applications that were once only available to large corporations with sophisticated information technology departments in the applications and content markets.

4.2 Devices

Devices continue to grow in number and variety as more computers, phones and other machines connect to the Internet. New devices have repeatedly revolutionized the personal computer (PC) market in the past three decades. Today, about 30% of households own a personal computer. The mobile phone market has also seen robust innovation. There are also more than 93% of the population owning a mobile phone. The emergence and adoption of new technologies such as radiofrequency identification and networked micro-electromechanical sensors, among others, will give rise to the "**Internet of Things**". Billions of objects will be able to carry and exchange information with humans and with other objects, becoming more useful and versatile. For example, the Internet of Things will likely create whole new classes of devices that connect to broadband, and has the potential to generate fundamentally different requirements on the fixed and mobile networks: they will require more IP addresses, will create new traffic patterns possibly demanding changes in Internet routing algorithms,

and potentially drive demand for more spectrum for wireless communications. These kinds of applications will become more popular in the field of agriculture and smart homes.

4.3 Networks

Network service providers are an important part of the Mauritian economy. Both existing fixed and mobile operators continue to upgrade their networks to offer higher speeds and greater capacities. New networking services providers have also announced their coming into operation with Fibre-to-the-Premises (FTTP) service. The affordability and actual performance of these networks will depend on many factors such as usage patterns, investment in infrastructure, and service take-up rates.

4.4 Adoption and Utilisation

Over one-fifth of Mauritians have adopted broadband; the adoption is likely to continue to increase, across different demographic groups and age groups. Broadband adoption among businesses is also quite strong as has been demonstrated in Section 2.

4.5 Policies and Programs to build the Mauritian Broadband

Broadband development strategies are implemented using policies, regulations, and programs. In this regard the benchmark approach has been used. The policymaking model recommended by the World Bank has been adopted in developing the broadband ecosystem model and policy orientations for Mauritius. Same is adapted and reproduced at Table 4.1 for ease of reference.

Component	*Early stage: Promote*	*Mass market: Oversee*	*Universal service: Universalise*
Networks	☑ Develop an enabling environment through policies and regulations that promote investment and market entry ☑ Reduce administrative burdens and provide incentives and subsidies for R&D, pilots, and network rollout ☑ Reduce tariffs for purchasing international connectivity ☑ Create certification systems for cyber buildings ☑ Allocate and assign spectrum for wireless broadband services	☑ Consider infrastructure sharing, including unbundling the local loop where applicable ☑ Reallocate spectrum to increase bandwidth	☑ Undertake, using public/private partnerships, as appropriate deployment of open access broadband networks in high-cost or remote areas ☑ Coordinate access to rights of way
Services	☑ Provide broadband networks to schools, government, etc. (government as an anchor tenant) ☑ Standardize and monitor service quality	☑ Create an enabling environment for intra- and inter-modal competition ☑ Ensure non-discriminatory access for service, application, and content providers	☑ Consider expanding universal service obligation to include broadband
Applications	☑ Undertake government-led demand aggregation ☑ Government agencies as early adopters and innovators Provide e-government and education applications ☑ Promote creation of digital content ☑ Develop local content and hardware sector	☑ Support secure, private, reliable e-commerce transactions ☑ Implement intellectual property protections	☑ Develop advanced e-government programs ☑ Offer grants to community champions and broadband demand aggregators
Users	☑ Significantly reduce the tariffs for broadband services & associated equipment ☑ Provide low-cost computers and other user devices, for instance in education ☑ Develop digital literacy programs for citizens	☑ Establish ethical guidelines for information use	☑ Expand universal service programs to underserved communities ☑ Create community access centers ☑ Subsidize user devices for poor households

Table 4.1: Adapted from Best practice approach for key policies and programs for building the broadband ecosystem
Source: The World Bank[8]

4.6 Defining the Mauritian Broadband Ecosystem

The overarching objective is to establish Mauritius as a leader in the region in broadband innovation and investment. All appropriate steps have to be taken to ensure that all Mauritians have affordable access to modern and high-performance broadband as well as the potential benefits to be derived. Broadband is a main driver of growth and innovation in the ICT industry, generating demand for semiconductors, consumer and enterprise software, computers, devices, applications, networking equipment and many different types of services. The underpinning policy is to establish a world-class broadband ecosystem that will help ensuring that the ICT sector continues to remain a crucial pillar of the Mauritian economy and allowing consumers to receive the substantial benefits that flow from the evolution of ICT. The ecosystem, thus, recommended for Mauritius is as depicted on Figure 4.1.

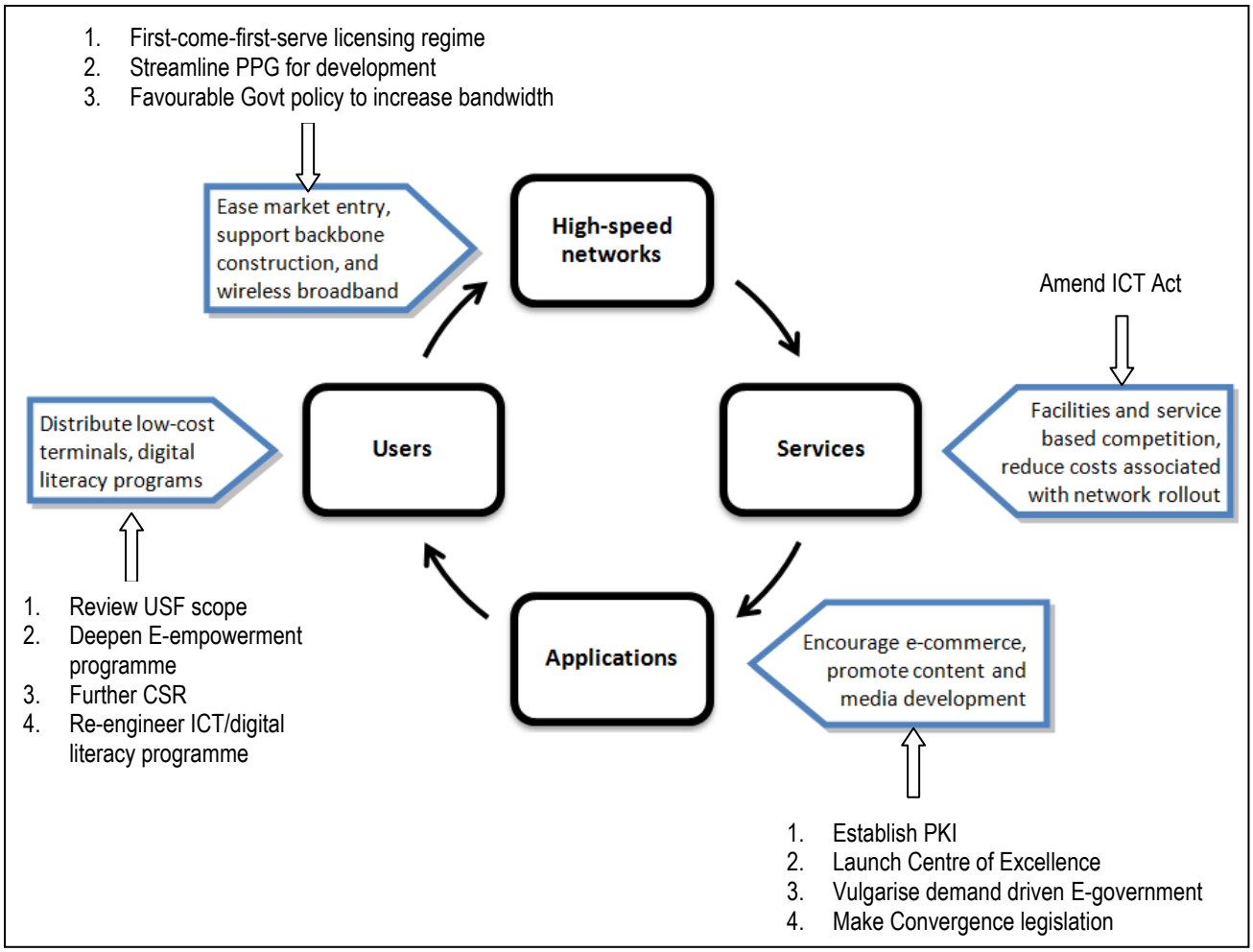

Figure 4.1: The recommended Mauritian Broadband Ecosystem

The recommended broadband ecosystem is vibrant and healthy in many ways. In many respect consumers' demand is strong. Service providers are investing in upgrades of fixed and mobile networks. New devices, and even new device categories, such as e-book readers, tablets and netbooks—are being created. New

applications keep emerging, and more and more content is available online and can be easily accessed in Mauritius especially through the setting up of a google mirror site in the country. However, there are some areas which need to be improved. Government policies and actions can foster innovation and investment across the ecosystem in four key areas:

- *Enacting policies to foster competition.* Competition is a major driver of innovation and investment, and the Ministry and other agencies have many tools to influence competition in different areas of the broadband ecosystem. These tools are best applied on a fact-driven, case-by-case basis. Therefore, continuous collection and analysis of detailed data on competitive behaviour must be the linchpin of effective competition policy. This plan establishes a process for such collection and, in addition, proposes several specific actions that will foster competition.

- *Freeing up more spectrum.* Government through the ICTA controls the availability and determine the cost of spectrum. Spectrum plays an important role in the economics of broadband networks. By ensuring spectrum is allocated and managed as efficiently as possible, the government can help reduce the costs borne by firms deploying network infrastructure, thus encouraging both competitive entry and increased investment by incumbent firms. This policy highlights actions that the ICTA will take to enable more productive uses of spectrum and make more spectrum available for broadband. The Government should encourage the introduction of flexible spectrum management regimes by making necessary amendments to the legislation. Such flexible regimes are expected to facilitate the introduction of innovative technologies.

- *Lowering infrastructure costs.* Government also facilitates, through the local authorities and municipalities the availability of other resources, such as pole attachments and rights-of-way. As with spectrum, ensuring these assets are allocated and managed as efficiently as possible can reduce the costs borne by firms and foster competition and investment. Policies that lower the cost of network deployment in that regard are also addressed.

- *Investing directly through research and development.* Government should invest directly in areas where the return on investment to society as a whole is greater than the return for individual firms. Research and development (R&D) is one of these areas, as the effects of R&D often extend beyond those anticipated by its funders in unanticipated ways. The policy contains specific actions for the creation of a broadband R&D agenda.

PART II:

THE POLICY

5. VISION AND MISSION

5.1 Vision

To transform Mauritius into a people-centred, development-oriented Information Society that allows optimal opportunities for all, government, citizens and businesses alike, to participate fully in the Mauritian Broadband Ecosystem thus lowering geographic barriers and minimising socioeconomic disparities.

5.2 Mission

The National Broadband Policy 2012 – 2020 (NBP2012) purports to facilitate the provision of affordable, accessible, universal access to broadband infrastructure and services to promote the social and economic opportunities made available by broadband in order to ensure the best possible conditions under which Mauritius can grow further as a knowledge-based society.

6. THE POLICY OBJECTIVES

The policy objectives of this NBP2012 are:

A. To achieve robust competition and, as a result maximise consumer welfare, innovation and investment.

B. To ensure efficient allocation and management of scarce resources, such as spectrum, facilities (e.g. poles), and rights-of-way, to encourage network upgrades and competitive entry.

C. To reform current universal service mechanisms to support universal deployment of broadband in even high-cost areas and ensure that low-income Mauritians can afford broadband.

D. To support efforts to boost adoption and utilisation of broadband.

E. To facilitate reform to laws, policies, standards and incentives to maximize the benefits of broadband in sectors where government influences significantly, such as public education, health care and government operations.

In order to achieve the above policy objectives, it will be necessary to consolidate mechanisms and build upon market-oriented policies to create an enabling framework for the development of the broadband ecosystem in terms of each of the objectives set, as per the following **action lines**:

A. Establishing Competition Policies.

The Ministry will develop a set of tools to protect and encourage competition in the markets that make up the broadband ecosystem: network services, devices, applications and content. There are multiple action lines that foster competition across the ecosystem. The NBP2012 captures the following:

A.1 Introduce a phased price reduction path for broadband services, which will likely address the initial challenge of boosting access and usage, while acting as a pre-cursor to improved competitive behaviour, at least during the 'promotion stage' of the plan. This may be consolidated through a similar phased reduction in the tariffs for international connectivity, over the said period. This will imperatively be accompanied by parallel price regulation at the upstream level to circumvent any risk of price squeeze that may lead to anticompetitive practices.

A.2 Define a time specific zero (or < 15%) VAT policy regarding investment, having in mind investors venturing into broadband network deployment, specifically related to infrastructure costs, in order to promote facilities based competition, during the 'promotion stage' of the plan.

A.3 Define a time specific zero (or < 15%) VAT policy regarding broadband consumption, having in mind users buying associated hardware and subscribing to broadband services, in order to further democratize access and restraining the digital divide, during the 'promotion stage' of the plan.

A.4 Collect, analyze, benchmark and publish detailed, market-by-market information on broadband pricing and competition, which will likely have direct impact on competitive behaviour (e.g., through benchmarking of pricing across geographic markets), while establishing a right trade-off against the risk of creating an information exchange platform for competitors. This will also enable the ICTA and the Competition Commission to apply appropriate remedies when competition is lacking in specific market segments.

A.5 Develop disclosure requirements for broadband service providers to ensure consumers have the pricing and performance information they need to choose the best broadband offers in the market. Increased transparency will push service providers to compete for customers on the basis of actual performance.

A.6 Undertake a comprehensive review of wholesale competition rules in collaboration with the Competition Commission to help ensure competition in fixed and mobile broadband services.

A.7 Initiate procedures to allow data roaming to determine how best to achieve wide, seamless and competitive coverage, encourage mobile broadband providers to construct and build networks, and promote entry and competition.

A.8 Make Regulations to allow a competitive and innovative video set-top box market**,** to be consistent with technology trends. This will allow consumers to make the most of the devices they use to access the video they watch today.

A.9 Clarify the relationship between users and their online profiles to enable continued innovation and competition in applications and ensure consumer privacy, including the obligations of firms collecting personal information to allow consumers to know what information is being collected, consent to such collection, correct it if necessary, and control disclosure of such personal information to third parties.

B. Ensuring efficient allocation and management of scarce resources.

Government establishes policies and legislations for the use of spectrum and oversees access to poles and rights-of-way, which are used in the deployment of broadband networks. Government also finances a large number of infrastructure projects. Ensuring these assets and resources are allocated and managed efficiently can encourage deployment of broadband infrastructure and lower barriers to competitive entry. The NBP2012 contains a number of action lines to accomplish these goals which are listed hereunder:

B.1 Spectrum is a major input for providers of broadband service. More efficient allocation and assignment of spectrum will reduce deployment costs, drive investment and benefit consumers through better performance and lower prices. The actions required on spectrum policy include the following:

- Make 500 MHz of spectrum newly available for broadband within 10 years, of which 300 MHz should be made available for mobile use within five years.
- Enable incentives and mechanisms to repurpose spectrum to more flexible uses. Mechanisms include incentive auctions, which allow auction proceeds to be shared in an equitable manner with current licensees as market demands change. These would benefit both spectrum holders and the public. Incumbents, meanwhile, could recognize a portion of the value of enabling new uses of spectrum.
- Ensure greater transparency of spectrum allocation, assignment and use through an ICTA-created spectrum dashboard to foster an efficient secondary market.
- Expand opportunities for innovative spectrum access models by creating new avenues for opportunistic and unlicensed use of spectrum and adopting new research findings regarding innovative spectrum technologies.

B.2 Infrastructure such as poles, conduits, rooftops and rights-of-way play an important role in the economics of broadband networks. Ensuring service providers can access these resources efficiently and at fair prices can drive upgrades and facilitates competitive entry. In addition,

test-beds can drive innovation of next-generation applications and, ultimately, may promote infrastructure deployment. Actions to optimize infrastructure use include:

- Establish low and more uniform rental rates for access to poles, and simplify and expedite the process for service providers to attach facilities to poles.

- Improve rights-of-way management for cost and time savings**,** promote use of municipal and local authority facilities for broadband, expedite resolution of disputes and identify and establish "best practices" guidelines for rights-of-way policies and fee practices that are consistent with broadband deployment.

- Facilitate efficient new infrastructure construction, including through "dig-once" policies that would make government financing of highway, road, bridge and building projects allowing joint deployment of broadband infrastructure.

For each of the above points, wherever resources are scarce, priority will be given to new entrants and non-dominant existing firms in the relevant market in an attempt to balance overall levels of competition.

C. Reforming Universal Service Mechanisms

All Mauritians should have access to broadband service with sufficient capabilities; all should be able to afford broadband to ensure that they have the opportunity to reap the benefits of broadband. Actions required include the following:

C.1 Broaden the USF contribution base to ensure USF remains sustainable over time.

C.2 Ensure universal access to broadband network services**.**

C.3 Establish a Broadband Connect Mauritius Fund to minimize the size of the broadband availability gap and thereby reduce contributions borne by household consumers.

C.4 Create mechanisms to ensure affordability to low-income Mauritians by introducing a Lifeline programme to allow subsidies to be provided to low-income Mauritians to be used for broadband.

C.5 Consider licensing a block of spectrum with a condition to offer free or low-cost service that would create affordable alternatives for consumers, reducing the burden on USF.

D. Support adoption and utilisation of broadband

All Mauritians should have the opportunity to develop digital literacy skills to take advantage of broadband so as to further the adoption and utilisation of broadband. Actions required in this regard include the following:

D.1 Launch a National Digital Literacy Group (NDLG) to organize and train youth and adults to teach digital literacy skills and enable private sector programs addressed at breaking adoption barriers.

D.2 Redefine the scope of the USF so as to shift this resource to support adoption and utilisation strategies.

E. Updating policies, setting standards and aligning incentives to maximize use for national priorities.

Local governments and municipalities play an important role in many sectors of the economy. Government is the largest health care player in the country, operates the public education system, regulates many aspects of the energy industry, provides multiple services to its citizens and has primary responsibility for national security**.** This policy document includes actions designed to unleash increased use, private sector investment and innovation in these areas. They include the following:

E.1 **Health care.** Broadband can help improve the quality and lower the cost of health care through e-health and improved data capture and use, which will enable clearer understanding of the most effective treatments and processes. Actions in this regard include the following:

- Help ensure that health care providers have access to affordable broadband
- Create incentives for adoption by expanding reimbursement for e-care.
- Remove barriers to e-care by modernizing regulations like device approval, credentialing, privileging and licensing.

- Drive innovative applications and advanced analytics by ensuring patients have control over their health data and ensuring interoperability of data.

E.2 **Education.** Broadband can enable improvements in public education through e-learning and online content, which can provide more personalized learning opportunities for students. Broadband can also facilitate the flow of information, helping teachers, parents, schools and other organizations to make better decisions tied to each student's needs and abilities. To those ends, actions required include:

- Improve the connectivity to schools and libraries to increase flexibility, improve program efficiency and foster innovation by promoting the most promising solutions and funding wireless connectivity to learning devices that go home with students.

- Accelerate online learning by enabling the creation of digital content and learning systems, removing regulatory barriers and promoting digital literacy.

- Personalise learning and improve decision–making by fostering adoption of electronic educational records and improving financial data transparency in education.

E.3 **Energy and Environment**. Broadband can play a major role in the transition to a clean energy economy. Mauritius can use these innovations to reduce carbon pollution, improve the energy efficiency and lessen dependence on foreign oil. To achieve these objectives, actions required are to:

- Modernize the electric grid with broadband, making it more reliable and efficient.

- Unleash energy innovation in homes and buildings by making energy data readily accessible to consumers.

- Improve the energy efficiency and environmental impact of the ICT sector by promoting green energy sources.

E.4 **Economic Opportunity.** Broadband can expand access to jobs and training, support entrepreneurship and small business growth and strengthen community development efforts. These are to:

- Support broadband choice and small businesses' use of broadband services and applications to drive job creation, growth and productivity gains.
- Expand opportunities for job training and placement through an online platform.
- Integrate broadband assessment and planning into economic development efforts.

E.5 **Public safety, emergency communication and national security.** Broadband can bolster efforts to improve public safety and national security by allowing first responders to send and receive video and data, by ensuring all Mauritians can access emergency services and improving the way the public are notified about emergencies. To achieve these objectives, actions proposed include:

- Support deployment of a nationwide, interoperable public safety mobile broadband network built on the present radio network of the Police department, over the next 5 years.
- Promote innovation in the emergency alert systems.
- Promote cybersecurity and critical infrastructure survivability to increase user confidence, trust and adoption of broadband communications.
- Develop cellular emergency signalling systems on the present mobile services.

E.6 **Improving Government Services.** Within government, broadband can drive greater efficiency and effectiveness in service delivery and internal operations. Through its own use of broadband, government can support local efforts to deploy broadband, particularly in un-served communities. To achieve these goals, actions required include improving government performance and operations through upgrade of the present GOC platform, enhanced cybersecurity, secure authentication and online service delivery. This also includes the use of VoIP for intra-government communication.

7. TARGETS

In order to ensure that measurable progress is made in the achievement of the set objectives, in addition to the action lines mentioned above, the NBP2012 also identifies six targets to be adopted by Mauritius, as set out hereunder, to serve as a compass over the next decade and which should be tracked very closely:-

- **By 2014, at least 60% of homes should have affordable access to actual download speeds of at least 10 Mbps and actual upload speeds of at least 5 Mbps; and by 2020, almost 100% of home should have affordable access to actual download of 100 Mbps.**

- **Mauritius should become a leader in the region in mobile innovation, with the fastest and most extensive wireless networks by 2020.**

- **By 2020, every Mauritian should have affordable access to robust broadband service and the means and skills to subscribe thereto if they so choose.**

- **By 2020, every public institution should have affordable access to at least 100 Mbps broadband service to anchor institutions such as schools, hospitals and government buildings.**

- **To ensure safety of the public at large, every alarm monitoring and security response service provider should, by 2020, have access to a nationwide, wireless, interoperable broadband public safety network.**

- **To ensure that Mauritius leads in the clean energy economy in line with the Maurice ile Durable (MID) programme, every Mauritian should, by 2020, be able to use broadband to track and manage their real-time energy consumption.**

8. Performance Dashboard Schedule

Targets	Metrics	Sources
At least 60% of homes should have affordable access to actual download speeds of at least 10 Mbps and actual upload speeds of at least 5 Mbps by 2014; and by 2020, almost 100% of home should have affordable access to actual download of 100 Mbps.	The nationwide, and per provider, average actual upload and download speeds of broadband networks	ICTA network performance measurements and provider disclosures
	Number of households with access to broadband networks with sufficient speed	SM household survey
	The nationwide, and per provider, minimum price for a broadband subscription with sufficient speed	ICTA tariffs determination
Mauritius should become a leader in the region in mobile innovation, with the fastest and most extensive wireless networks of any nation	MHz of spectrum released since 2010	ICTA self-reporting
	The nationwide, and per provider, average actual upload and download speeds of mobile broadband networks, by geographic area	ICTA network performance measurements and provider disclosures
	Percentage of population covered by 3G and 4G services	SM household survey and provider disclosures
	Percentage of population that subscribe to mobile broadband services, both overall and per socio-economic and demographic groups	SM household survey
Every Mauritian should have affordable access to robust broadband service, and the means and skills to subscribe if they so choose	Percentage of households with access to broadband networks with sufficient speed	ICTA and SM household survey
	The nationwide, and per provider, minimum price for a broadband subscription with sufficient speeds	ICTA and provider disclosures
	Percentage of population that subscribe to broadband services, both overall and by socioeconomic and demographic group	SM household survey
	Percentage of population with sufficient digital literacy skills	NCB and SM household survey
Every public institution should have affordable access to at least 100 Mbps broadband service to anchor institutions such as schools, hospitals and government buildings	Average actual upload and download speeds of broadband networks	ICTA network performance measurements and provider disclosures
	Deployment of networks with sufficient speed	ICTA
	Percentage of communities with sufficient access to broadband	ICTA and providers disclosure
	The nationwide, and per provider, minimum price for an institutional broadband subscription with sufficient speeds	ICTA and providers disclosure
To ensure safety of the public at large, every alarm monitoring and security response service provider should have access to a nationwide, wireless, interoperable broadband public safety network.	Percentage of first responders using the nationwide public safety network	ICTA and PMO
To ensure that Mauritius leads in the clean energy economy in line with the MiD programme, every Mauritian should be able to use broadband to track and manage their real-time energy consumption	Percentage of Mauritian homes that have smart electric meters capable of communicating real-time energy information to consumers	CEB

PART III:

POLICY MEASURES

9. COMPETITION AND INNOVATION POLICY

Innovations of the kind as broadband often drive the creation of a wide variety of products and services. The competitive forces that sparked these breakthroughs need to be nurtured so that Mauritius may reap the benefits of an established culture of innovation. The measures that are required to foster innovation and competition in the broadband ecosystem are spelt out. The outcomes for such policy measures are to enhance competition for value across the ecosystem, the transition from a circuit-switched network to an all-Internet Protocol (IP) network and the leveraging of the benefits of innovation and investment.

❖ POLICY MEASURES

9.1 Government, through the ICTA, will make more radiofrequency spectrum available for existing and new wireless broadband providers in order to foster additional wireless and wireline competition.

9.2 The ICTA will collect more detailed and accurate data on actual availability, penetration, prices, churn and bundles offered by broadband service providers to consumers and businesses, and will publish analyses of these data.

9.3 The ICTA will establish technical broadband measurement standards and methodology and a process for updating them. The ICTA will also encourage the formation of a partnership of industry and consumer groups to provide input on these standards and this methodology through a Public-Private-Regulatory Forum (PPRF).

9.4 The ICTA will continue its efforts to measure and publish data on actual performance of fixed broadband services. The ICTA will also publish a formal report and make the data available online.

9.5 The ICTA will issue directives to determine performance disclosure requirements from operators for broadband.

9.6 The ICTA will develop reasonable broadband performance standards for mobile services and small business users.

9.7 The ICTA will comprehensively review its wholesale competition regulations to develop a coherent and effective framework and take expedited action based on that framework to ensure widespread availability of inputs for broadband services provided to small businesses, mobile providers and enterprise customers.

9.8 The ICTA will initiate consultation that would clarify interconnection rights and obligations and encourage the shift to IP-to-IP interconnection where efficient.

9.9 The ICTA will hold consultation that will allow the industry to move forward promptly in the open proceeding on data roaming.

9.10 The Data Protection Office will consider clarifying the relationship between users and their online profiles.

9.11 The Ministry will establish a Public-sector Certification Authority to develop a trusted "identity providers" to assist consumers in managing their data in a manner that maximizes the privacy and security of the information exchanged with government on the E-government platform.

10. SPECTRUM POLICY

Historically, the ICTA's approach to allocating spectrum has been to formulate policy on a band-by-band, service-by-service basis, typically in response to specific requests for service allocations or station assignments in line with the ITU allocation plan. This approach has the limitation of being ad hoc, overly prescriptive and unresponsive to changing market needs. Wireless broadband is poised to become a key platform for innovation over the next decade. The use of wireless broadband is growing rapidly, primarily in the area of mobile connectivity, but also in fixed broadband applications. Key drivers of this growth include the maturation of third-generation (3G) wireless network services, the development of smart-phones and other mobile computing devices, the emergence of broad new classes of connected devices and the rollout of fourth-generation (4G) wireless technologies such as Long Term Evolution (LTE) and WiMAX.

The progression to 4G technologies may require appropriately sized bands, including larger blocks to accommodate wider channel sizes. The rollout of advanced 4G networks using new versions of LTE and WiMAX technologies will also intensify the impact on mobile broadband networks. The next generation of mobile broadband networks will support higher data throughput rates, lower latencies and more consistent network performance throughout a cell site. This will increase the range of applications and devices that can benefit from mobile broadband connectivity, generating a corresponding increase in demand for mobile broadband service from consumers, businesses, public safety, health care, education, energy and other public sector users.

The growth of wireless broadband will be constrained if the ICTA does not make spectrum available to enable network expansion and technology upgrades. In the absence of sufficient spectrum, network providers must turn to costly alternatives, such as cell splitting, often with diminishing returns. If Mauritius does not address this situation promptly, scarcity of mobile broadband could mean higher prices, poor service quality, an inability for the country to compete internationally, depressed demand and, ultimately, a drag on innovation.

Therefore, the ICTA must maintain a forward-looking perspective as it evaluates reallocations or other rule changes that will make more spectrum available for broadband. In general, a voluntary approach that minimizes delays is preferable to an antagonistic process that stretches on for years. However, the government's ability to reclaim, clear and re-auction spectrum (with flexible use rights) is the ultimate backstop against market failure and is an appropriate tool when a voluntary process stalls entirely. While flexibility in spectrum use is valuable, flexibility in access to spectrum can be just as important.

As a result spectrum policy requires reform to accommodate the new ways that industry is delivering wireless services. These reforms include making more spectrum available on a flexible basis, including for unlicensed and opportunistic uses. Given the length of the spectrum reallocation process, these reforms should reflect expectations of how the wireless world will look over the coming 8 years. These spectrum policy reforms should also ensure that there is sufficient, flexible spectrum that accommodates growing demand and evolving technologies especially in the light disruptive technology transformations that happen once every 10 to 15 years and the mobile broadband convergence, involving Internet computing and mobile communications, as well as more transformative breakthroughs that may not even be envisaged at this point in time.

Spectrum policy starts with transparency, i.e. disclosure about spectrum allocations, licensing and utilization. Transparency further increases the quality of policymaking by allowing outside parties, including citizens, companies, other government agencies and investors, to engage in the allocation process on an ongoing basis. In this regard the following policy measures are being set forth.

❖ POLICY MEASURES

10.1 The ICTA will launch and continue to improve on a spectrum dashboard.

10.2 The ICTA will create methods for ongoing measurement of spectrum utilisation.

10.3 The ICTA will maintain an ongoing strategic spectrum plan including a biennial assessment of spectrum allocations.

10.4 The ICTA's statutory power needs to be extended to enable it to conduct incentive auctions in which incumbent licensees may relinquish rights in spectrum assignments to other parties or to the ICTA.

10.5 The ICTA will launch consultation and make recommendations regarding the effectiveness of secondary spectrum markets policies and rules to promote access to unused and underutilized spectrum.

10.6 The ICTA will initiate actions to look into the feasibility of making 500 MHz available for broadband use within the next 8 years, of which, if feasible, 300 megahertz between 2.3 GHz and 3.7 GHz would be made available for mobile use within five years.

10.7 The ICTA will take steps to complete re-farming of the 2.3 and 2.6 GHz band to allow deployment of broadband services thereon.

10.8 The ICTA will embark on planning for the digital dividend resulting from the DTT migration with a view to reallocating some 150 MHz from the analogue broadcast television (TV) bands to broadband deployment.

10.9 The ICTA will promote at the International Telecommunication Union (ITU) innovative and flexible approaches to global spectrum allocation that take into consideration convergence of various radio communication services and that enable global development of broadband services.

11. INFRASTRUCTURE

Just as wireless networks use publicly owned spectrum, wireless and wired networks rely on cables and conduits attached to poles and along public roads. Securing rights to this infrastructure is often viewed by operators as a difficult and time-consuming process that discourages initiatives for them to invest in upgrading their network performance. Given that the permits to be issued to the operators often come from the local authorities, government therefore often has a significant role in network construction. Government also regulates how broadband providers can use existing private infrastructure like utility poles and conduits. Local authorities also have their say to encourage and facilitate fibre conduit deployment as part of public works projects like road construction.

It is the policy of government to ensure that the costs incurred by private industry when using public infrastructure are at a minimal so that the private operators may offer their services at affordable prices. This may be achieved in two ways. First, Government will take steps to improve utilization of existing infrastructure to ensure that network providers have easier access to poles, conduits, ducts and rights-of-way. Second, Government will foster further infrastructure deployment by facilitating the placement of communications infrastructure on Government-managed property and enacting “dig once” legislation. These two actions can improve the business case for deploying and upgrading broadband network infrastructure and facilitate competitive entry.

The policy measures in that regard are as follows:-

11.1 The ICTA will establish rental rates for pole attachments on a cost-oriented approach that are as low and close to uniform as possible.

11.2 The ICTA in collaboration with local authorities will establish a comprehensive timeline for each access process and reform the process for resolving disputes regarding infrastructure access.

11.3 The ICTA will after consultation with local authorities devise means to collect and make available information regarding the location and availability of poles, ducts, conduits and rights-of-way.

11.4 Government will come up with Regulations under the relevant legislations to establish a harmonised access policy for all poles, ducts, conduits and rights-of-way.

11.5 The ICTA will establish a joint task force with the relevant stakeholders to craft guidelines for rates, terms and conditions for access to public rights-of-way.

11.6 Government will consider the possibility of enacting a “dig once” legislation applying to all future public-funded projects along rights-of-way (including sewers, power transmission facilities, pipelines, bridges and roads) to reduce cost of infrastructure set up.

12. RESEARCH AND DEVELOPMENT

Research and Development (R&D) activity is the driver of innovation and productivity gains, which ultimately leads to economic growth. The Mauritius Research Council (MRC), universities and the private sector have an important role to play in spreading a research culture in the new Broadband Ecosystem. The development of research networks and wireless test-beds through a clear R&D funding agenda that is focused on broadband networks, equipment, services and applications with a high emphasis of the local context will allow new entrepreneurs and innovators to be born with a view to advancing E-applications that go a long way in improving the lives of citizens be it in the field of health or education.

Although measuring the effects of R&D is difficult, studies find that firms earn 20% to 30% returns on their investments[18]. R&D returns to society are even higher as innovators beyond original research teams are able to access research and take work in new directions[19]. Given that the gap between R&D returns for private companies and those for society presents a challenge for funding and conducting R&D, government can help fill the R&D investment gap by funding research that would yield net benefits to society but that would not earn sufficient returns to be privately profitable. This approach should include funding for direct research that have high impact on the Mauritians' lives and for broadband R&D at universities and other institutions.

Government will create a clear agenda and priorities for broadband-related R&D funding, focused on important research that would not be conducted in the absence of government intervention. The government will also promote R&D through regulatory policies allowing increased use of government resources. Examples include establishing research centres, centre of excellence or allowing access to spectrum in order to evaluate new technologies in ways that theoretical studies and simulations do not support.

The policy measures for R&D are as follows:-

12.1 Government, through the MRC, will focus broadband R&D funding on projects with varied risk-return profiles, including a mix of short-term and long-term projects (e.g., those lasting 5 years or longer).

12.2 Government will consider making a 'Research and Experimentation (R&E)' tax credit in the long term to approved private companies involved in broadband R&D a long-term to stimulate broadband R&D.

12.3 The MRC will develop a research road map to guide national broadband R&D funding priorities.

12.4 The MRC will study the possibility of establishing an open interdisciplinary research centre for areas related to broadband, addressing technology, policy and economics with the priorities established at 12.3 above.

12.5 The MRC will promote research programmes in the field of local content and media development as well as mobile applications.

12.6 The MRC, in consultation with the ICTA, will allocate funding to both a wireless test-bed for promoting the science underlying spectrum policymaking and a test-bed for evaluating the network security needed to provide a secure broadband infrastructure in Mauritius.

12.7 The ICTA will start a consultation process to establish more flexible experimental licensing procedures for spectrum and facilitate the use of this spectrum by researchers.

13. AVAILABILITY

Everyone in Mauritius should have access to broadband services[20] supporting a basic set of applications that include sending and receiving e-mail, downloading Web pages, photos and video, and using simple video conferencing. Ensuring that all people have access to broadband requires the ICTA to set a national broadband availability target to guide public funding. An initial universalization target of 1 Mbps of *actual* download speed and 256 kbps of *actual* upload speed, with an acceptable quality of service for interactive applications, would ensure universal access. This represents a reasonable speed that the typical broadband subscribers should receive and what many consumers are likely to use in the future, given past growth rates. While the nation aspires to higher speeds, operators will be forced to direct more investment toward meeting this initial target.

A universalisation target of 1 Mbps download and 256 kbps upload is aggressive. It is amongst the highest universalisation targets set by many countries in the world. Many nations, such as South Korea and Finland, have already adopted short-term download targets of around 1 Mbps. Over time, these targets will continue to rise. It is possible the speed requirements for the most common applications will grow faster than they have historically. But it is also possible compression technology or shifts in customer usage patterns will slow the growth of bandwidth needs. To account for this uncertainty, the ICTA should review and reset this target with the evolution of the market.

The policy measures are as follows:-

13.1 Government will conduct a comprehensive reform of the universal service framework in three stages to close the broadband availability gap.

13.1.1 Stage One: Lay the foundation for reform (2012 – 2013)

- Government through the Ministerial USF Committee will sanction new USF projects.
- The ICTA will improve Universal Service Fund (USF) performance and accountability by executing the USF management model and building capacity to adequately respond to USF needs in terms of approved projects of the Ministerial Committee.

13.1.2 Stage Two: Accelerate reform (2014 – 2016)

- The ICTA will have made enough disbursements from the USF.

- The Ministry will make Regulations to broaden the universal service contribution base in order to sustain funding under the USF in the long run.

13.1.3 Stage Three: Complete the transition (2016 – 2020)

- The ICTA will manage the total size of the USF to remain close to its current size in order to minimize the burden of increasing universal service contributions on consumers.

- The ICTA should eliminate any government funded legacy high-cost program to support broadband availability provided through the USF.

13.2 The Ministry will work towards facilitating demand aggregation and use of local networks when that is the most cost-efficient solution for anchor institutions to meet their connectivity needs.

14. ADOPTION AND UTILI ZATION

On the basis of the trend that has been noted there is no doubt that adoption rates will continue to rise. In addition to using ICT, many non-adopters do develop positive attitudes about the Internet once they have been given the opportunity to use same.

The policy measures set in this section address both adoption and utilization. "**Adoption**" refers to whether a person uses a broadband service at home or not; "**utilization**" refers to the intensity and quality of use of that connection to communicate with others, conduct business and pursue online activities. Research indicates that "differentiated use"— different levels of intensity and varied complexity of activities one pursues online — can affect the kind of offline benefits users experience[21]. Adoption is necessary for utilization, but utilization is necessary to extract value from a connection.

While cost is the leading barrier to adoption, there are other reasons that may keep potential users from getting broadband at home; lack of digital skills, irrelevance of online content and inaccessible hardware and software often work together to limit adoption. For non-adopters to find broadband valuable enough to subscribe, they need a basic knowledge of how to find and use trustworthy, substantive content. Similarly, if broadband costs fall because of lower prices or subsidies, consumers might be more willing to try it, in spite of doubts about its relevance or their own abilities to use it.

There is also an important social dimension to broadband adoption that cannot be overlooked. The primary incentive for broadband adoption is communication — two-way communication through e-mail, social networking platforms, instant messaging or video-chatting. People find broadband relevant when the communities they care about are online, exchanging information and creating content.[22] Once online, individuals will stay online if they continue to find information and broadband applications that are useful and relevant to their lives and when the people around them do the same. Ultimately, broadband adoption and utilization are not about owning a specific piece of technology or subscribing to a service but about making the Internet work for people. Getting people online is a critical first step, but the goal must be to ***keep*** people online through sustainable efforts that promote utilization and help each user derive value from the Internet in his or her own way.

Creating the conditions necessary to promote broadband adoption and increase utilization requires a range of activities. The government has a role in providing support to people with low incomes, ensuring accessibility, funding sustainable community efforts, convening key stakeholders and measuring progress. NGO's can often work cooperatively with government, focusing on issues important in the community. Private industry also has a

stake; businesses stand to gain because new adopters can become skilled customers and employees. All stakeholders should work together on broadband adoption issues, guided by a set of consistent principles:

- *Focus on the barriers to adoption.* Successful efforts address multiple barriers to adoption simultaneously. They combine financial support with applications and training that make broadband connectivity more relevant for non-adopters. Relevance, in turn, boosts the technology's perceived value and affordability.

- *Focus on broadband in the home.* While libraries and other public places are important points of free access that help people use online applications, home access is critical to maximizing utilization. Broadband home access can also help rural, low-income, and the vulnerable groups overcome other persistent socioeconomic or geographic disparities.

- *Promote connectivity across an entire community.* New users generally adopt broadband to stay in touch with others. In addition, people are more likely to adopt and use broadband if the people they care about are online and if they see how broadband can improve their quality of life in key areas such as education, health care and employment.

- *Promote broadband utilization.* Promoting access and adoption are necessary steps, but utilization is the goal. People must be able to use broadband to efficiently find information or use applications to improve their lives. A connection is just the beginning.

- *Plan for changes in technology.* Adoption programs have to evolve with technology. Both the trainers and the equipment they use to serve non-adopters must employ up-to-date technology and applications.

- *Measure and adjust.* Measurement and evaluation are critical to success because they allow programs to make adjustments on an ongoing basis.

- *Form partnerships across stakeholder groups.* Promoting adoption requires commitment from the State, industry partnership and support from nonprofits and philanthropic organisations. Sustainable broadband adoption and use will require efforts from all partners.

❖ POLICY MEASURES

14.1 The Government and ICTA will introduce a “Lifeline Assistance” for broadband for the vulnerable groups to make broadband more affordable for low-income households. Alternative sources of renewable energy will be promoted to power access devices with a view to reducing energy power consumption at the level of households.

14.2 The Government and ICTA will consider the possibility for free or very low-cost wireless broadband as a means to address the affordability barrier to adoption.

14.3 The government will launch a National Digital Literacy Program (NDLP) that creates a Digital Literacy Group and create an Online Digital Literacy Portal.

14.4 The NCB will explore the potential for public-private-partnerships to improve broadband adoption by working with other agencies.

14.5 The NCB will work with public and private partners in order to prioritize efforts to increase the relevance of broadband for the elderly.

14.6 The government will explore the potential of mobile broadband access as a gateway to social inclusion.

14.7 The NCB will work with the private sector and non-profit community to conduct a national outreach and awareness campaign.

14.8 The ICTA will establish a National Broadband Clearinghouse to promote best practices and information sharing.

15. HEALTH CARE

Improving health care in Mauritius is one of the most important tasks set by the government. Free health care already accounts for Rs8 billion in the national budget for 2011. Mauritians are aging; by 2040 there will be twice as many Mauritian older than 65 as there are today, accordingly health care costs will likely increase as a consequence. Rising costs would normally be less of a concern when there are tangible results for the population at large. To address this kind of situation, one can rely on technology which has the potential to really improve the way government delivers health services, but alone it cannot heal, whereas when appropriately incorporated into care, technology can help health care professionals and consumers make better decisions, become more efficient, engage in innovation, and understand both individual and public health more effectively. Analysis of information gathered through an e-health system can provide a basis for reform.

Video consultation is especially beneficial for extending the reach of under-staffed specialties to patients residing in rural areas. Remote patient monitoring enables early detection of health problems, usually before the onset of noticeable symptoms. Earlier detection allows earlier treatment and, therefore, better outcomes. Mobile health, although a solution which is in its infancy stage, is yet another new frontier in health innovation. This field encompasses applications, devices and communications networks that allow clinicians and patients to give and receive care anywhere at any time. Physicians download diagnostic data, lab results, images and drug information to handheld devices like PDAs and Smartphones; emergency medical responders use field laptops to keep track of patient information and records; and patients use health monitoring devices and sensors that accompany them everywhere. Through capabilities like these, mobile health offers convenience critical to improving consumer engagement and clinician responsiveness. Innovations in mobile medicine include new modalities of non-invasive sensors and body sensor networks. Mobile sensors in the form of disposable bandages and ingestible pills relay real-time health data (e.g., vital signs, glucose levels and medication compliance) over wireless connections.

A key barrier to greater broadband-enabled e-health adoption is misaligned incentives[23]. It is a fact that those who benefit most from use of these technologies are often not the same as those who shoulder the implementation costs. Providers are expected to pay for equipment and training and adjust to altered workflows. These costs often outweigh the direct benefits they can reasonably expect to gain, be it in the short run or long run, in terms of reimbursement for services facilitated by e-health. As a result, hospitals and physicians cite funding and unclear investment returns as major barriers to electronic health record adoption. Instead, it is payers and patients who reap most of the direct benefits of health.

It is equally important to recognize the radical change that this new approach will bring to health care. The health care delivery system has been dogged for years by criticism that incentives are not necessarily aligned to outcomes. The meaningful use mechanism is an attempt, supported by an enormous government investment to develop a new incentive model.

It is common knowledge that data are becoming the world's most valuable commodity. In multiple sectors, including finance, retail and advertising, free-flowing and interoperable data have increased competition, improved customer understanding, driven innovation and improved decision-making. The advanced use of data in health care offers immense promise in many areas:

- *Better treatment evaluations.* By using applications to collect and analyze existing data, which today are locked in paper charts, physicians and researchers can evaluate the efficacy and side effects of treatments from disparate groups of patients in order to develop best practices.

- *Personalized medicine.* Many therapeutic drugs are indiscriminately applied to vast populations without sufficient understanding of which treatments work better or worse on certain people. Genomic research produces huge amounts of data that, when combined with clinical data, could enable development of better targeted drugs. Such drugs could improve outcomes and reduce side effects.

- *Enhanced public health.* Accurately measuring health status, identifying trends and tracking outbreaks and the spread of infectious disease at a population level are extremely difficult. E-health enables widespread data capture which in turn allows better real-time health surveillance and improved response time to update care recommendations, allocate health resources and contain population-wide health threats.

- *Empowered consumers.* Consumers are too often passive recipients of care, not accessing, understanding or acting upon their own data. E-health applications that provide easy access and simplify vast amounts of data empower consumers to proactively manage their health. Empowered consumers better grasp their health needs, demand high-quality services and make informed choices about treatment options.

- *Improved policy decisions.* Innovation in health care delivery systems and payment models is stifled by the lack of suitable interoperable data. The prevailing health care payment model mainly pays for volume of services rendered rather than quality of services provided. However, the right data will help make outcomes-based reimbursement possible by allowing consumers, payers and providers to understand the impact of various prevention and treatment options.

Broadband e-health plays a key role in advancing policy priorities that improve health and health care delivery. Priorities set forth aim at:

- Improving care quality, safety, efficiency and reducing disparities
- Engaging patients and families in managing their health
- Enhancing care coordination
- Improving population and public health
- Ensuring adequate privacy and security of health information

❖ POLICY MEASURES

15.1 Government will consider developing a strategy that documents the proven value of e-care technologies, their meaningful use and charts a path for their widespread adoption.

15.2 Government will look into means to reduce regulatory barriers that inhibit adoption of e-health solutions.

15.3 The ICTA in consultation with the Ministry of Health will clarify regulatory requirements and the approval process for converged communications and e-health care devices.

15.4 Government will consider enlarging the scope of the USF to cover e-health projects.

15.5 Government will consider the establishment of a Health Care Broadband Infrastructure with the appropriate funding mechanism to deliver service at locations where existing networks are insufficient, including tele-health facilities to Rodriques and the outer islands.

15.6 The NCB will periodically publish a Health Care Broadband Status Report.

16. EDUCATION

The demands of the new information-based economy require substantial changes to the existing system. Businesses have often pointed to a widening gap between the skills of graduates and modern workforce demands. Measured against international benchmarks, Mauritius is at a disadvantage vis-à-vis other advanced nations in producing the required number of professionals; furthermore the study of maths and science is on a declining trend at secondary level.

In addition, there is widespread inability to engage students in learning, a lack of standards and assessments that measure learning effectively and insufficient access to timely, individualized content for students. Exacerbating these challenges is limited ability for teachers and principals to share best practices, content and strategies to improve achievement. The escalating cost of tertiary education principally, measured against overall results, is also a critical issue.

To address these challenges four core assurances should drive the strategy:

- Making progress toward rigorous college- and career-ready standards and high-quality assessments that are valid and reliable for all students, including students with disabilities.
- Establishing pre-kindergarten to college and career data systems that track progress and foster continuous improvement.
- Making improvements in teacher effectiveness and in the equitable distribution of qualified teachers for all students, particularly those most in need.
- Providing intensive support and effective interventions for the lowest-performing schools.

Broadband can be an important tool to help educators, parents and students meet major challenges in education. The country's economic welfare and long-term success depend on improving learning for all students, and broadband-enabled solutions hold tremendous promise to help reverse patterns of low achievement. With broadband, students and teachers can expand instruction beyond the confines of the physical classroom and traditional school day. Broadband can also provide more customized learning opportunities for students to access high-quality, low-cost and personally relevant educational material. And broadband can improve the flow of educational information, allowing teachers, parents and organizations to make better decisions tied to each student's needs and abilities. Improved information flow can also make

educational product and service markets more competitive by allowing schools and other organisations to develop or purchase higher-quality educational products and services.

❖ POLICY MEASURES

16.1 Support and promote online learning

- Government will establish standards to be adopted for locating, sharing and licensing digital educational content.
- Government will increase the supply of digital educational content available online that is compatible with standards established.
- The Ministry of Education and Ministry of Tertiary Education will periodically re-examine the digital data and interoperability standards it adopts to ensure that they are consistent with the needs and practices of the educational community.
- The Ministry of Education will consider taking legislative action to encourage copyright holders to grant educational digital rights of use, without prejudicing their other rights.
- The Ministry of Education will look into the possibility of providing support and funding for research and development of online learning systems.
- The Ministry of Education will consider investment in open licensed and public domain software alongside traditionally licensed solutions for online learning solutions, while taking into account the long-term effects on the marketplace.
- The Ministry of Education will establish a program to fund the development of innovative broadband-enabled online learning solutions.
- With a view to promote collaborative creative works government will consider establishing the necessary legislative framework to allow Creative Commons Licences especially in research and education/pedagogy.

16.2 Unlock the value of data and improve transparency

- The Ministry of Education will encourage the adoption of standards for electronic educational records.

- The Ministry of Education will develop digital financial data transparency standards for education. It should collaborate with the public and private education agencies to encourage adoption and develop incentives for the use of these standards.

16.3 Modernize educational broadband infrastructure

- The ICTA in consultation with the Ministry of Education will initiate consultations to set goals for minimum broadband connectivity for schools and libraries and prioritize funds accordingly.

- The ICTA will provide support for Internet connections to more schools and libraries.

- Government will work out strategies to give schools and libraries more flexibility to purchase the lowest-cost broadband solutions.

- The NCB, in collaboration with the Mauritius College of the Air (MCA) and the Ministry of Education, will develop educational and pedagogical tools for the general public to promote the broadband culture in the population.

- The ICTA will initiate consultation to fund wireless connectivity to portable learning devices. Students and educators should be allowed to take these devices off campus so they can continue learning outside school hours.

- Government will encourage all colleges to be connected with high-speed broadband and maintain that connectivity.

17. PUBLIC SAFETY AND SECURITY

Safety and security are vital to any nation's prosperity. Broadband can help public safety personnel to respond to emergencies very effectively and to respond swiftly when they occur. Broadband can also provide the public with new ways of calling for help and receiving emergency information.

Cutting-edge public safety communications system uses broadband technologies:

- To allow first responders anywhere in the country to send and receive critical voice, video and data to save lives, reduce injuries and prevent acts of crime and terror.
- To ensure all citizens can access emergency services quickly and send and receive vital information, regardless of how it is transmitted.
- To revolutionize the way citizens are notified about emergencies and disasters so they receive information vital to their safety.
- To reduce threats to e-commerce and other Internet-based applications by ensuring the security of the nation's broadband networks.

Unfortunately, many of us have not yet realised the tremendous potential of broadband to enhance public safety. Furthermore, many countries in the world, including Mauritius, face potential threats to the resiliency and cybersecurity of its networks, given that almost on a daily basis cyber attacks in different kinds of forms and tenor are being reported form different corners in the world. As the world moves online, digital borders are not nearly as secure as its physical borders. The country must do better. In a broadband world, there is a unique opportunity to achieve a comprehensive vision for enhancing the safety and security of the citizens. Careful planning and strong commitment could create a cutting-edge public safety communications system to allow first responders anywhere in the country to communicate with each other, sending and receiving critical voice, video and data to save lives, reduce injuries and prevent acts of crime and terror.

Broadband can also make the emergency alert systems more capable, allowing for better protection of lives and property. Similarly, government can use broadband networks to disseminate vital information to the public during emergencies, such as cyclones, pandemics and tsunamis in multiple formats and languages. Finally, well-structured and well-protected broadband networks could reduce threats to Internet-based applications. The proliferation of Internet Protocol (IP)-based communications requires stronger cybersecurity. Disasters and pandemics can lead to sudden disruptions of normal IP traffic flows. As a result, broadband communications

networks must be held to high standards of reliability, resiliency and security. The policy measures set out are designed to realize this vision.

❖ POLICY MEASURES

17.1 Promoting public safety wireless broadband communications

17.1.1 Create a public safety broadband network, including maritime safety information system.

- Create an administrative system that ensures access to sufficient capacity on a day-to-day and emergency basis.
- Ensure there is a mechanism in place to promote interoperability and operability of the network.
- Conform existing programs to operate with the public safety broadband network

17.1.2 Survey public safety broadband wireless mobile infrastructure and devices.

17.1.3 Ensure that broadband satellite service is a part of any emergency preparedness program.

17.1.4 Preserve broadband communications during emergencies.

17.2 Improving National Cybersecurity and protecting Critical Information Infrastructure

17.2.1 The Ministry will establish the CERT-MU as an autonomous body.

17.2.2 The CERT-MU will issue a cybersecurity roadmap.

17.2.3 The ICTA will expand its outage reporting requirements to broadband service providers.

17.2.4 The ICTA will after consultation with the CERT-MU create a voluntary cybersecurity certification program for ISPs.

17.2.5 The ICTA, in consultation with the Prime Minister's Office, will create priority network access and routing for broadband communications.

17.2.6 The ICTA will explore standards for broadband communications reliability and resiliency.

17.2.7 The CERT-MU will create a cybersecurity information reporting system (CIRS).

17.2.8 The ICTA in collaboration with the CERT-MU will explore network resilience and preparedness.

17.2.9 The CERT-MU should expand its international participation and outreach.

18. IMPROVING GOVERNMENT SERVICES

Government can use broadband to increase the efficiency of its own internal operations and help local authorities and communities deploy more broadband capability. Integrating and streamlining processes can help citizens especially at the lower rung of the economic ladder to receive all the safety-net benefits for which they qualify, and that has had a demonstrable effect on bettering their chances of getting out of poverty. Meanwhile, government services will operate more efficiently with the paperwork reduction that broadband technology allows.

Furthermore, the global, borderless nature of the Internet has also led to the emergence of new categories of threats that can come from anyone, anywhere in the world, at any time. Protecting the Internet and providing for cybersecurity is both an economic and national security challenge and collectively, one of the most serious challenges of the 21st century. How the government approaches and provides cybersecurity will be critical to the continuing evolution of the Internet in Mauritius.

❖ POLICY MEASURES

18.1 Improve connectivity through government action

- Government agencies and departments will serve as broadband anchor tenants for un-served and underserved communities.

18.2 Enhance internal government efficiency

- NCB will develop a vision and strategy to guide agencies on cloud computing.
- The Ministry, in collaboration with NCB, will hold an annual competition to recognize internal efforts to transform government using broadband-enabled technologies.
- The Ministry will set up a working group of senior officials to implement guidelines and requirements for inter-ministry coordination of e-government. This will include the development of information, Communication and Knowledge Management strategies to ensure an efficient online service delivery for Government-to-Government (G2G) and G2C applications.
- The CIB will accelerate adoption of media technologies for internal use in Ministries.

18.3 Improve service delivery

- The Ministry will, pursuant to the outcomes of the e-Government Strategy study to be conducted by the CIB, implement the recommendations that will promote online service delivery.

- The Government will consider re-examining the Data Protection Act to facilitate the delivery of online government services and to account for changes in technology.

- The government will undertake a series of efforts to improve the delivery of government services online.

- The Ministry will review the business process in Ministries that should aim to reduce paper-work in government thus enabling government to improve government services.

- The government will undertake a series of efforts to improve the delivery of government services online.

- The NCB will benchmark government websites against the private sector for making improvements on an annual basis.

- The NCB will promulgate Web standards and templates to make the Web presence easier to navigate, easier to recognize and accessible to people with disabilities.

18.4 Strengthen cybersecurity

- The Ministry, in collaboration with the relevant stakeholders, will develop machine-readable repositories of actionable real-time information concerning cybersecurity threats.

- Government will take an active role in developing public-private cybersecurity partnerships.

- The Ministry will expand existing and develop additional educational programs, scholarship funding, training programs and career paths to build workforce capability in cybersecurity.

- The Ministry through the CERT-MU will develop a coordinated foreign cybersecurity assistance program to seek assistance from foreign countries in the development of legal and technical expertise to address cybersecurity.

- The ICTA will work with Internet service providers (ISPs) to build robust cybersecurity protection and defences into networks offered to businesses and individuals without access to cybersecurity resources. ISPs that participate in this program should receive technical assistance from the ICTA in securing their networks.

19. IMPLEMENTATION AND BENCHMARKS

Implementation of this National Broadband Policy requires a long-term commitment to measuring progress and adjusting programs and policies to improve performance. It requires periodic assessments of where Mauritius stands in broadband deployment, adoption and utilization; in competition across networks, devices and applications; and in how effectively national priorities embrace the power of broadband. But evaluation is not an excuse for paralysis. Actions and their results matter most to capturing the opportunities broadband presents.

This document has set forth significant actions to be taken by various parties; a strong partnership among all broadband stakeholders is required to ensure that the policy objectives set are actually met. With a view to assisting in the implementation of this policy it is provided that:-

- The Ministry will set up a National Broadband Task Force to coordinate the implementation of the National Broadband Policy.

- The Ministry will publish a timetable of proceedings to implement the actions set out, publish an evaluation of plan progress and effectiveness, create a Broadband Data Depository and continue to publish information on the broadband deployment on the government portal a public resource for broadband information.

- The Ministry will publish a Broadband Performance Dashboard with metrics designed to track broadband policy goals.

Furthermore, as regards organisational responsibility the ICTA will be assigned all the regulatory policies functions while the National Computer Board (NCB) will be given full responsibility for the promotional functions. The Ministry will be responsible to link up with other line Ministries to ensure adequate policy coordination subject to the nature of the programme and projects under consideration in the implementation of the NBP2012.

20. CONCLUSION

This NBP2012 is premised on the potential of broadband to improve lives of Mauritians today and for generations to come. Mauritius is at a point of inflexion in its ICT journey and this broadband policy comes at a

time where the country can really leapfrog the sector forward to bring its benefits to other sectors. But broadband alone will not solve all the citizens' problems. It cannot on its own ensure that Mauritius bestows the best job, education, health care, public safety and government services on each and every Mauritian. Broadband is a critical prerequisite, though, to solutions to many of the challenges that are currently being faced. It can open up ways for innovators and entrepreneurs to assert leadership in the region. It can unlock doors of opportunity long closed by geography. It can enable education beyond the classroom and health care beyond the clinic and hospitals. Broadband is a modern necessity of life, not a luxury. It ought to be found in every village, in every home of this country. There has long been talk of the widespread and affordable use of broadband. This policy is about how to start making it happen. It is a transition from simple chatter to the difficult but achievable reality of implementation as enshrined in this Paper through the various policy measures.

21. LIST OF ABBREVIATIONS

2G	Second-generation
3G	Third-generation
4G	Fourth-generation
CAP	Community Access Points
capex	Capital expenditures
CERT	Computer Emergency Response Team
CIB	Central Informatics Bureau
CIO	Chief Information Officer
CIP	Critical Infrastructure Protection
CIRS	Cybersecurity Information Reporting System
CPE	Customer premises equipment
DPA	Data Protection Act
DSL	Digital Subscriber Line
DSLAM	Digital Subscriber Line Access Multiplexer
DTT	Digital Terrestrial Television
FCC	Federal Communication Commission
FTTN	Fiber-to-the-node
FTTP	Fiber-to-the-premises
G2C	Government to Citizens
G2G	Government to Government
Gbps	Gigabits per second
GDP	Gross domestic product
GPS	Global Positioning System
HD	High definition
HSDPA	High Speed Data Packet Access
IC3	Internet Core Competency Centre
ICT	Information and Communications Technologies
ICTA	Information and Communication Technologies Authority
IP	Internet Protocol
IPAWS	Integrated Public Alert and Warning System
ISM	industrial, scientific and medical
ISP	Internet service provider
IT	Information technology
ITU	International Telecommunication Union
Kbps	Kilobits per second
LTE	Long Term Evolution
M2M	Machine-to-machine
Mbps	Megabits per second
MCA	Mauritius College of the Air
MFN	Multi-Frequency Network
MRC	Mauritius Research Council
NCB	National Computer Board
Ofcom	Office of Communications
PC	Personal computer
PCS	Personal Communications Service

PDF	Portable Document Format
PKI	Public Key Infrastructure
PLMN	Public Land Mobile Network
PMO	Prime Minister's Office
POTS	Plain Old Telephone Service
PSTN	Public Switched Telephone Network
R&D	Research and development
ROI	Return on Investment
SD	Standard definition
SFN	Single Frequency Network
SIM	Subscriber Identity Module
SHDSL	Synchronous High-speed Digital Subscriber's Line
SLA	Service Level Agreement
SM	Statistics Mauritius
SMS	Short Message Service
Telco	Telecommunications
TV	Television
UHF	ultra high frequency
USF	Universal Service Fund
UNESCO	United Nation Educational Scientific and Cultural Organisation
VHF	Very high frequency
VoIP	Voice over Internet Protocol
WCS	Wireless Communications Service
WiMAX	Worldwide Interoperability for Microwave Access
WISP	wireless Internet service provider
WPS	Wireless Priority Service
WRC	World Radio-communication Conference

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