REPORT

Expanding access to education, energy and health services through digitally enabled delivery in Botswana

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FINMARK TRUST
Making financial markets work for the poor

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About FinMark Trust

FinMark Trust is an independent non-profit trust whose purpose is 'Making financial markets work for the poor, by promoting financial inclusion and regional financial integration'. We pursue our core objective of making financial markets work for the poor through two principle programmes. The first is through the creation and analysis of financial services consumer data to provide in depth insights on both served and unserved consumers across the developing world. The second is through systematic financial sector inclusion and deepening programmes to overcome regulatory, supplier and other market level barriers hampering the effective provision of services. Together, these programmes unlock financial inclusion and sector development through a symbiotic relationship between rigorous data collection and research activities. Our work can be found in South Africa, throughout the SADC region and the global arena.

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Access to Basic Services – 1 of 5 reports

Innovative programmes are required to help the poor rise out of long-term poverty and link vulnerable communities to services that build their human capital, like health and education. Affordable and more easily accessible access to basic services is likely to increase productivity, enabling individuals and households to strengthen and diversify their livelihoods.

This study focuses on five countries in the SADC region – Botswana, Lesotho, Madagascar, Malawi and Eswatini.

This scoping study has been conducted to identify the barriers and opportunities to enable affordable digital delivery and access to basic services.

- **Purpose:** New and existing knowledge is developed and utilised to improve access to education, health and clean energy service delivery systems.
- **Overall objective:** To generate insights from selected countries about the countries' landscape across these basic services and to identify blockages, partners and potential digital interventions that will broaden access.
- **COVID-19:** Align with COVID-19 recovery strategies and policies at a country level and identify intervention areas to support COVID-19 recovery.

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- Classmate
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- Human Resources Development Council (HRDC)
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- Motheo Technology
- Setswana Sa Bo Rre
- Smartcom
- Sydney Mogapi
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- Vista Life Science
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Executive summary

Access to basic services – education, energy, health – is an important socio-economic development goal and directly relevant to the achievement of the Sustainable Development Goals. Yet, many sub-Saharan African (SSA) countries still fare poorly in their delivery of these services. Socio-economic challenges and fiscal constraints undermine attempts to provide quality services to all.

Across the continent, several digitally enabled models are helping to fill this gap:

- In the education sector, COVID-19 has brought home the need for distance learning. Several initiatives already provide e-learning or tutoring as a complement to class-based learning. A number of models also drive access to digital, rather than hard-copy, content materials.
- In the energy sector there are several examples of solar home systems or mini-grids that extend electricity reach into areas outside the reach of the national grid, incorporating smart meters and digital payments.
- In the health sector, a number of telemedicine initiatives enable medical consultations over a distance, while mHealth models are used to share medical information and help with preventative care.

Botswana, given its upper-middle-income country status, fares better than many countries on the continent on basic service delivery. Government is committed to innovation, with the Smart Botswana policy driven by the Office of the Presidency setting the tone. Yet, challenges remain. Notably, the large surface area, with large tracts of sparsely populated land, poses a challenge for rural delivery, creating a stark rural-urban divide in terms of service delivery, but also in terms of connectivity.

Against this context, this study considers what the current role and potential scope are for digital delivery models to enhance access to basic services in education, energy and health in Botswana. It considers the current landscape in each focus sector as well as existing examples of digital delivery, as basis for a feasibility assessment and recommendations on the scope for digital delivery models in each sector.

Synopsis: education

Botswana has a high adult literacy rate, and education is free for the first 10 years of schooling. However, enrolment rates decline steadily across school years. Textbook access is fairly high, but there are significant regional disparities.

Rising levels of mobile phone penetration and internet connectivity may support e-learning solutions. Government is supportive of digitalisation via the national ICT Policy Maitlamo and the Thuto Net strategy that promotes e-learning. All schools in junior secondary now have computer labs. There are a few market initiatives already for e-learning as well as digital content to supplement classroom-based learning, two of them in partnership with mobile network operators to facilitate data access. Achieving scale remains a challenge.

Synopsis: energy

Two out of three Botswanans have access to the national grid. Extensive investment in power plants and private sector partnerships have improved local generation significantly, resulting in less reliance on imports. This high electrification rate, however, masks regional disparities: in the sparely populated rural areas, access drops to only 28%.

Where alternative and renewable energy sources are concerned, the Government of Botswana's Energy Master Plan sets goals for rural electrification that include the use of renewable energy. There are already a number of solar home system providers, but these serve higher-income households as well as businesses, rather than following the digitally enabled pay-as-you-go model aimed at the low-income market. Mini-grid activity is still nascent, but there are pipeline plans for a dozen mini-grid sites. The scale of both solar home systems and mini-grids is likely to remain limited in the medium term.

Synopsis: health

Ninety-eight percent (98%) of all health facilities in Botswana fall under the public health sector. As with education, public healthcare is provided for free. Healthcare facilities are fairly extensive, with 84% of the population living within a 5 km radius from at least a primary health facility.

Where digital delivery is concerned, there have been numerous telehealth pilot initiatives, but the lack of follow-through after the pilot stage is concerning. mHealth initiatives have been more limited. Government's commitment to creating an enabling environment is framed by the draft e-health strategy for 2020–2024, but the strategy has not yet been implemented.

What can be done?

The biggest constraint to digital delivery models across the three sectors would seem to be reaching scale. This includes overcoming demand-side uptake barriers. Government shows commitment, but more can be done to firm up the parameters of the enabling environment.

In **education**, digital upskilling of educators is required to help drive digital adoption by schools and learners. There is a need to facilitate dialogue among education ecosystem participants – across the public and private spheres – to advance the development of the edtech market. This could include introducing players from abroad to local stakeholders, as well as facilitating dialogue around more effectively leveraging MNO partnerships for affordable data access on educational platforms.

In **energy**, the main recommendation is to introduce the pay-as-you-go solar home system to the Botswana market, emphasising the digital finance link to smooth the upfront cost to consumers. This could be done through facilitating partnerships between credit providers and solar home system providers. The large distances to be covered for sales and maintenance in rural areas will, however, continue to challenge scalability. There is also an opportunity to promote smart meter solutions that would more seamlessly incorporate digital payments for electricity for those already on the national grid. Lastly, there is a

need for technical assistance for the development and implementation of renewable energy policies to cement the already supportive enabling environment.

In **health**, there is a need for ongoing dialogue between public sector players, donors and potential market innovators. Potential areas for onboarding or collaborating with private players may then be identified and their role and the benefits they bring more clearly positioned within the context of government's own priorities and milestones. Related to this, there is a need for technical assistance to finalise/update and implement the draft e-health strategy. Lastly, there is a general need for education and training of healthcare workers and the general population alike to build buy-in for digital engagement.

Overall, it is positive to see the existing traction in each of the sectors. However, funding and scope for reaching scale given the small population and low-density rural areas will remain challenges, as will device/hardware access, data costs and, in general, the "readiness" of the population to adopt and engage with digital tools. Botswana has seen some traction with digital payments, but free education and health diminish the use case for digital payments to facilitate access in these sectors.

These findings do suggest a role for a market systems facilitator such as FinMark Trust: in terms of advocacy, facilitating public–private dialogue, building relationships with new types of stakeholders, brokering partnerships and, importantly, making linkages between its financial inclusion work and basic service sectors.

1 Introduction

Large, sparsely populated country. Botswana is a landlocked Southern African country known for its diamond mining. The country is bordered by South Africa, Namibia, Zambia and Zimbabwe, with an estimated population of 2.3 million people in 2019 (World Bank, 2020). Most of Botswana is sparsely populated, as the Kalahari Desert covers over 70% of the terrain, and it is home to the world's largest inland delta, the Okavango River Delta (Siyabonga Africa, 2019).

Positive development trajectory, but economy under pressure. Despite the country achieving upper-middle-income status through its diamond-led development model and impressive economic performance[1], inequality[2], unemployment and HIV and AIDS prevalence rates remain high (World Bank, 2020). The COVID-19 pandemic (coming only a year after weakening global demand for diamonds and severe droughts led to a slowdown in growth from 4.5% in 2018 to 3% in 2019) has put the economy under pressure (World Bank, 2020). The dependence of the economy on diamond mining creates vulnerability to external shocks. It also introduces structural rigidities in the economy that restrict significant employment generation.

Table 1: Indicators comparing Botswana with SSA and high-income averages

Indicator/region	Botswana	SSA	High income
Access to electricity (% of population)	65% (28% for rural)	48% (32% for rural)	100%
Government spending on education (% of GDP)	7.1%	4.3%	4%
Current health expenditure per capita	USD483	USD84	USD5,284

Source: World Bank (2018)

[1] Government's major shareholding in diamond mining increased its revenues significantly through diamond export earnings. Consequently, this allowed the Government to invest heavily in development projects and recurrent expenditure (UN, 2021).

[2] Botswana is among the world's most unequal countries, with a Gini coefficient of 53.2 in 2015 (World Bank, 2015).

Despite progress, challenges in basic service provision remain. As indicated in Table 1, Botswana compares well to the rest of SSA on some basic service delivery metrics. However, the sparsely populated landscape increases the difficulty and cost of almost all basic service delivery. Electrification has positive impacts on health, education and income and is a great driver of productivity, which is key especially in poorer, rural areas of Botswana, yet rural electrification is below the SSA average at 28% (World Bank, 2018). Current health expenditure is marginally better than across sub-Saharan Africa but significantly below the extent found in high-income countries. The COVID-19 pandemic has exacerbated many of the existing challenges faced by service delivery in the country, which prompts the need for more rapid digital transformation and innovation.

Vision 2036 and Smart Botswana signal policy commitment to economic transformation and digital innovation. The Government is aware of the development challenges faced and aims to address these through the Botswana Vision 2026, a transformational agenda to achieve high-income status that complements the SDG agenda. The four pillars of this framework are: (i) sustainable economic development; (ii) human and social development; (iii) sustainable environment; and (iv) governance, peace and security (Vision 2036, 2019). The enhancement of basic service provision in the education, energy and health sectors would serve these broad goals. Further, the SmartBotswana (SmartBots) strategy developed by the Office of the Presidency aims to digitise the public sector in order to drive the country into a knowledge-based economy, as part of Botswana's transformation agenda in using ICT as a driver for economic development and diversification (Republic of Botswana, 2020).

Digital can help drive achievement of development goals. There are many examples in Africa where digital delivery models are helping with basic service

delivery in clean energy, education and health – each important towards the achievement of the Sustainable Development Goals (SDGs)[3].

High mobile penetration and internet access can support digital delivery. To be able to harness digital delivery for economic development and service provision, a country needs to be "digitally ready", including having the infrastructure, connectivity and device access to enable scaling of digital models. Botswana fares relatively well:

- According to the World Bank's Digital Adoption Index (DAI), Botswana scores 99 out of 134 economies on the Network Readiness Index (NRI), which covers four pillars: technology, people, governance and impact (Portulans Institute, 2020). Though this ranking is low in global terms, Botswana fares well compared to regional peers such as Lesotho (121), Eswatini (122), Madagascar (124) and Malawi (127) (Portulans Institute, 2020).

- Botswana ranks seventh in Africa for digital maturity, outperforming the region in all four pillars, which cover technology, people, governance and impact (Portulans Institute, 2020).

- Mobile phone ownership as a percentage of total population increased from 40% to 64% between 2014 and 2019 (Statistics Botswana, 2020). In addition, Botswana outperforms its peers in having a high level of mobile subscriptions in 2019 at approximately 163% as compared to Lesotho (75%) Malawi (48%) (ITU,2019). Further, there have been positive developments in expanding fibre connections throughout the country and installing Wi-Fi hotspots in public areas. With this, internet access has improved from 41% in 2014 to 64% in 2019 (Statistics Botswana, 2020).

3 For example, Snapplify is a digital content platform operating in the education sector and is designed to be a one stop shop for educators and improve learning performance of students across Africa and other emerging markets; Kasha, meanwhile, is an example of a health tech solution that acts as a mobile store built specifically for women in Africa to meet their specific health needs and overcome last-mile distribution challenges. And finally, Africa Clean Energy (ACE) in Lesotho is an example of a clean energy delivery model that provides basic solar charging functionality with a thermal cookstove.

Challenges in data costs and digital payments uptake. However, out of 228 countries globally, Botswana is among the top 14 countries with the most expensive data (The Botswana Gazette, 2020). The benefits and opportunities offered by technology have also not fully carried through to financial service provision. It is estimated that only approximately 23% of adults used mobile money in 2018[4]. The main reason cited for the lack of uptake is that people are not interested in taking up mobile money, plus a lack of information on the services (FinMark Trust, 2019).

Against this context, this report assesses *how access to basic services (education, energy, and health) in Botswana can be improved through digital business models.*

The report is structured as follows:

- Section 2 describes the research methodology.
- Section 3 presents a framework for assessing the feasibility of digital delivery models for basic service delivery.
- Sections 4 to 6 outline the country context, model overview, feasibility assessment and practical recommendations on the role of development actors and agencies in overcoming access and delivery challenges in each of the focus sectors. Section 4 considers education, Section 5 energy, and Section 6 health.

Section 7 draws cross-cutting conclusions and recommendations.

[4] The underlying source only indicated the total number of mobile money accounts. We estimated the percentage of mobile money accounts by taking the total number of active 30-day and 90-day mobile money accounts (323,623) in 2018, as a percentage of the total population in 2018 of 2,254,126. In short: 323,653/1,397,558*100.

2 Methodology

The methodology focused on crowding in the insights of key experts, industry and other ecosystem stakeholders and consisted of the following core activities:

- A desk review of the country context as it relates to basic services access and delivery
- A literature review and desktop scan of global and local best-practice digitally enabled delivery models for expanding service delivery in the sectors of education, energy and health
- Expert interviews with ecosystem actors from the public sector, private sector innovators, civil society organisations and development actors
- The development of a conceptual framework for assessing the feasibility of different types of digitally enabled delivery models for each sector, which was then used to identify those models with the highest potential for impact and reach
- Testing the feasibility assessment results with ecosystem actors during an interactive virtual workshop hosted on 23 March 2020

Key terms or definitions referred to throughout this report are:

- Digital transformation is defined as the transformation of economic activities through digitisation and/or digitalisation. Digitisation entails converting analogue processes into digital processes, while digitalisation entails inserting digital processes into the workings of businesses or everyday life (The Enterprisers Project, 2020).
- Digitally enabled models are models that leverage digital technologies, including both digital tools and digital channels to enhance the delivery of a product and/or a service to consumers (Fourweekmba, 2020).
- Digital tools are programmes and website and/or online resources that make it easier to complete a task, e.g. machine-learning applications (Department of Health and Social Care (UK), 2020).
- Digital channels refer to digital communication and/or payments platforms, e.g. mobile money channels.

3 A framework for assessing the feasibility of digitally enabled delivery models

Sectoral feasibility highly dependent on context. To address the country's unique basic service delivery challenges and reach scale, digital delivery models need to be context appropriate. This report therefore assesses the feasibility of the various models identified for each sector in the country context.

Feasibility framework at the nexus of affordability, access, regulatory and market dynamics. The analytical framework used to assess the feasibility of the different models within their sectoral context consists of four feasibility criteria: affordability, access, regulatory feasibility and market dynamics:

- Affordability. To determine the affordability of digital models for specific target groups, elements such as the cost of accessing and using the model, consumer or household disposable income, and expenditure habits all need to be considered.
- Access. Various factors contribute to the proportion of the population that will ultimately be able to access the model. These include:
    - **Digital connectivity.** Digital connectivity is a decisive factor when seeking to exploit the opportunities of digitalisation through digitally enabled delivery models. It is therefore important to understand the availability of ICT infrastructure and mobile devices for communication and transactional purposes in Malawi – this would also consider whether public institutions such as schools and medical facilities have internet access, for example.
    - **Analogue support infrastructure**. Digitally enabled delivery models rely on a combination of digital and physical layers to be effective. One of the physical layers needed is a distributed agent network that enables ongoing person-to-person engagement for customer onboarding, delivery and product maintenance, among other things.
    - **Basic physical infrastructure.** Finally, it is important to consider the accessibility of basic physical infrastructure such as road

networks, national power grids and basic service institutions such as schools and clinics.

- Regulatory feasibility. This refers to government structures, regulations, policies and incentives that either support or impede the delivery of basic services either through existing channels or through digitally enabled delivery models.

- Market dynamics. This refers to the viability of the digital model from the provider's perspective. This is affected by a number of factors, but for the purpose of this research, the focus is on the level of competition in the market and the scalability, given any potentially large barriers that may need to be overcome.

Sections 4 to 6 build up a feasibility assessment for digital delivery models in the education, energy and health sectors in Botswana, respectively, covering:

- Context: the sector context to which digitally enabled solutions can be applied and the core challenges faced in expanding access to these services

- Best-practice models: an overview of African and global models that could help to overcome the specific delivery and access challenges faced, alongside specific examples found in the Botswana context

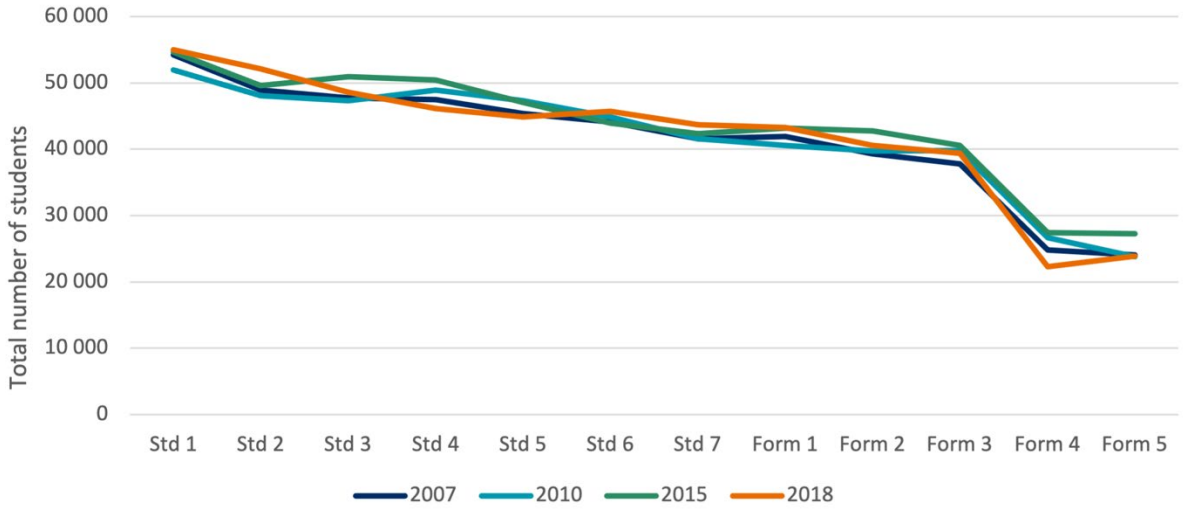
- Feasibility: an assessment of the feasibility in the Botswana context of each key model of digital delivery at the hand of the analytical framework as set out above, to form the basis for recommendations per sector

4 Education

Despite free primary education, poor-quality outcomes give cause for concern.

Primary education is free and voluntary for the first 10 years of schooling, while secondary education has a minimal fee from which poor people are exempt (Statistics Botswana, 2020; World Bank, 2014). The education policy has had good basic results: Botswana has a high adult literacy rate at 90% in 2014 as compared to SSA (62%) and global averages (85%). However, challenges remain as enrolment rates decline steadily as school attainment progresses, with a significant drop-out rate in Forms 3 and 4 (Statistics Botswana, 2018; UNICEF, 2019) as indicated in the figure below:

Figure 1: Primary and secondary enrolment rates by grade across different years



Source: Statistics Botswana (2018)

Further, a shortage of textbooks and school infrastructure[5], especially in rural areas, impede on the quality of education delivery and the performance outcomes of learners (UNICEF, 2019).[6]

Drive to enhance connectivity and hardware access. In 2013, 89% of schools had access to electricity, while 47% of students had access to internet at schools (GESCI, 2017). Consultations with ecosystem stakeholders suggest that a shortage of digital devices such as laptops and tablets, coupled with connectivity challenges in schools, derail schools from taking advantage of digitally enabled models in the market. Government is aware of these challenges and is spearheading the Thuto Net programme, an expansive project under the National ICT Policy (Maitlamo) in Botswana (UNESCO, 2016). Thuto Net seeks to link all secondary schools to the internet and computer labs. By 2017, 104 secondary schools throughout the country had access to the internet and the programme was rolling out to other secondary schools (IST-Africa, 2017). A similar initiative will also be rolled out to primary schools through a programme of refurbishing computers used in government departments with appropriate programmes for primary schools. This initiative is believed to provide opportunities for the private sector to ensure support and maintenance of the equipment (IST-Africa, 2017).

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[5] According to UNICEF (2019), approximately 67% of all learners have access to textbooks; however, access in the northwest region lags at around 50%. In addition, there are large shortages of school infrastructure and specialist classrooms for teaching science subjects. For example, in primary schools, the classroom backlog is 15% of the current stock (UNICEF, 2019). Qualified ICT teachers was estimated at 5% in 2013 (GESCI, 2017).

[6] According to UNICEF (2019), poor performance of learners in the Junior Certificate Examination (JCE) prevents learners from continuing to Form 4. Results in the Primary School Leaving Examination (PSLE) have improved, with transition rates from junior to secondary increasing from 54% between 2003/2011 to 64% in 2016, but pass grades are still relatively low and vary widely from region to region (UNICEF, 2017). In addition, there has also been a recent downward trend in the performance of junior high school certificates, indicating that the quality of students sent to secondary and higher education is declining (UNICEF, 2017).

4.1 Institutional arrangements

Intricate landscape of authorities. Figure 2 depicts the interlinkages between actors in Botswana's education sector:

- At the primary level, responsibility is shared between the Ministry of Basic Education (MOBE), who is responsible for primary and secondary education, including one year of Early Childhood Care and Education (ECCE), and the Ministry of Local Government and Rural Development (MLGRD), who is responsible for infrastructure, furniture and stationery, as well as feeding programmes for children in primary schools. However, the provision of ECCE is also decentralised and is the responsibility of district councils assisted by the MLGRD.

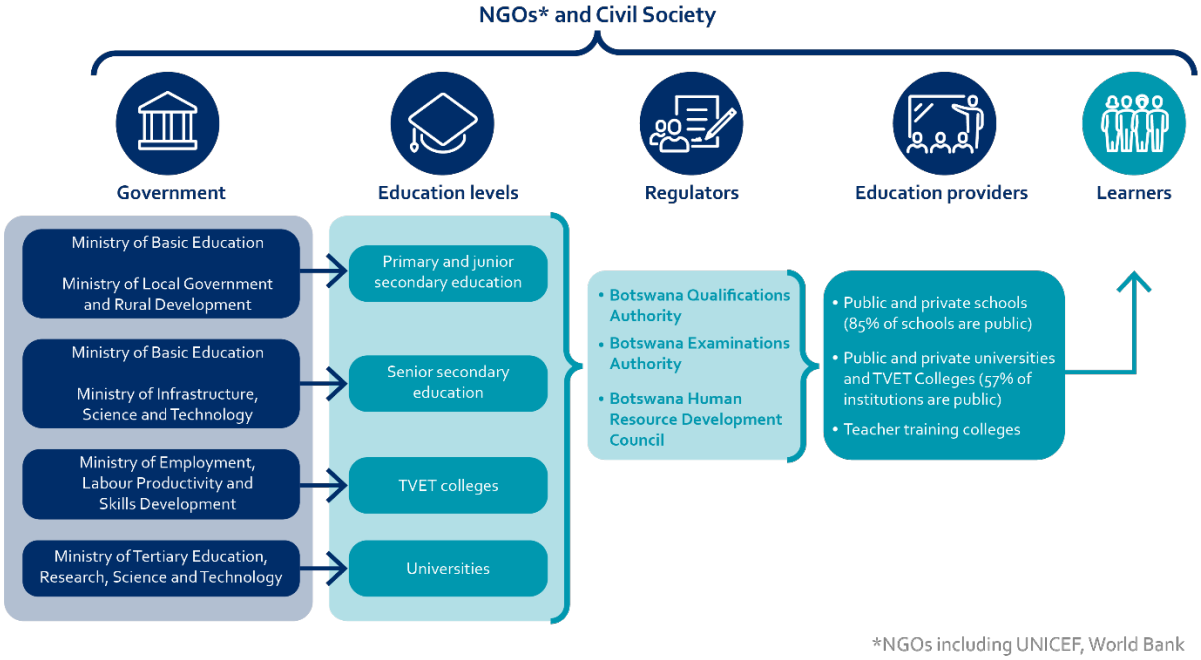
- At the secondary level, responsibility is shared between MOBE and the Ministry of Infrastructure, Science and Technology (MIST), who are responsible for managing the maintenance of senior secondary schools, and building classrooms and schools with funding provided by MOBE.

- At the post-secondary level, responsibility is shared between the Ministry of Employment Labour Productivity and Skills Development (MELPSD), who oversees TVET colleges, and the Ministry of Tertiary Education, Research, Science and Technology (MTERST) who is mandated to oversee tertiary education (UNICEF, 2019).

- The regulatory bodies responsible in the education system include the Botswana Qualifications Authority (BQA), the examinations counsel and Botswana's Human Resource Development council. BQA has a mandate to ensure the standard of vocational training.

- Eighty-five percent (85%) of schools and 57% of tertiary institutions fall under the public sector.

Figure 2: Supply-side actors and interlinkages in Botswana's education sector



Sources: UNICEF (2019) and UNESCO (2016)

4.2 Accessibility and household expenditure on education services

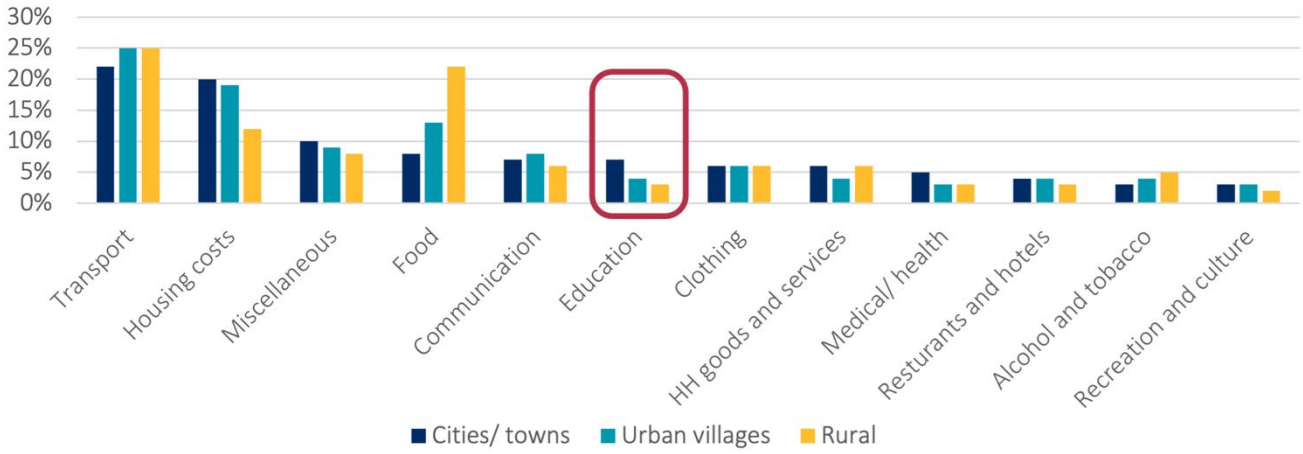
Widespread access. As discussed above, the free public-school policy means that education is widely accessible in Botswana. Across Botswana, 85% of schools are publicly run, implying that education is free for most learners (UNESCO, 2017). Despite declining enrolment at especially the senior secondary level as indicated in Figure 1 above, net enrolment[7] is still high overall, estimated at 90.2% at the primary level (Statistics Botswana, 2018).

Ancillary costs in practice. Despite free schooling, learners still incur ancillary costs associated with uniforms, travel and school lunches. On average, Botswana households spend more on education-related expenses than compared to other countries in the region. For example, in Botswana, expenditure related to education amounts to 7% of total expenses for urban

[7] The Net Enrolment Ratio (NER) is the percentage of the population of primary school aged 6-12 years.

households, 4% by households, 4% in urban villages and 3% for households living in rural areas (see Figure 3 below), while in Lesotho households spend on average 3% of their total household income on education, and in Malawi 2% (FinScope Lesotho, 2011; Government of Malawi, 2011).

Figure 3: Botswana household expenditure profile in 2015/2016: monthly expenditure in different categories as a % of total expenses



4.3 Best-practice digitally enabled delivery models in education

According to literature, there are two major digital delivery models in the education sector: e-learning and tutoring, and digital content libraries. This section will provide an overview of the features of the two models as found internationally, plus note applications or examples in the Botswanan context.

E-learning and tutoring

E-learning and tutoring can help to provide education services remotely. This model enables learners to engage interactively with teachers, tutors and peers on tasks and exercises for remote learning purposes. Furthermore, learners can ask content questions and make use of machine learning to track and assess learner development. These models can include language learning apps, virtual

teaching or tutoring, video conferencing or online learning software. Research suggests that this type of learning can increase information retention and decrease education time required. In many examples, this type of model is adaptive and able to provide the correct level of support for students based on their unique level of educational attainment.

Box 1: Sterio.me

Sterio.me is a Nigerian start-up that uses text messages to provide educational material and recordings of lessons for students to help them remember concepts taught at school. In short, teachers pre-record lectures, quizzes and questions and send them for free using SMS. Teachers are notified when students complete the course and receive their own performance. This allows educators to immediately receive comprehensive real-time analysis, which enable them to support students individually. Sterio.me does not require internet access and can be accessed from any basic feature phone.

In 2014, Sterio.me announced a Tutor.ng partnership with the U.S. Government to launch a full stack mobile learning experience across Nigeria. It includes SMS and voice Tutor.ng education services for Sterio.me and e-learning via mobile internet, mobile and other platforms. In addition, the Sterio.me technology is available to third-party users, such as NGOs, businesses and governments to launch their own voice services and messaging.

Source: (Halilou, 2016), (VIMEO, 2021)

Imperative for e-learning and digital content during COVID-19 lockdown.
School closures due to the COVID-19 pandemic have created a direct imperative the world over to pivot to remote/e-learning. In Botswana, for example, NGO Young1ove changed from an in-person educational delivery model to providing e-learning and tutoring through a call and SMS intervention (a so-called low-tech digital model). Their results showed that distance learning through SMS and mobile phone interventions could reduce innumeracy by 52%.

Box 2: Young 10ve

Young 10ve, one of Botswana's largest NGOs, provided a call and SMS message intervention in response to COVID-19. The initiative provided educational instruction for students in 10,000 households across Botswana.

Young 10ve conducted a rapid randomised trial and presented some experimental evidence to minimise the impact of the pandemic on learning. Their results showed that distance learning by phone and simple text messaging can improve numeracy by up to 52% for less than USD14 per child. The initiative was conducted in partnership with Oxford University, Columbia University and Jamil Poverty Action Laboratory (J-PAL).

Source: (Young 10ve, 2020)

Existing initiatives in Botswana. Apart from the low-tech Young1love example, the research identified two e-learning edtech initiatives in the Botswanan market: Classmate and Atlega. These start-ups provide learning software where learners can access school content, can complete assessments and quizzes to test their knowledge on relevant topics, and can receive progress reports to ensure holistic educational support. These models are accessible mainly through USSD functionality to ensure reach to all learners from various socio-economic backgrounds.

Box 3: Atlega

Atlega is a mobile-learning application that was conceptualised to address issues related to accessibility, inclusivity and affordability to quality education. Founded in 2019 and launched in Gaborone, Conexus partnered with Orange Botswana and launched a mobile learning app. Its aim is to tap into the high mobile penetration in the country to develop online learning.

The learning app uses a subscription-based model that is accessible via dialling a USSD from a smartphone, feature phone or tablet. This app also provides access to content based on

Botswana's national curriculum, tutoring services and access to educational news and other relevant student information.

Stakeholder consultations revealed that the platform is zero-rated for mobile subscribers using the network and offered at a minimum fee of P2 for subscribers using alternative network providers.

Source: (Tswana times, 2018), (Botswana Daily News, 2019), and stakeholder interviews

Digital content library

Digital content libraries can provide a cost-effective way for students to access educational content remotely. Digital content libraries allow students to download books and other educational content, either permanently or for a specific period. This could be a cost-effective alternative to the purchase of hard-copy books and materials. The challenge with these types of models is that they usually require internet access and a digital device that can read digital content programmes.

A relevant example from Botswana that combines the e-learning and digital content models is Classmate (see **Box 4**). It was launched by a start-up to solve educational outcomes in Botswana.

Box 4: Classmate

Classmate is a youth-owned business founded in 2017 and launched in partnership with the Botswana Innovation Hub. The model is a digital content library that creates and markets educational content from tutors and educators and provides feedback on assessments and quizzes taken on the platform.

The model is based on USSD, which makes it accessible on feature phones. Learners can access the content by paying USD0.3 per day, which is deducted from their airtime balance. There is, however, a 250MB content download limit.

Stakeholder consultations indicated primary users of the platform are learners in Forms 3, 5 and 7. The platform currently has 13,000 active users; however, as many as 30,000 users were recorded on the platforms while hard lockdown restrictions were in place for COVID-19 in 2020.

Key challenges faced by this provider include a lack of partnership opportunities to expand the platform's content offering, a lack of trust among consumers in local providers and difficult relationships with MNO partners.

Source: (Classmate, 2020)

Digital technology can also help with school management, facilitate payments. In addition to the e-learning/tutoring and digital content models, digital technology can be applied in mainstream schooling as an aid to help teachers and schools to grade tests, provide homework or schoolwork reminders, or stay in contact with parents for updates. They can also help schools to stay in contact with the national education department and manage and share their data (such as school registration and attendance). Moreover, digital financial services can bring efficiency gains in school payments. However, this use case is less applicable in Botswana, given the prevalence of free public schooling.

4.4 Feasibility assessment

As mentioned in Section 3, assessing the feasibility of digital models in the local context requires us to consider affordability, access, regulatory feasibility and market dynamics. This section considers the feasibility of the e-learning/tutoring and educational content models in the Botswanan context, taking the public education system as a baseline.

Table 2. Feasibility assessment: digital education models in Botswana

	E-Learning and tutoring	Educational content	Public education
	• Enables continued learning to take place remotely, i.e. teaching, exercises, etc. • Low digital skills levels required for usage • Feedback loop with schools • Low to no data required (USSD/SMS mobile channel) • Regulatory approval typically required	• Enables remote access to educational content • Improves affordability of textbooks • Requires data connectivity • May require smartphone	• Primary education meant to be free • Cost for parents and guardians still a barrier • Significant regional differences in access • Distance to schools a challenge
Affordability	✓✓	✓✓	✓✓✓
Access	✓✓	✓✓	✓✓
Regulatory feasibility	✓✓	✓✓	✓✓✓
Market dynamics	✓✓	✓✓	✓✓✓

✓ Low ✓✓ Medium ✓✓✓ High

Source: Authors' own, based on desktop review and key informant interviews

***Baseline*: public education**: The public sector provides the baseline against which the other models are compared. It is not a like-for-like comparison, however, as digital education models do not seek to replace classroom-based learning, but rather to supplement it. At present, public education is free for the first 10 years of schooling – hence it receives three ticks for affordability. Access to public education remains quite strong, but a drop in enrolment at secondary school level means that it has been assigned two ticks for accessibility. Public education receives three ticks for both regulatory feasibility and market dynamics due to Botswana having dedicated regulation for basic education and

the public education system being the main provider of educational services in the country.

E-learning and tutoring

Affordability: **E-learning and tutoring can provide an affordable way to supplement traditional education at schools.** E-learning and tutoring models are emerging as affordable digital solutions to supplement traditional learning in Botswana, particularly in light of the COVID-19 pandemic and associated restrictions. One of the benefits of these models is the relatively low cost that learners would need to pay to use them. For example, Young 10ve (see ***Box 2***) has developed what it refers to as a "low tech solution" that enables learners to receive SMS-based maths and literacy tasks and engage interactively with trained facilitators over the phone, all free of charge to the learner. As the cost burden remains with the provider, learners are incentivised to use this model more frequently. Assuming a low-cost service is offered (around USD1 per subscription), it is estimated that approximately 280,544 individuals (see Appendix) would find this model affordable. For these reasons, this model has been allocated two ticks for affordability.

Access: **USSD-based models promote access.** Botswana has one of the highest mobile penetration rates in Africa, and around 65% of the population own a mobile device. A substantial proportion of these devices are likely to be feature phones, which would limit access for models relaying on online usage. However, at present all of the digitally enabled models we identified in Botswana's ecosystem (Classmate, Young 10ve, Atlega, Clicking Generation) are accessible through USSD channels. In rural areas or lower-income households, learners may not have access to even a basic mobile device, and one out of every three Botswanans do not yet have a mobile phone. For these reasons, this model has been allocated two ticks for accessibility.

Regulatory feasibility: **Facilitative regulatory environment.** Stakeholder consultations indicate that for providers seeking to serve the basic education sector, i.e. learners from Standard 1 to Form 5, there are limited requirements in terms of content accreditation. This would suggest that there are no regulatory

barriers to e-learning in Botswana. Progress has also been made in creating an enabling environment for digital innovators through the introduction of specific policies such as the Thuto Net programme. Nevertheless, the fact that there is no specific regulatory framework means that this model is allocated two ticks for regulatory feasibility.

Market dynamics: **Positive outlook**. The fact that there is already some activity in the market shows that there's appetite for innovation – both among the providers stepping forward to play in this space and the regulators that are seeking to improve school ICT infrastructure and access to mobile devices. Scalability may still be an issue, however, as users are more familiar with face-to-face channels of education, and this can undermine uptake and usage. For these reasons, this model has been allocated two ticks for market dynamics.

Educational content

Affordability: **Digital content can be significantly more affordable than buying textbooks.** In Botswana, public education is free, and secondary education attracts a minimal fee. Classmate, as a hybrid between e-leaning and digital educational content, charges a small fee of USD0,3 per day. The access provided for this fee is limited to 250MB worth of content. Beyond that the users bear the costs. Atlega, a similar platform in collaboration with Conexus, partnered with Orange Botswana to be free for Orange users and is offering its services for a minimal USD0,2 to alternative network subscribers. Both of these platforms remain relatively affordable for learners and, as such, have been allocated two ticks.

Access: **No substantive access barriers.** Globally, the educational content model most often relies on data-based devices such as smartphones and computers to access content. However, in Botswana this model is showing promise, with the market making use of USSD functionality and partnering with MNOs to make the model more affordable and accessible. Both Atlega and Classmate are accessible via dialling a USSD code and hence could be accessible via a feature phone. Further, the extensive investment by the Government in extending ICT infrastructure and connectivity in the country also broadens

access to these models[8]. This model is therefore allocated two ticks for accessibility.

Regulatory feasibility: **Regulatory requirements would depend on the digital book being downloaded.** The current education sector strategic plans mentioned earlier, such as Thuto Net, supports the design and implementation of ICT in teaching and learning. While some books can be self-published, copyright laws still need to be followed. This is particularly true in the case of textbooks. There may also be regulation on language or on age suitability of books that may need to be considered. However, the material provided digitally may, in some instances, be privately developed as a supplement to the current curriculum, hence would not need regulation. As such, this model has been allocated two ticks.

Market dynamics: **Nascent market shows potential**. As discussed, there is some activity within the market, with four current players identified. Hence two ticks are assigned for market dynamics. However, stakeholder consultations have suggested that meaningful partnership opportunities are limited in the current market, referring to there being a lack of options when it comes to partnering with content providers and that partnerships with telcos can be quite rigid, with stifling exclusivity agreements. If these barriers can be overcome, these models will likely be able to reach more users and offer a wider range of educational content.

[8] Stakeholder consultations highlighted that internet infrastructure is being expanded throughout the country to reach last mile consumers and that Wi-Fi hotspots are being rolled out in public areas and schools. This impacts positively on access to educational content models. Stakeholder consultations do, however, highlight continued challenges of access to necessary devices.

4.5 Recommendations for Botswana's education sector

Table 3: Key recommendations in the education sector

Proposed solutions
• Supporting infrastructure roll-out • Digital upskilling of teachers • Stakeholder coordination to advance digital education

The biggest constraint in the market would seem to be hardware access and reaching sustainability and scale (which includes overcoming demand-side/uptake barriers). Three recommendations arise:

Digital upskilling of educators. It is important that educators be able to use digital technology accurately. Where schools are provided with educational tablets, educators need to be able to support children's learning through these digital devices. Stakeholder consultations suggested that it is important to upskill and train teachers in using digital resources, as they are essential in driving the uptake of educational digital models for schools; and they, in turn, impart skills to their learners.

Supporting government in extending ICT infrastructure in schools. A key barrier to the uptake and usage of digital education models is the lack of infrastructure available in public schools. Progress is being made by State-owned enterprises, such as Bofinet, in providing public schools with the necessary ICT infrastructure to support digital solutions. Stakeholder consultations do, however, highlight difficulties in extending this infrastructure to more remote schools, where often private players have little incentive to develop ICT infrastructure due to the lack of a business case. It is therefore left to the public sector to serve these areas, at least initially. Stakeholders indicate government efforts to do so have been hampered by a lack of funding. There may be an opportunity for FinMark Trust to connect public sector players with

donors or development funders that may be willing to support infrastructure development projects in rural schools.

Stakeholder coordination to advance digital education in Botswana.

Partnership formation will be a key element in supporting the growth of the edtech ecosystem in Botswana – enabling existing players to scale, as well as new players to enter. There will need to be strong coordination between several key players to ensure access, affordability and scalability of current and potential new models. The key players to engage include:

- Educational content platform providers. Stakeholder consultations underlined the lack of digital content as a barrier to creating more value on their platforms and attracting more users. At present, there are limited partnership opportunities available with established content providers in Botswana. Thus, there will be value in introducing local stakeholders to providers from elsewhere in the region (such as Snapplify).

- Demonstration cases from abroad. There may also be value in inviting e-learning models from elsewhere in the continent that have achieved scale (such as Eneza Education or M-Shule in Kenya) into the dialogue, to share learnings and explore partnership opportunities.

- The Ministry of Education in Botswana, as it has oversight over schools that can be integrated into these models and has ownership of much of the national curriculum content, which may form part of the service offering to leaners, thus providing an aggregator and additional distribution channel for content to learners.

- Telcos such as the BTCL and Orange. Stakeholder consultations indicated current partnership arrangements with telcos may exclude certain learners from accessing edtech solutions where they are only available free of charge to subscribers of a specific network. It would be important to consider how telco-edtech provider arrangements, such as exclusivity clauses and arrangements for the zero-rating of data for e-learning and digital-content platforms, may be structured to realise widespread access and usage of these models.

5 Energy

Progress in local generation reduces reliance on imports. Botswana's electricity sector depends on large-scale thermal coal power plants utilising domestic coal from reserves estimated at 200 billion tonnes, coupled with electricity imports through the Southern African Power Pool (SAPP) (Africa Energy Portal, 2020). Demand for electricity often exceeds supply, resulting in load shedding and use of back-up diesel power plants. Over a third of Botswana's electricity demand is from the mining sector, followed by the commercial sector, the residential sector and then the Government.

Extensive investment in power plants and private sector partnerships have improved local generation significantly (see Figure 4 below). Botswana's Vision 2036 highlights that it is a goal of the Government to reach a 50% target of energy contribution in the energy mix and to stop being reliant on imports from South Africa and become a net exporter of clean energy (Statistics Botswana, 2016; Botswana Power Cooperation, 2019). However, insufficient supply due to technical challenges at the recently constructed Morupule-B power plant prevents it from adding capacity to the national grid (Botswana Power Corporation, 2019).

Figure 4: Summary of local and imported electricity generation

Source: (Africa Energy Portal, 2019)

Historically strong reliance on non-renewable energy. Sixty-two percent (62%) of the installed generation relies on non-renewable sources such as coal (Africa Energy Portal, 2020). However, the country has high solar energy potential with direct normal irradiation (DNI) of 3,000kwh/m²/year, which is among the highest in the world (EEP Africa, 2018). Biomass potential is limited, as woody biomass and agricultural residues are insufficient to generate and distribute electricity on a sustainable basis, but Botswana has a cattle population estimated at 2.2 million, which indicates promising biogas potential (EEP Africa, 2020). However, few domestic biogas digesters have been installed in the country. Finally, Botswana is one of the top four Southern African countries with good wind potential, but this has not been explored yet (SE4ALL-Africa, n.d.).

Households mainly reliant on electricity and biomass. According to Statistics Botswana (2018), close to 65% of households make use of electricity for lighting. However, electricity consumption is limited across geographical lines, with the highest usage among towns at approximately 82%, followed by urban areas at 79% and rural areas at 35% (Statistics Botswana, 2018). Electricity is also the main energy source for heating. For cooking, more households (36%) still make use of wood as energy source, followed by liquid petroleum gas (LPG), which is used by 35% of households. About a quarter (24.6%) of households use electricity for cooking.

5.1 Institutional landscape

Mix of players in the supply ecosystem. This section outlines the key actors and interdependencies in Botswana's energy sector:

- Grid electricity in Botswana has traditionally been the domain of Botswana Power Corporation (**BPC**). The energy parastatal is responsible for the generation, transmission and distribution of on-grid electricity supply for urban and rural areas.
- The **Ministry of Minerals, Energy and Water Resources**, via the Department of Energy Affairs, is the policymaker for the energy sector in Botswana and, as such, coordinates with other Ministries, including Ministry of Environment, Wildlife and Tourism. The Ministry also works

in collaboration with development partners to formulate policies. For example, it works with the World Bank in developing a renewable energy strategy. The main policy framework for the energy sector is the Botswana Electricity Master Plan (BEMP). BEMP, which launched in the 1990s, outlines various goals for rural electrification, including the efficient use of renewable energy. Among other initiatives, it highlights government promotion of solar energy, off-grid solutions and grid extension, in addition to the removal of investment barriers and the creation of appropriate institutional frameworks (IEA, 2012). Further, the Ministry has plans to develop mini-grids in 12 villages across the country. Sizes of the units will range from 0.4MW to 4MW, with a total generation capacity of 35MW.

- The regulator is the **Botswana Energy Regulatory Authority** (BERA). BERA was formed in 2017 and is responsible for: setting and maintaining service standards; ensuring sustainable and secure supplies in the energy sector; protecting and preserving the environment; and maintaining best international regulatory practice. Stakeholder consultations revealed that after BERA's formation, it developed and implemented a rate of return methodology to set tariffs to be reflective of the costs BPC required to meet its revenue requirements. Stakeholder consultations also highlighted that since the BERA started functioning in 2018, there has been more focus on driving innovation and developing a framework that creates a more enabling environment for innovators and IPPs.

- In 2007, the Electricity Supply Act was amended to allow for the participation of IPPs to generate electricity and sell it to the national power utility (BPC). In 2020, BERA allotted generation licences to three **independent power producers** (IPPs) for the construction of power plants with an 827MW generation capacity. This is the first time such licences have been issued (ESI-Africa, 2020). Furthermore, Botswana is a member state of the Energy and Environment Partnership Trust Fund (EEP), a multi-donor fund that provides early grants and catalytic funding for innovative clean energy projects, technologies and business models. There are currently two solar requests for proposals in the market, launched by BPC: one related to a 100MW solar power plant that will be used to power Gaborone, and a hybrid solar project that supplies 20 villages. Bids have been submitted and are currently in the evaluation phase (DLA Piper, 2019). Moreover, recent developments

under the Amended Electricity supply Act of 2007 encourage mini-grid9 providers to play a more active role in contributing to the grid by generating electricity and being linked into BPC's transmission networks, which ultimately feed electricity supply to the end-user.

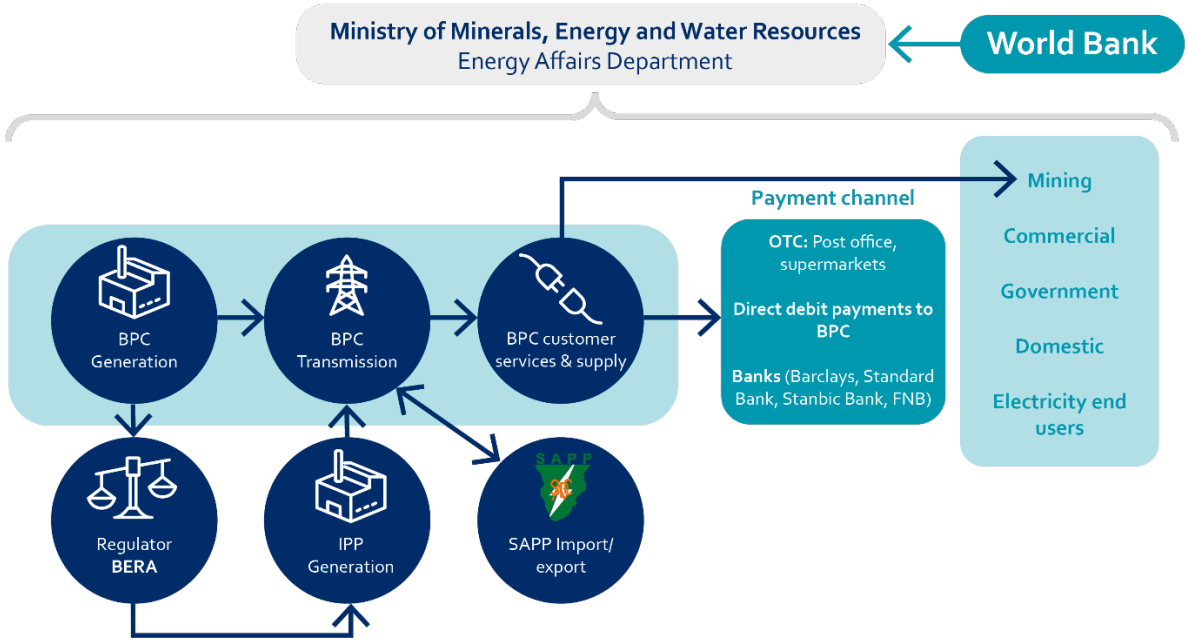
- Apart from the IPPs, there are also independent suppliers in the system who sell solar home systems (SHSs)10 directly to the public (see Box 5 below for an example).

- There are a wide variety of payment channels available to consumers. As also indicated in Figure 5, consumers of electricity in Botswana, including individuals and businesses, have various payment rails through which they can pay for electricity. These include filling stations, shops, BPC outlets, banks and mobile payment channels. However, mobile payments for electricity have not received much traction considering that only 323,653 people have active mobile money accounts, which are primarily used for buying airtime, sending money and only 16% for paying bills (FinMark Trust, 2019).

Figure 5: Energy sector supply-side actors and interlinkages

9 A mini-grid or microgrid is a miniaturised version of the larger grid, a configuration of energy resources, distribution wires and buildings, all within a distinct geographic footprint.

10 SHSs are innovative and clean electricity sources systems based on smaller stand-alone photovoltaic technology and offer power for lighting and some appliances to remote off-grid households.



Source: Botswana Power Corporation (2015), Get-Invest (n.d.)

Box 5: Shumba Energy – example of an IPP

Shumba Energy is a locally owned coal and energy development company that was launched in 2011 in Botswana and listed on the Botswana Stock Exchange. The company provides on-grid solutions and is a major industry player, which has several expansion projects, which include the two-stage coal IPP projects for BPC. Additional services include, acquiring coal exploration licences in Botswana, mining, production and sustainable supply of thermal energy.

- Being developed to supply electricity to South Africa under the South African Coal Baseload IPP Programme for Cross Border Projects
- Shortlisted on the Government of Botswana Greenfield Coal Baseload IPP Programme which serves as a parallel bid submission.

Sources: Provider website

5.2 Access[11]

Electricity access unequal on geographic lines. As noted in Section 1, it is estimated that approximately 65% of Botswanans have access to electricity. However, there is a large urban-rural discrepancy in access, with less than 30% access in rural areas while in urban areas the access rate is much higher at 72% (World Bank, 2018). Stakeholder consultations highlighted that building transmission lines is very capital intensive. This limits the potential to expand grid access for rural households in sparsely populated areas. This is illustrated in Figure 6 below, with on-grid transmission mainly situated in densely populated areas in the south east regions of the country.

Figure 6: Electricity transmission networks

Source: Get-Invest (n.d.)

Several policy initiatives to enhance access. Botswana's Energy Master plan aimed to improve livelihoods by improving affordability and access to electricity in rural areas. However, the subsidised electricity tends to benefit large

[11] Note that it is not possible to gauge percentage of household expenditure on energy in Botswana, as the expenditure data group utility payments into household goods and services.

consumers in commercial and industrial industries rather than households at the margin (IFC, 2020). Under the National Electricity Standard Connection scheme, the connection fee to the national grid is set at only P5,000 (BERA, 2020). While this enhances access from a user point of view, it creates a challenging commercial environment for potential future private developers. The renewable energy feed-in tariff strategy, drafted in 2011, has not yet been implemented, and the Government is not considering any further action because of the heavy burden of subsidies for potential users of Small-scale Distributed Generation (SSDG)[12] (IFC, 2020).

System losses[13] on the decrease. According to Castellano et al. (2015), distribution and transmission losses lead to increased generation capacity required to meet energy demand, thus pushing up costs for the power plants and increasing tariffs in many African countries. However, system losses are on the decrease in Botswana, from an estimated 15% in 2018 to 14% in 2019, a 6.67% percentage decrease (Botswana Power Cooperartion, 2019).

5.3 Overview of best-practice digitally enabled delivery models for expanded access to clean energy

Given the challenges in expanding connections to the national grid in Botswana, solar home systems (SHSs) and mini-grids have been identified as two digitally enabled delivery models that may contribute to enhanced electricity access. These models could provide individuals and households with access to clean, reliable and cost-effective energy through the use of innovative off-grid infrastructure and technology. Below, each of these models is outlined at the hand of global best-practice features, noting what examples are found in Botswana.

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[12] SSDGs generally refer to power generation from small-scale systems, such as photovoltaic modules, small wind turbines and micro-hydropower solutions, which are close to the end user and are primarily used for self-powering. See IFC (2020) for more information.

[13] System losses refer to the power that is lost during electricity transmission and distribution of the system.

Solar home systems (SHSs)

Plug-and-play solution to rural household electrification. SHSs are innovative and clean electricity source systems based on small stand-alone photovoltaic technology. They offer power for lighting and some appliances to remote off-grid households. These relatively simple, plug-and-play type solutions can be quickly set up and start offering the user near-immediate generation capabilities. Currently, a wide range of SHSs are available globally, both in terms of their generation capacity and their cost to the user. Smaller SHSs typically consist of one photovoltaic panel and a battery, to which devices can be connected.

A small SHS could power a charger for a mobile phone along with several power-efficient light bulbs, while larger SHSs may have the capacity to power devices such as a TV or radio. An even larger SHS can power electricity-intensive devices such as fridges, geysers and even stoves/ovens, but these may be prohibitively expensive for most households in low-income markets in Africa.

This system can therefore be divided into multiple tiers based on the types of household appliance it can power (see Table 4 below).

Table 4: Multi-tier matrix for measuring access to household electricity services

Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
Task lighting **AND** phone charging	General lighting and phone charging **AND** television **AND** fan (if needed)	Tier 2 **AND** any medium-power appliances	Tier 3 **AND** any high-power appliances	Tier 4 **AND** any very high-power appliances

Source: World Bank (2015)

In-principle use case for Tiers 1 and 2 in Botswana. Based on stakeholder consultations, current electricity consumption in rural households in Botswana remains relatively low, mainly due to a lack of affordability for the bottom-of-the-pyramid consumers. This low demand may justify the use of an SHS that

provides enough electricity for Tier 1 and Tier 2 appliances, rather than a bigger system or connection to the national grid. An example of such an SHS operator in the region is Africa Clean Energy (ACE) in Lesotho[14]. It primarily focuses on energy-efficient biomass cookstoves, but also incorporates a Tier 1 solar component.

In practice: targeting higher-income groups. A number of SHS providers are already operating in the Botswana market[15]. The indicative upfront cost of a Tier 1 system found in the Botswana market is USD93, whereas a Tier 2 system is USD324 (see Box 6 below). Consultations indicate that relatively high upfront cost means that these providers primarily target middle- and upper-income households who want to supplement energy provision during a power outage, or higher-income households, businesses or game parks/resorts operating in off-grid areas. The calculations on potential reach given cost, as outlined in the Appendix to this report, suggests that a basic Tier 1 SHS model in Botswana has a very limited potential target market in Botswana as compared to other basic SHS in neighbouring regions[16].

Box 6: Solar International

Solar international Botswana is a solar company that was formed in 1998 and based in Gaborone. The company has experience in solar-powered telecommunication systems, energy and environmental consulting, designing, supplying, installing and maintaining solar-powered products.

The simplest solar energy includes small batteries and wiring. To prevent the battery from getting damaged due to overcharging or discharging, a charge regulator is added.

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14 African Clean Energy (ACE) is a social enterprise founded in 2011 in Lesotho that provides renewable electricity and thermal energy to remote rural and peri-urban areas in the country. The basic ACE connect package consists of the cooker stove plus 10-watt solar panel, built in battery and USB port to connect an LED lamp attachment. Consumers can also use stove for heat and cooking. The price ranges from USD111 cash or USD115 paid in instalments over ten months, at no interest, with an initial deposit of USD17. For more information see Africa Clean Energy (n.d) and Lesotho Times (2020).

15 For example: Solar International, So Solar, Grit-tech and Shumba Energy.

16 Refer to the Appendix of this report for more detailed costing information and assumptions.

Depending on the size of the solar panels and batteries, the system can power 12V (DC) lamps and radios, usually at a cost lower than the P1,000.

A much larger system that can power an additional appliance such as a TV requires two or more solar panels and batteries and will cost more than the P3,500. In addition, for a house that is already wired with electricity, the solar system can be wired into the distribution board, and once there are power outages, the solar power would kick in without incurring additional expenditure on wiring.

Source: Provider website

Innovative financing schemes key to expanding access. The affordability barrier could be overcome through innovative finance schemes that spread the upfront cost over a number of months. Though we have not found examples of such initiatives in Botswana, SHS providers elsewhere have acknowledged the need to offer lower-cost financing solutions to their customers as a way to make their products more affordable and accessible. In the case of ACE, substantial progress was achieved by granting users interest-free loans for the first 10 months to make the model more affordable for consumers. To address defaulting loans, ACE has control of both the smartphone and the biomass stove that allows ACE to remotely shut down the system until payments are made. Consultation with ACE suggests non-repayment rates are low, with less than 10% of customers not following through on payments. In Malawi, SHS provider Yellow Solar[17] is able to offer an effective rate of around 32% per annum to consumers[18].

Maintenance of SHSs an ongoing concern. When compared to other models, such as a national grid or a solar mini-grid, the SHS represents a relatively lower-quality device that is designed to meet the basic electricity needs of households quickly but is not necessarily built to be operational for extended

[17] See https://www.yellowsolarpower.com/ for more information.

[18] Low-income individuals are often seen as higher risk by banks and can therefore be charged substantially higher interest rates – up to 60%–90% annualised.

periods. This can create ongoing maintenance risks and associated costs, should it be overused[19].

Physical distribution a key consideration for the SHS model. One of the keys to the scalability of the SHS model is the ability to establish or leverage an effective distribution network. A distribution network in this context comprises a combination of supporting infrastructure such as roads, warehouses for storing goods, vehicles for delivery of SHSs to households and an agent network to service various locations. In Botswana, there is a growing urbanised economy. Beyond urban areas, however, the country is sparsely populated, with 70% of the surface area covered by the Kalahari Desert. This challenges the physical distribution of SHS products.

Mini-grids

An off-grid community electrification solution. A mini-grid or micro-grid is a miniaturised version of the larger grid, within a distinct geographic footprint. There is no size limit, but micro-grids tend to be scaled to discrete operations, such as a small village, neighbourhood, community, business park, education campus, mine or an industrial facility. Mini-grids are developed in response to the growth in distributed generation, which brings generation closer to the point of consumption. The concept allows local control over localised generation. Mini-grids also allow renewable energy resources to be used efficiently in communities isolated from the national grid. The size and development of micro-grids allow smart grid features to be incorporated, which optimises power generation, storage and use (Energize, 2020).

Mini-grids experiencing growth in Africa. According to a 2018 Navigant report, the Middle East and Africa are forecast to be the world's fastest-growing market for mini-grids – at a compound annual growth rate of 27%, representing

[19] A qualitative study carried out in rural Bangladesh to determine the impact of SHS on rural livelihoods revealed the standard of SHS components should be improved and the need for greater after-sales service care to enhance the sustainability, ensure and preserve the popularity of these models (Kabir, et al., 2017).

almost 1,145 MW by 2027. African governments are beginning to recognise the negative financial and environmental impacts of reliance on fossil fuels or biomass for energy, so forward-looking countries are shifting their policies in order to prioritise distributed renewable energy (Homer Energy, 2019). Mini-grids offer longer-term energy solutions and arguably more sustainable development impact. Most systems have a productive lifespan of 15 to 25 years, which is longer than many other clean-energy technologies such as cookstoves.

Mini-grids not in competition with SHS. SHSs and mini-grids are often perceived to be direct competitors in low-income markets. However, the two models are in fact complementary. SHS electricity has immediate appeal to householders because of its relative simplicity, but it serves only limited household electricity needs. Moreover, it cannot be scaled up to adequately power commercial businesses, health clinics, schools or other facilities required for rural economic development. For that transition to occur, it is necessary to take the next step up the energy ladder to mini-grids, which can handle more robust electricity generation.

Mini-grids cater for growth in demand. Another advantage of mini-grids vis-à-vis SHS is that they allow for growing electricity demand. The introduction of electricity may support local economic development, which will generate additional electricity use cases. Mini-grid systems can be built to allow room for expansion as demand grows.

Mini-grid maintenance is crucial. For mini-grids to be sustainable, they need ongoing maintenance[20]. A lack of local expertise often means that renewable energy contracts are awarded to foreign experts. The issue with this arrangement is that some of these experts are not familiar with the local conditions and they may not be available for the continuous operation and maintenance of the systems.

[20] For example, the maintenance exercise includes cleaning the dust on solar PV modules, checking the battery contacts and replacing battery cells or failed inverter/controllers and circuit breakers. Theft of and security for these systems is another maintenance consideration.

Mini-grid investments on the horizon for Botswana. According to the Ministry of Mineral Resources, Green Technology and Energy Security, 12 solar photovoltaic mini-grids are in the pipeline. These mini-grids are intended to be built in 12 villages across the country with sizes of the units ranging from 0.4MW to 4MW with a total capacity of 35MW.Currently only two of 12 projects on tender have been awarded, and they are to be built in Bobonong and Shakawe villages, while the other 10 sites were still at tender stage and scheduled to operate from February 2022 (energy central, 2020).

5.4 Feasibility assessment

Table 5 summarises the feasibility assessment for each of the two digital energy models in the Botswana context, as compared to the national grid as baseline, followed by a discussion on each assessment. This is done according to the same four feasibility assessment criteria introduced in the framework described in Section 3 of this report.

Baseline: national grid. Although national policy has been geared towards standardising and driving down the cost of connecting to and using the national grid, costs remain relatively high and hence the national grid has been assigned two ticks for affordability. Access to the grid is high in Botswana, at 65%. However, there are areas where it is not feasible to extend the national grid, particularly in in rural areas, and as such the grid has been allocated two ticks for accessibility. Finally, both regulatory feasibility and market dynamics receive three ticks, as national policy has up to this point been primarily geared at the BPC and the national grid remains the largest-scale electricity network in Botswana.

Table 5: Digital energy models feasibility assessment

Solar Home System (SHS)	Mini-grid	National-grid
• Lighting, mobile charger and additional device • High flexibility	• Lower cost of energy • Lower investment for villages	• Most affordable for consumers

	• Regulatory requirements minimal • Distribution of generation capacity	• Local management required • Multiple projects on the horizon	• Centralise energy generation and distribution • Subsided by the Government • Unreliable support
Affordability	✓	✓✓	✓✓✓
Access	✓	✓	✓✓
Regulatory feasibility	✓✓	✓✓✓	✓✓✓
Market dynamics	✓✓	✓✓	✓✓✓

✓ Low ✓✓ Medium ✓✓✓ High

Source: Authors' own, based on desktop review and key informant interviews

Solar home systems

Affordability: **SHS unaffordable for many households.** As discussed, the market for SHS is still quite a niche space in Botswana, targeting largely higher-income households, with no current financing/pay-as-you-go schemes to smooth the upfront cost. The affordability calculations in the Appendix suggest that a mere 2,794 users could afford a Tier 1 SHS based on their likely income, access to a phone, product cost and available income for electricity consumption. Thus, this model has been allocated only one out of three ticks for affordability.

Access: **Limited outlook.** Apart from the affordability constraints to access outlined above, potential access is also constrained by the relatively broad reach of the national grid and the limited current target market of SHS operators, given the sales and maintenance constraints implied by the vast and sparsely populated areas outside of the national grid reach. Thus, this model has been allocated one out of three ticks for access.

Regulatory feasibility: No explicit regulation, but also not prohibited. There is no specific regulation that hinders players from entering the market for SHS. While it is not prohibited, it is important for the Government to actively encourage an environment for which these initiatives can thrive. Stakeholder consultations suggest that since the establishment of BERA, the environment has been encouraging of private players to increase competition in the sector and provide more affordable solutions for lower-income households. To date, this stance has not yet been reflected in an influx of new and innovative players in the Botswana market. However, signalling a supportive environment is a step in the right direction, and therefore regulatory feasibility receives two out of three ticks.

Market dynamics: Limited dynamics for taking mature niche market to scale. The current market is relatively mature, with providers that have been in the industry for more than a decade. However, as discussed, there is no current market activity to harness digital delivery to take SHS to scale or into the lower-income rural market. The low population density in off-grid areas serves as a disincentive for such a model. Thus, the SHS model scores two out of three ticks for market dynamics.

Mini-grids

Affordability: Mini-grids likely to require higher tariffs than the grid. Relative to the national grid, mini-grids are likely to be a less affordable option, at least initially. The national electricity tariff for residential consumers is relatively low, with a fixed charge of USD2,90 for domestic users and USD0,09 per kWh up to 200 kWh and thereafter USD0.12 per kWh, which applies to 65% of the population that has access s to electricity. While government subsidies make these relatively low tariffs possible for the grid, for mini-grid providers there is a significant upfront investment for establishing a mini-grid system. This means that the tariffs would likely need to be higher than national grid tariffs to be viable. It is therefore unclear how rural households would be able to afford this model without providers receiving financial support in the short run. In the medium to long run mini-grid models start to become more affordable for

consumers. As a result, we have allocated two out of three ticks for this model's affordability.

Access: Mini-grids potentially more accessible in the future, but currently limited. While mini-grids have been on the radar of the Botswana Government and private companies for some time (there is evidence of pilot projects[21] having been implemented as early as 2012), there is currently little in the way of significant active solar mini-grid systems in the country. Thus, this model has been allocated one out of three ticks for access. As discussed in Section 5.3, there are, however, plans to develop a number of mini-grids in the coming years. This bodes well for the accessibility of these models for rural or unserved households.

***Regulatory feasibility*: Positive policy stance.** Stakeholder consultations suggest that the formation of BERA in 2018 has led to an opening up of the energy sector, paving the way for alternative IPPs and mini-grid providers to enter and operate. This bodes well for future engagements with mini-grid providers in the country and may signal to providers the willingness of the regulator to encourage innovation and competition in the market. However, since there is no existing framework for mini-grids, this model received two rather than three ticks as part of the feasibility assessment.

Market dynamics: Complementary role to the national energy grid. As discussed, the research did not find any existing mini-grid initiatives, but there are pipeline plans by the regulator to introduce several mini-grids in the coming years. Thus, the concept of mini-grids does appear to be gathering momentum in the country, with several key documents making reference to the role of mini-grids in improving local generation capacity and meeting the growing household demand in the country. This model therefore received two out of three ticks for market potential.

[21] In 2012 Botswana Technology Centre (BOTEC) impolemented a pilot for a 5.7 kW centralised solar PV power plant in a remote village of Motshegaletau.

5.5 Recommendations for Botswana's energy sector

Table 6: Key recommendations in the energy sector

Proposed solutions
• Inclusive financing schemes to support access to SHS • Promoting smart meter solutions and digital payments • Policy technical assistance

Inclusive financing arrangements to drive uptake of SHS. At present, the number of consumers that would be able to afford a low-cost SHS product in Botswana remains extremely low according to our target market sizing calculations (see Appendix). This is due to the relatively high upfront costs charged for these models. For many lower-income households in Botswana, accessing finance remains a key barrier. People outside of formal employment are often seen as higher risk by banks and can therefore be charged substantially higher interest rates – up to 60%–90% annualised. Elsewhere in SSA, SHS providers have therefore acknowledged the need to offer lower-cost financing solutions to their customers as a way to make their products more affordable and accessible, and there are several examples where SHS systems are paid for in instalments at low or no interest. There may be potential for FinMark Trust to play a facilitation role in terms of convening discussions between SHS providers and credit providers to introduce financing options that reduce the upfront cost of SHS. In addition, there may also be scope to facilitate discussions with low-income-market-focused SHS providers from elsewhere in the region, like Yellow Solar in Malawi and ACE in Lesotho, to better understand how and whether such a model could be viable in Botswana given the different topography/population spread.

Promoting smart meter solutions and digital payments. There is an opportunity to drive the use of digital payments for electricity as the majority of households already have prepaid meters installed, but these are manual. A key next step may be to coordinate among key stakeholders such as BPC, BERA and

MNOs to encourage and support innovation around how households can better manage electricity usage and make the payment leg more convenient and affordable. The potential here is already being explored by innovative start-ups such as SMARTCOM, which received a grant from the Botswana Innovation Hub to develop a prototype for a smart metering solution for households to better manage their electricity usage and to create a more seamless digital payments experience using mobile money. There is an opportunity for FinMark Trust to walk the journey with such players to ensure that they get to market and have the right partnerships to scale. Such players can then be used as a demonstration case for how BPC can successfully integrate innovative payments solutions into the grid network.

Providing technical assistance for the development of renewable energy policies. Stakeholder consultations revealed that BERA is supportive of innovation and sets an enabling policy stance for innovators. There may therefore be an opportunity to facilitate more focused and ongoing engagements between prospective innovators and BERA to create a clearer roadmap around how to navigate the energy regulatory space, as well as to source industry inputs into the development of new guidelines so that they are better geared to reflect market needs and realities.

6 Health

Botswana faces a heavy disease burden, especially in HIV/AIDS. Botswana records the fourth-highest HIV prevalence in the world, with 20.3% of the population aged 15 years and above infected with HIV (AVERT, 2020). Tuberculosis and malaria also pose a challenge (CDC, 2019). The country has a high but declining infant mortality rate of 41.6 per 1,000 live births in 2017 (UNICEF, 2019).

Substantial spending on healthcare, but still below international target. In 2018, the health sector received the third-largest share of government spending (after education and general administration) at 12%[22]. However, this is still below the Abuja[23] target of 15% (UNICEF, 2018).

eHealth strategy a work in progress. In 2015, with the assistance of WHO, Botswana developed a draft eHealth strategy, premised on the WHO/ITU eHealth Strategy. The draft strategy aimed to have telehealth services, mHealth, and a standard telehealth infrastructure in place by 2016; however, this has not occurred because the strategy has yet to be approved (Ncube, et al., 2020). Stakeholder consultations for the current study indicate that the draft has recently been adapted and finalised as the eHealth Strategy of Botswana 2020–2024 and that it now needs to proceed to the implementation stage.

6.1 Institutional arrangements and supply-side dynamics

Healthcare is delivered through a decentralised system centred on primary care. Figure 7 illustrates the role of various institutions in healthcare provision. The Ministry of Health is the main healthcare provider, with 98% of all health

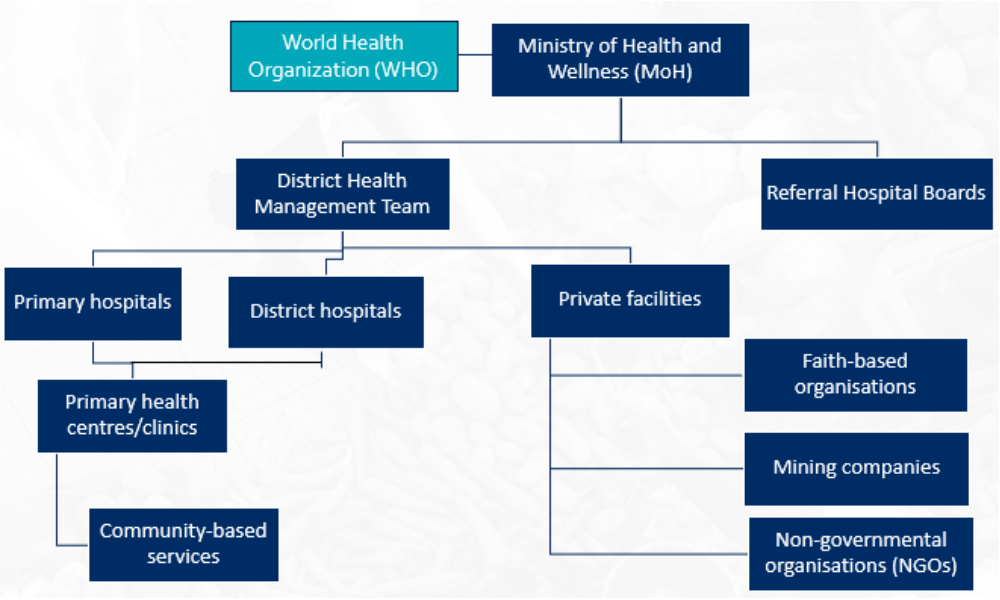
[22] The health budget accounted for an average of 11% of total expenditure in the five years from 2014/15 to 2018/19. The total health expenditure budget increased by 2.4% from P8.1 billion in 2018/19 to P8.3 billion in 2019/20 (UNICEF, 2019).

[23] The Abuja declaration was formed in 2001 following a pledge by African Union countries to commit to a target of at least 15% of their annual budgets to improve the health sector.

facilities falling under public sector care through a decentralised system with 27 health districts (UNICEF, 2018). Development agencies such as the World Bank are involved in providing technical and financial assistance to the ministry. The District Health Management Teams (DHMTs) are responsible for running a network of health facilities, hospitals, clinics, health posts and mobile stops, as well as community-based preventative and promotive services. Each district has a district health team led by a public health specialist. Each district also has an average of three or more posts for health promotion officers, depending on the size of the district (UNICEF, 2018).

Parallel private system. In addition to government-sponsored institutions, faith-based organisations, non-governmental organisations and mining companies provide a parallel system of private healthcare through a complementary network of clinics and hospitals (UNICEF, 2018). There are an estimated 354 private clinics, eight hospitals and 106 pharmacies. While private healthcare providers play a key role, inadequate controls on the private sector raise serious consumer-protection-related concerns (Gutierrez & Marshall, 2018).

Figure 7: Institutional arrangement in the health sector



Sources: UNICEF (2018), Pacific Prime (n.d.)

Supply chain management issues. The availability of medicines remains one of the challenges faced by Botswana's health system. The Central Medical Store (CMS) is responsible for supply chain management of all health goods, including public sector medicines. In 2018, the average supply of essential drugs in public health facilities was 84.7%, compared with the target of 97% (ACS, 2020).

6.2 Access and affordability

Extensive reach enhances access. In total, there are 1,628 health facilities in the country (70.66 per 100,000 people) with mobile stops[24] making up the bulk of healthcare facilities (Ministry of Health and Wellness Botswana, n.d). Regardless of the country being sparsely populated, 84% of the population live within a 5 km radius from a health facility, while 96% live within a 15 km radius (Statistics Botswana, 2017). However, public hospitals are mainly located in the Eastern regions of the economy, particularly in Gaborone (Seitio-Kgokgwe et al, 2014).

Table 7: Health facilities in Botswana in regional comparison

Health facility	Botswana	Eswatini	Lesotho	Malawi
All types of hospitals	35	6	21	119
All types of clinics/ mobile stops	1,242	6	21	369
Health centres/posts	351	8	188	517
Total	1,628	127	278	1,005

Source: Ministry of Health and Wellness Botswana (2018) and Statistics Botswana (2018), Lesotho Review (2018), WHO (2019) and Government of Malawi (2017)

[24] Mobile health stops refer to clinics that do not have a permanent structure and are staffed by nurses and health education assistants to provide primary health care services such as HIV testing (Ministry of Health and Wellness, n.d)

Shortage of healthcare professionals. Despite the broad reach of facilities, access to effective healthcare is undermined by limited human and technical resources (Ndlovu, et al., 2014). Botswana's doctor-to-patient ratio (0.5/1,000) is marginally better than SSA averages (0.2/1,000); however, below high income (3/1,000) (World Bank, 2018). Further, there are very few medical specialists in the public health sector (for example, there is only one dermatologist), most of whom live in urban areas (Ncube, et al., 2020). Stakeholder consultations revealed that doctors prefer not to work in rural remote areas, making the use of digital delivery models important in expanding healthcare delivery in remote areas.

Public facilities are free at the point of access. Health services are provided for free in all MOHW facilities, which serve more than 98% of the population. Patients are charged a nominal co-payment of P5, but this is reportedly rarely collected (Gutierrez and Marshall, 2018). It is therefore not surprising that households incur very little out-of-pocket health expenditure. Data from Statistics Botswana (2018) shows that, in 2015/2016, urban households spent on average 5% of their monthly expenses on healthcare-related expenses, dropping to 3% for rural households (see Figure 3 in Section 4.2).

Limited access role for health insurance. Given the extensive reliance on public healthcare, there is a limited role for health insurance to enhance access to healthcare. For example, 17% of the population and 42% of employed persons have some form of health insurance (Gutierrez & Marshall, 2018).

6.3 Overview of best-practice digitally enabled delivery models for expanded access to health

According to the eHealth literature, there are 13 types of digital delivery models in the healthcare sector globally (see Appendix B). Two categories are identified as particularly relevant in the SADC context: telehealth and mHealth. Below, each is outlined based on global best practice, with reference to the applicability in the Botswana market.

Telehealth

Digitally extending health services. Telehealth is a digitally enabled delivery model that connects healthcare providers and patients, where distance is a critical factor, through online services, chats, video calls, texts and other digital communication tools. It is used for diagnosing, treating and preventing diseases and injuries. This allows service providers to cater for the healthcare needs of diverse clients, provided the patients have access to a tablet, a computer or even a basic phone. The shortage of healthcare practitioners and facilities in SSA, particularly in rural regions, makes the telehealth model a potential way of optimising existing healthcare resources, making them more accessible to a wider segment of the population (see Table 8).

Table 8: Features of the telehealth model that can improve health outcomes

Telehealth systems	Local healthcare providers	Implementing partners	Healthier low-income patients
Employ ICT in transmitting text, audio, video or images to local healthcare workers Provide modern ways of diagnosis, treatment and prevention Design as simply as possible with the flexibility to adapt to older technologies	Access telehealth tools to consult with experienced doctors or specialists Rely on augmented professional support that helps users reman in rural settings	Set up a turnkey solution that is plugged in to existing systems Share costs between private and public actors for set-up, equipment, training and maintenance, etc.	Receive quality care at home or a local kiosk in rural areas Reduce time, travel and related costs for accessing specialist care Deal with fears and resistance to use of technology and accelerate its adoption

Source: World Bank (2017)

Benefits both patients and public health workers – key during the COVID-19 pandemic. According to Monaghesh & Hajizedah (2020), telehealth has the potential to reduce the use of resources in health centres and to improve access to care for those who can afford it. It also reduces the risk of person-to-person infection, as this model can extend the reach of healthcare professionals

beyond the traditional clinical setting to enable remote care and diagnosis. During COVID-19, this is vital to curb the risk of transmission through face-to-face contact. For healthcare workers the benefits extend to being able to consult/obtain expert inputs to help with the fulfilment of their services. Telehealth can also be used as a training tool to reach those healthcare workers in rural areas.

Various pilots in Botswana. Numerous telehealth initiatives (addressing, among others, dermatology, cervical screening, oral medicine and eye-screening) have been piloted in Botswana, with the country being reported to be the first African country to scale a telehealth model at the national level (see **Box 7**) (Ndlovu, et al., 2014). A recent example, triggered by the COVID-19 pandemic is the Doctors E-consult app (Africa Business Insider, 2021). It was designed by a group of young professionals as a one-stop shop that allows people to use their mobile phones to book appointments, engage in remote consultation with a health professional, make payments online and purchase medication online. At the time of writing, there were plans to shortly launch the application on the Google Play store (Doctors E-Consult, 2021).

Limited sustainability and scalability. Stakeholder consultations suggest that, despite most pilot initiatives being successful, there are challenges in scaling the initiatives at a national level once donor funding had been withdrawn. Only one project (Kgolagano – as featured in the box below) managed to scale up with government intervention (Ncube, et al., 2020). Stakeholder consultations indicate several challenges that impede scale and sustainability of pilots, including frequent leadership change from ministry, which led to delays and lack of buy-in from the Government, human resource migration to the private sector once health professionals were trained, as well as technical and social challenges, such as the lack of interoperability of systems, malfunctioning of devices, and a cultural misalignment between IT providers and practitioners.

Box 7: Kgolagano

Kgolagano operated between 2010 and 2012 in a public–private partnership (PPP) with various ecosystem players. It is the first pilot initiative to scale at the national level in Africa and the first in the country to utilise TV white spaces for internet connection in practising telemedicine. The aim of the project was to improve access to specialised healthcare service delivery throughout Botswana, hence improving patients' outcomes and also reducing hospital congestion in the few available referral facilities. A mobile application was developed to scale the project; however, development funding was withdrawn, and this has stalled the rollout, as the project awaits new funding from the Government.

The Kgolagano mobile telemedicine system covered four medical specialties: oral health, dermatology, radiology, and cervical cancer screening, all of which involve visual inspection. Healthcare workers were provided with smartphones that are equipped with a built-in camera and data-enabled SIM cards donated by the Orange Foundation of Botswana.

All four mobile telemedicine projects used the same model in which the healthcare worker collected pertinent clinical history and associated images pertaining to a complex patient case, utilising a smartphone with a telemedicine application. The collected history and images are then sent via mobile phones directly by the referring healthcare worker to an in-country remote specialist for consultation. The specialist uses the information to diagnose the illness and recommend an appropriate course of treatment. The in-country specialist also has the option of forwarding the case to an international specialist for further input and collaboration. The national specialty manager is the uniting force for each programme, working to train the healthcare workers on site, as well as coordinating all parties involved in the scaling-up and sustainability of their programme.

The initiative reached 15 locations in Botswana, 27 clinicians have been trained, and 696 cases were successfully treated. However, major challenges included malfunctioning of mobile devices, accidental damage of devices, and misalignment due to poor digital literacy between IT and healthcare providers.

Source: Microsoft Botswana (2015), Design Indaba (n.d.), (Ndlovu, et al., 2014) and KIIs

mHealth

A mobile self-care solution. The mHealth model refers to the concept of mobile self-care and involves the use of mobile devices such as mobile phones and other wireless devices to enhance access to health information, improve the distribution of routine and emergency health services, or provide diagnostic tools. It can be used, for example, to communicate key information to pregnant women on what to monitor and what treatment to seek, when. Today, countries such as Ethiopia, Kenya, Nigeria and South Africa are leading the way in using mHealth solutions for health-service delivery. This is being driven by a number of factors, including the expanding penetration of mobile networks in rural communities, the reduced costs of mobile handsets and innovative technologies that integrate mobile applications with traditional health-service delivery models. mHealth has found applications in treatment compliance, data collection and disease surveillance, health-information dissemination, point-of-care support for health workers, and health promotion.

Services can either be "push" or "pull". The services or health interventions are usually reminders, informational messages, or supportive content. Pull treatments refer to those that an individual initiates, so it requires them to be aware of when they need support. Push treatments are those services that the provider sends out to a specific group. This model uses mobile apps or SMS/USSD technology, which can be useful on basic phones.

mHealth has shown great promise in low resource situations, but challenges remain. Benefits include patient education, health promotion, disease self-management, decrease in healthcare costs, and remote monitoring of patients (Alghamdi. et al, 2015). WelTel, an mHealth solution in Kenya, demonstrates how mHealth can promote positive outcomes in target groups and could result in significant cost savings for government. However, infrastructural and cultural issues such as reliability, network availability, illiteracy and social acceptability could hold back the adoption of mHealth solutions (Nsor-Anabiah, S. et al, 2019).

Limited initiatives in Botswana. The box below outlines Orange Botswana's mHealth pilot. It demonstrates how various aspects of mHealth services can promote blended learning for healthcare workers to improve their clinical

knowledge and performance (GSMA, 2020). In addition, Young 10ve, a youth-led NGO that traditionally provided face-to-face health education and numeracy interventions, pivoted as part of their COVID-19 response to provide a call and SMS intervention to reach children remotely. Stakeholder consultations revealed that low-tech interventions have been beneficial in providing healthcare information to students and linking students to public health services. The response of these interventions has been positive from both parents and learners. According to Young 10ve, parents indicated that this initiative has created an environment to engage on sensitive topics. Further, Microsoft and the University of Botswana (closely affiliated with the Ministry of Health) have partnered to develop an Integrated Healthcare Information Service through Mobile Telephony (IHISM). Individuals can use their basic mobile devices to ask questions about HIV/AIDS via SMS messages and receive a reply straight to their mobile phones (Vital Wave Consulting, 2009).

Box 8: Orange Botswana: e-training initiative

The e-training initiative was launched in 2014 as a corporate social responsibility project by Orange Botswana, in collaboration with the Ministry of Health and a partnership between the University of Botswana and the University of Pennsylvania.

Orange developed a data bundle to provide free browsing of specific medical websites and all lectures on the initiative. It grouped students within a closed user group to allow them to consult each other or their lecturers through mobile devices for free.

It also incorporated a telemedicine component in that it allowed instant communication between nurses working in clinics, who might be in remote areas, and specialist doctors in major hospitals.

Source: Botswana Daily News (2014), Sunday Standard (2014)

6.4 Feasibility assessment

Table 9 summarises the feasibility assessment for each of the two digital health models in the Botswana context, compared to the public health system as a

baseline. This assessment is conducted against the same four feasibility assessment criteria introduced in Section 3.

Baseline: public healthcare. Given the free healthcare, broad distribution network and the fact that the public healthcare system is well regulated, the public healthcare system is scored highly feasible on all three these fronts. While it does not directly compete with the other models, public healthcare is assigned three ticks for market dynamics, given its scale.

Table 9: Feasibility of health models

	Telehealth	mHealth	Public healthcare
	• Remotely extending the reach of healthcare practitioners • Improved access and use of existing human resources • Provide training to healthcare workers to improve clinical knowledge and perfomance	• Enables remote health data capture, diagnosis and information sharing • Preventative healthcare solutions • Assistive technology solutions	• General consultation is P5 (USD 0.46) • Sexual reproductive health services and ARV treatment is **free** • Mobile stops make up the bulk of health facilities • Shortage of healthcare professionals
Affordability	✓✓	✓✓	✓✓✓
Access	✓	✓✓	✓✓✓
Regulatory feasibility	✓✓	✓✓	✓✓✓
Market dynamics	✓✓	✓	✓✓✓
			✓ Low ✓✓ Medium ✓✓✓ High

Telehealth

Affordability: **Affordable option but unsustainable in the long term.**

Generally, the fee for the underlying service provided via telehealth is a

significant cost driver in telehealth models seen globally. However, in Botswana reproductive health and antiretroviral treatment (ART) services are free to all citizens, and there is only a nominal fee of about US0.5 for consultations for other services in the public health sector; no one is denied service due to an inability to pay[25]. This is important to note, as it would mean that telehealth initiatives located in the public healthcare space would not need to incur a fee for the remote consultation. The feasibility assessment indicates that 987,807 adults could afford a USD1 monthly subscription for a health-tech product. Thus, this model receives two out of three ticks for affordability.

Access: **Advancements in ICT infrastructure and connection networks in rural areas promote inclusion.** As discussed in Section 1, Botswana has good ICT infrastructure, and access to mobile phones has improved. Stakeholder consultations revealed that as part of the Smart Botswana initiative, 296 health facilities should receive Wi-Fi connectivity through the country's national fibre network (BOFINET) in partnership with the MOHW and the Office of the Presidency. This facilitates accessibility for telehealth. However, there are still funding challenges to extend these projects, as the MOHW contributes only a small budget to maintain ICT within the sector. Overall, the lack of sustainability means that there is limited access to such initiatives in Botswana at present – hence one out of three ticks.

Regulation: **Telehealth policy to be implemented.** A scan of global best-practice models in the health space suggests that there are a number of regulatory considerations in telehealth. Regulators remain concerned over the medical ethics of healthcare officials not seeing the patient in person as well as the protection of consumer data. According to stakeholder consultations, the main regulation that would be applicable in the SADC context would be personal data protection regulation, as is the case under the Protection of Personal Information (POPI) Act in South Africa. In Botswana, the Data Protection Act, 2018 (which was assented to by Parliament on 3 August 2018) is

[25] https://www.healthpolicyproject.com/pubs/7887/Botswana_HFP.pdf

currently on notice, awaiting commencement (Data Guidance, 2021)[26]. As discussed, Government, with the assistance of the WHO, has developed an eHealth strategy that has so far not yet been implemented (Ncube, et al., 2020). This raised a question around the extent to which digitally enabled delivery models such as the telehealth model would be sufficiently supported and governed in the Botswana context. However, recent consultations suggest that the policy has now been approved and awaits implementation. Thus, this model receives two out of three ticks from a regulatory feasibility standpoint.

Market dynamics: **Challenges to scalability.** As noted, there has been much interest in the telemedicine model in Botswana, with a number of pilots launched. However, stakeholder consultations indicate that many of these initiatives were unable to reach sufficient scale for a number of reasons, including but not limited to, a lack of funding beyond the pilot phase, resistance by consumers and practitioners in moving from traditional healthcare to digitally enabled solutions and a lack of political will and buy-in to support the scaling-up of initiatives. Thus, this model receives two ticks for market dynamics.

mHealth

Affordability: **mHealth applications generally low-cost for the consumer.** mHealth, unlike telehealth, provides users with healthcare information and tools to enable self-care and diagnosis with a greater emphasis on digital tools and content. As medical practitioners are less involved, mHealth often tends to be more affordable than telehealth. In Botswana, mHealth initiatives are provided at low or no cost. For example, the Integrated Healthcare Information Service is free and users only incur the cost of sending an SMS. Thus, this model receives two out of three ticks for affordability.

[26] Prior to the introduction of the Data Protection Act, 2018, Botswana did not have any primary legislation that regulated the protection of personal data and ensured the privacy of individuals in relation to their personal data.

***Access:* mHealth increases access to simple health solutions.** mHealth models, much like telehealth, can be provided either through more SMS/USSD channels or through more data-reliant channels such as websites or mobile apps. Where mHealth models can be offered through SMS/USSD channels, this will likely increase access in areas that have limited mobile internet connectivity and among the population cohort that does not have smartphones. However, the low levels of activity by mHealth providers and the lack of established solutions in Botswana suggests there is limited current accessibility for consumers. For this reason, this model has been assigned one out of three ticks for access.

***Regulation:* eHealth policy signals an enabling environment.** As with telehealth, there is no dedicated regulatory framework pertaining to mHealth in Botswana, and although mHealth is covered in the Ministry of Health's eHealth strategy, this strategy has not yet been approved or widely implemented. While the existence of the eHealth strategy may facilitate market entry and operation, the fact that it is not officially implemented means that there is little guidance on key issues such as quality assurance and consumer data protection. As with telehealth, the mHealth model receives two out of three ticks from a regulatory feasibility standpoint: There is no prohibition of this model in existing regulation, but neither is there a clear framework that sets regulatory parameters for market operation.

Market dynamics: Open market with some opportunities, but challenges remain. At present there is low activity relating to mHealth in the Botswana market. While there have been mHealth pilots, none have reached national scale. Stakeholder consultations suggest that there is a need to offer the service at low-to-no cost to the consumer, at least initially, to boost adoption and usage. This requires external funding. It is not yet clear whether there is a business case for offering this model, given the lack of scale and funding sustainability. Thus, this model receives one tick for market dynamics.

6.5 Recommendations for Botswana's health sector

Telehealth solutions show promise, but active support is needed. Botswana's sparsely populated landscape calls for innovative measures to broaden equitable healthcare delivery. The country's increasing mobile phone penetration and advancements in ICT infrastructure can be leveraged to facilitate telehealth solutions. There have been a number of telemedicine pilots already, showing acknowledgement of the use cases to be served. However, the lack of sustainability thus far indicates a need to go back to the drawing board in designing a telehealth pilot that would scale. It also suggests that ongoing public or donor funding may be required for sustainability.

Below, we outline the recommendations for FinMark Trust stemming from the analysis:

Table 10: Key recommendations in the health sector

Proposed solution	Telehealth/mHealth
Partnership opportunity	• Ministry of Health and its partners, such as the University of Botswana e-Health Research Unit
Intervention areas	• Facilitating dialogue • Education and training of consumers and decision-makers • Technical assistance for eHealth policy implementation

Creating dialogue between public sector players and potential market innovators. Much of the impetus so far seems to come from the Ministry of Health in collaboration with institutions like the University of Botswana and donors. Stakeholder consultations suggest that the Government may need to reconsider the role of the private sector in driving digital health solutions in Botswana. To date, there appears to have been a reticence from the Government in seeking out and including private sector stakeholders early on

and walking the journey with them from inception to piloting and beyond, which may be one of the reasons why scaling initiatives to make them sustainable has been so challenging thus far. Possible areas of intervention may involve undertaking initial engagements with public stakeholders that are driving digital healthcare in Botswana to better understand their strategic direction and key objectives for the sector going forward. Potential areas for onboarding or collaborating with private players may then be identified and their role and the benefits they bring more clearly positioned within the context of the Government's own priorities and milestones. Establishing a clearly defined and inclusive approach may also create greater certainty among private players who may then be more willing to participate in these initiatives.

Education and training to secure buy-in. There seems to be an acknowledgement by key players in the health sector, such as the Ministry of Health, of the importance of supporting digitalisation of the sector as a means of achieving improved health outcomes in the country. Despite this, stakeholder consultations have noted that there remains substantial cultural pushback by both clinicians and consumers who do not yet understand, nor are convinced by, the value in adopting digital health solutions – most of them still prefer to continue with more traditional approaches to healthcare. Some of the reasons for this are low levels of digital literacy, low usability of digital solutions, a lack of end-user training and a lack of clinical and technical expertise, among others, which undermine widespread user acceptance in the market. A potential area for intervention may be in coordinating bespoke education and training campaigns among villages and communities that may not be comfortable in engaging with digital models, or implementing dedicated programmes to upskill health workers around the use of these models.

Technical assistance for eHealth policy update and implementation. While the policy stance has been supportive of innovation, the absence of an implemented policy framework may contribute to uncertainty in the market and discourage private players to enter. The final recommendation is thus to provide technical assistance to the Ministry of Health around the next phase of

the eHealth strategy and to ensure that it proceeds to implementation. It would be important for such a process to include extensive stakeholder consultation.

7 Conclusion

This report assessed the scope for digital delivery to enhance access to education, energy and health in Botswana. While the research suggests that access can still be improved across all three focus sectors, Botswana already performs relatively well in terms of its current levels of accessibility and its adoption of inclusive policies to support the provision of basic services.

The research and stakeholder engagements point to an acknowledgement by public and private sector players alike of the potential for digital deliverable models to play a greater role in improving the basic services ecosystem in the country. There are several key elements in Botswana's favour when it comes to expanding the role of digitally enabled delivery models across the three focus sectors. Firstly, there has been a deliberate effort to foster and drive innovation in the basic services space as is evidenced by various strategic and regulatory measures proposed, including the Smart Botswana strategy, ThutoNet, eHealth Strategy and VISION 2036, and the growing role of local innovation institutions such as the Botswana Innovation Hub. Secondly, Botswana's relatively high rate of urbanisation facilitates the extension of ICT infrastructure and services to households in these areas ahead of rolling out digitally enabled delivery solutions. Finally, Botswana outperforms all of its neighbours, South Africa excluded, from a digital readiness perspective, suggesting it is well placed to take the next step in growing its digital capabilities.

Despite these positive drivers, however, the topography means that it remains challenging to roll out models that require an on-the-ground agent network or some form of in-person engagement into sparsely populated rural areas, and the small population constrains scale. Moreover, stakeholders note funding constraints and, while the policy stance is enabling, implementation frameworks are not always in place. The result is that, among the several existing initiatives identified, few have scaled or proven sustainable beyond the pilot phase.

Thus, there is a role for a market systems facilitator like FinMark Trust to facilitate public–private dialogue, broker partnerships, introduce learnings from

international best-practice models and address potential demand-side barriers to uptake. There is also scope to further develop and leverage the digital payments market to support digital delivery and, on the energy side, to advocate for the innovative use of credit for access to SHSs.

This role will require an ongoing, on-the-ground commitment to walk the journey for the development of viable digital business models to support the expansion of basic service delivery in Botswana.

Appendix

Appendix A: Methodology and assumptions for estimating the potential market for digital delivery in each sector

As part of this research, a feasibility assessment was conducted to identify the digitally enabled delivery models that have the highest potential for impact and reach in Botswana. The potential market that could be reached for the energy, education and health sectors was estimated by drawing on FinScope data, national CPI data and market research on product prices across SADC and by making several assumptions to ensure the data reflected the current reality in Botswana.

To estimate the potential market that could be reached for each of the sectors, the following data was used:

- **FinScope data was used to estimate household and individual incomes along with mobile access.** As the latest available dataset was several years old, we adjusted the income brackets in the data using official CPI inflation rates. The intention was to arrive at a conservative estimate of the potential market, and therefore a conservative approach was taken in the assumption on likely income growth during recent years.
- **Token costs for each of the sectors are based on a desktop scan of products within the sectors from across SADC.**
    - For the energy sector, SHSs were divided into two tiers. Tier 1 includes basic products that offer lighting and phone charging, while Tier 2 products offer these capabilities along with the ability to power one or more devices, such as a radio or TV. For the market estimate, a price was taken that reflected the typical cost of a Tier 1 product: USD93 per month. Data points on the upfront costs and ongoing monthly payments for the SHS model were drawn from the public websites of SHS providers.
    - For the education and health sectors, many products offered free access, making their potential markets theoretically equivalent to all adults who have access to the required type of phone. Alternatively, some services require a fee to access the

platform, however – additional costs that are carried by the user, and these vary considerably, making it difficult to estimate the size of these markets. Therefore, an USD8-per-month subscription service was chosen, as this illustrates the average monthly amount for some edtech services in the education market, while health sector models are free.

- To estimate the portion of household and individual income that is allocated to various expenditure categories, including electricity (5.3%), education (2.2%) and health (1.4%), we drew on the Statistics Bureau's monthly CPI calculations and the weights for each of these consumption categories.

The analysis proceeded in the following steps:

- Estimate household and individual income levels and create a grid with numbers and percentages of adults within specified income brackets (the brackets are predefined by FinScope).
- Adjust incomes using CPI and convert to dollars in real terms.
- Adjust the income grid further by reducing cells to reflect access to feature phones or smartphones
  (as a digital connection is required to make use of these services).
- Use the resultant grid to create three new grids for each of the sectors, by multiplying the figures in each cell with the percentage that households and individuals have available to spend on products from each sector.
- Calculate the total number of adults who could afford a product at various price points, using the sector-specific grids.
- Create ranges for the number of adults who would have access to products at different price points and income allocation per sector to test the sensitivity of the results to the assumptions.

The final single figures for each sector are:

- **Energy:** Approximately 2,794 adults could afford a Tier 1 SHS based on their likely income, access to a phone, product cost and available income for electricity consumption.
- **Education:** Approximately 280,544 adults could afford a USD1 monthly subscription for an edtech product.

- **Health:** Approximately 987,807 could afford a USD1 monthly subscription for a health-tech product.

Appendix B: Classification of digital health solutions, with global examples

Solutions	Definition	Example	Country
Health logistics	Provide digital solutions for logistics arrangements, delivery and delivery of medical supplies and products. It also includes emergency services, including on-demand delivery of patients, organs and medical supplies such as blood or equipment.	Zipline builds, designs and operates drone aircraft for the delivery of blood, cryoprecipitate, frozen plasma, and platelets.	Ghana and Rwanda
Medical equipment	Services related to the design, development, and manufacture of medical hardware. Business-to-business (B2B) solutions include medical devices used by hospitals or physicians to facilitate work and serve patients. Enterprise-to-consumer (B2C) solutions include wearable devices, prosthetics and devices for the eyes, ears or mouth that support the Internet of Things (IoT).	Bionic Limbs provides persons with disabilities with a wide variety of open-source solutions to boost their productivity.	Egypt
Remote diagnostics and monitoring	Diagnosis refers to the visual or use of invasive and non-invasive diagnostic tools to identify medical conditions. Monitoring includes solutions that allow healthcare professionals and individuals to control their health after the diagnostic phase	mScan provides portable mobile ultrasound services to pregnant mothers.	Uganda
Biotechnology	Biotechnology refers to the manipulation and production of products from organisms, such as pharmaceuticals and	54gene offers a genetic testing platform to Africans.	Nigeria

Solutions	Definition	Example	Country
	medical supplies, genetics and cellular research, and the development of vaccination. Biotechnology can improve diagnostic services, disease prevention and medical care.		
Health information	Digital solutions that promote the dissemination of knowledge, awareness and education and provide insights into topics such as disease, maternal or reproductive health and medical procedures. The impact of COVID-19 has led to greater traction in the use of health information services to promote access to and promotion of good health practices in the developing world.	KEA Medicals provides medical identity solutions to patients and hospitals.	Benin
Health on demand	Connect patients to a range of digital platforms for online healthcare solutions, enabling them to see relevant service providers across multiple regions and professions in real time. These platforms facilitate effective communication and appointments with selected doctors.	HomeCare24 is a platform that allows users to search for registered nurses and caregivers	Indonesia
Assistive technology	Digital solutions/software or devices to improve the wellbeing and functionality of persons with disabilities (PWDs) and the elderly. The programme aims to promote greater access to and use of mobile technology by PWDs in emerging	Dreet provides low-cost hearing loss detectors and treatment.	Botswana

Solutions	Definition	Example	Country
	markets and to maximise opportunities for social and economic inclusion.		
Health management	Digital platforms and software help healthcare providers manage their day-to-day operations and patient activities more efficiently. A suite of services includes electronic health records, scheduling, billing, and digital communication with patients. At the B2C level, the Health Management Platform helps patients or individuals track their health goals.	Afya Rekod is a medical data storage platform that allows patients to store their health records.	Kenya
Telehealth	Connect digital solutions for healthcare providers and patients, enabling them to communicate directly via text, online chat platform, phone or video chat. Due to the impact of COVID-19, telehealth services have developed a significant attraction in developing countries.	Maya provides a digital wellbeing assistant that connects users with real doctors and therapists	Bangladesh
E-Pharmacy	Provide a digital platform for the purchase and delivery of medicines and supplies. These platforms help healthcare professionals or medical facilities store stocks of medical products and enable individuals and families to order prescription, over-the-counter and other health-related products.	mPharma offers a pharmaceutical inventory management subscription service.	Ghana and Kenya

Solutions	Definition	Example	Country
Health fintech	Digital solutions that make it easier for individuals to get health insurance or have health savings accounts	WellaHealth provides a microhealth insurance solution for malaria.	Nigeria
Lifestyle	Lifestyle solutions are platforms and mobile applications that promote and manage healthy lifestyles, such as employee programmes, fitness and nutrition counselling platforms, self-assessment and monitoring applications, and websites that connect users with stakeholders who provide health facilities.	Instadiet connects users to dietitians, nutritionists or health coaches.	Egypt
E-training	Digital solutions to train healthcare professionals to improve clinical knowledge and performance. These solutions have proved useful in providing distance training to community health workers during the COVID-19 pandemic.	Amref Health provides an e-learning mobile solution that trains community-based health workers.	Kenya

Source: (GSMA, 2020)

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Expanding Access to Education, Energy and Health Services Through Digitally Enabled Delivery in Botswana

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