Development of a National Broadband Strategy Project

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For

Botswana Communications Regulatory Authority

DRAFT NATIONAL BROADBAND STRATEGY

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 Executive summary

1.1 Context

Broadband is widely acknowledged as a key-enabler of a knowledge-based society. It has been proven by numerous studies that an increase of 10% in broadband penetration accelerates the economic growth by more than 1 percentage point. Besides, broadband has other social and political benefits. It promotes and facilitates social and market interaction by connecting consumers, businesses and governments. Politically, broadband enhances accountability and transparency by facilitating easy and fast communications. Furthermore, a number of services such as education, health and financial services can be delivered on line thanks to broadband.

The National Broadband Strategy (NBS) aims at increasing the accessibility of broadband services throughout the country and improving its affordability. It takes into account the variety of needs among the users, from citizens in rural areas to corporate and institutional entities in the main cities. The strategy considers the supply-side policies (fostering the deployment of networks and the accessibility to broadband) as well as the demand side policies (developing the usage and the range of services based on broadband).

Based on the outcome of a thorough assessment of the current situation with respect to Botswana's strength and weaknesses in the broadband domain, the Strategy defines clear policy and strategic objectives with a roadmap to achieve such objectives. It also identifies key projects to be implemented, and presents the articulation between its different phases.

The National Broadband Strategy is anchored within broader national policies and goals. It must be understood as providing a basis through which the national policy objectives outlined in various Government policy documents, initiatives and interventions can be achieved. That is, it is both a product and an enabler of the implementation of other Government policy initiatives.

The underlying principle that underpins the strategy is the recognition and belief in competition as a driving force for innovation, efficiency and affordability. In this way, the implementation of the strategy would be carried out in such a way that it complements rather than contradict other key Government policies that promote competition. These include such Government policies as the National ICT Policy (Maitlamo); Competition Policy 2005, Privatisation Policy and other national initiatives.

Broadband is defined as an ecosystem that encompasses networks, the services that the networks carry, the applications they deliver, as well as users. This definition considers the fact that setting a threshold in terms of throughput speeds alone cannot take into account the continuous evolution of technology, applications and needs, or the great variety of requirements between users and the fact that users are mainly interested in the services provided rather than the technology that conveys such services.

1.1.1 Current situation in Botswana

The broadband supply chain is made of international connectivity, a national backbone, backhaul links or metropolitan access links, and a local access network (fixed or mobile, wireline or wireless).

International connectivity is always an issue for landlocked countries such as Botswana, especially when most of the content is hosted abroad. The decision by Government to invest in undersea cables was a major positive step. However, transit costs to reach the landing stations from the country's borders remain high and thus a major constraint.

The national fibre optics backbone that connects all urban centres and major villages constitutes a key asset for the country. Combined with backhaul links, this infrastructure serves the local access networks.

Wireless mobile networks cover most of the population. The upgrading of these networks to 3G technology in urban centres and the biggest villages has enabled mobile operators to start catering for broadband as well.

The copper local loop that serves all urban centres and major villages is also a major asset as xDSL is a proven and reliable solution to provide high quality broadband services to corporate, enterprises and residential users. However, the cost of deploying it beyond its current extent would be prohibitive.

An important innovation to enhance citizens' access to broadband services is the availability of Kitsong Centres. These are public access centres which can be used by people who do not have personal devices to access information and communications services. The current model of existing Kitsong Centres should be improved as many of these centres are not properly operated and / or managed.

In terms of usage, the main factors that have been found hindering a wider development of broadband are:

- The relatively high level of retail prices;
- The high level of wholesale prices and the lack of transparency;
- A lack of local ecosystem.

1.2 Demand side policies

1.2.1 Content

Local content availability is of prime importance for Botswana. Content provision can only be the result of interaction of many market players and cannot rely only on top-down decisions. The Government actions should focus on supporting bottom-up initiatives for developing Web-hosting, Web agencies, appropriate content and applications, e- and m-commerce, etc.

In Botswana the Government plays a major role in the provision of services to the people. The e-Government Strategy and implementation plan have therefore been identified as being key drivers for broadband diffusion. Accordingly the implementation schedule for the e-Government Strategy should be publicised and efforts should be made to comply with it.

1.2.2 Capacity building

ICT capacity building among the population is a key requirement for a wider penetration of broadband usage. The Strategy includes the setting-up of a structured mass Digital Literacy programme and defines targets and typical contents. This programme would be implemented with the support of “trainers for trainers” to be located in Government funded Internet access establishments (schools, libraries, Kitsong centres). These trainers would deliver basic digital literacy curriculum. These efforts could be supplemented by other initiatives such as the setting-up of an online digital literacy portal.

1.2.3 Affordability

The provision of computers and affordable Internet connection in public access sites (Post offices, libraries, etc.) would help in increasing the number and the category of people who could use IT.

Furthermore, allowing users to be aware of the services available and giving them the means to compare the offers would increase competition in the provision of broadband services and thereby reduce prices. Hence, it is desirable that all operators and ISPs publish the services/products they offer and applicable price information of their standard offers on publicly available media such as their websites.

1.2.4 Legal framework

Finally, an appropriate legal framework is critical for effective implementation of the broadband strategy. Such a framework should facilitate the deployment and utilisation of the broadband infrastructure as well as engender trust and confidence in the uptake of broadband services. Legal reform is therefore necessary, in particular in the following areas:

- Electronic Commerce and Signatures
- Consumer protection
- Protection of Personal Data
- Cyber crimes
- Security of Systems and Networks
- Infrastructure Deployment and Usage

Botswana should domesticate the relevant SADC Model Laws. They are based on international best practices and would ensure a speedy and effective implementation of the recommendations of Maitlamo as well as laying the legislative foundation for the implementation of the National Broadband Strategy.

1.3 Supply side policies

The actions that the Government and the Botswana Communications Regulatory Authority (BOCRA) can take on the supply side are of different nature. These include:

- Spurring or funding (directly or indirectly) the deployment of new networks (upgrades, extension, etc.) in order to increase accessibility.
- Facilitating access to networks, infrastructures and wholesale services for all players in the market in order to enhance competition on a level playing field, to foster the emergence of new services and their affordability.
- Acting directly on the costs for access to networks and for the purchase of IT equipment to improve affordability.

1.3.1 Wholesale offers: accessibility and reduction of prices

The first category of decisions to be taken for the success of the strategy relates to the improvement of accessibility to wholesale offers as well as reduction of prices. These include:

- The publication by all PTOs of their wholesale catalogue (standard offers available to other PTOs or ISPs) would spur competition in the sector.
- The discussion with neighbouring countries, at bilateral or at regional SADC level, with a view to reduce and regulate transit charges to the undersea cable landing stations.
- Carrying out a cost study in order to realign the costing models with the conditions of access to international bandwidth, and with current transmission technologies which are less sensitive to distance.
- Modifying the wholesale ADSL price structure in order to improve competition by having the end customer deal with a single bill for Internet access and service, and by splitting the wholesale cost between pure access and backhaul charges.
- Performing replicability test of retail services from dominant operators to check whether small players would be able to reproduce the retail offers from dominant operators using the same wholesale services, and thus avoid squeeze effects.

In addition, deployment of networks could be facilitated by making passive infrastructure sharing mandatory, and by encouraging Radio Access Network (RAN) equipment sharing.

1.3.2 Wireless Next Generation Access (NGA) network

Mobile broadband provides the quickest and most cost effective means of providing broadband services especially in rural areas where the availability of copper network is not widespread. Mobile broadband therefore remains the most viable and preferred method of ensuring speedy and affordable way of expanding access to broadband service in Botswana.

The deployment of Next Generation Access (NGA) technologies such as 4G/LTE could be spurred first by providing additional spectrum in the lower frequency range. This spectrum is particularly suited for rural areas due to its bigger coverage range. Therefore the digital TV migration process should be accelerated so as to release the 800 MHz band.

The provision of spectrum for the NGA networks should be subject to commitments by the operators to cover at their own cost the major urban centres and villages, where the modelling has shown that such areas could be profitable.

The coverage of a number of rural areas will require some form of subsidy on account of the fact that these are non-profitable areas. The approach to allocation of subsidy should be similar to the one adopted during Nteletsa II programme, following a reverse auction model with the tender being awarded to the operator requiring the least subsidy. This tender should be organised on a regional basis, with a division of the country along the lines fully discussed in the report.

Furthermore, the availability of broadband connectivity in farms has been identified as a need by BOCRA and the Government. However, using 4G/LTE for all farming areas in the country would be extremely expensive as shown later in this report. Therefore, the preferred approach is to address broadband provision in the farms on a case by case basis taking the needs of each specific area into account. In this way, it would be possible to come up with other affordable solutions given each area's requirements. However, in the short term only farms already covered by existing network(s) should be included in the above-mentioned tender.

1.3.3 Fixed broadband and ultra-fast broadband access

The provision of Symmetric-DSL (SDSL) would provide very good bandwidth of acceptable international standards for professional connectivity (symmetry, guaranteed capacity, quality of service, service level agreements, etc.). The cost for implementing this technology is not too prohibitive. It can thus be done rapidly. Accordingly, BTC should upgrade its xDSL infrastructure to incorporate SDSL. BTC's wholesale offers for this service should be such that all ISPs who wish to use it to provide retail SDSL services are offered cost oriented tariffs on fair and transparent terms.

Reaching world-class ultra-fast broadband is feasible through the roll-out of a fibre-to-the-x (FTTx) in targeted geographic areas. Fifteen (15) urban centres and villages have been identified for this purpose.

Where due to the nature of the infrastructure, for example the infrastructure being a natural monopoly or what amounts to a bottleneck to market entry; then access to such infrastructure should be on open access principles to promote, enable and or maintain competition at service level. FTTx infrastructure in the context of Botswana seems to be a candidate to be considered a natural monopoly access to which should be on open access principles.

Bofinet is the only player that can meet the requirement of open access principles as it shall not provide services at retail level.

1.3.4 Promotion of Internet Access in Rural Areas

Satellite broadband access in rural areas should be supported through specific subsidies to be granted on a case by case basis, when no other solution can provide the same level of service at a reasonable cost.

As explained above, the presence of Kitsong Centres remains critical. Therefore the current model should be improved and the centres could even be upgraded to provide broadband services and also include equipment that would upgrade them into wireless Local Internet Access Points (LIAPs). An audit should be carried out to distil useful lessons that could be taken on board during the rollout of community access centres as part of the broadband infrastructure.

Potential steps of increasing the roll out of LIAPs should be taken including ensuring that the cost of backhauling internet traffic from LIAPs to ISP's main centres is cost based, defining a rollout schedule for LIAPs, etc.

1.3.5 Making use of additional capacity

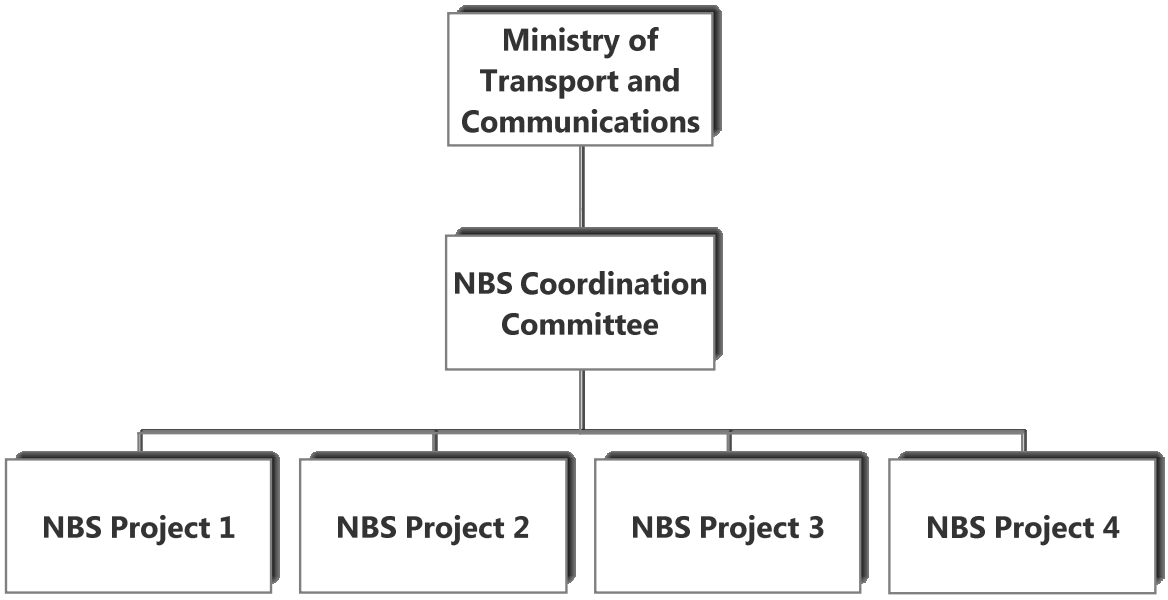
Setting up an entity that would use the excess fibre optic cable network owned by BPC to provide telecommunications services would be a good option. However, there are difficulties in getting consensus amongst stakeholders in the short term due to various reasons. In the circumstances a more palatable option would be to allow BPC to lease its excess dark fibre to the main operators (Bofinet, BTC, Mascom, Orange), if they are interested. This should be subject to a simple licence/authorisation by BOCRA in order to put this valuable national resource to use, for the benefit of consumers, increase the available capacity, provide redundancy and in some cases provide new fibre infrastructure.

1.3.6 Availability of IT equipment

The availability of low cost laptops and smartphones will be a critical success factor for the development of Broadband in Botswana. In particular, smartphones will be the main access devices to broadband for rural inhabitants who are very sensitive to price levels. Thus, the Government of Botswana should consider exempting smartphones, laptops and other similar ICT equipment from import/customs duties and / or Value Added Tax.

1.4 Implementation issues

A National Broadband Strategy Coordination Committee should be set-up to ensure an efficient implementation of the strategy and a coordinated approach with respect to the provision of services, including the provision of power in areas targeted for broadband infrastructure and rollout of e-government services. This structure is described below hereafter. Responsibilities and functions of all the entities that constitute the Broadband Implementation Structure are discussed in the report.



The NBS should be subjected to review at least every five (5) years by an independent third party appointed by the Ministry responsible for communications provided that the first of such a review should take place in 2018.

In terms of funding, an important source is the Universal Service Fund that should be set-up as per recommendations of the study on the "Development of a Universal Access and Service Policy for the Communications Sector in Botswana" (2006) with whatever modifications that the Government has made to the recommendations therein. It should be financed from a combination of sources including operator levy, direct Government contribution, and any lawful contribution from an approved third party contributor.

Furthermore, a broadband observatory tool that will monitor the key performance indicators to track the progress in the execution of the National Broadband Strategy is proposed.

An implementation schedule shows the timing for launching and executing the projects and recommendations presented in this report, with the identification of quick wins, to be dealt with in the coming months.

Further details on the above issues are discussed in this report and the accompanying Appendices (as a separate document).

2 Context

2.1 Objectives

The National Broadband Strategy is anchored within broader national policies and goals. It must be understood as providing a basis through which the national policy objectives outlined in various Government policy documents, initiatives and interventions can be achieved. That is, it is both a product and an enabler for the implementation of other Government policy initiatives.

Some of the key policies and strategic interventions against which the strategy is being developed include the Economic Diversification Drive (EDD), the National ICT Policy (Maitlamo), and the e-Government Strategy.

The overall policy objective of the strategy is to establish a coordinated approach to ensure that reliable high speed networks are universally accessible throughout the country. It is also aimed at ensuring an equitable and affordable access to broadband services by all people over time. In particular, the objectives of the strategy are to ensure:

- Development and adoption of a national consensus on the meaning and definition of broadband in line with international best practice.
- Creation of an enabling environment for the deployment of broadband infrastructure and utilisation or uptake of broadband services.
- To promote and create an environment conducive to the growth of the demand for and utilisation of broadband services.
- To ensure universal access to broadband services by development of appropriate funding mechanism that involves public private sector partnerships and or targeted subsidies.
- To ensure the implementation of diverse Government policies and initiatives that are conditional upon the availability of broadband infrastructure and services.
- To create an enabling legal and regulatory framework that:
  a) is conducive to the rapid deployment of broadband infrastructure;
  b) encourages and ensures increased uptake and usage of broadband services by all citizens;
  c) engenders confidence and trust in electronic commerce and transactions;
  d) promotes the protection and respect of privacy and personal dignity through appropriate instruments for regulation of personal data;
  e) addresses potential illegalities and unacceptable content;
  f) ensures the integrity and security of the broadband networks;

g) introduces and promotes flexibility in the use of scarce resources such as spectrum to ensure the broader availability of broadband services;

- To ensure the availability and accessibility to broadband services for diverse uses;
- To facilitate and encourage economic diversification *inter alia* by promoting and facilitating -
  a) Research and development;
  b) Innovation;
  c) Creation of appropriate and relevant local content.
- To create an enabling environment necessary for making Botswana a regional ICT Hub;
- To create an enabling environment for e-government initiative.

2.2 Broadband

2.2.1 Traditional understanding of broadband

Traditionally broadband is defined in terms of data transmission speed. However, there is no universally agreed definition of which speed amounts to broadband. Each country generally adopts a definition that reflects its unique needs and challenges.

Definition of broadband in terms of speed has its advantages. The approach assists policy makers understand broadband. Targets for the country can easily be set and achievement thereof measured. The data transfer rate determines whether users are able to access basic or more advanced types of content, services, and applications over the Internet. It also determines the cost of accessing such services.

Speed based definition of broadband however, has a number of limitations. These include the following:

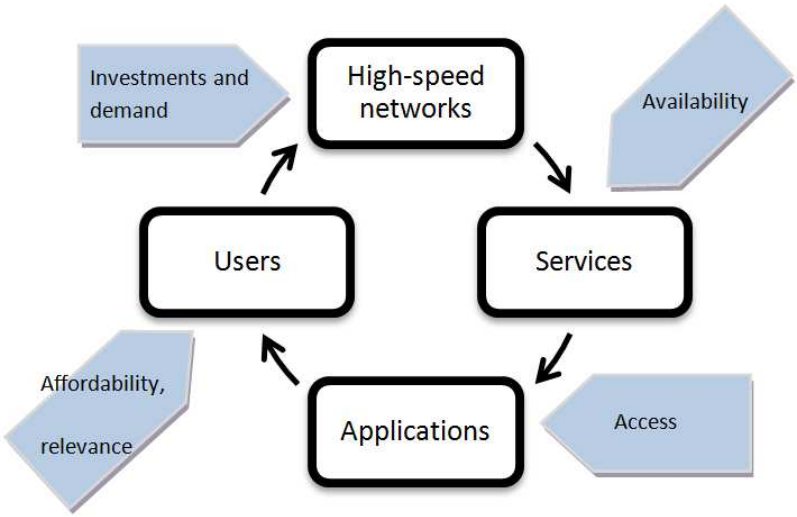
- The approach is not universal since definitions vary among countries and international organizations (See Interim report in Appendix section 2 for various definitions by countries and international organizations).
- Definitions based on speed may not keep pace with technological advances and applications required for broadband to bring the desired benefits. What is considered “broadband” today, may be regarded as too slow in the future, as more advanced applications and technologies are being developed. Any speed based definition of broadband will, therefore need to be updated over time.
- It fails to take into account the type of services and or applications to be accessed by consumers.
- The definition may not reflect the speeds actually experienced by end users. Such speeds may be much higher than the ones set by the government as broadband threshold or vice versa.

2.2.2 Broadband as an ecosystem

Broadband is increasingly seen as an ecosystem rather than the traditional notion of a specific type of network connectivity or minimum transmission speed. Conceptualizing broadband as an ecosystem makes it possible to define it by including all its core elements. These are networks, the services that the networks carry, the applications they deliver, as well as users. It also makes it possible to factor the transformative elements of broadband such as technological, business, and market developments.

The ecosystem approach includes both the supply and demand sides of the market. It thus leads to a rethinking of strategies to spur broadband access and use. In particular an ecosystem based approach enables policy makers to appreciate that it is critical to create an enabling environment for the supply-side growth in terms of access to networks and services as well as facilitating demand for and adoption of broadband services (demand-side). Figure 2-1 below provides a high level representation of a general broadband ecosystem.

Figure 2-1: The concept of Broadband ecosystem



Source: World Bank

2.2.3 Defining Broadband for Botswana

While the ecosystem conceptualisation of broadband provides a framework for the development of effective broadband strategies and policies, it does not do away with the need to have measurable outputs.

Accordingly, when a new coverage project is launched, targets could be set taking into account the technology intended, the types of users (e.g. professional usage or mass market, etc.). These targets could be defined in terms of download/upload speed, quality of service, available services, etc. Defining such targets at implementation also brings the advantage of remaining in line with the continuous improvement and evolution of networks capabilities and expected usages.

Recommendation 1 Botswana should adopt a predominantly ecosystem-based approach to broadband.
Targets (speed, QoS, etc.) should be defined at the implementation of each individual project.

An initial objective of having 10 Mbps download speed available for 90% of the population, 90% of the time, within 3 years after the adoption of the present Strategy appears to be reasonable.

2.2.4 Importance of Broadband

A detailed discussion on the socio-economic and political benefits of broadband appears in the interim report (Appendix section 2). These include:

- Contribution or facilitation of economic growth: Botswana is currently grappling with issues of sustainable economic growth through a number of initiatives such as the Economic Diversification Drive (EDD). An increase in broadband usage would lay an enabling environment for this and other Government initiatives and spur the growth of the services sector.
- Enhancing growth in productivity levels.
- Assists in full exploitation of the smart phones to offer more than basic internet but to facilitate access to more services such as financial credit, information, newspapers, games, entertainment, e-government services, etc.
- Reduction of unemployment.
- Creation of new economic opportunities for users, service providers, application developers, and network operators alike.

Broadband has the potential to benefit the whole country and an entire spectrum of Batswana's life. Increasingly broadband is being used to facilitate efficient and effective delivery of public services. The success of the e-Government Strategy is conditional upon deployment of broadband infrastructure and access to broadband services.

3 Key Strategic Issues

3.1 Current situation in Botswana

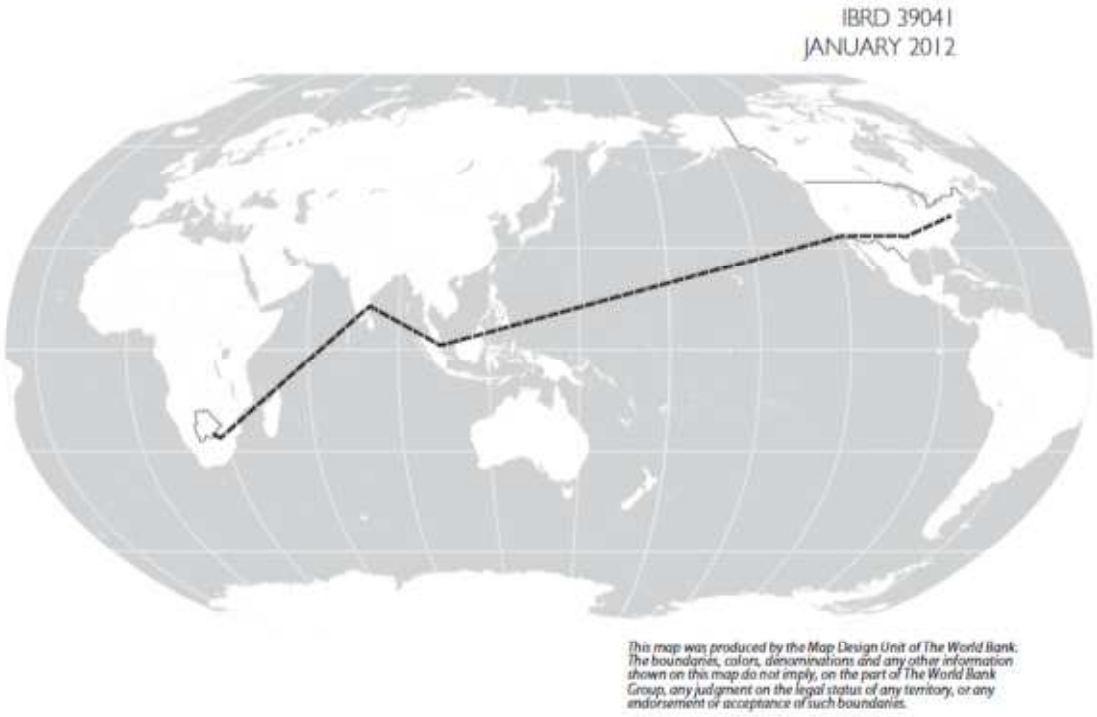
3.1.1 Infrastructure

3.1.1.1 International Access

The results in Phase 1 report show that international bandwidth is a limitation for a smooth access to Internet in Botswana. The reasons are technical and financial. Technically most of the content to be accessed is hosted abroad (mainly in USA and Europe) and no international global Internet exchange (GIX) is available in Botswana.

Accordingly, most of the traffic generated in Botswana has to transit through international connections and bandwidth availability can become a bottleneck. Financially, the level of prices for international connectivity has been identified as one of the major constraints by many stakeholders. Even though the connection to two new submarine cables (EASSY and WACS) might improve the situation, there are high disparities between transit costs from the country's borders to submarine cable landing stations depending on international route (Namibia versus South Africa) and the operator in the neighbouring country that provides transit connectivity to the landing station.

Figure 3-1: Internet Protocol Packet Route from Washington DC to Gaborone

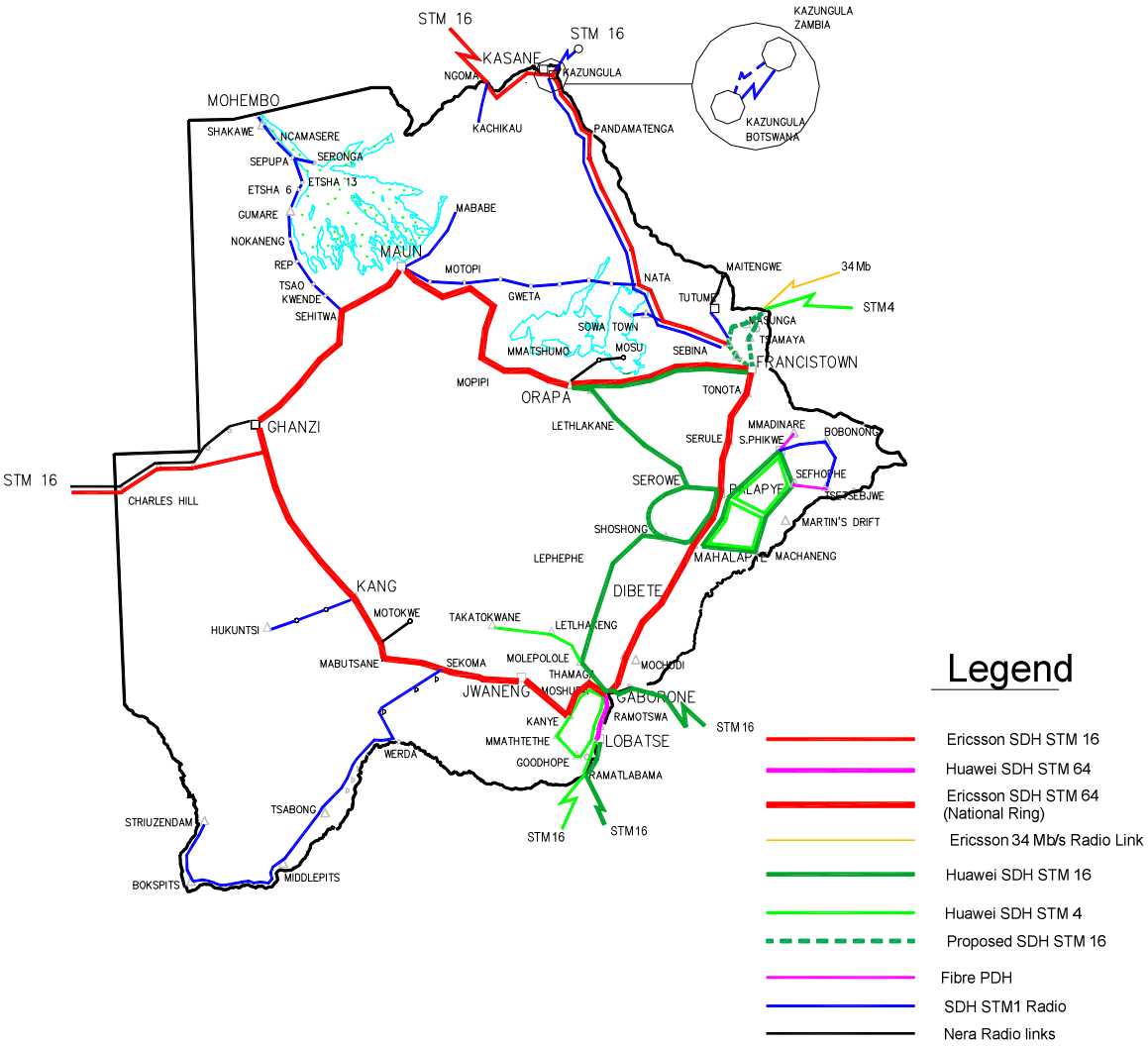


Source: Telecommunications Management Group Inc., World Bank

3.1.1.2 National backbone

Botswana has a fibre optic cable backbone in the form of a ring with connections to all urban centres and major villages. It constitutes a key asset for the country because such a backbone is required to support the development of access infrastructure throughout the territory. The main backbone will be owned by BoFiNet, but other operators, and in particular Mascom do also have their own cables along the main routes (Gaborone- Francistown road for example).

Figure 3-2: BTC National Transmission Network Layout



3.1.1.3 Backhauling

The backhaul network is the portion of the network that connects the backbone with the access network (e.g. copper local loop by collecting DSL traffic gathered in exchanges, wireless access by collecting traffic from base stations or BSC/RNC).

Currently, the backhaul network does not appear to be a major constraint. Operators rely on leased lines, their own microwave links or in the biggest cities on their own metropolitan area network (MAN) fibre optic cables.

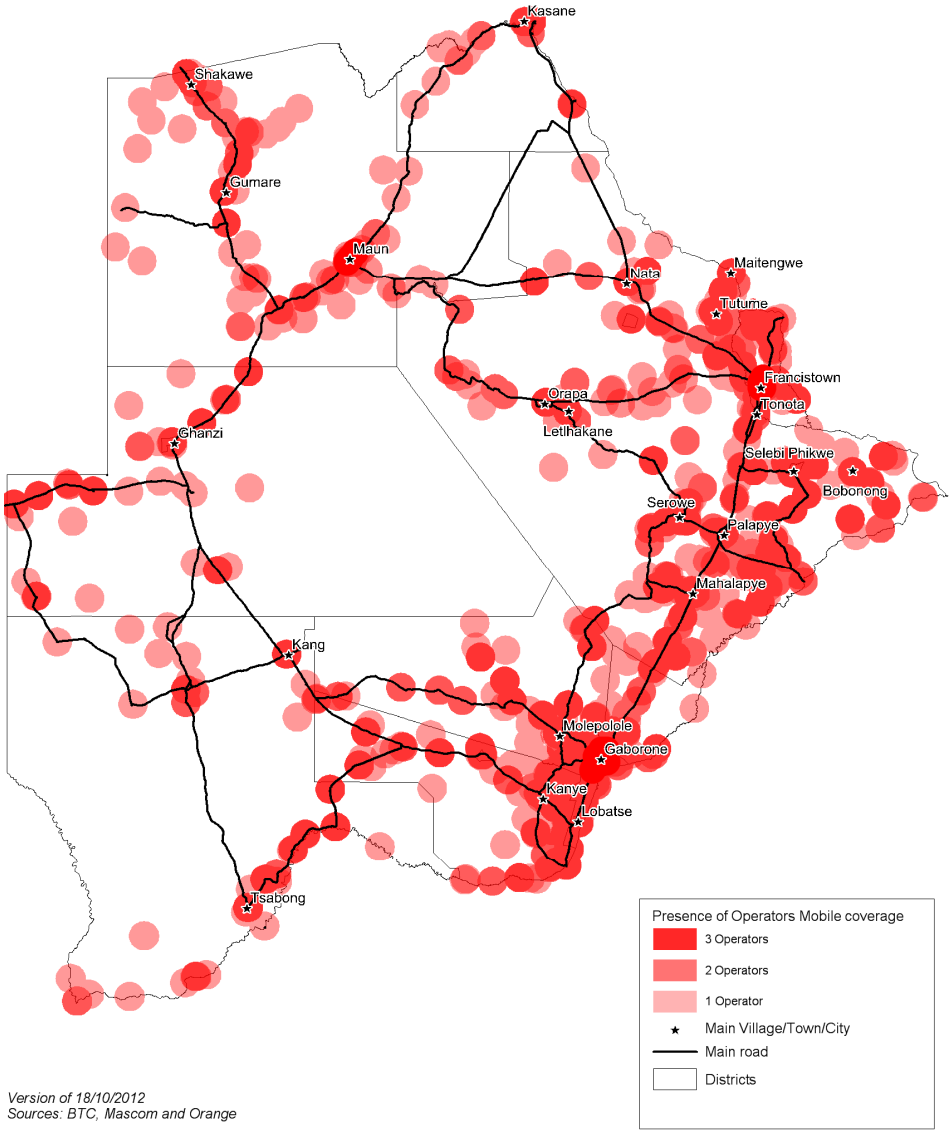
Future evolution of networks and traffic demand will however lead to an increase in the demand for more capacity on backhaul links that can provide wholesale Ethernet/IP based services.

3.1.1.4 Access segment

3.1.1.4.1 Mobile coverage

Currently mobile telephone coverage is relatively satisfactory for most large and medium sized villages. Main roads are also partially covered. 3G coverage however is limited to main cities and some major villages. Outside densely populated areas, there is generally only one operator available. Hence users have to use SIM cards from various PTOs and cannot be certain that they can be reached on their main contact number wherever they are.

Figure 3-3: Mobile coverage over Botswana



Information collected during interviews shows that operators are currently improving the 3G reach of their networks and some have even launched 4G LTE pilot projects.

3.1.1.4.2 xDSL

All urban centres and major villages are covered by the copper local loop. Exchanges are enabled for xDSL service. This is a major asset for the country, as xDSL is a proven and reliable solution to provide broadband reaching relatively high bitrates in up- and downlink, with a good quality of service. It can thus cater for corporate, enterprises and residential needs.

Nevertheless, it has to be emphasised that even though a large number of villages are covered with copper local loop, in most cases this is only limited to the centre of each village while extended parts of the respective village generally do not have copper lines. Rolling-out more cable is expensive as it requires civil works and it would not be wise to invest heavily in this technology which is bound to be replaced eventually by fibre networks. Accordingly, copper cables will not be extended that much.

The current speed rates available in Botswana are relatively low with regards to general xDSL capabilities.

3.1.1.4.3 Satellite

Satellite connections remain expensive in Botswana, even though new offers for cheaper satellite connection emerge.

Consequently this technical solution cannot be considered as a general way to provide broadband services on a large scale in the country. However, it should be considered for most remote areas. Besides, the cost of access to satellite connection should be used as a threshold when assessing the relevance of any terrestrial solution in low density areas.

3.1.1.5 Kitsong centres

The Government launched an initiative to have communities connected through the use of Kitsong Centres (KCs). These are community access points which have been installed by various operators and Botswana Post. The Nteletsa II programme was an opportunity to increase the number of such centres. These places mostly provide only basic services (airtime resale, telephony, photocopy services, etc.). The most advanced of these though offer broadband facilities together with related services such as training.

Unfortunately the model being implemented currently for Kitsong Centres does not work properly since the bulk of them are operated by Village Development Committees (VDCs), whose members do not have computer skills. As per the Nteletsa contracts between the Government and the operators, the operators trained personnel to run the Kitsong Centres but some trainees leave the KC’s to look for better paying jobs thus rendering the KCs dysfunctional.

3.1.2 Usage

The international benchmarking done on fixed and mobile broadband penetration during Phase 1 of this study showed that while mobile telephony penetration was high, both fixed and mobile broadband penetration were relatively low in Botswana, compared to other African, European or Middle-East countries. This situation needs to be addressed, since the success of the National Broadband Strategy depends on the provision of affordable access and on the capacity of the population to find utility for broadband services. There are many aspects that were covered during the study, and the conclusions, detailed below, are grouped according to some main factors that contribute to the low broadband penetration:

- The relatively high level of retail prices;
- The high level of wholesale prices and the lack of transparency in the wholesale offers;
- A lack of local ecosystem.

3.1.2.1 Retail prices and affordability

The international benchmarking showed that prices for broadband services in Botswana are high compared to other African, European or Middle East countries. This is true for mobile and fixed broadband services. Since the comparisons took into account the differences of purchasing power (purchasing power parity) in the countries involved in the benchmarking study, the situation in Botswana really reflects high prices for broadband services.

It is therefore clear that under the current level of retail prices, there is little chance that broadband services can develop in Botswana. Accordingly prices need to decrease to affordable levels in order for the objectives of the strategy to be realised. The key question is what should be taken as an affordable price for broadband services in Botswana. There is no direct answer to this question. It is impossible to determine *ex ante* what would be the right level of price. Moreover, most of the people will be able to spend money for such services only if they see the utility for the service.

However, the international benchmarking brought some light to the absolute level of prices that would meet the demand. These benchmarks show that an affordable price for a 20 Mbps ADSL connection should not exceed 40 to 50 USD in purchase power parity (total price to be paid by the customer, including the access and the bandwidth), which means a retail price in a range of 170 to 220 BWP including taxes. The same analysis conducted for a mobile 2 GB monthly consumption leads to a range of 90 to 170 BWP per month.

To reach these levels of prices will require significant decreases in retail tariffs by the operators. Our analysis shows that this is possible only if some conditions on wholesale prices are met, as detailed below.

3.1.2.2 Wholesale prices

Our analysis and discussions with the stakeholders led to the conclusion that the major factors that lead to the current level of retail prices are:

1. The cost of the international bandwidth

   Our modelling shows that a cost of international bandwidth falling in a range of 100 to 200 USD per Mbps per month would highly contribute to retail price reduction. However, current international prices (as per Botsgate price list from BTC) are significantly above this range. Considering the current decrease in prices of international bandwidth, resulting from capacities leased on submarine cables, Botsgate tariffs appear not to reflect costs.

2. The cost of national bandwidth

   The analysis made on national bandwidth showed a high dependency of prices on distance. This is linked to the current cost models, which reproduces previous price structures for national leased lines. However, the technological evolution has dramatically reduced the dependency of costs on distance, as a result of the use of optical fibre and transmission systems with virtually no need for signal regeneration. Accordingly, current national bandwidth prices seem not to reflect costs.

3. The economic model for the resale of ADSL

   The current wholesale ADSL price structure is based on:

   - An access charge, paid directly by the customer to BTC, covering the network between the customer premises and the point of presence of the ISP,
   - A bandwidth charge, paid by the ISP to BTC.

The end user, therefore, pays two bills for a single service, which is undesirable from a customer perspective. This approach also maintains a commercial link between the customer and BTC, which in turn introduces the potential for unfair competition. Moreover, in this situation, ISPs have very little ability to innovate on services and tariffs, bringing very little possibility for price decrease in ADSL services. During discussions with BTC, it emerged that BTC is in the process of reorganising the ADSL market in consultation with the ISPs such that by the end of 2013, ISPs will be responsible for managing their customers. However, the issue of Botsgate tariffs remains.

3.1.2.3 Usage conditions

There are other conditions for broadband adoption than those linked to the service offering and prices. These include the capacity of the services to be of real value to consumers, whether mass market or business. It does not matter how low the prices

may be if the potential users do not get any value from the service or do not have the capacity to use or exploit the service.

One of the key issues that was identified during discussions with many stakeholders is the lack of local or national content. Despite the current development of national projects (e.g. e-Government), there is currently very little locally produced content. The small size of the population is one of the factors that explain this lack of content: the larger the population, the lower the cost of content production, due to economies of scale.

Content provision is a complex ecosystem involving many different players, financial flows and business models. The emergence and development of local applications and content which can bring real value to customers (business or mass market) is the result of a complex combination of private and public investment as well as the ability to choose the best segment or domain.

It has also been observed that one of the barriers that the population encounters in relation to access to data services was the lack of computer skills. There have, nevertheless, been some efforts to lower this barrier (for instance computerising all libraries in the country through the Sesigo Project, equipping schools with computers, providing Internet in Post Office Kitsong Centres, etc.). These efforts should be intensified and coordinated to facilitate public access to computer skills.

3.2 Key strategic responses

Development levers for broadband services in the country are of various sorts. They should address the need to enhance usages by fostering local content, promoting digital literacy, creating an online environment that is safe for all stakeholders (citizens, households, entrepreneurs, businesses, government bodies, etc.). These are mainly demand-side policies.

In parallel, supply-side policies will enable the development of access to broadband services: support the deployment of next generation access networks with extensive footprint (making broadband as close as possible to a universal service) but also to cater for users with highest needs with technologies capable of providing high speed together with the best quality of service, and positioning Botswana within the class of the most advanced countries in the region in terms of broadband infrastructure and services.

Coupled with the above initiatives, making markets work more efficiently by enhancing competition, reducing wholesale prices and making sure that all stakeholders operate on a level playing field will induce a decrease in the retail price and more innovation in the services. These actions, combined with measures to reduce the cost of terminals (e.g. by eliminating or reducing import duties on computers and smart phones) will improve competition in the market and thus improve affordability of broadband services.

4 Demand-side policies

4.1 Introduction

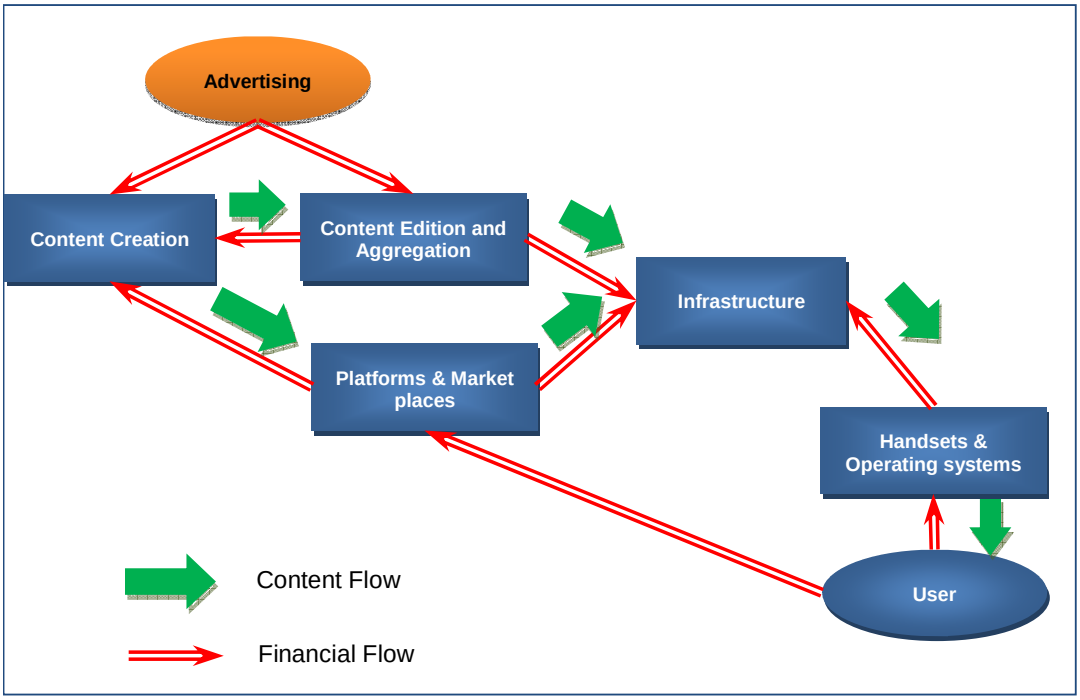
The availability of content is of prime importance to the development of broadband services in Botswana. As previously mentioned, a successful content provision is a complex ecosystem with many players. Content provision can only be the result of interaction of market players. Of course, national programmes such as e-Government play an important role in creating a momentum of the value chain, but there are no means to determine *ex ante* the potential value creation for a given content.

The National Broadband Strategy is therefore intended to provide the best possible ground for market players by providing necessary incentives for such players to create and provide attractive content, under natural market conditions. This, in general can be done without any top-down directive for content creation. This bottom-up approach should be supplemented by the development of national public programmes in education, health or other domains of general interest.

4.2 Local content

Content is part of a complex system which forms a value chain necessary for the development of broadband services: content will emerge only if it can be hosted, transported by networks, accessed through operating systems and handsets, financed via the end user, advertising or other sources, etc. A simplified representation of the value chain is proposed below:

Figure 4-1: Simplified Value Chain of on-line content



Not all the elements of the value chain may be fostered by local investment: for instance, Content Edition and Aggregation, or Platforms & Market Places, are based on audience model and are provided by major worldwide players (such as Google, YouTube, Facebook, Twitter for content edition and aggregation and Appstore and Android market for Platforms and Market Places). The same is true for Handsets & Operating systems. It should be noted that there are some promising initiatives for low cost smartphones, such as the Microsoft / Huawei 4Afrika Windows Phone, which should be sold at 150 USD (source: NY Times, 5/2/2013).

There are two areas were national initiatives would bring potential high value:

- Web hosting (as part of the infrastructure component of the value chain)
- Content Creation

4.2.1 Identification of key development areas

There are at least three major domains were content creation could be supported through national initiatives.

a) Content development

There are key opportunities where broadband services can provide lots of benefits for the population. Most of these opportunities are described in the Millennium Development Goals (MDGs) for 2015 programme of the United Nations. The ITU has described some examples of initiatives already taken that contribute to some of the MDGs. There are important ITU and World Bank programmes in the fields of Education, Health and Agriculture, involving partnerships with local players, governments, Non-Governmental Organisations (NGOs), etc.

b) E-commerce and M-commerce

Another important field of development is electronic commerce (e-commerce) and mobile commerce (m-commerce). E-commerce has become a common practice in many countries and M-commerce is now facing a similar development. According to Forrester Research, M-commerce will experience a double digit figure growth in the USA for the coming years, and e-commerce will still grow quicker than traditional commerce.

Botswana should follow similar trends in the growth of E- and M-Commerce, provided that some prerequisite conditions are satisfied, such as the existence of proper legislation to ensure security for the transactions, and an appropriate access to on-line banking or on-line payment (see next section). On the other hand, E- and M-commerce could be additional drivers for getting connected to a broadband network.

c) Mobile Banking (M-banking)

According to the GSM Association, more than 140 m-banking services were operational in the world at the end of 2011. In Africa, Kenya is experiencing a very important development of M-Mesa Safaricom service which provides m-banking services to 54% of the mobile users. Other countries have also launched m-banking services, such as Tanzania, Ghana, and of course Botswana, where mobile operators and commercial banks provide cash services through m-banking.

A study conducted in Ghana showed that m-banking could improve access to banking services by removing some of the barriers (such as the difficulties to access banks or the cost of traditional banking services) provided that other conditions (e.g. confidence in the system, compatibility with practice, etc.) are met, irrespective of the poverty level of the population.

Two models coexist for m-banking services:

- Driven by a bank: the service is offered by a bank that has a relationship with the client, and uses the operator as a distribution channel;
- Driven by an operator: the relationship with the client is held in this case by the operator, in many cases this is done in partnership with a bank.

Operators' ability to reach a large audience makes the second model more attractive in most African countries.

4.2.2 Priorities for content development in Botswana

Considering the number and variety of possible initiatives, some priorities have been established, taking into account the potential cost and impact of each initiative. The resulting list of priorities is presented below.

Recommendation 2 Public investments and resources should be allocated to actions listed in Table 4-1: Actions and funding, with a particular focus on:

a) e-Government implementation

b) Develop Web Hosting and Web agencies.

c) Develop appropriate content and applications

Table 4.1 referred to in Recommendation 2 indicates whether projects require direct government funding or government’s facilitative intervention.

Table 4-1: Actions and funding

	Priority level	Actions required	Type of funding
1	**Develop Web hosting and web agencies**	Set up a consultation for content developers, software companies, Web hosters, universities… with questions and proposals relative to: • Type of technical investment required (housing, servers…) • Type of competencies required (engineers, marketing, …) • Potential effective projects (incubator, technical centres…) • Form private / public cooperation: financing, facilities provision, promotion… Determine a procedure that should be used to evaluate and decide which initiatives should be included in the program	Public funding could consist in: • Direct investment in techno-zones (infrastructure, promotion…) • Tax incentives (exemptions) for companies investing in projects selected for the program • Awards (including prices) for best projects (develop transparent selection criteria for choosing projects that should be funded)
2	**Develop appropriate content and applications**	• Initiate discussions between the Committee and relevant partners (education, health, agriculture… and by function: content, applications, software, equipment…) based on existing experience in Botswana and other countries. • Formalise projects that require public support or financing	Public funding could consist in: • Direct investment in development (software or hardware) or in private / public partnerships • Tax incentives (exemptions) for companies investing in projects identified for the program • Awards (including prices) for best projects
3	**M-banking**	• Initiate discussion with operators and banks as regards challenges and constraints they face. • Identify public contribution (promotion, legislation…) • Ensure appropriate legislation to secure transactions	Private funding. This is already taking place through private initiatives between banks and mobile operators.
4	**E and M-commerce**	• Ensure appropriate legislation to secure transactions	

	Priority level	Actions required	Type of funding
5	**Rollout of broadband services**	• Prioritise the rollout of broadband services. • Coordinate infrastructure rollout with the rural electrification programme.	• PPP between operators and the Government. • BPC, Government and Development Partners.
6	**Publicise e-Government Services as they come online and provide Public Training in using ICTs**.	• Publicise e-Government Services as they come online through public forums. • Use existing initiatives such as Sesigo (BNLS) to provide public training on the use of ICTs to access e-Government services. • Leverage existing programmes	• Public funding. • Assistance from development partners.

Notes:

1- Content services in the fields of education, health and agriculture are recognized by international organizations (such as the ITU) as being of paramount importance to contribute to Millennium Development Goals (MDGs) and therefore have a maximum potential impact. The cost of these initiatives may vary from limited cost (e.g. corresponding to the procurement of software platforms already developed in other countries) to high cost (involving hardware deployment or vast digitalization of existing content, or developing specific medical applications such as tele-surgery);

2- The e-Government initiative has a number of projects related to putting Government services online, using broadband services to improve the delivery of Government services and generally transforming the way Government interacts with business community and citizens.

3- The cost of development of E and M-commerce is essentially software for front and backend systems, as well as the development of on-line catalogues, and the usage of these services is highly dependent on consumption patterns;

4- M-banking requires the participation of banks or financial institutions and development and/or utilization of security software and protocols as well as appropriate legislation;

5- Web hosting and software development requires appropriate infrastructure and competencies, which may be costly, but are a prerequisite for the development of local content and services.

The preceding analysis suggests that the Government should establish a multi-sector committee with representatives from public and private sectors to coordinate and prioritize the rollout of broadband infrastructure and services. The structure and functions of such a committee are discussed in section 6.1 of this report.

4.3 e-Government

In Botswana, Government plays a major role in the provision of services to the people. It is the largest employer as well as the largest buyer of goods and services. Almost everyone in the country interacts with government, and uses its services, at various times throughout their lives. Government is thus an important driver of demand for broadband services.

As e-Government matures and more information becomes available online (in a convenient and user-friendly manner), more and more citizens and businesses will begin to embrace ICT to access e-Government information and services. This will quickly increase the uptake of ICTs across all segments of society. The success of this strategy therefore depends on the leadership of the Government at all its levels and within various ministries and departments in the adoption and promotion of the uptake of broadband services as well as in the delivery of Government services and information online.

In order to effectively leverage e-Government services as a driver for demand for broadband services a number of conditions should be fulfilled:

- e-Government services must be made available on mobiles phones as most people have one and it will be the main device used to access Internet.
- accessibility to smart phones must be increased. It is therefore critical that appropriate incentives are put in place to make smart phones in general affordable and to provide e-government services in a format suitable for such devices (development of Apps).
- The deployment of broadband infrastructure must be aligned to the e-Government services implementation plan. One can expect operators and service providers to adjust to this new demand by extending the reach of their broadband networks and services.

Nevertheless, interviewed stakeholders have expressed their concerns as regards what they perceive to be slow implementation of e-Government services so far.

Recommendation 3 The Government should communicate what services will be made available online and by what dates, and accelerate the implementation of the plan so as to create the need as well as the demand for e-Government Services

4.4 Training program for ICT use

4.4.1 Libraries, teaching, etc.

One of the usefulness of an ecosystem understanding of broadband is that it enables a correct appreciation of the demand side of the equation. Building a state of the art broadband infrastructure while the majority of the people in the country lacks the basic skills to access broadband services is of no benefit to the country. As the benchmarking exercise revealed, countries that were successful in transforming their economies from resource to service based economies through increased adoption of

broadband services invested heavily not just in the deployment of broadband infrastructure but also in the building of capacity amongst the population to spur demand.

ICT capacity building among the population is a key requirement for a wider penetration of broadband usage. Broadband Internet access is essential, but access alone is not enough. Basic computer skills and high-level cognitive skills for finding, evaluating, ethically using, creating, and sharing information are also required for digitally inclusive communities.

Recommendation 4 A structured mass Digital Literacy programme should be launched as an integral part of the implementation of this Strategy. The delivery of the programme should be through a public private sector model to be spearheaded by the Ministry of Education and Skills Development in consultation with the Ministry of Local Government and Rural Development and BOCRA

The Digital Literacy campaign could take various forms and target different categories of people and users:

- Learning the basic use of computers, mobile devices in rural areas (access to the Web, CV writing, etc.)
- Advanced ICT training (for example in schools ICT Clubs could be established to facilitate the teaching ICT services).
- The use of websites and e-services for small and medium companies and associations.
- Funding for Sesigo Project to provide basic computer training in public libraries

Such training campaign would also provide an opportunity to identify local community champions. Such people's leadership and skills would make them valuable agents for the promotion of the uptake of broadband services. They would also provide support to other people in their communities. This would also be a way to revitalise some of the Kitsong centres while at the same time identifying potential sources of relevant local content that would ensure that trainees keep and maintain the usage of broadband services.

In parallel with the training of people, it is important to ensure that people who do not have private devices for accessing broadband services can use public facilities such as Kitsong Centres, post offices and public libraries equipment with such devices.

Recommendation 5 Public access to broadband facilities should be intensified through:

i. Provision of computers with internet access in Post Offices;

ii. Funding for the provision of internet access in public libraries. Internet connectivity to public libraries should be subsidised through the Universal Service Fund.

iii. Public Telecommunications Operators should provide internet connectivity to libraries at discounted tariffs.

4.4.2 Digital Literacy "Trainers for Trainers"

Consideration should be given to training a group of "Trainer for Trainers". This should comprise all centres that have Government funded Internet access establishments like schools, libraries and Kitsong centres. These establishments are on the front lines of digital inclusion and digital literacy efforts nationwide. They are uniquely positioned to provide access to technology and support digital literacy development. The trainers for trainers must be trained in delivering basic digital literacy curriculum as listed in the table hereunder.

Table 4-2: Typical Digital Literacy Curriculum

Module	Content
Basic Computer Skills	Computer Types; Hardware and Software
	Keyboarding and Mousing
	Windows Navigation : Start menu, Window sizing, drag & Drop
	Introduction to MS Word : Creating, editing and organising documents
Introduction to Internet	Basic Concepts: Home page, menu, link; Browsers; Web addresses
	Search engines; Domains; Evaluating and Comparing websites
	Email Setup and use; Attachments; Security
	Online Sources for Health, Agriculture, Education and employment
Security and Safety in the Digital Age	Guidelines for Digital Interaction; security for email, texting and social media
	Privacy, secure websites and passwords

Table 4-3: Proposed organisation for the training of trainers

Initiatives	Milestones/Targets	Duration	Lead Entity
Train Kitsong Centres Administrators as Trainers	All districts	6 months	Entity - MTC Funding – BOCRA/USF
Train Librarians as Trainers (in Collaboration with Sesigo)	All districts	6 months	Entity: MYSC Funding: BOCRA/USF
Train Primary School Teachers(Selected) as Trainers	Sample of 200 teachers per district (sample to include all ICT teachers)	6 months	Entity: MOESD Funding - Govt
All trained Trainers develop their respective communities in basic digital literacy	-1 month National Training roll-out planning -18 months implementation -3 months – monitoring and evaluation	24 Months	Entity: BOCRA Funding – USF
Rollout IT-Essentials(or equivalent) in Secondary Schools	-1 month National Training roll-out planning -18 months implementation -3 months – monitoring and evaluation	24 Months	Entity: MOESD Funding: Govt
Develop Digital Literacy Portal(In Collaboration with the eGov project)	-1 month – Design and Planning -4 months implementation -1 months – monitoring and evaluation	6 Months	Entity: e-Gov Funding: Govt

4.4.3 Online Digital Literacy Portal

As part of the implementation of the National Broadband Strategy, Government should consider the creation of an Online Digital Literacy Portal. The portal should include high-quality online lessons that users can access and use at their own pace. Offline resources should be made available for printing or ordering and distributed by libraries, schools and Kitsong Centres.

4.5 Customers' information

Increased competition in the provision of broadband services is and should continue to be the key policy objectives of Government. It is trite that for competition to yield desired or optimal results, the consumers should have timely relevant information as regards the available services in the market and associated tariffs. Only when

customers are aware of the services available could they use their purchasing power as an incentive for providers to compete for customers and thereby reduce prices. Broadband market is not different.

There should be a mandatory disclosure of information related to the available services and their respective costs. The obligation to disclose relevant price and product information first and foremost lies with the service providers. However, regulatory interventions can be used to encourage service providers to disclose information to the customers. In addition, the Regulatory Authority has the option of obtaining information from the service providers on their standard offers, in comparable presentations. The regulator can then collate the information from different operators, publish online and through other means, price comparisons for equivalent services.

Once customers are aware of the price differentiations, they would make informed and rationale decisions and opt for those service providers that offer attractive services at affordable prices. The more effective competition, facilitated by information to customers, the more likely broadband services would be affordable.

Recommendation 6 Improving customer information

BOCRA should issue a regulatory directive mandating operators and ISPs to publish products, services and price information on their standard offers, on their websites or in other easily accessible means.

If it appears necessary in the future, BOCRA could also collect and collate this information and publish comparisons. The said publication should not make any recommendations as regards the best or cheapest offers. Such decision should be left to consumers to make.

4.6 Legal framework

An appropriate legal framework is critical for effective implementation of the broadband strategy. Such a framework should facilitate the deployment and utilisation of the broadband infrastructure as well as engender trust and confidence in the uptake of broadband services. Legal reform is therefore necessary. In some areas, reform is already underway.

The strategy will impact different sectors of the economy and society in different ways. It is not practical to address all the legal issues that may emerge as a consequence of the implementation of the strategy. Some issues could best be addressed by, for example, community education and training (public awareness campaigns). Reform should be targeted at those areas without which full benefits may not accrue from the adoption of the strategy.

4.6.1 Electronic Commerce and Signatures

Broadband usage, may be depressed if there is no legislation regulating electronic commerce and signatures. An appropriate law on these two areas would give

consumers confidence in using broadband services. The principles underlying the general law are based on face to face transactions and not online transactions. The overall objective of e-commerce and transaction legislation should, therefore, be to remove obstacles and uncertainties about the use of electronic documents and electronic communication arising out of the general law, which is biased towards face to face or paper based transactions.

Botswana does not currently have legislation dealing with electronic commerce and signatures. However a process to come up with legislation on this area is already under way as there is a draft Bill on E-Commerce and Signatures.

The reform of legislation should be based on best practice elements. The key principles include the following:

- Legislation should be technology and or media neutral. Legislation must be such that it accommodates both written and electronic transactions and or exchanges. Key legal concepts must be redefined to accommodate e-transactions.
- A contract is not invalid solely by virtue of the fact that it is electronic. Similarly signatures or records are not denied legal effect solely because they are electronic.
- A decision to exempt some transactions from the reach of e-legislation must be based on an objective criterion taking into account the inherent nature of such transactions.
- The electronic commerce and signature legislation must take a functional approach.
- The e-legislation must ensure that online consumers receive the same level of protection when they shop online as they do when they transact on a person to person basis.
- Admissibility of data evidence in legal proceedings.
- Equivalency rules for retention of documents, production of documents
- With respect to signatures, the legislation must be such that it sets the conditions to be satisfied by a “secure electronic signature.”

A policy decision must be taken as to the reach or application of the electronic commerce legislation. Some countries limit the application of electronic commerce and signatures legislation to commercial transactions only, while others allow for the adoption of the e-legislation to non-commercial transactions.

4.6.2 Consumer protection

The e-legislation must provide protection to consumers who would otherwise not be provided with appropriate remedies by the common law and or the traditional paper bias legislation. Key features of such legislation include the following elements;

- The creation of an accessible, predictable, safe and transparent trading environment, which operates across territorial borders and jurisdictions.
- Promotion and protection of party autonomy with respect to e-transactions.
- Obligations of on-line suppliers are clearly spelt out in legislation.
- Addresses the liability of service providers.
- The authentication of e-signatures.

Recommendation 7

i. The proposed legislation on electronic commerce must contain best practice elements and must in particular comply with the key principles of the SADC Model Law on Electronic Transaction and Electronic Commerce.

ii. The legislation should have an opt in provision that allows parties to decide to transact online and or person to person transaction as well as allow such parties to extend the legislative coverage to non-commercial transactions.

iii. Transactions that require a ceremonial act for their validity must be exempted from the scope of the e- legislation.

iv. Other transactions such as those dealing with alienation of immovable property should also be exempted from the coverage of e-commerce legislation

4.6.3 Protection of Personal Data

One of the key policy concerns in any country that desires to encourage increased uptake of broadband service is how to address privacy concerns raised by online transactions. Unless members of the public have confidence that personal information they provide online is secure, the uptake of broadband services may be depressed. It is critical to ensure that the use of broadband services should not weaken the protection of personal data. Botswana faces the same challenges in this regard.

While different pieces of legislation attempt to protect personal privacy, there is no legislation that deals specifically within the context of increased use of online communication and or transactions. However the Communications Regulatory Authority Act has provisions intended to protect personal privacy and data to some extent. Section 54 makes it an offence for a provider of telecommunications services to:

- Intercept customer messages;

- Disclose to any person the contents of any messages;
- Disclose to any person information about a customer;
- Use any information about the customer for its benefits.

Section 54 exempts information that was required for criminal investigations and or for criminal proceedings. Section 55 also addresses some aspects of personal privacy. It is an offence to send an electronic message that is:

- Indecent;
- Obscene;
- Intended to cause annoyance, inconvenience or anxiety to another person.

The Communications Regulatory Authority Act however, does not deal with key issues related to protection of privacy in the context of e-transactions. The key legal principles to be incorporated in privacy legislation dealing with e-commerce include the following:

a) The collection, storage and processing of personal data must be necessary for a specified and declared purpose.

b) An obligation to update the data and a limitation in collection and treatment of such data must be in place.

c) Disclosure of personal data must only be pursuant to legal power and or consent of the subject.

d) Effective and capacitated institutions are critical to ensure the safety of the collection and storage of personal data.

e) The entities overseeing personal data must be accountable.

f) Proper categorization and treatment of data.

g) An individual should have control over his/her own data.

h) Clear rules for cross border transfers of data are necessary to ensure the protection of personal data.

i) The establishment of a protection regime for personal data in the form of a regulatory agency is crucial.

Recommendation 8 The promulgation of data protection law based on the SADC Model Law on Data Protection

4.6.4 Cyber Crimes

The increased use of computers and smart phones and particularly broadband services has the potential to facilitate the commission of certain offences (cybercrimes). Cybercrime can be divided into two areas. These are the ones where a computer or computer technology is used in the commission of a more traditional

crime (such as theft, fraud) and one where the crime is intrinsically related to the computer or computer technology (such as the introduction of a virus, altering data or hacking). Botswana legislation adequately addresses the first type of cybercrimes. However, as there is need for reform with respect to the second type of cybercrime. Attempts are under way to address some of the challenges in this area through the ongoing discussions on the possible amendment of the Cybercrime and Computer Related Crimes Act of 2007. The review should take account of the best practice principles, including principles contained in the relevant SADC Model law.

Recommendation 9 The Cyber and Computer related Crimes Act should be reviewed to align it to best practice including the SADC Model Law on Computer Crime and Cybercrime.

4.6.5 Security of Systems and Networks

The full implementation of the National Broadband Strategy will depend, among other matters, on secure systems and networks. Legislation on secure networks protects personal privacy as well as enabling Government to address security issues. As clearly emerges from the benchmarking exercise, it is necessary to have legislation that regulates lawful access and the necessary guidelines for cryptology including the rules relating to encrypted data. While the Communications Regulatory Authority Act deals with some aspects of network security (See in this regard section 56 of the Act that seeks to protect networks by outlawing the damaging or obstruction of construction or maintenance of communications networks), it does not provide for a comprehensive framework for network security.

4.6.6 Infrastructure Deployment and Usage

The existing legal framework in Botswana is supportive of an orderly deployment of infrastructure. There is for example provision for an infrastructure service providers' licence. In terms of optimal usage of existing infrastructure there exist provisions for interconnections and guidelines for infrastructure sharing.

4.6.7 Conclusion

The benchmarking exercise revealed that the SADC ICT Laws Harmonisation project has built the necessary foundation on which Botswana should elaborate its legal framework to promote the uptake of broadband services. The SADC Model Laws on such areas as Electronic Transactions and Electronic Commerce, Data Protection and Cyber Crimes are based on international best practices.

As seen from Recommendation 7 to Recommendation 9 above, Botswana should domesticate the relevant SADC Model Laws. Such an approach would ensure a speedy and effective implementation of the recommendations of Maitlamo as well as laying the legislative foundation for the implementation of the National Broadband Strategy. Needless to state that the domestication should reflect Botswana's legislative approach and constitutional framework.

5 Supply-side policies

5.1 Introduction

The actions that the Government and the Regulation Authority can have on the supply side are of different nature:

- Spurring or funding (directly or indirectly) the deployment of new networks (upgrades, extension, etc.) in order to increase the accessibility
- Facilitating the access to networks, infrastructures and wholesale services for all players on the market in order to enhance competition on a level playing field, to foster the emergence of new services and their affordability
- Act directly on the costs for the access to networks and for the purchase of IT equipment to improve the affordability.

5.2 Improve the accessibility to wholesale offers

5.2.1 Wholesale catalogue (standard offers)

A condition precedent to the establishment of a dynamic and competitive telecommunications market is the presence of transparency in the wholesale offers made available to third party telecommunications operators and Internet service providers.

Recommendation 10 All PTOs and ISPs should publish their catalogues (standard offers) detailing their wholesale offers, containing the key technical and contractual terms and conditions to be committed to, between the PTO acting as a wholesaler and its PTO or ISP customers.

Such a catalogue would provide transparency as regards conditions of contract as well as on prices. It should be subject to comment by affected wholesale customers before being adopted. In the event of major disagreement, BOCRA should make a determination of matters under dispute.

Typical items to be covered by such a catalogue are presented in details in appendix section 6. They include:

- Wholesale Leased Lines Offers
- Wholesale Ethernet transport Offer
- ADSL
- Wholesale Infrastructure sharing (e.g. each operator should be required to provide the cost of collocation)
- Call termination rates

As per market situation today, this will be relevant for ISP only if they are interconnected to PTOs for voice telephony, as they would have to publish their call termination rates.

Improving the transparency and the replicability of prices would enhance the competition level between players on the market and then indirectly improve the affordability of broadband services for end-users.

5.2.2 Pricing structure

The overall objective is to ensure that wholesale prices are effectively cost oriented (to the cost of an efficient operator) and sufficiently unbundled. This is a necessary condition to make the playground effective for fair competition, so as to foster competition on the retail market for the benefice of the end user, with lower prices and more innovative services.

5.2.2.1 International and national bandwidth pricing

International bandwidth is accessible with Botsgate services from BTC. In view of BTC's dominant position with respect to international bandwidth, these tariffs should be cost oriented. Moreover, the recent increase in international capacities made possible by access to the WACS and EASSY submarine cables has dramatically reduced prices in international bandwidth. This benefit should be passed on to national operators and finally to the end user. However, the current cost model does not seem to reflect cost orientation of Botsgate prices.

Besides, transit tariffs from the border to landing stations are strategic for the country as they impact the whole chain of broadband supply. A review of the total cost of international bandwidth through the two undersea cables shows that transit charges through Namibia and South Africa constitute from 43% to 68% of the total charge for bandwidth from the Botswana border to London. Clearly these short distances should not constitute such high proportions of the total costs.

The country will not benefit from the investments which the Government has put in the development of undersea cables if the transit charges from the border to the landing ports remain prohibitively high. Senior management of all operators with connections to the undersea cables should take the lead in negotiating lower transit charges from their counterparts in South Africa and Namibia where the undersea cables terminate. It is true that lately transit charges in South Africa have started to decrease as competition in the provision of international connectivity in the country increases. However, more can still be done and this matter cannot be left to commercial negotiations only. The operators should consider other options and innovations such as negotiating Indefeasible Right of Use (IRUs), capacity swapping where they can offer to carry costal countries' traffic to other landlocked countries in return for access to the undersea cables at no cost, issuing public / open international tenders for international operators to bid to carry their traffic to the undersea cables at the end of every contract (instead of negotiating contract extensions), not signing long term contracts which put them at a disadvantage when new opportunities arise elsewhere with better terms and condition, etc.

Furthermore, the South-Africa gains importance as a regional Internet hub. International Internet content is cached locally and the demand from Botswana does

not systematically require undersea connection up to London. Transit charges from the South-African Internet exchanges to the Botswana border have also a direct impact on the overall cost of accessing this data.

In addition to the above suggestions, BOCRA and the Government should also make concerted efforts to make the issue of high transit charges an agenda item at appropriate regional fora such as SADC ICT Ministers' Conferences, SADC regulators' conferences, etc. and to solicit support from other landlocked countries that also face similar problems. Therefore some form of monitoring should take place and the negotiation of prices should not be left solely to operators. The Southern African Development Community (SADC) countries have as a key objective economic integration, amongst others. Needless to say that the high transit charges paid by landlocked countries lead to high charges for ICT services in these countries and thus stifle development.

Recommendation 11 Operators with direct access to the EASSY and WACS undersea cables should:

(a) Negotiate much lower transit charges with their counterparts in Namibia and South Africa for access to the WACS and EASSY undersea cables, respectively.
(b) Consider negotiating IRUs and/or capacity swaps with their counterparts in these countries in lieu of transit charges.
(c) Sign short term contracts for connectivity to the undersea cable in order to benefit from the increased competition in market segment and thus avoid being stuck with prohibitively expensive contracts.
(d) Issue open/public international tenders at the end of each contract for international connectivity to the undersea cables (instead of negotiating contract extensions) so as to benefit from increasing competition in this market segment.

Recommendation 12 The Government should discuss transit charges imposed by operators in Namibia and South Africa with its counterparts in these countries, either at bilateral or at regional level, with a view to having such tariffs reviewed. The intention should be to have these tariffs regulated by the respective national regulators. Such regulation can be achieved, once agreed at Government level, by ensuring that the tariffs are cost oriented and are subject to review by the respective national regulators. The SADC regulator's forum could initiate a study to develop a cost model which should be put to public comment by all regional services providers, operators and other stakeholders before it is adopted and for implementation across the SADC Region.

The benchmark exercise reveals that in comparison to other countries, the cost of bandwidth in Botswana is much more sensitive to distance. This situation might impede the development of competition in large areas of the country, since the provision of broadband services in remote areas may result being uneconomic. This is linked to the current cost models, which reproduces previous price structures for national leased lines. However, the technological evolution has dramatically reduced

the dependency of costs on distance, as a result of the use of optical fibre and transmission systems with fewer signal regenerators and IP based transmission systems which are far more flexible and efficient and can be configured to cater for individual requirements in contrast to legacy SDH systems with granular capacities.

Recommendation 13 BOCRA should conduct an appropriate study in order to realign BTC's existing cost models developed in the recent past with a view to:

- understanding the effect of decrease in international bandwidth and access to submarine cables;
- making the said model more aligned to current transmission technologies and less sensitive to distance. The level and structure of wholesale tariffs for national bandwidth should be adapted in view of technological evolution.

5.2.2.2 Wholesale ADSL Price Structure

The current wholesale ADSL price structure is based on:

- An access charge, paid directly by the customer to BTC,
- A bandwidth charge, paid by the ISP to BTC.

The access charge covers the cost of the local loop line and ADSL equipment (DSLAM, modem) and the backhaul, whereas the bandwidth charge covers the cost of backbone. The following changes could be made to the current situation:

a) Pay the access charge to the ISP and not to BTC

The current situation compels the end customer to keep on paying a bill to BTC. Two drawbacks result from this situation:

- the first one is that it makes life more complex for the customer, who has to manage two different bills;
- the second one is that it does not provide a fair playground for competition, since BTC keeps a commercial link with the customer whereas the Internet service is provided by the ISP.

Recommendation 14 The access charge and the bandwidth charge should be both paid by the ISP to BTC (as it is done in other countries), in order for the end customer to deal with a single bill for Internet access and service.

Recommendation 14 may require the implementation of new functionalities within the billing and information systems of operators. Therefore operators should be given up to one year to implement this recommendation.

b) Split the access charge in relation to costs

The current structure of the access charge is a unique price per access covering the local loop and the backbone. This structure is relevant for Internet service to the

mass market, but does not allow service differentiation, such as VOIP or constant bit rate (CBR) services for business customers. The simplest way to address this issue, and also the most used worldwide according to the results of the benchmarking study, would be to separate the local loop (pure access) and backhaul: local loop price would not depend on bandwidth and backhaul price would depend on quality of service requirements.

Moreover, the copper local loop is an essential facility and should be priced on a cost-oriented basis.

BTC has expanded its offers to enable retail operators to resell 7 different levels of access speed. This is a welcome development that should be extended, as copper has proven worldwide to be a transmission medium capable of growing together with the increase of users' needs.

Recommendation 15 The access charge should be split between pure access and backhaul charge. Pure access should be based on BTC actual costs for the local loop and not dependent on bandwidth, backhaul should be related to bandwidth and quality of service.

5.2.3 Introduction of replicability tests on retail services for dominant operators

Following a general trend, the telecommunications market in Botswana has led to the emergence of new players that have managed to acquire and keep sustainable positions on the market. This changing structure of the market has created new problems. In particular, one of the tasks of the regulator is to prevent operators from engaging in unfair competition by abusing their dominant position or collective dominant position.

The model of *ex ante* regulation has been adopted in Europe and many African countries. This model focuses regulation on identification of market power, based on the definition of relevant markets.

In particular, the existence of vertically integrated operators providing services on competitive and non-competitive markets should be specifically scrutinized, as these operators may benefit from unfair cross subsidization between non-competitive and competitive markets. One simple tool used by regulators to monitor this situation is to carry-out replicability tests of retail services from dominant operators, to check whether other operators would be able to reproduce the retail offers from dominant operators using the same wholesale services, and avoiding squeeze effects.

In practice, the objective of bringing prices down through a stronger but fair competition requires that no player should benefit from its dominant position, in particular in the case where there is vertical integration between fixed and broadband or mobile services.

Recommendation 16 BOCRA should undertake a study to put in place replicability tests on retail services in order to avoid the possibility of squeeze effects for small players. The study should rely on a relevant market and significant market power analysis in order to focus replicability tests only on players with significant market power.

5.2.4 Infrastructure sharing

BTA issued Guidelines on Passive Infrastructure which came into effect on 1st October 2012. The Guidelines encourage sharing of passive infrastructure amongst all licensed operators. During public consultations, stakeholders expressed strong reservations about efficacy of mandating infrastructure sharing through guidelines as opposed to regulations issued under the relevant law.

Infrastructure sharing could be extended to sharing active components, i.e. Radio Access Network (RAN) equipment. In this case, operators can share the cost of rolling out the 4G infrastructure and dimension the capacity of each node to cater for their combined requirements. Each operator keeps their identity, and traffic from their respective customers will be routed and billed by the respective operators.

The structuring scheme for property rights over the shared infrastructure has to be studied and clearly defined: infrastructure could belong to a single operator, with lease agreements to others, including long term agreements such as Indefeasible Rights of Use (IRUs), or it could be placed in a joint venture between operators.

5.2.4.1.1 Advantages of this option:

a) The operators share the cost of rolling out the broadband infrastructure.

b) Each operator keeps their identity and bills their customers directly. Thus from a commercial point of view, the operators continue to compete against each other in the same way they would if they did not share in the cost of rolling out the infrastructure.

c) Consumers benefit from the fact that all the PTOs would provide service in each area and thus avoid the situation where certain areas are only served by one operator (as is the case with infrastructure rolled-out under Nteletsa II.

d) This option retains the benefits of full competition at service delivery level while reducing the cost of infrastructure development for each operator.

e) Sharing the cost of infrastructure rollout increases the chances of profitability even in areas where that would not be the case if each operator incurred the full cost of infrastructure development on their own.

5.2.4.1.2 Challenges of this option:

a) Operators will still have to agree on a formula for sharing the cost. For example the cost could be shared equally, prorated in proportion to market (customer base) share, etc. Agreeing to an acceptable methodology could prove difficult.

b) The infrastructure rollout process could be delayed on account of different procurement procedures amongst participating operators.

c) Agreeing procedures for upgrading the shared infrastructure could be complicated.

d) Agreeing an acceptable method of recording/recognising the shared assets in each company's books could be a challenge.

Recommendation 17 Infrastructure sharing

i. The passive infrastructure sharing guidelines should be given legal effect by promulgating them as regulations under the Communications Regulatory Authority Act.

ii. BOCRA should intervene in the event of disputes.

iii. RAN sharing should be encouraged but not made compulsory on account of the complexities associated with its implementation.

A stated in section 5.2.1, each PTOs should publish a catalogue (reference offer), which should be subject to public comment, for its infrastructure sharing offers with applicable tariffs and standard conditions.

5.3 Deployment of a wireless Next Generation Access (NGA) network

Mobile broadband provides the quickest and most cost effective means of providing broadband services especially in rural areas where the availability of copper network is not widespread. Mobile broadband therefore remains the most viable and preferred method of ensuring speedy and affordable way of expanding access to broadband service in Botswana.

5.3.1 Spectrum

Mobile broadband requires the associated spectrum. The radio spectrum is a valuable and scarce resource which should be put to good use to provide services which would otherwise be unavailable to consumers. The manner in which spectrum is allocated, managed and used is therefore of paramount importance. The framework for spectrum licensing should fully take account of this importance by having appropriate regulations and spectrum licence conditions. There should in particular be the legal right on the Regulator to:

- repossess any unused spectrum in accordance with conditions under which it was allocated, and
- reallocate it to operators who are prepared to use it to meet Government's policy objectives of providing broadband services to all parts of the country.

Recommendation 18 Botswana and its neighbours should discuss and agree measures to accelerate the digital TV migration process so as to release the 800 MHz band which is most suitable for delivering mobile broadband services in rural areas. The emphasis should be on clearing border areas of TV transmitters in this band.

This spectrum band is particularly suited for rural areas due to its bigger coverage range. Therefore the digital TV migration process should be accelerated so as to facilitate the roll-out of next generation access networks in rural areas.

5.3.2 Tendering process

5.3.2.1 Major Urban Areas

The analysis in Section 3.7 of the Appendix shows that villages and towns with populations of more than 10,000 inhabitants (clusters 4, 5 and 6) would be profitable for an operator with a significant customer base and thus would not require any subsidy from the Government.

There could be an operator that does not meet the profitability requirement in clusters 4, 5 and 6 on account of having a smaller customer base. However, it would be wrong to subsidize such an operator while others are required to bear the full cost of deployment in the same areas at their cost because such an arrangement would distort the market. In any event, all operators started off with none profitable operations and they had to build their customer bases at their own cost to reach profitability levels.

As a policy position all mobile operators should be required to provide mobile broadband services to all villages, towns and cities in Clusters 4, 5 and 6 on a competitive basis and without any subsidy from Government. Thus the granting of additional spectrum licenses should be conditional upon such operators providing broadband services in the said areas without any subsidy.

Recommendation 19 4G/LTE spectrum will only be granted subject to the following conditions:

i. The operator shall provide services in Clusters 4 to 6 at their own cost.

ii. The operator shall complete the rollout within a period to be specified in the spectrum licence.

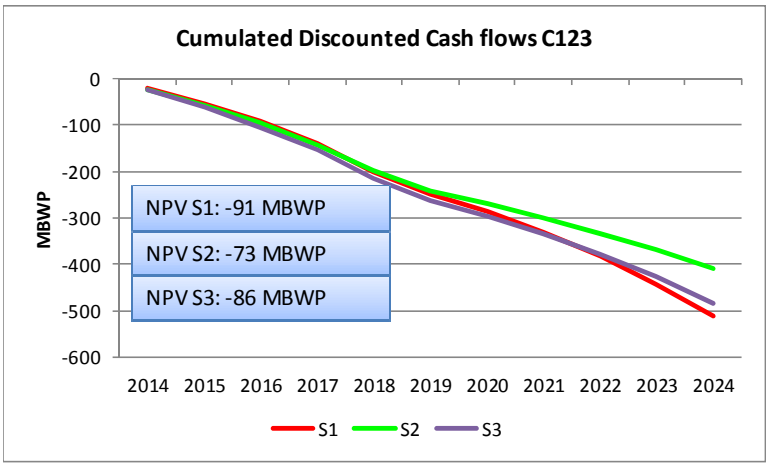
iii. The operator will be allowed to use either 3G or 4G/LTE spectrum in any village or town in Clusters 4 to 6 if they choose to.

iv. The 4G/LTE spectrum for broadband infrastructure will be national and the operator may use it at any other location beyond those in Clusters 4, 5 and 6 at their discretion.

5.3.2.2 Rural areas

The rollout of mobile broadband infrastructure in villages/locations with a population of less than 10,000 inhabitants (clusters 1, 2 and 3) will require some form of subsidy on account of the fact that these are non-profitable areas.

Figure 5-1: Cumulated Discounted Cash-Flows over 10 years, for clusters 1 to 3, according to 3 scenarios of penetration rate forecasts



The total infrastructure CAPEX for these areas is estimated at 230 million BWP.

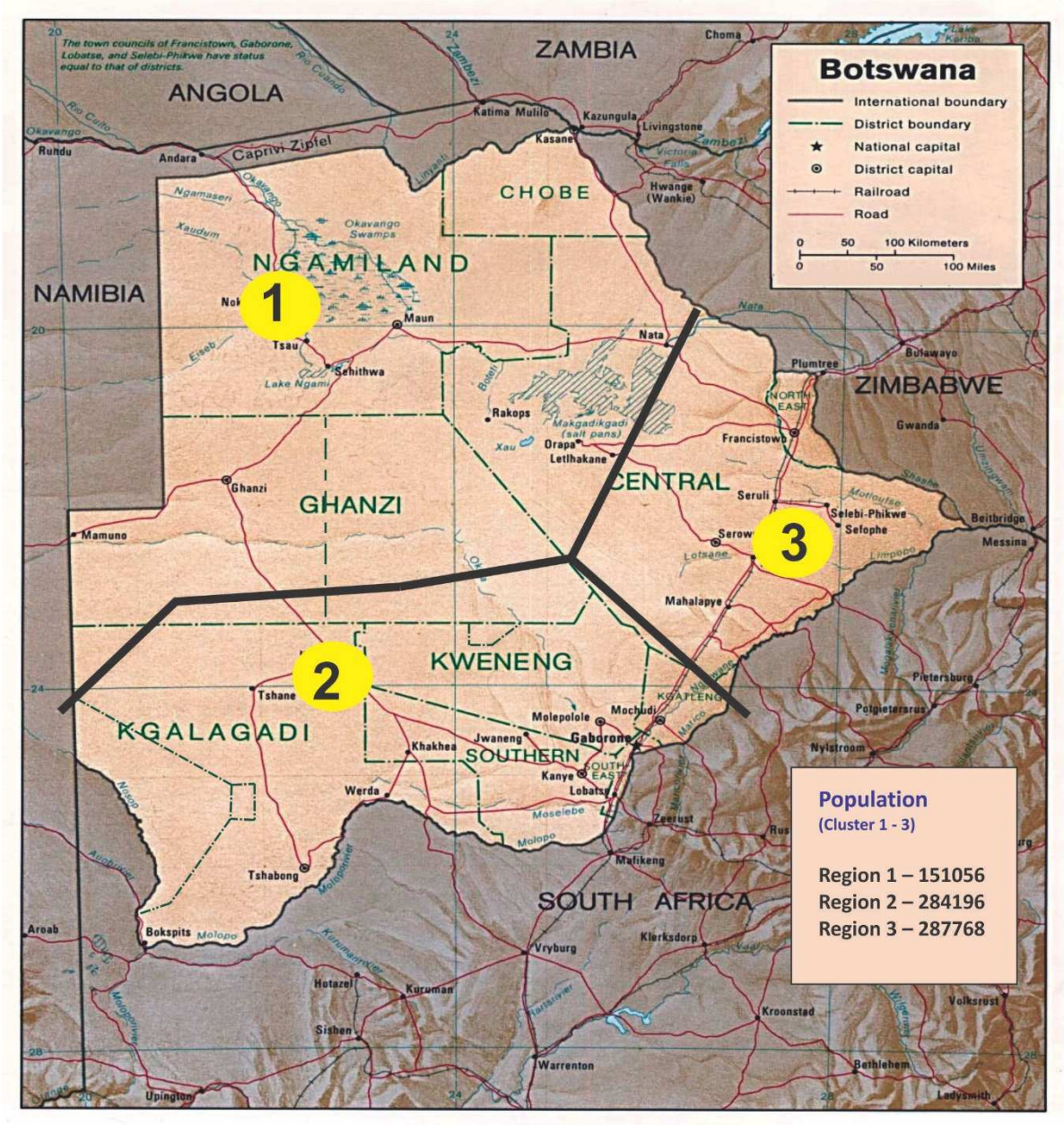
The approach to allocation of subsidy should be the one adopted during Nteletsa II programme, following a reverse auction model with the tender going to the operator requiring the least subsidy. In summary, the subsidy should be based on the following principles.

- Any stakeholder, should be authorised to compete to be granted subsidies (Open and Competitive Principle).
- Subsidy should be necessary in the sense of it compensating only the additional or net costs related to the characteristics of the investment that would be prone to hinder such investment (Necessity Principle)
- The subsidy should be proportionate to the identified additional costs (proportionality principle).
- The conditions for the provision of subsidies should not put any candidate at an advantage over others (Transparency Principle).

Stakeholders who have a spectrum licence should be authorised to bid using any technology applicable to that spectrum, subject to whatever restrictions that may be applicable to their Service and Spectrum Licences.

It is recommended to divide the country into three areas as shown in Figure 5-2 below and to issue a tender for reverse auction for each region.

Figure 5-2: Proposed regions to be tender for under reverse auction



In addition to providing coverage to the villages and towns specified in the respective regions (refer to Appendix for list of villages in each region), the winner will be required to provide broadband services at tourist camps and lodges (whose locations will be specified in the tender documents) using whatever technology (including satellite) that they deem most appropriate in their respective areas. The reverse auction tender for each area will apply to both the mobile broadband infrastructure and whatever technology that the winner may propose for tourist camps and lodges, subject to the said technology meeting the minimum requirements that will be specified in the tender.

Recommendation 20	**Coverage of rural areas (Clusters 1 to 3)**
The country should be divided into three areas as shown in Figure 5-2 above for purposes of issuing a tender for reverse auction to provide mobile broadband infrastructure and services in villages in Clusters 1, 2 and 3 in each region and associated tourist camps and lodges.	

5.3.3 Broadband Infrastructure for Farms

BOCRA and the Government would like broadband services to be provided in all farms shown in figure 5-3 below.

Figure 5-3: Farms considered for mobile broadband coverage

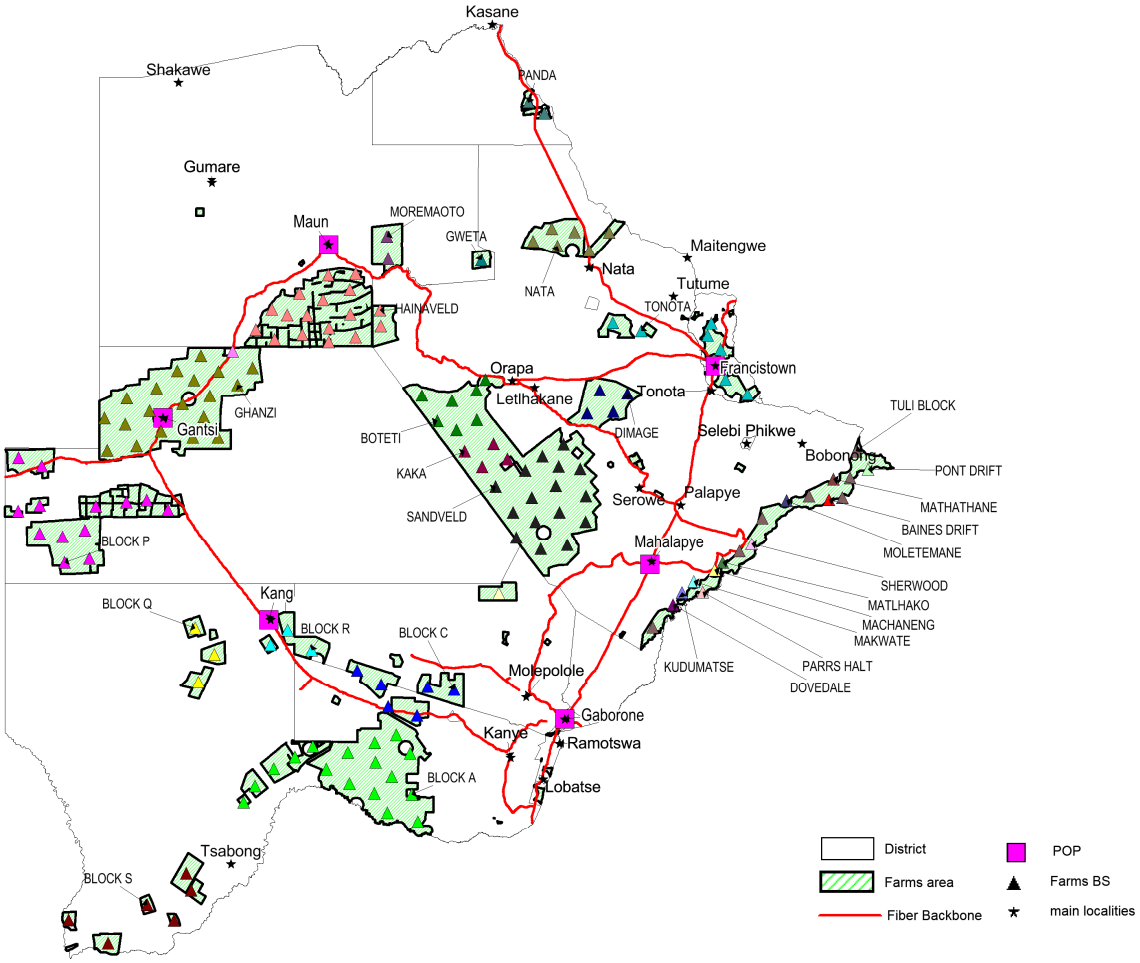


Table below shows a summary of the estimated costs for providing broadband infrastructure in the farms, based on a 4G/LTE solution.

The analysis of costs shows that extending the wireless mobile NGA network to these areas would only be suitable for some farms which happen to be near existing

telecommunications infrastructure. Furthermore, as per the Agricultural Infrastructure Development Initiative studies done by Botswana Institute for Development Policy Analysis (BIDPA) in 2004 and revised in 2009, rolling-out telecommunications infrastructures in farms should go together with the roll-out of other facilities, such as power, roads and water. Power and roads are required for proper operation and maintenance of telecommunications infrastructure.

Table 5-1: Farms coverage estimated expenditures

	CAPEX in kBWP				OPEX in kBWP per year			
Area	New Sites	RAN Equipments	Backhaul MW Equipments	Total	New Sites	RAN Equipments	Backhaul MW Equipments	Total
BAINES DRIFT		387	375	762		51	46	96
BLOCK A	2 604	6 586	6 376	42225	57	861	777	2279
BLOCK C	868	2 324	2 251	14329	19	304	274	792
BLOCK P	2 083	5 036	4 876	33322	46	659	594	1765
BLOCK Q	521	1 162	1 125	8140	11	152	137	417
BLOCK R	521	1 162	1 125	8140	11	152	137	417
BLOCK S	1 042	2 324	2 251	16280	23	304	274	834
BOTETI	1 215	2 712	2 626	18993	27	355	320	973
DIMAGE	694	1 550	1 500	10853	15	203	183	556
DOVEDALE		387	375	762		51	46	96
GHANZI	2 778	7 361	7 127	45700	61	962	868	2514
GWETA	174	387	375	2713	4	51	46	139
HAINAVELD	2 951	6 586	6 376	46126	65	861	777	2364
KAKA	694	1 550	1 500	10853	15	203	183	556
KUDUMATSE		387	375	762		51	46	96
KUKE		387	375	762		51	46	96
MACHANENG		387	375	762		51	46	96
MAKWATE		387	375	762		51	46	96
MATHATHANE		387	375	762		51	46	96
MATLHAKO		387	375	762		51	46	96
MOLETEMANE		387	375	762		51	46	96
MOREMAOTO	347	775	750	5427	8	101	91	278
NATA	1 042	2 324	2 251	16280	23	304	274	834
PANDA	521	775	750	7377	11	101	91	321
PARRS HALT		387	375	762		51	46	96
PONT DRIFT		387	375	762		51	46	96
SANDVELD	2 778	6 198	6 001	43413	61	811	731	2225
SHERWOOD		387	375	762		51	46	96
SOJWE	174	387	375	2713	4	51	46	139
TONOTA	1 042	2 712	2 626	17042	23	355	320	931
TULI BLOCK	694	2 712	2 626	13141	15	355	320	845
TOTAL	**22 742**	**59 272**	**57 388**	**372 219**	**498**	**7 751**	**6 992**	**20 337**

***Note**: The highlighted lines show farms with existing infrastructure for mobile coverage*

For more remote farms with larger surface areas, alternative technologies should be reviewed at implementation, taking into account the level of development on the farms in the area under consideration, the availability of commercial power in the area or the feasibility of using solar power, actual or potential agricultural production levels as assessed by the Ministry of Agriculture, and the specific needs in terms of bandwidth required, whether mobility of the broadband service is a necessity or not, whether the system provided must have terminals that are compatible with the public networks, etc. Thus the provision of broadband infrastructure in the farms that are far from existing telecommunications infrastructure should be assessed on a case-by-case basis at implementation to avoid the potential of developing infrastructure at a high cost which may end up being underutilised or worse still, being "white elephants".

Recommendation 21 Broadband Infrastructure for Farms

i. Farms which are already covered by existing wireless networks should be included within the scope of coverage of clusters 1, 2, 3 as addressed by Recommendation 20

ii. A specific needs analysis should be carried out for all farms or farming areas which are far from existing network coverage, taking into account the development status and agricultural production level of each farm as assessed by the Ministry of Agriculture. The outcome of this assessment should be used to prepare a tender for coverage of such farms and Tenderers should be allowed to propose the most suitable technical solution for each place.

5.4 Enhance services based on copper with offers dedicated to professionals

Most BTC's telephone exchanges are equipped with ADSL 2+/Re-ADSL. The cost of deploying copper is very high and its rollout takes a long time. Accordingly, while it is critical that the existing copper infrastructure be maintained and used to provide broadband services, it would not be advisable to rely on expanding the copper infrastructure as a means of providing broadband services because of the high cost and delays in the rollout out of the infrastructure.

SDSL (symmetric-DSL) is a proven and robust technical solution that gives possibilities to provide very good bandwidth, without the limitation in uplink experienced with most of the xDSL technologies in use. It can be implemented on the short term, together with service level agreements compliant with international standards for professional connectivity.

Table 5-2: SDSL Network investments

SDSL Network at	10%	penetration rate, i.e. for	1 541	customers	CAPEX in kBWP	OPEX in kBWP per year
		SDSL CO Equipments			6 900	340
		SDSL CPE Equipments			6 000	450
		Network Management			1 100	80
		Total SDSL Network Costs			**14 000**	**870**

As seen in the table above, implementing this technology is relatively affordable from a cost perspective and can be done rapidly, especially when compared to FTTx roll-out.

Recommendation 22 Upgrading of xDSL Infrastructure

i. BTC should upgrade its xDSL infrastructure to incorporate SDSL so as to provide symmetrical broadband speed for professionals, businesses and Government institutions (symmetrical upload/download data).

ii. In relation with the above, guaranteed capacities (no best effort) should be offered together with Guaranteed fault repair time

iii. Since BTC has no competitor in this market segment, it (BTC) should cover all costs associated with upgrading the xDSL infrastructure with its own funds. However, as with the case for ADSL, wholesale conditions should make it possible for all ISPs to build competitive SDSL retail offers.

Point (iii) of Recommendation 22 should be implemented in line with the replicability principle mentioned in Recommendation 16.

5.5 Rolling-out Fibre-To-The-x

The National ICT Policy (Maitlamo) and the 2008 Excellence Strategy identify a state-of-the-art telecommunications infrastructure as being key to the development of the country. Deployments of Fibre-to-the-x (FTTx, where x stands for home, office, or building) have started worldwide and in the future, fibre optic networks will replace copper in the access network and create a new local loop. Actually, FTTx can even be categorised as Ultra-Fast Broadband.

As a policy position, the importance of FTTx is acknowledged. However, given the high cost associated with its deployment, it is proposed that its deployment be limited to targeted geographic areas and / or services:

- The geographic areas should include the urban centres and major villages in the country listed in the table below and not to “free zones” only. As a matter of policy, FTTX should be extended to industrial areas, commercial centres, central business districts, civic and community centres in urban areas and major villages.
- In principle, residential areas should also be covered with FTTx infrastructure. However, the feasibility, in terms of costs of including residential areas in the rollout of FTTx should be done on a case-by-case basis at implementation.

This will involve developing some criteria for selecting which residential areas should be included in the rollout that is underpinned by the provision of a subsidy.

Table 5-3: FTTH roll-out CAPEX

		FTTx Roll-out CAPEX	
	Population	**All plots**	**Industrial, Commercial, Civic & Community plots**
Gaborone	231626	1 380 million Pula	222 million Pula
Francistown	98963	900 million Pula	165 million Pula
Molepolole	66466	739 million Pula	73 million Pula
Maun	60273	890 million Pula	89 million Pula
Serowe	50820	565 million Pula	56 million Pula
Selebi-Phikwe	49411	463 million Pula	78 million Pula
Kanye	47013	522 million Pula	52 million Pula
Mahalapye	46409	516 million Pula	51 million Pula
Palapye	37256	414 million Pula	41 million Pula
Orapa and Letlhakane	32486	246 million Pula	53 million Pula
Lobatse	29007	272 million Pula	46 million Pula
Jwaneng	18016	195 million Pula	24 million Pula
Ghanzi	14809	112 million Pula	24 million Pula
Tsabong	8945	68 million Pula	14 million Pula
Kang	5992	92 million Pula	20 million Pula
TOTAL		**7 373 million Pula**	**1 008 million Pula**

Note: "*All plots" includes "Residential, Industrial, Commercial, Civic and Community Plots."*

On account of the cost which makes the FTTx a natural monopoly, the possibility of operators funding the deployment of a large FTTx network in many localities of the country on their own is almost non-existent. Accordingly funding for the deployment of the FTTx infrastructure would have to be either heavily subsidised through the Universal Service Fund, by the Government directly and or through its wholly owned entities. In this regard, Bofinet is perfectly placed to play this role, as a wholly Government owned entity involved in the provision of communications infrastructure. To ensure that all service providers and consumers benefit from it and to foster competition, the services delivered on the FTTX infrastructure should be provided on Open Access Network (OAN) Principles.

The basic principles of an OAN are that:

1. Consumers must be free to choose any service provider on the OAN;
2. Any authorised service provider must be free to deliver services over the OAN;

3. Any authorised service provider should be allowed to add access points to the OAN, subject to technical feasibility and the service provider paying for the cost of establishing the access point;
4. Service providers should be offered Transport Layer services at various levels depending on their requirements;
5. All service providers must be offered services on fair and non-discriminatory terms and conditions;
6. The OAN operator should not compete with its customers (service providers) by offering retail services (directly to end users).

Bofinet is the only operator that can meet all the requirements of open access principles as it shall not provide services at retail level.

Recommendation 23 Development of FTTx in major cities

i. Bofinet should be designated as the operator responsible for the deployment of FTTx network.

ii. Bofinet shall be obligated to allow other operators to access the FTTx on open access principles.

iii. The rollout of FTTX should in the short to medium term give priority to connecting Commercial, Industrial, Civic and Community Areas in urban and major rural centre.

iv. Deployment in residential areas shall also be considered subject to developing some criteria at implementation for selecting which residential should be included. The said criteria should take into account both the cost and expected demand for the FTTx infrastructure in the targeted residential areas.

Notwithstanding Recommendation 23, if other operators decide to build their own FTTx infrastructure at their own cost, they should be encouraged to do so as such an undertaking would increase the availability of the best broadband infrastructure in the country.

5.6 Promotion of Internet Access in Rural Areas

5.6.1 Ensuring a thorough broadband coverage: satellite

As explained in the interim report (see appendix section 2), satellite connections in Botswana are only suitable for remote locations and not for mass market. Nevertheless in areas where the roll-out of a terrestrial network is not affordable, this technology could provide solutions for specific cases such as enterprise connections, Kitsong (Community) Centres, farms, lodges in game reserves, etc.

Recommendation 24 Satellite broadband access should be supported through specific subsidies to be granted on a case by case basis, when no other solution providing the same level of service is (or foreseen to be) available.

5.6.2 Options for encouraging ISPs to rollout services in rural areas

Currently internet usage in rural areas is in its infancy. The rollout of e-Government services will only have a positive impact on the lives of the majority of people if rural areas can have access to internet as well. Access to broadband services for the rural areas is not just a matter of convenience. It would have immediate and practical benefits in terms of saving rural inhabitants time and the cost of travelling from their respective villages to major urban centres where such Government services may currently be available.

The extension and upgrade of mobile networks (to 3G/4G) will increase the accessibility of broadband. In addition to the catalogue from the main PTOs, reinforcing the presence of Value Added Network Services (VANS) in rural areas would widen the range of available offers for citizens, fostering competition between service providers and making sure that people can chose the best sited solution for their usage. Besides, due to limited access to terminals on one hand and the lack of digital literacy on the other, the presence of community access centre remains critical.

The necessity for Government intervention through the provision of appropriate subsidies to incentivise the roll out of Local Internet Access Points (LIAP) in all rural areas is accepted as a reality.

In the appendix a detailed discussion is provided on the current state of different local community centres (Kitsong Centres). These centres currently provide basic ICT services (photocopying, faxing, printing, limited Internet access). These would have to be upgraded to provide broadband services and also include equipment that would upgrade them into wireless LIAPs to enable residents of such villages to subscribe directly with ISPs that will be operating such facilities.

In order to for the Kitsong centres to be transformed such that they offer community access as well as LIAPS, a number challenges such as lack of a harmonised approach to ownership and operation of these centres would have to be overcome. In addition the issue of sustainability of these centres must be addressed.

Recommendation 25 An audit should be carried out on Kitsong Centres provided under the Nteletsa II project, as well as other related projects such as Sesigo and the implementation of Kitsong centres by Botswana Post. The outcome of such a study should provide useful lessons that could be taken on board during the rollout of community access centres as part of the broadband infrastructure.

The practice of basing backhaul charges payable by ISPs on distance has a depressing effect on the establishment of internet access points by ISPs in rural areas. In order to address this challenge, it is necessary that where broadband

access is provided by ISPs in the remote areas, the backhaul charges be independent of distance. The option would be to have PTO themselves provide internet services in the rural areas. However, these are small operations which would be better provided by ISPs in collaborations with PTOs while PTOs focus on the bigger tasks of developing and operating the broadband infrastructure and leaving the operation of Kitsong Centres and LIAPs to ISPs instead of Village Development Committees who generally have little or no expertise in ICTs. Where subsidy for the development of LIAPs is payable, such subsidy be made conditional on the successful PTO providing both the broadband infrastructure and LIAPs either directly or through cooperation with an ISP

The decision as regards the location of LIAPs and/or which Kitsong centres should be upgraded should be made taking into account the results of the audit from Recommendation 25.

Recommendation 26 Potential means of increasing the roll out of Local Internet Access Points (LIAPs) in rural areas:

i. The cost of backhauling internet traffic from LIAPs to ISP's main centres should be made independent of distance.

ii. A rollout schedule for internet LIAPs should be developed starting with urban areas and large villages and eventually smaller villages as the demand for broadband service develops.

iii. The programme for the rollout of internet LIAPs and upgrade of Kitsong Centres should be synchronised with the rollout of e-Government services to ensure a quick adoption of broadband services.

5.7 The case for BPC as a telecommunications operator

The Botswana Power Corporation (BPC) owns 850 km of fibre optic cable which covers most of the major urban areas and large villages on the eastern side of the country.

Setting up an entity that would use the excess fibre optic cable network to provide telecommunications services would be a good option. However there are difficulties in getting consensus amongst stakeholders in the short term due to various reasons.

In the circumstances a more palatable option would be to allow BPC to lease its excess dark fibres to the main operators (Bofinet, BTC, Mascom, Orange), if they are interested. This should be subject to a simple licence/authorisation by BOCRA in order to put this valuable national resource to use, for the benefit of consumers, increase the available capacity, provide redundancy and in some cases provide new fibre infrastructure.

Recommendation 27 BOCRA should authorise BPC to lease its excess dark fibre optic cables to the main operators (Bofinet, BTC, Mascom and Orange) to make use of this valuable national asset, increase the extent of the national backbone and provide redundancy for improved network security.

BOCRA should ensure that BPC uses open and transparent procedures for leasing its fibres to the main operators, and that no operator gets the exclusivity to leasing the excess fibres.

5.8 Availability of IT equipment

The availability of low cost laptops and smartphones will be a critical success factor for the development of Broadband in Botswana. In particular, smartphones will be the main access device to broadband for rural inhabitants who are very sensitive to price levels. Reducing their cost would then improve the overall affordability of broadband for the largest part of the population.

The emergence of new low cost handsets is a chance that needs to be taken into account. However, this should be accompanied by a friendly tax policy which would exempt customs barriers to such electronic equipment.

It has been shown in other countries that maintaining tax barriers on electronic equipment was a handicap to the development of telecom services. Such a practice has the potential to lead to the development of a grey market, where illegal equipment would be sold to the population, with negative consequences on the State revenues, as well as on the quality of service and on the perception by consumers.

Recommendation 28 The government of Botswana should consider exempting smartphones, laptops and other similar ICT equipment from import/customs duties and Value Added Tax.

6 Implementation of the National Broadband Strategy

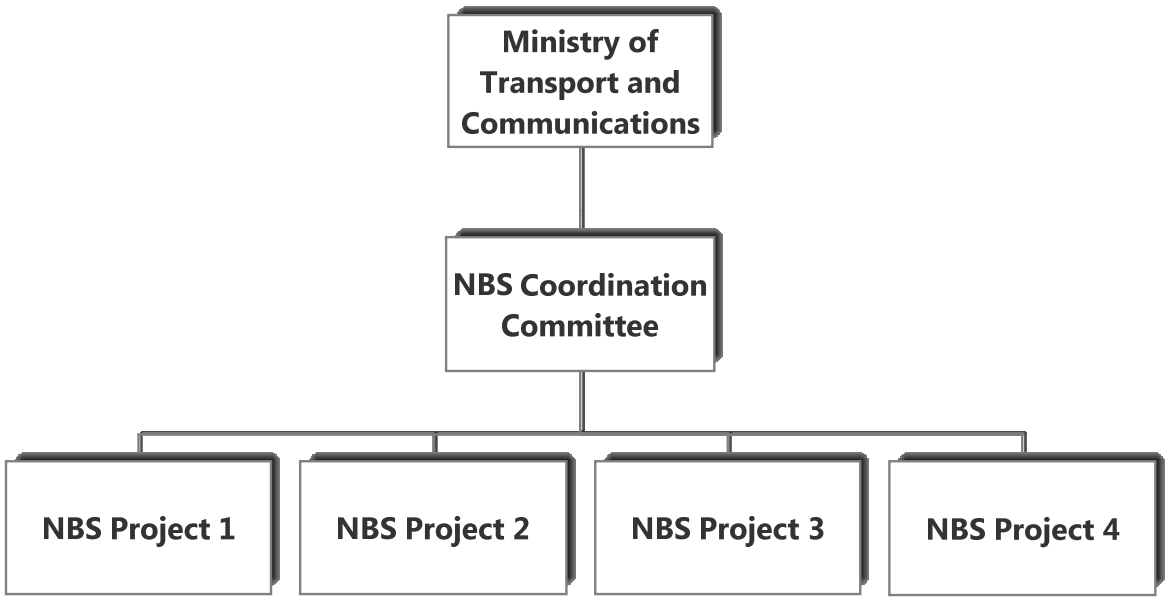
The proper implementation of the National Broadband Strategy depends to a greater extent on a well-coordinated implementation framework. Coordination is required for several fundamental reasons:

1. There is need for coordination with respect to provision of critical services such as the provision of power/electricity in schools, libraries, border offices, etc. as well as the supply of IT equipment to these and other facilities.
2. Coordination is also required to ensure that the deployment is aligned to the implementation of e-government strategy and other Government initiatives that require broadband infrastructure and services.
3. Coordination is necessary to consider all aspects (supply-side and demand-side policies) of broadband ecosystem.

6.1 National Broadband Strategy Coordination Mechanisms

The structure shown in Figure 6-1 below should be responsible for the coordination of the National Broadband Strategy. Proposed functions of each entity are discussed hereafter.

Figure 6-1: National Broadband Coordination Structure



6.1.1 Ministry of Transport and Communications (MTC)

The National Broadband Strategy will cut across all Government ministries and institutions. Accordingly the Minister responsible for Information and Communications Technologies (currently being the Ministry of Transport and Communications) shall take ownership of the implementation of the NBS and be responsible for:

1. Coordinating across all Government Ministries and Parastatal Organisations. This coordination will involve bringing requirements of all Government ministries and institutions in relation to broadband services to the National Broadband Strategy (NBS) Coordination Committee (whose role is discussed below) for action.
2. Reporting NBS activities, progress and challenges to the Government.
3. Seeking funding, where applicable, directly from Government, development partners and funding institutions and private sector.
4. Negotiating and signing contracts with service providers and other institutions on behalf of Government or ensuring that same is done by other relevant Government agencies as the case may be.
5. Assisting the NBS Coordination Committee with whatever assistance they may require from Government.
6. Providing secretarial services for the NBS Coordination Committee.

6.1.2 National Broadband Strategy (NBS) Implementation Committee

The NBS Coordination Committee should consist of representatives from:

a. Ministry of Transport of Communications (MTC);
b. Botswana Communications Regulatory Authority (BOCRA);
c. Botswana Innovation Hub (BIH);
d. Botswana Confederation of Commerce Industry and Manpower (BOCCIM);
e. A representative of Consumers and;
f. Other institutions as the Committee may co-opt from time to time as necessary.

The NBS Implementation Committee shall be chaired by a representative of the ministry responsible for Information and Communications Technology (currently being the Ministry of Transport and Communications). The Minister responsible for Information and Communications Technologies (hereinafter called the Minister) shall have the right to change the structure and representatives of any of the organisations mentioned above as he may see fit.

The NBS Coordination Committee (the Committee) shall be responsible for high level coordination of all national projects that the Minister, in consultation with the

Committee, deems to form part of the National Broadband Strategy, from time to time.

The Committee shall:

a. Review all current national projects and recommend to the Minister those that he should be considered for inclusion in the ambit of the National Broadband Strategy.
b. Define and justify future NBS projects such as ICT Training initiatives, local content development projects, auditing of the Kitsong Centres, etc. for inclusion in the NBS and identify applicable implementing agencies/institutions.
c. Not deal directly with any projects. Instead, relevant implementing agencies/institution under which the specific projects fall shall be responsible for projects execution activities. The said agencies/institutions will provide regular progress reports on their respective projects to the NBS Coordination Committee. The Committee will give the implementing agencies whatever assistance and guidance they may need to ensure that NBS projects are executed in a coordinated manner.
d. Provide regular reports to the Minister as regards the execution and challenges related to the NBS projects and seek assistance as necessary.
e. Coordinate the Review the National Broadband Strategy as per Recommendation 30 and submit a report to the Minister of responsible for Information and Communications Technologies as regards their findings and recommendations.
f. Undertake any other tasks as may be assigned by the Minister.

In addition to the above functions, BOCRA shall be responsible for ensuring that operators granted 4G/LTE spectrum comply with the conditions attached to such spectrum licence as part of its regulatory function.

Recommendation 29 The National Broadband Implementation Structure should be set-up as described above to ensure an efficient implementation of the strategy and a coordinated and aligned approach with respect to the provision of the services including power, equipment and e-government services.

6.1.3 Review of the Strategy

In order to ensure that the Strategy remains relevant to the country's needs, it is necessary that it be subjected to strategy impact and relevance review at regular intervals. The purpose of the review is to:

- Assess the extent to which the broadband access and usage targets set out in the National Broadband Strategy are being achieved and identify and resolve challenges if any;

- Assess the impact of the implementation of the strategy on different sectors of the economy
- Review the regulatory impact on the implementation of the Strategy

In order to obtain an objective assessment, the review shall be carried out by an independent third party outside of Government.

Recommendation 30 The NBS should be subjected to review at least every five years by an independent third party appointed by the Ministry responsible for communications provided that the first of such a review should take place during the second quarter of 2018

6.2 Performance monitoring

The continuous monitoring of the results provided by the strategy is of paramount importance to assess the successes, identify projects that do not provide the expected outputs, take into account changes in the ecosystem, etc.

By defining metrics and Key Performance Indicators (KPI) that will be assessed on a regular basis (e.g. every year), an observatory would then have the possibility to measure the progress made in Botswana for the diffusion of Broadband at all level of the population and economic world. More than reaching pre-defined targets, it is the evolution of each KPI that will provide useful information about the achievements and impediments of the Strategy.

Recommendation 31 BOCRA should setup a broadband observatory tool that will be a tool to monitor the evolution of key performance indicators showing the progress in the execution of the National Broadband Strategy

Table 6-1: Typical KPIs for NBS monitoring

1	Average broadband speeds:
1.1	for mass market with mobile broadband networks
1.2	for mass market with fixed line networks
1.3	for professional market (corporate and administration)
2	Average bandwidth accessed by 90% of the population, 90% of the time
3	Mobile broadband penetration rate
4	Fixed broadband penetration rate
5	Ultra-fast broadband.
5.1	Percentage of sites in commercial, civic and community areas with access to fixed ultra-fast broadband.
5.2	Percentage of households with access to fixed ultra-fast broadband.
6	Farms
6.1	Percentage of farms that have undergone specific needs analysis
6.2	Percentage of farms with at least 50% of broadband coverage
6.3	Percentage farms with 10 Mbps download 90% of the time
7	Average price of broadband subscription (to be broken down for all types of fixed and mobile connections)
8	The cost of 1 Mbps international bandwidth access
9	International capacity / Retail Broadband capacity (as a proxy for local consumption)
10	Traffic
10.1	Incoming/outgoing data traffic to/from Botswana
10.2	Traffic within Botswana
11	Number of Internet sites hosted in Botswana
12	Number of ".bw" top-level domain names
13	Number of trainers for trainers
14	Statistics on imported terminals (smartphones, laptops)
15	Percentage of people with basic computer skills
16	Usage penetration
16.1	Percentage of people using e-Government services
16.2	Percentage of businesses using e-Government services
16.3	Percentage of people using e- and m-Commerce transactions
16.4	Number of mobile banking service customers
17	Number of Kitsong centres or public facilities with broadband access (total number, number of villages equipped)
18	Number of PTOs offering discounted tariffs to libraries
19	Number of independent NBS reviews undertaken.
20	Presence of an active Universal Service Fund

6.3 Sources of the subsidy

As pointed out above, the main source of the subsidy would be Government directly or indirectly.

A direct subsidy would in most cases, involve, a direct allocation from public funds. The allocation would be to the relevant ministry and be administered by the relevant department as happened during Nteletsa II.

Indirect Government subsidy would be for example through funding from a Universal Service Fund to which operators would be required to contribute. It is entirely possible to combine the two and require Government to make a specific contribution or allocation to the universal service fund.

Recommendation 32 Funding

i. Government should set up the Universal Service Fund as per recommendations of the study on the "Development of a Universal Access and Service Policy for the Communications Sector in Botswana" (2006) with whatever modifications that the Government has made to the recommendations therein.

ii. The universal access and service fund should be financed from a combination of sources including operator levy, direct Government contribution and from any lawful contribution from any approved third party contributor.

7 Schedule

The schedule hereafter provides the global overview of the project to be implemented for the execution of the strategy. Projects shown in the first part are quick wins in the sense that their implementation does not require a long preparation and first returns can be observed rapidly after the project is launched.

Obviously some projects such as fostering local content can be launched rapidly and provide short results on the very short term, but it is also a continuous process that will be adapted and improved during the complete duration of the strategy by taking into account the outcomes of the first decisions and to cater for the extremely rapid changing environment of applications and services online.

Figure 7-1: National Broadband Implementation Schedule