REPORT

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

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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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- Central Bank of Eswatini
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Executive summary

Access to basic services – education, energy and health – is an important socio-economic development goal, yet many sub-Saharan African (SSA) countries still fare poorly in their delivery of these services. This also holds true for Eswatini: While the country compares favourably to other countries in the region with regard to the reach of its national electricity grid, the use of renewable energy is still limited. The education and healthcare sectors each face fiscal and service delivery constraints, leading to sub-optimal outcomes.

Across the continent, several digitally enabled models (defined as any implementation models that leverage digital technologies to enhance the delivery of a product and/or a service to consumers) are emerging to help fill the gap in basic service delivery.

This study considers the current landscape in each focus sector in Eswatini, existing examples of digital delivery, as well as what the scope is for digital delivery to enhance access to basic services in Eswatini, to conclude on what is needed to unlock that potential role.

Education synopsis

Primary education is free in Eswatini, but the education system is marked by funding shortfalls and high repetition rates. Pre-primary and secondary school is not free, and there are low attendance rates. Enrolment drops substantially from the primary to the secondary level.

Where the scope for digital delivery is concerned, teachers need to be upskilled on digital methods and both teachers and students require access to devices and data for digitally enabled models of delivery to succeed. Currently, there are limited digital initiatives on the ground contributing to access to education, with the Educare model implemented by leading mobile network operator MTN being the prime example. COVID-19 has created an imperative to boost digital delivery.

Digital payments have not made significant inroads in the public education system, as hard-copy receipts are still preferred.

Energy synopsis

Eswatini has made significant progress towards universal access, with an estimated 80% of the population already connected to the national grid. However, the system is challenged by poor quality of supply and a limited capacity to meet additional demand, especially in certain regions. For low-income and rural households, the ability to pay for electricity beyond simple use cases, rather than access *per se*, is the main challenge.

Looking forward, the Government wants to reduce its reliance on power imports to improve the security of its electricity supply, further increase access to electricity as well as improve the quality of the electricity it currently offers. However, key regulatory and policy frameworks for diversifying energy are still in development.

Digital payments already play a role in the electricity market and are particularly relevant in rural areas where outlets for making cash-in payments are limited.

Health synopsis

The fact that there are few, if any, deep-rural areas in Eswatini means that the majority of the population is situated within easy reach of a health facility. However, the healthcare system is skewed towards primary care and service delivery challenges and healthcare outcomes continue to be sub-optimal.

While the Ministry of Health has developed a roadmap for investments in ICT via the Kingdom of Swaziland eHealth Strategy 2016 – 2020, the impact of this strategy is unclear and there is little evidence of significant digital integration or innovation within the health sector – public or private. The research did not identify any digital health services targeted at the low-income population.

As with the energy sector, the health market is not yet being targeted for digital payments.

What can be done?

In *education*, there is scope to explore the potential for digital content to supplement traditional forms of learning, particularly given the achievements of the MTN pilot.

In the *energy* space, the already extensive national grid presents an opportunity to improve access to electricity by focusing on auxiliary services such as payments and introducing smart appliances to better manage household consumption. The need for alternative models (e.g. solar home systems or mini-grids) is less pronounced in Eswatini than in other countries in the region given the extensive reach of the grid. Nevertheless, there is a potential market systems facilitation role for FinMark Trust in leveraging mini-grid pilots for test-and-learn purposes and in facilitating dialogue, as well as in brokering introductions for establishing partnerships that would see solar home system or mini-grid providers from elsewhere in the region entering the Eswatini market.

In *health*, the limited current activity related to digital innovation means that there would be need for a market-making role: advocating for the role of digital in extending reach or building efficiencies in service delivery and getting this topic onto the policy agenda. There may also be scope for showcasing the one model already on the market and seeking ways to support that to scale beyond the current use cases.

Across all three sectors, *digital payments* are likely to play an increasingly important role in enhancing access to basic services going forward. It will, however, be important to foster ongoing public–private dialogue for enabling environment and partnership building across the digital payment, financial inclusion and basic services spheres to ensure that the right balance of cost, sustainability and access is achieved.

1 Introduction

Access to basic services is an important socio-economic development goal to help any country along its journey to poverty alleviation and growth. While many SSA countries still fare poorly in their delivery of these services, digitally enabled models are emerging to help fill this gap. This study looks to unpack what the scope is for digital delivery to enhance access to basic services in the education, energy and health sectors in Eswatini and what is needed to unlock these digital tools.

Context

Small, landlocked country with strong economic ties to South Africa. The Kingdom of Eswatini, formerly Swaziland, is situated between South Africa and Mozambique. Comprising only 17,000 km² with a population of just over one million people, it is the smallest landlocked country in the Southern Hemisphere (Eswatini Tourism, n.d.). Seventy-one percent (71%) of the population live in rural areas, and the country is divided into four regions: Hhohho, Lubombo, Shiselweni and Manzini. Many Swazis leave the country in pursuit of work, and 24% of people in Eswatini rely on remittances as their main source of income (FMT, 2019)[1]. Eswatini is economically connected to South Africa as it relies on the country for around 65% of its exports and around 70% of its imports (World Bank, 2021).

High levels of poverty. Despite Eswatini being categorised as a lower-middle-income country, it is marked by high rates of poverty, with 63% of the population falling under the national definition of poverty; FinScope 2018 found that 41% of Swazis earned USD1.9 or less per day. The unemployment rate is estimated to be around 23%, and the country ranked 138th out of 189 countries on the UN Human Development Index (Naidoo & Loots, 2020).

[1] According to the World Bank's 2017 bilateral migration matrix, around 94 thousand Swazis have migrated from the country with South Africa being the most common destination (2017).

Good access to basic services, but quality concerns. On the surface, access to basic services in Eswatini is good; around 80% of the population are connected to the national grid, 85% live within an eight-kilometre radius from a health facility, and primary education is free, with 95% net enrolment and 100% completion rates. However, as this study will show, the quality of the access to basic services is problematic, as the electricity supply is not secure with frequent power outages, the majority of health facilities can only provide basic health care, and primary education is marked by high repetition rates while secondary education has low enrolment and even lower completion rates.

Relatively good connectivity, but cost of data and access to smart phones may impede digital model adoption. Connectivity and access to devices is important for digitally enabled delivery models to be viable in a country. Eswatini has a high rate of 3G coverage, with 91% of the population having access to 3G, as well as a 97% penetration rate for mobile connections (GSMA, 2019). In 2018, around 40% of the Swazi population had a mobile money account according to FinScope. In comparison, only around 30% of the population had a bank account. Eighty-eight percent (88%) of the population owns a mobile phone, while the penetration of smart phones is around 54% (FMT, 2019). Despite this, Eswatini still only has an overall score of 39.2 on the GSMA Mobile Connectivity Index and is considered "emerging". In comparison, South Africa is a "transitioner" and has a score of 60.1. The drivers for Eswatini's comparatively low index score are content and service (20.9) and affordability (39.8) (GSMA, 2019). Infrastructure is rated higher, with a score of 48.1, and consumer readiness is scored 59.1 (GSMA, 2019) The cost of data is rated as the most expensive on the continent, at USD21.39 for 1GB (Gilbert, 2019).

Structure

The rest of this report assesses the feasibility of digital models in extending access to energy, health and education in Eswatini. 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.

2 Methodology

This research was commissioned by FinMark Trust and completed by Cenfri following a mixed-research methodology, consisting of:

- A literature review and desktop scan of digitally enabled delivery models found internationally for expanding service delivery in the sectors of education, energy and health, as well as any examples found in Eswatini
- A desktop review of the macroeconomic, policy and sectoral landscape of Eswatini to provide a diagnosis of the country's context as it relates to basic services access and delivery
- Key informant interviews with expert actors in the ecosystem, including those from the public sector, the private sector, civil society organisations, development actors and donors
- For each sector, a qualitative and quantitative feasibility assessment exercise of different types of digitally enabled delivery models in the Eswatini context
- Testing the feasibility assessment results with ecosystem actors during an interactive virtual workshop

Key terms or definitions referred to throughout this report to note are:

- Digital transformation is defined as the transformation of economic activities through digitisation and/or digitalisation. The former entails converting analogue processes into digital processes; the latter entails inserting digital processes into the workings of businesses or everyday life (The Enterprisers Project, 2021).
- Digitally enabled models refer to a broad set of implementation models underpinned by technological innovations; essentially, these models leverage digital technologies (e.g. digital tools, digital channels) in order to enhance the delivery of a product and/or a service to consumers (FourWeekMBA, 2020).
- Digital tools are programmes and websites 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).

- A digital channel refers to a digital platform through which communications and/or payments can occur, e.g. mobile money channels.

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

As noted in Section 1.1, Eswatini is above certain indicators for access to basic services, but it still has significant ground to cover to ensure extensive access to quality basic services. Digitally enabled delivery models have the potential to help fill the gap. Globally, a wide range of digital enabled models are already being used to enhance access to basic services. However, the local context means that not all models will be appropriate or viable for adoption in Eswatini. See Sections 4 to 6 for an outline and assessment of the feasibility of digital delivery models in each of the study's sectors.

This section describes the analytical framework that was applied for assessing the feasibility of models in each of the sectoral contexts[2]. The framework consists of four key feasibility criteria: affordability, access, regulatory feasibility, and market dynamics.

- **Affordability.** Elements such as the cost of accessing and using the digitally enabled delivery model, the level of disposable income of the consumer or household and their expenditure habits all play a role in determining how affordable these models are for a particular target segment or group of users.
- **Access.** A number of 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 fully exploit the opportunities of digitalisation through digitally enabled delivery models. It is therefore important to understand the extent to which ICT infrastructure and mobile devices are readily available for communication and transactional purposes in Eswatini – this consideration should include whether public institutions such as schools and medical facilities have, for example, internet access.

[2] This analytical framework is also applied to other country studies in this series.

    - **Analogue support infrastructure.** Digitally enabled delivery models rely on a combination of digital and physical layers in order 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 to what extent basic physical infrastructure such as road networks, national power grids and basic service institutions such as schools and clinics are present and accessible.

- **Regulatory feasibility.** This refers to government structures, regulations, policies and incentives that can either support or impede the delivery of basic services through either existing channels or 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 factors, but for the purposes 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.

In Sections 4 to 6, the starting point for the feasibility assessment for each sector is understanding the context within which digitally enabled solutions can be applied and the core challenges faced in expanding access to these services. Next, we introduce those best-practice models that could best help overcome the specific delivery and access challenges faced in the sector, based on a non-exhaustive scan of models in Africa and globally and consider the prevalence thereof in Eswatini. The feasibility of each of these key models is then assessed by applying the analytical framework as set out in this section in the Eswatini context, to derive recommendations per sector for Eswatini.

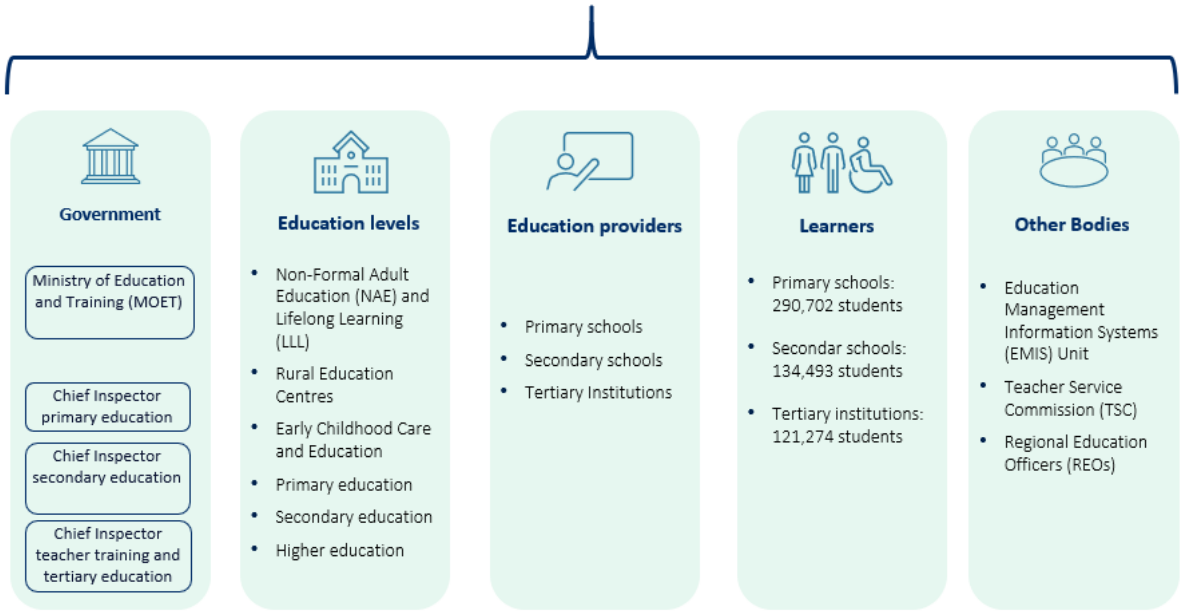
4 Education

This section sets out the assessment of the scope for digital delivery to enhance access to education in Eswatini. The synopsis is that, while primary education is free in Eswatini, it is marked by funding shortfalls and high repetition rates. Pre-primary and secondary school is not free and have low attendance rates. Additional spending on education is limited by high levels of poverty on the user side. Where the scope for digital delivery is concerned, teachers need to be upskilled on digital methods and both teachers and students require access to devices and data for digitally enabled models of delivery to succeed. Currently, there are limited digital initiatives on the ground contributing to access to education.

4.1 Institutional landscape

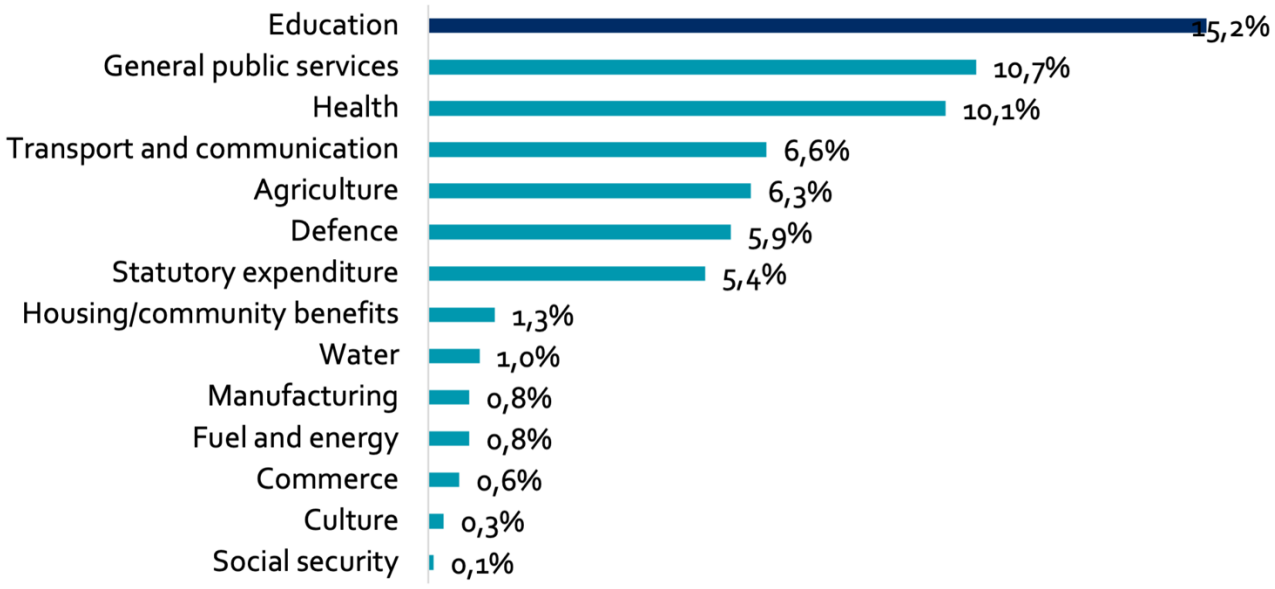
Education sector supervised by the Ministry of Education and Training. The education sector is overseen by the Ministry of Education and Training via Chief Inspectors for primary education, secondary education as well as teacher training and tertiary education, as laid out in Figure 1. Other bodies that assist the Ministry in overseeing the sector includes the Eswatini Higher Education Council, which regulates higher education. The education system comprises Early Childhood Care and Education (preschool), primary, secondary and higher education, as well as Rural Education Centres, Non-Formal Education and Lifelong Learning. Education for school-aged children is provided by primary schools (with 290,702 students) and secondary schools (with 134,493 students), both private and public. Furthermore, the education system comprises preschools and tertiary institutions (the latter with 121,274 students).

Figure 1 : Eswatini education sector overview: Supply-side actors and interlinkages

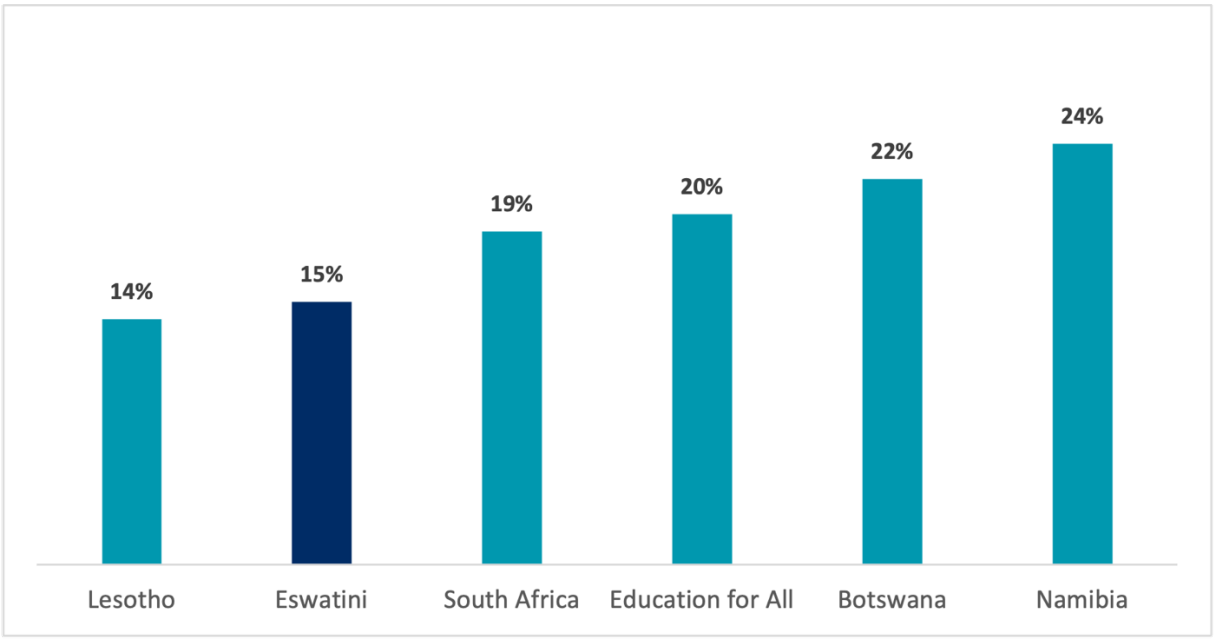


Relatively high public spending on education, but shortfall remains. Education receives the highest percentage of the total budget for all the sectors in Eswatini, as seen in Figure 2 below. Government expenditure on education in Eswatini was 15% of the budget in 2017, which was below the spending of its neighbouring countries South Africa, Namibia and Botswana (Figure 3). The expenditure was also below Eswatini's commitment to dedicate 20% of its total budget to education as part of the Education for All Declaration. Within the education budget, 57.8% is spent on primary education and 39.1% on secondary education (UNICEF, 2019).

Figure 2: Education sector overview: Public spending on each sector as percentage of total budget



Source: UNICEF (2019)



Source: UNICEF (2019)

Reliance on donor funding for free primary education. Between 2014 and 2018, donor financing to the Eswatini education sector amounted to USD21.7 million, most of which flowed into the education budget. In Eswatini, "the majority of the education budget is financed by domestic revenue, although donors contribute to about half of the capital budget" (UNICEF, 2019).The European Union is the main donor to the Free Education Programme (UNICEF, 2019). A reliance on donor funding could lead to sustainability concerns, should donor funding be cut.

4.2 Access and usage

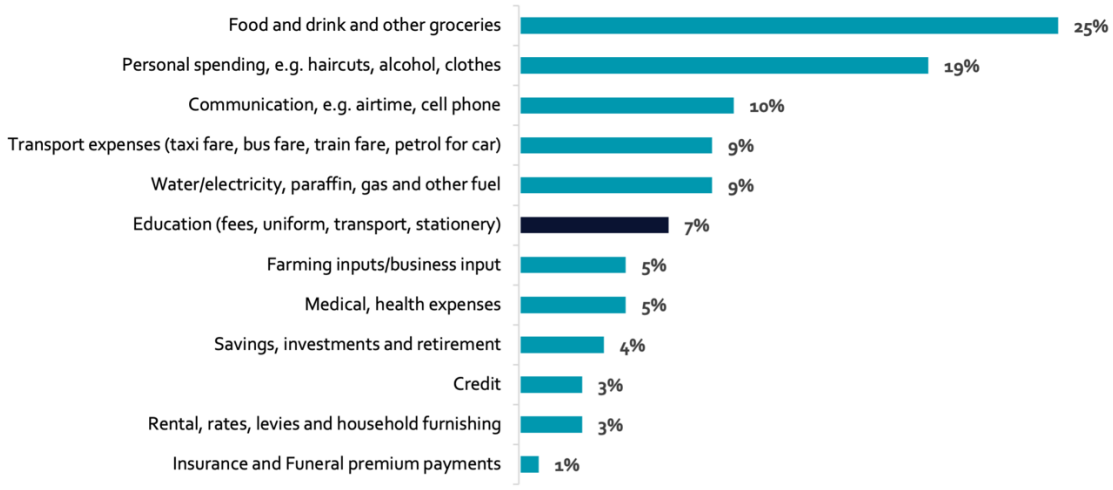
Free primary education enhances access, but high repetition rates. Primary education became free for students from Grade 1 to Grade 3 with the enaction of the Free Primary Education Act of 2010. In 2015, this free education was extended to Grade 7. Under the Act, grants are also paid to secondary schools to extend free education to orphaned and vulnerable learners. Under the Free Education Programme, primary education had 95% net enrolment and 100% completion rates in 2015. However, primary education is also marked by high repetition rates that stakeholder consultations link to language of instruction, the qualification level of teachers and limited early childhood development (ECD), among others. According to Hamid et al "the average student takes 13 years to complete the seven-year primary education cycle" (2015).

Low enrolment rates for preschool, low enrolment and completion rates for secondary schools. In 2011, preschools had a net enrolment rate of only 18%. All preschools in Eswatini are private, meaning that most households cannot afford the tuition fees. Stakeholder consultations further reveal that after free primary schooling, parents experience a price shock when students begin secondary school. Secondary schools in 2015 only had a 49% net enrolment rate and a 27% completion rate (Naidoo & Loots, 2020).

Affordability and access barriers. Apart from the affordability concerns for pre-school and secondary school, as outlined above, certain primary schools also require "top-up fees", which many households cannot afford. In Eswatini, the average adult spends USD12.11 a month on education, out of a monthly total

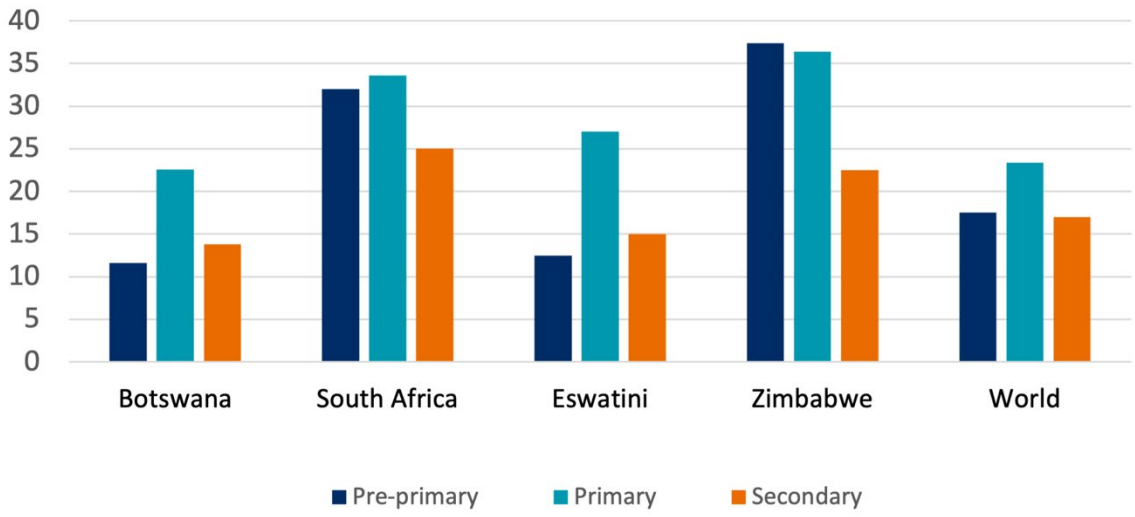
expenditure of USD173. This includes fees, uniforms, transport and stationery (FMT, 2019). In addition, there is a shortage of schools, especially secondary schools, and students in rural areas often have to travel long distances to school, which "increases the costs of accessing school education" (Hamid, et al., 2015).

Figure 4: Expenditure on education as a percentage of total household expenses



Quality concerns. Despite the amount that the Eswatini Government spends on education, the quality of education remains a concern. Reportedly, Eswatini "has been challenged with the issues of unqualified and general shortage of skilled teachers" (Hamid, et al., 2015). Many secondary schools have inadequate infrastructure, in particular ICT laboratories. In addition, teachers also often lack knowledge of digital tools and are unable to use ICT in teaching. Further, while the pupil–teacher ratio in Eswatini compares favourably with those of neighbouring countries, the Ministry of Education and Training stated during a key informant interview that this is an average that does not reflect divisions on the ground, such as between rural and urban areas.

Figure 5: Pupil–teacher ratio compared to regional peers and global average



From a desktop scan of global digital delivery models in the education sector, **e-learning and tutoring** and **digital content libraries** have been identified as two potential solutions to some of the key challenges faced by the education sector in Eswatini, such as the low teaching and learning outcomes, low levels of basic computer skills for learners and COVID-19 restrictions. These models have the scope to provide primary and high-school learners with reliable and affordable access to the essential educational resources needed to ensure key learning outcomes in Eswatini – outcomes that would be important for the attainment of SDG 4[3].

E-learning and tutoring

Interactive learning model. The e-learning and tutoring model enables learners to make use of a mobile device to engage interactively with digital education content such as courses, modules and training for remote learning purposes.

[3] Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Through a mobile device, a simple platform connects learners to educational resources meant to supplement the national curriculum. Key features common across this type of model may include an "Ask a Teacher" function, where students can ask questions to a pool of teachers or tutors also connected to the platform and receive responses. There may be a financial incentive for tutors who would be able to reach a greater number of learners while teachers would be able to engage in a more focused way with learners who use this service. Learners will also be able to access lessons and quizzes as part of their revision and homework. At present, this type of model is operational in countries such as Kenya and Zambia.[4] In Kenya, for example, M-Shule (see Box 1) had reportedly reached around 20,000 students in 2020. Meanwhile, a similar player, Eneza Education, reached 1.6 million subscribers across Côte d'Ivoire, Ghana, Kenya and Rwanda, with 1.5 million of them being in Kenya.

Box 1: M-Shule

M-Shule is the first personalised, mobile learning platform in Africa to empower learners through adaptive learning and SMS. M-Shule's platform uses machine learning to provide personalised training, life skills information, and data tracking over SMS and chatbots. Learners can access instructional, academic or vocational content on the most basic phones, with no need for smartphones or the internet. The adaptive platform uses SMS interactions to deliver self-development tools, personalised lessons and micro-courses that adjust topics and pathways to users' individual needs, backgrounds and performance. At present, M-Shule is operational in Kenya. It reached around 20,000 students in Kenya in 2020.

For educational training, learners receive more difficult content when they do well, or easier content if they need to build foundational knowledge. Their learning profile dynamically updates based on their tracked learning progress and selects the best next sets of content and information to maximise their potential. As learners interact, the platform analyses their performance and progress, after which the analytics, insights and reports are shared with the learner's school, teacher and parents through SMS and web-based channels, allowing the student's performance to improve through SMS learning. In this way, this model can help to

4 Briterbridges (2020)

inform targeted learning approaches, based on the relative strengths and weaknesses of a specific learner.

Source: M-Shule (2020)

Data-driven, blended learning approach. Based on an international desktop scan, e-learning and e-tutoring models often incorporate a blended learning approach that combines classroom time with online learning to build theory and practical skills, while providing access to guidance and support. This is done by collecting and analysing data relating to learner progress on the platform and sharing this with teachers to enable a more learner-centric approach to education. The analytics component is completed by the digitally enabled delivery model provider or an affiliate organisation.

Some traction in Eswatini. This model is currently being piloted by MTN in Eswatini as part of a hybrid model also incorporating digital content – see Box 2 for an overview.

Accreditation may be required. Stakeholder consultations with similar model providers in other African markets noted there are normally several steps to be completed before operations can begin:

1. Engage with regulatory authorities for education and telcos
2. Seek approval from the relevant education board for content used
3. Seek approval from the relevant education board for accreditation of teachers

To ensure the appropriateness of content used, service providers may collaborate with private publishers, schools and various ministerial bodies such as the Ministry of Education and Higher Education Council (HEC). Depending on the technical expertise of the provider, it may be appropriate to partner with telcos and leverage existing rails to effectively reach learners.

Three main cost drivers. Desktop research suggests that the main cost drivers for this model are implementation, content adaptation and skills.

- **Implementation.** The actual cost of sending an SMS is a big driver. While certain providers enable learners to send free messages, providers pay a negotiated rate with MNOs to do so.
- **Content adaptation.** While the technical process and learner support can be automated, each time content is adapted human labour is required, which drives up costs.
- **Shifting to other channels.** As these models grow, they may seek to incorporate additional channels beyond SMS such as browser and mobile app functionality. Making this switch is likely to involve further investment in software, processes and skills.

Limiting the reliance on internet connectivity boosts access. While many educational technologies rely on an internet connection, an increasing number of e-learning and e-tutoring models in Africa are shifting their focus to enabling learning via SMS or USSD, given the lack of mobile connectivity and the cost of data. In Eswatini, 54% of mobile devices owned are smartphones, and 47% of the population is connected to the internet (Kemp, 2020). This suggests that, although Eswatini has a more connected population when compared to neighbouring markets such as Lesotho[5], a substantial portion of the population would still be unable to access an e-learning and/or an e-tutoring model in cases where a smartphone or a reliable internet connection was needed. As noted, data costs are also high in Eswatini and may be prohibitive for the low-income market. Nevertheless, there are initiatives currently emerging in Eswatini such as Eswatini Smart School[6] and MTN's Educare programme (see Box 2) that have introduced data-driven e-learning solutions to enhance learner access to education. In the case of the Educare initiative, MTN has implemented a zero-

5 In Lesotho, 24% of mobile devices owned are smartphones, and 32.5% of the population is connected to the internet (Lesotho Communications Authority, 2017),

6 Eswatini Smart School is a local digital platform seeking to enhance the use of technology in education and the teaching process. The programmes major features include 1) E-learning 2) Course creation tools for teachers and 3) Technical support.

rating arrangement to overcome the high costs of data. This enables users to upload or download content without incurring any data costs.

Digital content library

Access to digital educational content. According to key informant interviews, the cost of learning resources (e.g. textbooks and exercise books) adds to the relatively high cost of secondary schools, which causes many learners to drop out of school at this point. The digital content library model makes educational content such as textbooks and study aids available to learners in a digital medium through a mobile device. The digitisation of educational content can potentially provide learners with access to a wider range of materials and removes the cost of physical distribution. Platforms such as Snapplify[7] and Siyavula[8], which operate in South Africa, are good examples of this type of model, as is Classmate in Botswana[9].

Multisided platform rather than content developer. Under this model, a provider acts in a similar way to a multi-sided platform through which suppliers and consumers are connected for the purchase of educational content – in this way, the model can act as an ecosystem facilitator. A benefit of this model is that through partnerships with different publishers, digital textbooks can be made available at varying quality and price levels to suit the needs and income limitations of different schools and learners.

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7 Snapplify is a South African edtech company that establishes a marketplace for digital education content, related educational services, and devices. Snapplify provides institutions with everything they need to create a secure, collaborative e-learning environment for students, Since starting their operations in 2011, Snapplify has been able to reach a range of institutions (7,196) and learners (369,988) in the education sector. For more, see https://www.snapplify.com/

8 https://www.siyavula.com/

9 Classmate, a Botswana USSD-based edtech initiative, is another example of a digital content library that creates and markets content from tutors and educators and provides feedback on assessments and quizzes taken on the platform. Classmate currently has 13,000 active users on its platform.

One homegrown example. As with e-learning, the digital content library model is still nascent in Eswatini. The only example identified through the research is MTN Eswatini's Educare model, which blends e-learning with digital content.

Box 2: MTN Educare

The Educare programme is an initiative of the MTN Foundation in Eswatini that was introduced because of the COVID-19 pandemic. The primary objective of the Educare programme is to bring improved student learning and better teaching methods to all students through ICT tools.

The platform is currently an educational content platform that has been configured to allow users to upload and download content, enrol online and make digital payments. The current version also includes continuous assessment modules to enable learner assessments on an ongoing basis.

Due the platform requiring an internet connection and mobile data to access content, MTN made the decision to zero-rate the platform so learners can download content for free and only pay a monthly fee of between USD0.7 to USD1.70 to access the Educare platform.

At the time of writing, the MTN Educare initiative had 3,600 users and has enrolled five schools, with a further 30 schools registering interest in partnering with the initiative.

As part of this initiative, the MTN Foundation is also aware of the need to provide learners with mobile devices to access this content. They have indicated a willingness to work closely with the Government to introduce an inclusive device financing scheme whereby learners and parents can get access to a mobile device through incremental payments of between USD4.7 and USD10 per month over 24 months.

Source: MTN Educare Eswatini (2020)

4.4 Feasibility assessment

Table 1 summarises the feasibility assessment for the two digital education models found in Eswatini and includes the public education system as baseline.

Baseline: public education. At present, public education is free at the primary school level, but according to stakeholder consultations becomes costly at the secondary school level. It has therefore been assigned one out of 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 given two out of three ticks for accessibility. Public education receives a full three ticks for both regulatory feasibility and market dynamics due to Eswatini having dedicated regulation for basic education and the public education system being the main provider of educational services in the country, respectively. It should be noted, however, that the comparison to the public education system is not a like-with-like comparison, as digital education models do not seek to replace classroom-based learning, but rather to supplement it.

Table 1:Feasibility assessment of education models

	E-Learning and tutoring	Digital content library	Public education
	• Enables remote learning • Limited but increasing due to COVID-19 with regulatory buy-in • Numerous interested service providers • Requires data connectivity • May require smartphone	• Enables remote access to educational content • Improves affordability of textbooks • Requires data connectivity • May require smartphone	• Free primary education • Funding and infrastructure gap • Distance to schools challenging for learners • Cost of secondary and pre-primary school difficult for many households to meet
Affordability	✓✓	✓✓	✓
Access	✓	✓	✓✓
Regulatory feasibility	✓✓✓	✓✓✓	✓✓✓
Market dynamics	✓✓	✓✓	✓✓✓
			✓ Low ✓✓ Medium ✓✓✓ High

The feasibility assessment for each model is outlined further in the following sections.

E-learning and tutoring

Affordability: Supplementing education with affordable short-term online learning. E-learning and tutoring appears to be an affordable model to supplement education or to support short-term online learning during the COVID-19 pandemic, given the need for social distancing measures and restrictions. As discussed, MTN Eswatini's Educare platform, for instance, costs learners between USD0.7 and USD1.7 per month[10]. Although primary education is free in Eswatini, the average adult spends USD12.11 a month on education, out of an expenditure of USD173. This includes fees, uniform, transport and stationery (FMT, 2019). An e-learning subscription would add only marginally to this expense. Hence, these models receive two out of three ticks for affordability. A cross-cutting challenge, however, is the price of data and devices needed to use these platforms. The feasibility assessment indicates around 470,709 users could afford a USD1 monthly subscription for an edtech product (see Appendix).

Access: Potential to increase access to education, but still in development. In Eswatini, primary and secondary school learners continue to be confronted with challenges that hinder their access to basic education, including long travel distances to schools and a general shortage of schools, among others. E-learning and tutoring platforms can assist with addressing some of these barriers and therefore increase access to education. However, stakeholder consultations indicate that these models are not yet widespread in the market[11]. Stakeholders continue to cite a lack of digital devices among learners and the high cost of data as key barriers to accessing digital education solutions more broadly. This model therefore receives one out of three ticks on Table 6,

[10] For international comparison: M-Shule is provided at a cost of USD4 per month, Eneza education at only 84 USD cents per month. The cost associated with digital content libraries would depend on the cost of the underlying content provided, as the platform merely facilitates access to a range of content provided by third-party providers.

[11] Although the impact of the COVID-19 pandemic provides an impetus for a general shift towards digital innovations for service delivery.

as accessibility still remains relatively low. As noted in Box 2, MTN is working to overcome this challenge to help the Educare model to scale.

Regulatory feasibility: Supportive for e-learning and tutoring in Eswatini. Regulatory authorities such as the Ministry of Education and the Higher Education Council have been supportive of e-learning and tutoring since before the COVID-19 pandemic. Currently, the Ministry of Education is considering proposals from various service providers to offer similar digitally enabled education models. The Ministry is of the opinion that if any tool adopted during the pandemic brought value and increased access to education, it will be maintained after the pandemic has ended. Thus, the Ministry sees the potential value of digital initiatives to address barriers to education. Furthermore, stakeholder consultations suggest that, although regulatory bodies such as the Higher Education Council (HEC) do engage with new providers quite closely around their initiatives, the intended target segment and the cost, no specific regulatory approvals are required as long as no new content is generated that would need to be curriculum compliant. This suggests an enabling regulatory environment for these types of models, resulting in three out of three ticks being allocated in the feasibility assessment.

Market dynamics: Limited current market activity, but increasing interest. At present, MTN, through its Educare initiative, and the Eswatini Smart School programme appear to be the only significant initiatives in the digital education delivery market. As mentioned, stakeholder consultations suggest interest is also being generated by prospective providers that are looking to enter this space. Given the size of the Eswatini market and the barriers to scale experienced by the existing initiatives, the potential for digital models to reach scale remains uncertain, and hence two out of three ticks have been allocated to this model.

Educational content

Affordability: Digital content models a way to reduce cost of key educational resources. Digital content models may make it more affordable for learners to access educational content by enabling schools or private providers to digitise

learning content aligned with the national curriculum, removing the cost associated with printing and physical distribution. Currently, the major provider for e-learning and tutoring, MTN, also supports educational content on its platform Educare. As discussed in the e-learning overview, the monthly subscription is likely to be relatively affordable. More broadly, however, the cost of digital content can vary depending on the actual product and may still be unaffordable for many learners. Furthermore, educational content models are also confronted by similar issues as e-learning and tutoring models, particularly when it comes to the high cost of data. To reduce the financial burden on learners, certain providers have begun zero-rated digital content platforms both for teachers uploading content and for students accessing and downloading content. In this way, digital content becomes more affordable and accessible to these users and has therefore been allocated two out of three ticks as part of the feasibility assessment.

Access: Hardware and data requirements challenge accessibility. It is key to note that this model may in certain cases be reliant on the user having access to more advanced devices than is the case with the e-learning and tutoring model. Users are likely to require, at minimum, a basic smartphone device to be able to engage properly with digital content through this model. This is likely to present a challenge to learners in Eswatini as access to mobile devices is already low and data costs are relatively high – hence the digital content model is allocated one out of three ticks in the feasibility assessment. The high network coverage by major MNOs such as MTN is, however, a positive and may create a more conducive environment for this model where other key enabling conditions are in place. In more rural regions where connectivity is a challenge, collaboration between the providers of digital content models and local schools may lead to innovative solutions, such as the aggregation of content and caching on-site, to enable learner access to digital content under this model. Snapplify's "Snapbox" solution, for instance, may be a good case study as it has the potential to be moved to more urban areas for a time to enable content to be downloaded and then taken back to the rural schools, for example, where content can be shared with other devices without requiring internet access. This

is an example of the innovative ways in which users are overcoming connection challenges to improve access to educational content.

Regulatory feasibility: Supportive framework. Regulatory authorities are supportive of the digital content model and see the value it brings in supplementing traditional education. According to the Ministry of Education, the Government vets textbooks used as part of the national curriculum in the primary and secondary education sectors, meaning it will be relatively straightforward to digitise this material online. Interested educational content providers will need to obtain approval from the relevant authorities before launching such platforms in Eswatini. For these reasons, this model is allocated three out of three ticks for this criterion.

Market dynamics: Limited activity, but there are interested players. At present, the supply of digital content in Eswatini is limited. As with the e-learning and tutoring model, MTN is the major player in this market. Providers do, however, appear to see a business case for educational content platforms in Eswatini despite the small size of the country limiting the potential for scale. According to the consultations, a number of prospective players are engaging with the Ministry of Education and Higher Education Council. As such, market dynamics for this model are allocated two out of three ticks as part of the feasibility assessment.

4.5 Recommendations for Eswatini's education sector

Given this feasibility assessment, what can be done to support the development of digital models to enhance education delivery in Eswatini?

Table 2: Key recommendations for the education sector

Proposed solution	E-learning and tutoring/Digital content library
Partnership opportunity	• Private sector • Mobile network operators, notably MTN Eswatini

	• Public-sector coordination institutions • Ministry of Education, Eswatini
Intervention areas	• Advocacy and stakeholder coordination • Support development of inclusive financing schemes for widespread mobile device access • Digital skills training for educators and/or learners

Stakeholder coordination to advocate for digital access. Partnership formation will be a key element in supporting the growth of the edtech ecosystem in Eswatini. 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 that need to be contacted include:

- The technical solution providers and innovation hubs such as the Royal Science and Technology Park
- The Ministry of Education in Eswatini as it will have 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.
- MTN, as the nation's leading MNO, will be an important stakeholder in considering how data arrangements, such as the zero-rating of data for e-learning and digital-content platforms, may be implemented to realise widespread access and usage of these models.

Mobile device access schemes to overcome barriers to ownership. Stakeholder consultations highlight that many learners in public schools in Eswatini still do not have access to mobile devices. This represents a significant barrier to access and ongoing use of both the digital content and e-learning and tutoring models. Market stakeholders such as MTN Eswatini are attempting to address this issue by introducing a device financiering scheme for lower-income learners and parents. This highlights an opportunity for securing buy-in from government or

private sector players to develop schemes similar to the one MTN is implementing to enhance access to devices.

Digital skills transfer for teachers. Digital competencies are becoming increasingly important in supporting both teaching and learning over digital platforms or channels. Studies have highlighted the relatively low level of digital skills among teachers as a potential barrier to the uptake and effective use of digital learning tools (DAI, 2020). In cases where schools are provided with educational tablets, computers or other digital devices, educators need to be able to support children's learning through these digital devices. There may therefore be an opportunity for development agencies to intervene more directly in support of digital skills programmes or initiatives to develop these competencies for the use of digitally enabled delivery models.

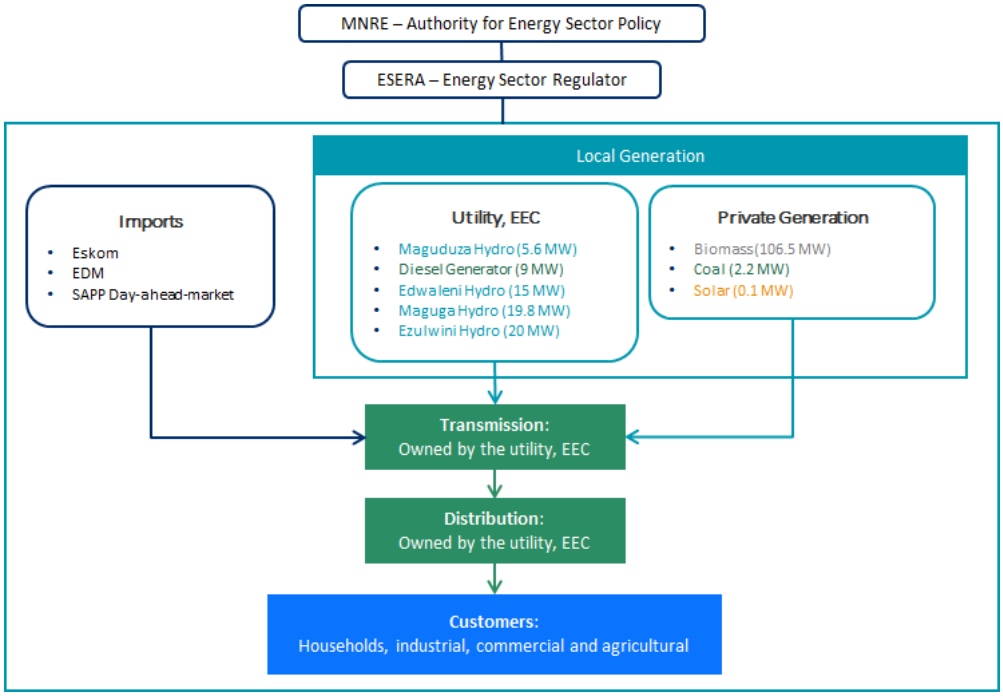
5 Energy

Eswatini looking to develop energy sector but challenges remain. Eswatini has made significant progress towards its stated goal of universal access by 2022, reaching an estimated 80% of the population by 2020 (Naidoo & Loots, 2020). Strides have also been made in reaching transmission efficiency – Eswatini has the lowest transmissions and distribution losses in SSA (World Bank, 2019). However, the system is challenged by poor quality of supply and a limited capacity to meet additional demand, especially in certain regions. Looking forward, the Government wants to reduce its reliance on power imports to improve the security of its electricity supply, further increase access to electricity, and improve the quality of the electricity it currently offers. However, key regulatory and policy frameworks for diversifying energy are still in development and may take time before they are fully adopted. Further, low-income and rural households face high costs both in connecting to the national grid and in paying for and using electricity.

5.1 Institutional and supply landscape

Figure 6 outlines the actors and interlinkages in the Eswatini electricity market:

Figure 6: Energy market overview: Supply-side actors and interlinkages



Source: ESP (2018)

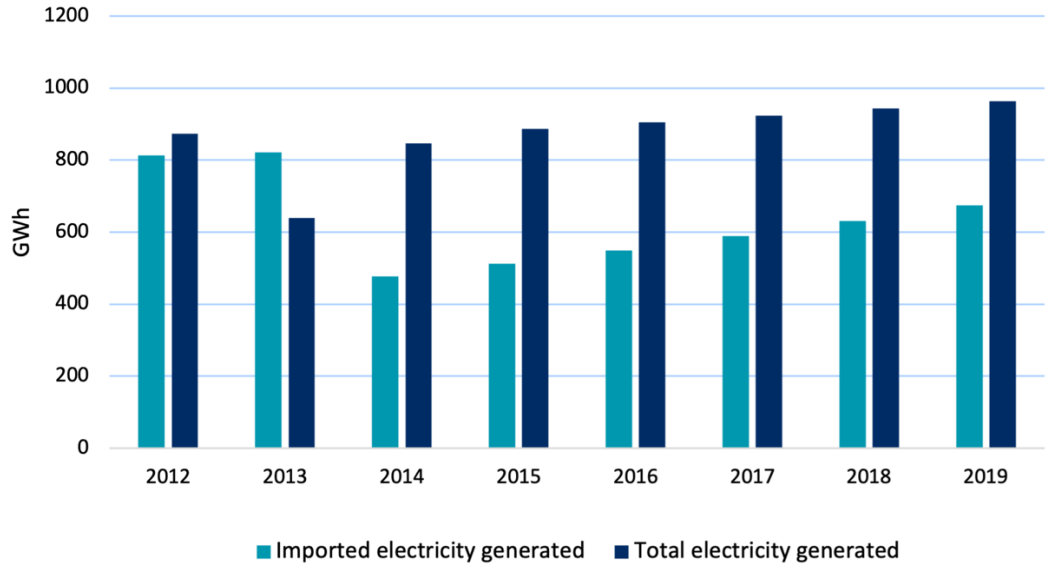
Energy sector overseen by the Ministry of Natural Resources and Energy and the Eswatini Energy Regulatory Authority. The energy sector is supervised by the Eswatini Energy Regulatory Authority (ESERA), which falls under the Ministry of Natural Resources and Energy (MNRE). ESERA has control over the "generation, transmission, distribution, supply, use, import and export of electricity in Eswatini" (ESERA, 2018). The regulator sets the price of electricity in line with the tariff methodology set out in the 2007 Electricity Act. The national power utility is the Eswatini Electricity Company (EEC). The EEC has its origins in the Swaziland Electricity Board dating back to 1963, which subsequently became the Swaziland Electricity Company in 2007 when ESERA was established (EEC, 2021).

The National Energy Policy and the Energy Masterplan 2034 frame the sector. The MNRE published an updated National Energy Policy in 2018. Among its objectives are having modern energy services and security of energy supply in Eswatini (Naidoo & Loots, 2020). The same year, the MNRE also published the Kingdom of Eswatini Energy Masterplan 2034, which endorsed the United Nations' Sustainable Energy for All initiative and embraced the imperative for access to clean, sustainable energy (MNRE, 2018). The Masterplan

acknowledges the focus to date on extending the national grid to increase access to electricity, particularly in rural areas. As a result, 76.5% of the country has access to electricity (AEP, 2021). However, the Masterplan sets out that it may not be cost-effective to connect the remaining rural areas to the national grid, as they are too remote, and that off-grid solutions, such as mini-grids and solar home systems (SHSs), would be better suited here (Naidoo & Loots, 2020).

Reliance on imported electricity leading to lack of security of supply. Eswatini is a net importer of electricity, both directly from South Africa and the Southern African Power Pool (SAPP). During the 2018/2019 financial year, 326.7 GWh of electricity was locally produced by four hydropower stations (60 MW). An additional 941.7 GWh of electricity was imported (EEC, 2019), mainly from South Africa, where power generation is dominated by coal, to supply the system requirement of 1,259.9 GWh for the year. This represented emissions of ~1,063 $MtCO_2$. According to the SAPP, Eswatini's electricity demand is expected to grow to 1,863 GWh by 2025 and peak demand will grow by 72 MW from the current level of 237 MW. Amidst this growing electricity demand, the national power utility plans to expand capacity; however, only 40 MW of new generation projects were noted in the 2019 annual report at various stages of planning or development. Another 40 MW solar photovoltaic (PV) power and 40 MW of biomass power is being procured under the country's Independent Power Producer (IPP) procurement programme. The shortfall between the growing demand and current build programme indicates that imports will likely continue for the foreseeable future (Naidoo & Loots, 2020). As Figure 7 indicates, imported electricity decreased in 2014 but has since been on a slowly increasing trajectory:

Figure 7: Energy market overview: Electricity generation, share of imports



Source: EEC (2019)

EEC's own generation less secure due to reliance on hydropower. Table 10 shows that the EEC generates the majority of its electricity from hydropower, which relies on rainfall and dam capacity. As a result of "variable and unreliable rainfall patterns… hydro stations are not run constantly but rather serve as peaking power" and "in drought years like 2016, the EEC has only been able to generate 10% of total electricity output" (Naidoo & Loots, 2020). Therefore, the EEC's own contribution to the national grid is not completely stable.

IPPs to increase local generation. Eswatini is moving to decrease its reliance on imported electricity and increase local IPPs through using the renewable energy resources available in Eswatini. The sugar industry in Eswatini is already an important IPP, as it utilises its biomass residue and bagasse to generate electricity for its own use and places excess electricity into the national grid. Royal Swazi Sugar and Ubombo Sugar Distillery have 37 megawatts and 41.5 megawatts of available capacity each, which makes up 24.6% and 27.6%, respectively, of the total available local capacity in the country. These two companies together make up 97.2% of the available capacity through private generation in Eswatini. The remaining amount is sourced from thermal (specifically coal) and solar PV sources (World Bank, 2019). Table 3 outlines the current electricity generation landscape in Eswatini.

Table 3: Electricity generation by source and capacity

Eswatini generation	Plant	Installed capacity (MW)	Available capacity (MW)	Technology
EEC generation	Maguga	19.8	19.8	Hydro
	Maguduza	5.6	5.6	Hydro
	Ezulwini	20	20	Hydro
	Edwaleni	15	15	Hydro
	Edwaleni Diesel Plant	9	9	Diesel
Private generation	Royal Swazi Sugar	65.5	37	Biomass
	Ubombo Sugar Limited	41.5	41.5	Biomass
	USA Distillers	2.2	2.2	Thermal
	Wundersight	0.1	0.1	Solar PV
Total (MW)		178.7	150.2	

Source: The World Bank (2019)

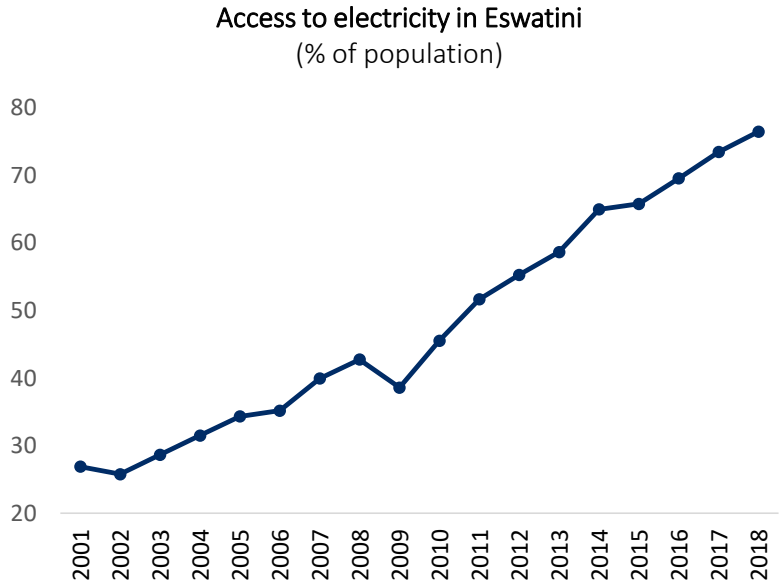
Barriers to IPPs maximising electricity distribution. Stakeholder consultations indicate that other sugar and timber companies are generating electricity for their own use or are interested in generating their own electricity, as timber also

produces biomass residue. These companies could potentially distribute excess electricity into the national grid, and the timber industry has established an association with the sugar industry, which "includes the exploration of power generation opportunities using the available biomass resources" (World Bank, 2019). The biomass industry can generate a significant amount of electricity to support Eswatini in becoming more self-sufficient in its electricity supply. However, stakeholder consultations suggest that there are challenges in practice to smaller independent power producers supplying the national grid. Notably, the bidding process for IPPs reportedly does not fully utilise the economies of scale available. ESERA only accepts bids from interested IPPs for set windows. This means that companies that reach capacity after the window has closed are not able to become IPPs. Further, presently IPPs together contribute only 40MW to the national grid, even though this is below the number of megawatts these IPPs are capable of contributing.

5.2 Access and usage

Access to electricity has greatly improved. As illustrated in Figure 8, Eswatini has made significant progress in increasing the electrification rate: from 5% of the population in 2003 with access to electricity, to 75% in 2017 (MNRE, 2018), and rising to an estimated 80% by 2020 (Naidoo & Loots, 2020). This is in large part due to the Rural Electrification Programme (REP) under the Ministry of Natural Resources and Energy, with dedicated funding from the Government. It has been complemented by community-led electrification projects for which funding was accessed through the Rural Development Fund or Microprojects Programme that is supported by both the Government (World Bank, 2019) and grants from cooperating partners including the Republic of China (Taiwan), and the EU (via a micro-project programme). The REP is integral to the Government of the Kingdom of Eswatini's Vision 2022 national development strategy, which aims for Eswatini to attain "developed" country status by 2022 (Government of Eswatini, 2019).

Figure 8: Energy market overview: Access and usage



Source: World Bank (2021)

Regional differences remain. The high national electrification rate masks significant variance between urban centres and rural areas. In 2017, 67.4% of the 265,000 Swazis living in rural areas had access to grid-supplied electricity[12] compared to an access rate of over 97% in urban areas. The Energy Masterplan 2034 notes that most households are within a kilometre from the national grid, but it is increasingly expensive to extend the network to remote areas (Naidoo & Loots, 2020). In addition, access to electricity also varies by region, see Table 12. In the Shiselweni region in particular, the network has limited capacity to meet demand, and the supply is of poor capacity. A total of 1,016 outages were recorded on the medium and high voltage network in 2018. This region is therefore a focus area for the Government to increase access in Eswatini. The Shiselweni region has the longest 11kV distribution network in the country (c. 90km). Due to its length and current loading, the line experiences higher technical losses than the rest of the country (World Bank, 2019).

[12] Note that even this lower rural rate is still high by SSA standards.

Table 4: Energy market overview: Variation by region

Region of Eswatini	Households with electricity (2014)	Percentage of population in the region (2014)	Gross National Income per Capita (in USD1,000 2011 PPP) (2018)	Households cooking on wood, straw, grass, dung, etc. (2014)
Shiselweni	48%	18%	6.86	72.6%
Lubombo	66%	20%	8.49	51.6%
Hhohho	67%	25%	10.6	47.7%
Manzini	70%	37.1%	10.3	31.6%

Source: Global Data Lab (2020)

Rural reliance on traditional fuels. These realities drive rural use of traditional fuels, especially wood and paraffin, for cooking and heating. The use of biomass for heating and cooking has negative environmental impacts, for example deforestation and the degradation of air quality. In response to this, the Energy Masterplan 2034 states that rural households should be disincentivised away from biomass cooking and that this should be done through measures such as alternative cooking products and mini-grid solutions (Naidoo & Loots, 2020).

Correlation between access to electricity and education, income and poverty. Naidoo and Loots (2020) put forward that access to electricity correlates with the level of education, the income and the poverty level of consumers in Eswatini. This is seen for education in that "only 65% of those with no education or only primary education has access, while 91% of those with a tertiary education has access to electricity from the grid" (Naidoo & Loots, 2020). For income, 76% of Swazi adults earn USD121 or less a month; and in this income group, 73% have access to electricity. Of the Swazis that earn more than USD121, which is 24% of adults, 86% have access to electricity. Further, 43% of

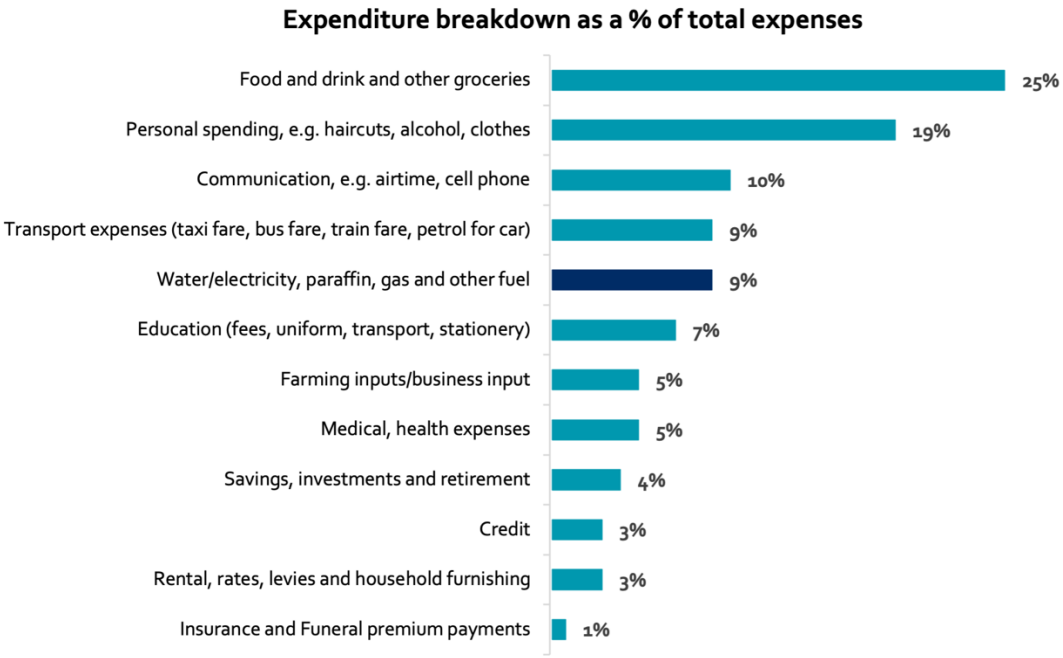
Swazi adults reported experiencing a poverty event in a given year (one of which being "unable to send children to school"), and access to electricity in this group was 66%. Meanwhile, the remaining Swazi adults who did not experience a poverty event had an 86% access to electricity rate (Naidoo & Loots, 2020).

5.3 Affordability

Tariffs are not cost-reflective in Eswatini. The commercial industry subsidises a substantial portion of the cost of electricity for the residential sector, and the cost of doing so has led some industry players to turn to off-grid solutions. During the key informant interviews, stakeholders disagreed on whether the tariffs in Eswatini are cost-reflective, meaning the "revenue from the tariff does not cover the full costs of producing power plus a market-related return on capital invested" (Naidoo & Loots, 2020). The World Bank, however, put forward that tariffs are not cost-reflective, as in 2016 the household tariff was USD0.10 per kWh but the cost of supply was estimated to be USD0.14 per kWh (Naidoo & Loots, 2020).

Low-income households are energy poor. On average, energy makes up 9% of total monthly expenditure by households in Eswatini, the highest out of the three sectors in this study (Table 13): the average adult spends USD15.57 per month on energy expenses out of an average monthly expenditure of USD173 (FMT, 2019). However, as 58.9% of households live below the poverty line of USD65 per person per month, Naidoo and Loots argue that "poorer households are experiencing energy poverty (although less pronounced than in other SADC countries)" (2020). This is due to the disparity between the percentage that the poorer population spends on utilities versus the rest of the population relative to their respective incomes; the higher income population spends 12 times more on utilities than the rest of the population (Naidoo & Loots, 2020).

Figure 9: Energy market overview: Energy as a % of total expenditure



Source: FMT (2019)

EEC looking to restructure tariffs. The residential tariffs for electricity from the national grid are reportedly lower than the tariffs permitted for off-grid solutions such as mini-grids and SHSs. As a result, from the consumer's perspective, the pricing for off-grid solutions is less favourable than for the national grid. Currently, the EEC has a domestic tariff as well as a lifeline tariff for poverty alleviation at USD0.12 and USD0.11 respectively. The once-off connection cost for prepaid electricity, which is how most electricity is paid for, is USD7.95, which is considered costly for lower-income communities (EEC, 2021). However, the ESERA is working on the tariff structure to make it more standardised and easier to understand as well as revisiting the connection cost and the tariff differentiation. Domestic customers are subsidised up to 40% in certain instances, which the EEC says is unsustainable. As a result, the EEC is looking to reduce the cross-subsidy between the commercial and residential sectors and introduce a subsidy within the residential sector along income and usage lines.

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

It is clear from this discussion that, despite very good grid reach, electricity access is not yet ubiquitous in Eswatini, leaving room for alternative delivery models to fill the gap. SHSs and mini-grids have been identified as possible digitally enabled delivery models to contribute to Eswatini's energy objectives. These models could provide individuals and households with access to clean, reliable and cost-effective energy through the use of innovative infrastructure and technology. Several examples in SSA already attest to the potential of these models. Table 5 outlines the cost and reach of an example of each model.

Table 5: Regional examples of energy models, including costs and reach

Model	Provider	Cost to consumer	Reach
SHSs	M-Kopa	USD0.6 per/kWh[13]	230,000 homes in Kenya
Mini-grid	One Power	USD0.33 per/kWh	20,000 homes in Lesotho

Source: Triodos Investment Management (2015)

Solar home systems (SHSs)

The SHS market is limited in Eswatini. Stakeholder consultations suggest that only higher-income individuals wanting to opt out of the national grid currently buy SHSs on a case-by-case basis. This overview therefore references global and regional best-practice in digitally enabled, mass-market-focused SHSs, as basis for the assessment in Section 5.5 of the potential for the introduction of digital SHSs in Eswatini.

Plug-and-play solution to rural household electrification. SHSs are innovative and clean electricity sources that avoid domestic air pollution, noise pollution

[13] Based on SHS costs in Malawi. National grid costs approximately USD0.2 per/kWh (Eales et al., 2020)

and greenhouse gas emissions. The PV technology used in SHSs is a relatively efficient way of delivering continuous, but limited, amounts of electricity to remote off-grid households for lighting and appliances. In rural areas that are not connected to the grid, SHSs have been used to meet a portion of a household's energy demand, fulfilling basic needs for electricity. This system can be divided into multiple tiers based on the types of appliance used in the household (see Table 6).

Table 6: 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 a fan	Tier 2 uses AND any medium-power appliances	Tier 3 uses AND any high-power appliances	Tier 4 uses AND any very high-power appliances

Source: (ESMAP, 2015)

Based on stakeholder consultations, current electricity consumption in rural households in Eswatini 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, for instance, rather than a bigger system or connection to the national grid. An example of an SHS operator the region is Africa Clean Energy (ACE). See Box 3 for details. This organisation operates in Lesotho and primarily focuses on energy efficient biomass cookstoves, but also incorporates a Tier 1 solar component in the system.

Box 3: Africa Clean Energy

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 and has since expanded some of their offerings outside of Lesotho. Since starting operations, approximately 60,000 biomass stoves have been sold around the world, with the majority of sales in Southern Africa.

The basic ACE connect package consists of the cooker stove plus 10-watt solar panel, a built-in battery and a USB port to connect an LED lamp attachment. Consumers can use the stove for heat and/or cooking. The price ranges from USD111 cash or USD115 paid in instalments over 10 months, at no interest, with an initial deposit of USD17.

A recent survey highlighted that after seven months customers can save more money than they pay for the stove – key to this is the interest-free loan.

This model involves the distribution of interest-free loans for the first 10 months to make it 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.

The ACE model relies heavily on a local sales and agent network to conduct onboarding and take-up, address payment challenges and financial literacy challenges, and offering maintenance services.

Sources: Africa Clean Energy (n.d.) and Lesotho Times (2020)

SHSs rely on incremental payment structure. Because of the relatively high upfront cost of SHSs (the average upfront cost of a Tier 1 system is USD23, whereas a Tier 2 system is USD45[14]) and low levels of disposable income at the household level in emerging markets such as Eswatini, energy service providers (ESPs) often permit customers to pay for the SHS through small, incremental

[14] Refer to the Appendix of this report for more detailed costing information and assumptions.

payments over a longer period, and in this way they incur a lower upfront cost that may be more affordable. This pay-as-you-go (PAYG) (see Box 4 for details) payment structure not only provides greater flexibility to customers but also offers ESPs a way of making price points more accessible to households and a way of providing greater control over the payment for and usage of the SHS.

Box 4: Pay-as-you-go (PAYG)

The PAYG business model is an innovation that emerged to resolve the energy-access challenge and to provide electricity generated from renewable energy sources at affordable prices, with payments facilitated by the mobile technologies available in these areas.

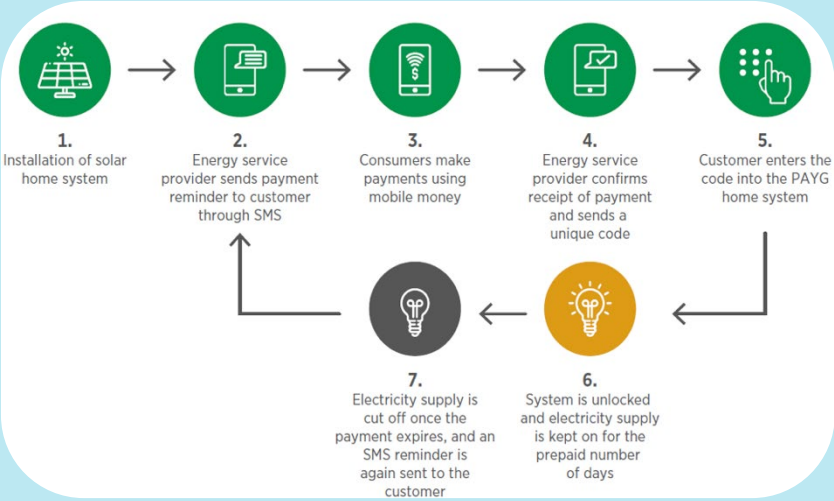
ESPs can provide either a "lease-to-own" model or a "usage-based payment" model.

The lease-to-own model involves customers paying for the entire generation capacity (i.e. SHS) in small instalments over a period of one to three years. A small solar PV system capable of powering light bulbs and small appliances, such as radios, and of charging mobile phones, is priced at approximately USD150. These systems are usually paid for in instalments over six to 24 months. Solar PV systems with batteries that can power major appliances that need uninterrupted supply (e.g. refrigerators) can cost up to USD1,000. This can be repaid by customers in instalments over six to 36 months. More than 90% of SHSs operate using the lease-to-own model (Sotiriou et al., 2018). If a customer consistently fails to pay the daily, weekly or monthly rates, the ESP will go to the customer's house and remove the system.

The usage-based payment model involves customers prepaying for the electricity supply (in kWh). The customer loads money onto a prepaid meter and can use the amount of electricity that corresponds to the amount of money paid. Once the period lapses, the solar PV system is turned off automatically by the ESP through a remotely managed control system until the next payment is made. Unlike the lease-to-own model, the customer never owns the system but consumes only the electricity generated. Despite being used mostly in the context of solar PV systems, the PAYG usage-based payment model can be used for any type of system, including grid-supplied electricity. The payments are usually made via

mobile credit, by sending a text message. The systems can feature a remote monitoring system that can be activated via mobile network connection.

The visual below represents the PAYG concept.



Source: IRENA (2020)

Innovative financing schemes key to uptake of energy models. SHS providers have also acknowledged the need to offer lower-cost financing solutions to their customers as a way to make their products more affordable and accessible[15]. In the ACE case study, 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 shutdown 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, an SHS provider named Yellow Solar is able to offer an effective rate of around 32% to consumers by positioning its price point low enough to generate added value for consumers.

[15] Accessing finance remains a key challenge for low-income households in SSA and becomes a focal issue when considering appropriate energy models for widespread use. 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.

In this way, providers can achieve greater scale and lower default rates on repayments, making lower interest rates a sustainable model.

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 periods. This can create ongoing maintenance risks and associated costs, should it be overused. Providers such as ACE are, however, able to collect data on the usage of the stoves by customers using the Global System for Mobile Communication (GSM) technology, which may help to identify and address harmful customer behaviour going forward. Stakeholder consultations revealed that common maintenance issues arising with these systems include customers using the system to drive appliances the system is not designed to support and users being unfamiliar with these systems and their vulnerabilities, which leads to a breakdown of these systems. For instance, the batteries sold in SHSs deteriorate quickly when drawn below 50% of their charge. Where this is done continually, the battery is destroyed, rendering the system unusable. From the provider's perspective, the cost of sending out maintenance staff to each house and address where these faults occur can become unproductive, particularly where these products are fully paid off or fall outside of their service plan or warranty. Providers such as ACE do make use of their agent network to educate consumers on the safe use of their products, which offers a potential approach to ensuring products are well maintained.

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 Eswatini, the low rate of urbanisation (24%) would further necessitate a well-functioning agent network for physical distribution of SHS products and for consumer onboarding and education in rural areas. At present, there is little evidence of SHS providers operating in

Eswatini, and those that are appear to be mainly serving higher-income households.

Mini-grids

As with SHSs, there are no current examples of mini-grids as digital delivery models in Eswatini. The EEC is now initiating the first mini-grid pilot installation for the country to provide electricity to a small, isolated, rural village. The expectation is for the 35kWp, 200kWh solar PV battery system to be commissioned before the end of 2020 (UNDP, 2021). This overview therefore draws on international best practice.

An off-grid community electrification solution. A mini-grid is a miniaturised version of the larger grid, a configuration of energy resources, distribution wires and buildings, all within a distinct geographic footprint. There is no size limit, but mini-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 developed in response to the growth in distributed generation, which brings generation closer to the point of consumption, and the microgrid 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 microgrids 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 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 life span of 15 to 25 years, which is longer than many other clean-energy technologies such as cookstoves.

Mini-grids not in competition with SHSs. Owing to similarities in the technology used and the consumer segments targeted, SHSs and mini-grids are often perceived to be direct competitors in low-income markets. However, instead of competing, the two technologies 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 and other resources 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 is that they allow for growing electricity demand. The introduction of electricity may support local economic development, which will generate additional electricity use cases. Experience in other countries indicates that mini-grid providers model not only current demand, but also potential future demand. This modelling is largely based on data from recently electrified communities to build a probability function and generate realistic forecasts of a community's electricity demand. Mini-grid systems can then be built to allow room for expansion as demand grows.

Mini-grid maintenance is crucial. The importance of effective maintenance in achieving sustainable mini-grids cannot be overemphasised. Appropriate systems design and routine maintenance are a necessary technical aspect that is a priority in mini-grid planning, development and management. The 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. 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.

Regulatory environment still a grey area, although progress has been made. The nature of the energy sector in SSA means that models such as mini-grids are usually heavily regulated. The reason for this is that mini-grids tend to operate in similar spaces to the national grid and form a local monopoly. This is an inherent part of the business model of a micro-utility such as a mini-grid, and for this reason the close regulation of tariffs and services in such instances is necessary. One of the main challenges, however, is that regulators and policymakers are still developing appropriate policy for renewable energy and mini-grid deployment, making it difficult to navigate this space (International Review of Electrical Engineering, 2015).

5.5 Feasibility assessment

Table 16 summarises the feasibility assessment of the energy sector for the two digital energy models as compared to the national grid as baseline.

Baseline: national grid. Although national policy has been geared towards driving down the cost of connecting to and using the national grid, costs remain relatively high, and hence this has been allocated two out of three ticks. Access to the grid is high in Eswatini; however, there are areas where it is not feasible to extend the national grid and, as such, the grid has been allocated two out of three ticks for accessibility. Finally, both regulatory feasibility and market dynamics receive three out of three ticks as national policy has up to this point been primarily geared at the EEC, and this has led to the national grid achieving scale.

Table 7: Feasibility assessment of education models

	Solar Home System (SHS)	Mini-grid	National grid
	• Limited to higher income market • Likely require donor to reach scale or some kind of capital • Lack of local partners for invested parties	• Does not exist yet apart from one pilot • Policy and framework in development • Does sugar industry already do a mini-grid? (KII question) • Incorporate those who are too rural for the national grid • High upfront investment cost, likely require donor and/or public-private partnership	• High network coverage • Unreliable supply • Controls transmission and distribution • Reliance on imported electricity • IPP forms part of grid network, moving to leverage more
Affordability	✓	✓	✓✓
Access	✓	✓	✓✓
Regulatory feasibility	✓✓✓	✓	✓✓✓
Market dynamics	✓	✓	✓✓✓
			✓ Low ✓✓ Medium ✓✓✓ High

The feasibility assessment for each model is outlined further below.

Solar home systems (SHSs)

Affordability: Less affordable than the national grid. Relative to established models such as the national grid, an SHS in Eswatini is a relatively unaffordable option for many low-income households. In part, this is due to residential tariffs of the national grid being subsidised by the commercial sector. Therefore, from the perspective of the residential population, the upfront costs associated with solar mean that SHSs do not compare favourably with grid connections, and the

stakeholder consultations indicate that the use of SHS is mostly by middle- and higher-income households who opt out of the grid in favour of solar connections, due to quality concerns with the grid. The consultants therefore suggest that the SHS model as currently applied in Eswatini is not an affordable option for low-income households without support through government subsidies or donor funding. Thus, one out of three ticks has been allocated for affordability. The feasibility assessment suggests that only around 7,825 users could afford a Tier 1 SHS based on their likely income, access to a phone, product cost and available income for electricity consumption (see Appendix).

Access: Limited to higher-income population. In Eswatini, there is little evidence of widespread activity in the SHS market, with those providers that are operating largely targeting higher-income households. Piloted projects for systems for the lower-income segments have not reached scale, as these projects required funding support that proved difficult to obtain. The consultations indicated that, because the Government is already investing in extending the national grid and increasing the quality of supply, government funding for such alternative models would not be forthcoming. There are examples of SHSs such as solar cookstoves found in neighbouring markets such as Lesotho (see Box 3), which could be introduced in this market, but no interest has been expressed to date, and therefore this model only achieves one out of three ticks for accessibility.

Regulatory feasibility: Policies support SHSs. Stakeholder consultations suggest that the SHS model is not subject to dedicated regulation and that the Eswatini Government is encouraging of private innovators to enter the market, particularly those operating in the green energy space. This can be seen in the Kingdom of Eswatini Energy Masterplan 2034 and the Programme Framework for Affordable Renewable Energy in Swaziland (PARES), 2018. There are several reasons for this, including an acknowledgment of the need to supplement the current grid, given constraints around generation capacity and that rural households that remain out of reach of more conventional solutions, and the view that the SHS and national grid models will not be competing against each

other. Regulatory feasibility for the SHS model therefore appears high, as is reflected in the three out of three ticks allocated in the feasibility assessment.

Market dynamics: Limited scale and players in the market. There are few SHS players in the market at present, and partnership opportunities for prospective parties to coordinate with remain limited. Furthermore, the extensive national grid in Eswatini does reduce the potential for reaching scale for SHSs in the country. As a result, market dynamics in Eswatini do not appear conducive to the sustainable operation of SHSs providers, and hence this model receives only one out of three ticks for this segment of the feasibility assessment[16].

Mini-grids

Affordability: Less affordable than the national grid. Relative to established models such as the national grid, mini-grids are likely to be a less affordable option for many low-income households, at least initially. The national electricity tariff for residential consumers is relatively low at USD0.10 per kWh and applies to 80% of the country. 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. As a result, it is likely that there may be a degree of resistance from residential consumers regarding the use of the mini-grid and associated higher tariffs even if the regulatory environment allowed mini-grid providers to operate. In a country where household disposable income is already stretched, it is unclear how rural households would be able to afford this model without providers receiving additional financial support. As a result, we have allocated one out of three ticks for this model's affordability.

Access: Limited to higher-income population. Unlike many countries in the region, Eswatini has not had a spontaneous uptake of mini-grids. This can be

[16] There is still *a potential need* for off-grid solutions such as solar home systems (SHSs) combined with clean cooking solutions to provide rural households access to some form of basic electricity, but current market dynamics are not favourable.

ascribed to a number of factors such as the already high electrification rate in the country (80%), with most settlements within a kilometre from the national power network and a relatively low demand for electricity by isolated and often impoverished rural communities (only 27% of the adult population use more than 1,460kWh per year), making it difficult to attract private-sector investment. What this means it that at present there are no options available for households to access mini-grids. Though the Government is launching a mini-grid pilot for one village, the incremental access gains will be limited, given the small scale. As such this model currently scores one out of three ticks for accessibility.

Regulatory feasibility: Mini-grids mooted for Eswatini. Mini-grids have been noted as a potential part of the solution to address both the last mile electrification challenges and the growing electricity demand, especially among more rural households, while also contributing to the renewable energy targets and climate change commitments for the country. According to the consultations (Msibi, 2021), the energy regulator in Eswatini in November 2020 initiated a process to develop a mini-grid and off-grid regulatory framework for the country. The scope appears quite comprehensive, covering a range of topics that can help to reduce risks to developers and facilitate investment in renewable energy mini-grids. It also includes the development of processes and procedures necessary to implement the framework. The targeted completion date is during the first half of 2021. While a specific delivery model has not been selected by the Ministry of Natural Resources and Energy or the Regulator, the Ministry has indicated the intention to encourage private-sector participation in the sector. It is expected that the development of the regulatory framework will begin to shape the preferred direction and will represent a significant milestone for mini-grid development in the country. It is a base assumption of the Africa Minigrids Programme (AMP)[17] national project that this framework will be in place at implementation to guide the AMP activities (Naidoo & Loots, 2020).

[17] The AMP is a new UNDP-led Africa-wide initiative, funded by the Global Environment Facility, and in partnership with AfDB and the Rocky Mountain Institute. Under the AMP, UNDP will support an initial 11 African countries in developing the enabling environments to increase the

On paper, it therefore does appear that progress is being made regarding the development and implementation of a regulatory framework to support mini-grid models. However, the regulatory framework still needs to be fleshed out and would need to deal with practical implementation challenges such as bottlenecks around licensing of new players, competitive bidding processes and tariff structures. As such, current regulatory feasibility receives one out of three ticks as part of the feasibility assessment.

Market dynamics: Mini-grids still nascent in Eswatini. Mini-grids appear to represent a niche solution within the Eswatini electricity market rather than a direct alternative or competitor to the national grid. At present, the lack of mini-grid providers may be appealing to prospective players, as it would, in theory, give them more room to play in this space. However, the rural and unserved segments of the population, which will likely be intended beneficiaries of mini-grid technology, are still relatively small, with little in the way of commercial opportunities in these regions. Consequently, the remaining market potential for mini-grids is likely to be low, suggesting the scaling necessary to make mini-grid operations financially viable and attractive to private-sector operators may not be available without public or donor support. At present, this model therefore receives one out of three ticks as part of the feasibility assessment.

5.6 Recommendations for Eswatini's energy sector

The extensive reach of the national grid means that the energy sector may be less of a priority area for supporting digital delivery in Eswatini than in other countries in the region. Table 17 summarises the recommendations stemming from the energy feasibility assessment:

Table 8: Key recommendations for the energy sector

commercial viability of renewable energy mini-grids and scale up investments in decentralised renewable energy solutions in Africa.

	Proposed solution
Partnership opportunity	*Mini-grid and SHS providers* *MTN Eswatini*
Intervention areas	*Mini-grid test-and-learn with developers and policymakers* *Refining digital payments for national grid* *Supporting players from the region in entry into Eswatini market*

While viable mini-grid implementation limited at present, test-and-learn opportunities exist. At present, potential developers highlight uncertainty around their ability to generate revenue from electricity sales to recover the investment and access to affordable financing as the most significant barriers and expected risks to developing mini-grids in Eswatini. Given the size of the country and the fact that 80% of households are already connected to the grid, the unserved consumer pool targeted by mini-grid developers becomes even smaller. While this context does not present an obvious market for conventional mini-grid developers, it may provide an opportunity to test solutions in rural areas and at a community level to understand market uptake and switching from biomass to clean energy solutions. In this context, there may be scope for FinMark Trust to assess what the usage patterns of consumers in rural or isolated households are when it comes to electricity and how the introduction of a mini-grid may affect this. This assessment may then be used to model likely future demand patterns that can inform long-term fit-for-purpose mini-grid design and implementation, as well as the finalisation of the regulatory framework. This can also be used to analyse consumer willingness and ability to pay for mini-grid use, providing an indication of the types of tariffs developers can charge and what consumption may look like under this tariff.

Digital payments already integrated into national grid, but room for improvement. Eswatini has high levels of financial inclusion that can be leveraged

to enhance payments efficiency in the energy market. In 2018, 75% of adults with access to electricity had a formal (non-bank) account (mostly mobile money) while 82% were banked. Stakeholder consultations further confirmed digital payments options such as mobile money and online banking are already available for individuals to pay for energy utility services in Eswatini. In rural areas, where there are few alternatives such as shops that are within easy reach to make payments, mobile money may be the most accessible way of paying for electricity. However, according to the consultations, the cost of mobile-money transactions makes this a relatively expensive payment option. As a result, there may be an opportunity to engage with financial sector regulators and MNOs around the cost of mobile-money transactions when making payments for key basic services such as electricity.

Supporting entry by regional players to support switch from biomass to more sustainable SHSs. In Eswatini the population relies on multiple fuel sources to meet its domestic and productive energy needs. In rural areas, biomass continues to be used by those without access to the national grid or those unable to afford grid electricity for cooking and heating, and candles, paraffin and electricity for lighting. Approximately 90% of the total energy consumed by rural households is provided by fuel wood. Because biomass resources are essentially free, and the cost of electricity and electrical appliances is not, households have little incentive to use more environmentally sustainable alternatives, and this has contributed to environmental degradation. For many households, affordability, cultural norms and a lack of alternative options in the Eswatini market make it difficult to change behaviour and to shift to cleaner energy solutions. FinMark Trust may therefore consider supporting players from elsewhere, such as the Lesotho-based initiative ACE, in expanding its footprint to the Eswatini market through the sale of solar cookstoves. ACE already has an established model for its cleaner biomass cookstove and experience in operating in small markets. FinMark Trust may also be in a position to connect ACE to key industry players in Eswatini such as MTN (the major MNO), ESERA (the energy regulator) and local financing partners.

6 Health

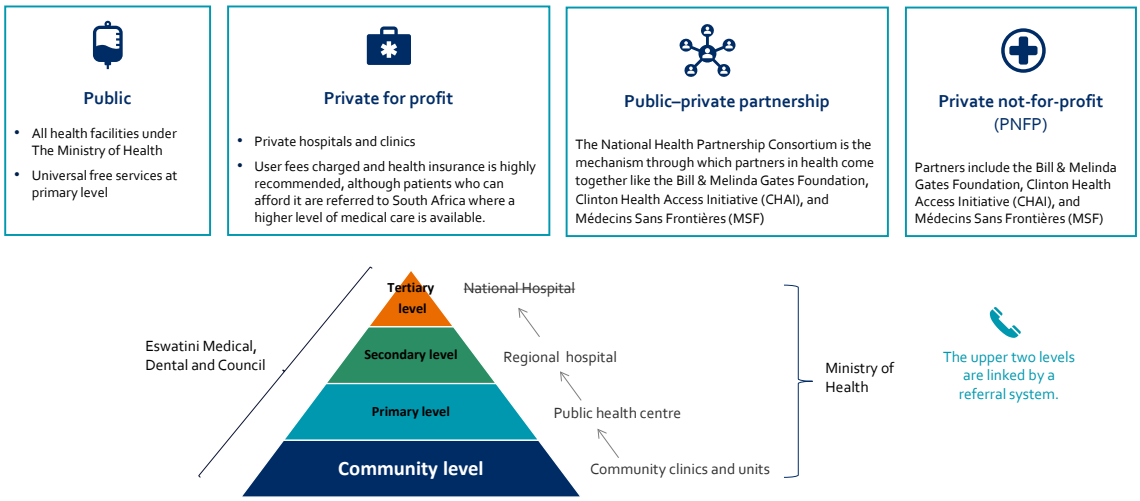
Eswatini faces a dual epidemic due to high HIV/AIDS and tuberculosis rates. Eswatini has the highest rate of HIV/AIDS in the world, with 27% of the population having tested positive for the virus. Further, 65% of Swazis with HIV/AIDS also have tuberculosis. Eswatini is making progress in reducing the rates of HIV/AIDS and tuberculosis, and access to primary health facilities is good. Despite this, the quality of service remains an issue, and there is a funding shortfall in health services (World Bank, 2021; Avert, 2020).

Strong performance in some areas, but weak in others. Eswatini is ranked 13th-lowest in the world in terms of life expectancy, with an average of 59 years. Infant mortality and maternal mortality ratios are lower than average ratios for SSA but higher than lower-middle income and world ratio averages. The contraceptive prevalence in Eswatini of 66.1% is above the world average of 53.8%, while the Universal Health Coverage of 63% is close to the world average of 65% (World Bank, 2021).

6.1 Infrastructure and institutional landscape

Figure 10 outlines the institutional landscape in Eswatini's health sector.

Figure 10: Health market overview: The healthcare system



Source: WHO (2018), Magagula (Magagula, 2017), Ministry of Health and Social Welfare (2018), Ministry of Health (2020)

Health infrastructure is relatively evenly distributed. According to the Ministry of Health, "up to 85% of the population lives within a radius of eight kilometres from a health facility" (2007). While the distribution of health facilities is fairly even across the country, there tends to be a larger number concentrated where more people are situated (FMT, n.d.).

No national hospitals in Eswatini. There are three regional hospitals, two mission hospitals and one referral hospital, but no district or national hospitals in Eswatini. This means that patients have to go elsewhere, usually to South Africa, for more specialised care, although this is dependent on affordability.

Primary and basic healthcare dominates the system. Out of the 135 health facilities in Eswatini, 113 are clinics, illustrating the reliance on clinics to provide access to healthcare (Table 19) (WHO, 2019). There are also 2,000 Rural Health Motivators in Eswatini, which are operated by community health workers under the Ministry of Health at Neighbourhood Care Points. Rural Health Motivators provide complementary services and advice to communities, specifically focusing on the feeding of infants and young children, hygiene and sanitation, immunisation as well as the monitoring of the growth of children (de la Rey, 2020). While clinics and Rural Health Motivators are important health facilities, they only provide basic healthcare, and their prevalence reflects that there is a reliance on community-level healthcare in Eswatini. Ninety-two (92) of the total health facilities are public under the Ministry of Health, while 43 health facilities fall under non-profit or faith-based organisations. These privately run facilities include 40 clinics, one public health unit and both of the mission hospitals in the country (WHO, 2019).

Table 9: Healthcare facilities in Eswatini, Lesotho and South Africa

	Eswatini	Lesotho	South Africa

All types of clinics	**113**	2	3,640
All types of health centres	**8**	95	302
Public health units	**8**	0	0
Regional hospitals	**3**	0	47
Mission hospitals	**2**	8	0
Referral hospitals	**1**	1	0
District hospitals	**0**	11	254
Health post	**0**	0	34
National central hospitals	**0**	0	9
Provincial tertiary hospital	**0**	0	17

Source: WHO (2019)

Lack of specialist healthcare skills in Eswatini. There are no specialist surgical workforce officials in the country. There are 4.1 nurses and midwives per 1,000 people in Eswatini, which is higher than the average rates for SSA, lower-middle income countries and the world. However, Eswatini only has 0.3 physicians per 1,000 people, which is lower than the average rates for lower-middle income countries and the world (Table 20). Further, Swazi students can study nursing or pharmacology in the country but cannot study to be a doctor locally. Prospective students have to obtain their qualification and complete the

required years of experience outside of Eswatini before they can return to practice as doctors within the country.

Table 10: Summary of health official indicators in Eswatini

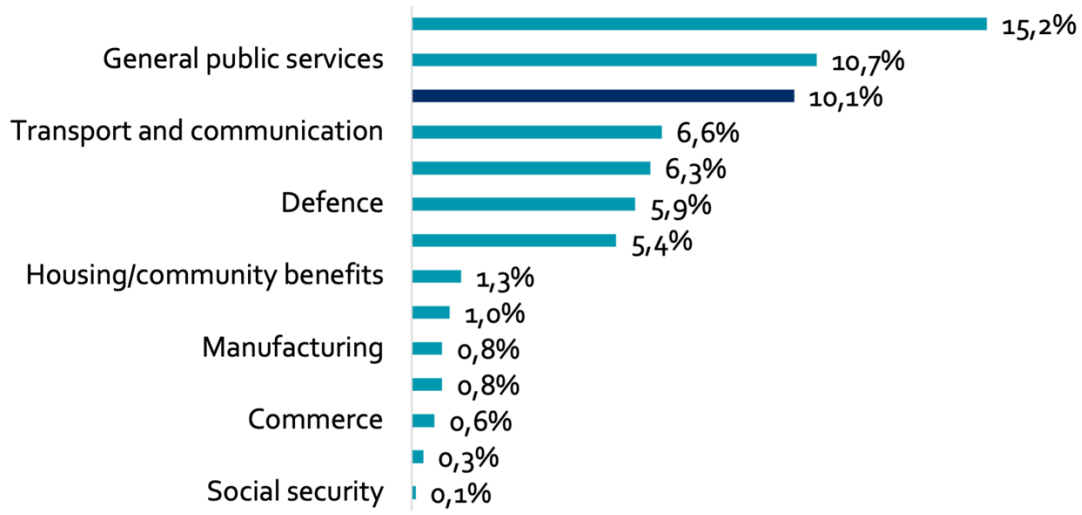
	Eswatini	Sub-Saharan Africa	Lower-middle income	World
Physicians (per 1,000 people)	**0.3**	0.2	0.8	1.6
Nurses and midwives (per 1,000 people)	**4.1**	1	1.8	3.8
Specialist surgical workforce (per 100,000 population)	**0**	2	10	--

Source: World Bank (2021)

Relatively high public spending on healthcare, but still below some averages.

The health sector received 10.1% of the total government expenditure in 2018/2019, which was the third-largest contribution of all the sectors (Figure 11).

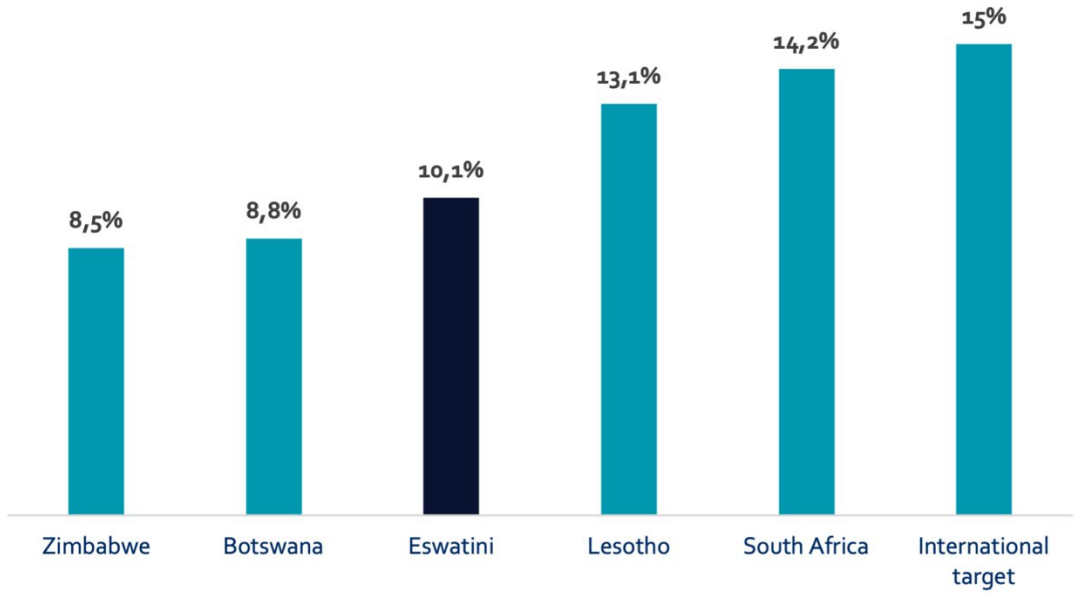
Figure 11: Health sector overview: public spending on health as percentage of total budget



Source: UNICEF (2019)

Eswatini dedicates more to its health sector than Zimbabwe and Botswana, but less than Lesotho and South Africa and remains below the international target of 15% (Figure 12). Further, expenditure on health per capita is USD271, which is higher than the average of USD85 for lower-middle-income countries, but significantly lower than the world average of USD1,110. Despite this, according to UNICEF, while the nominal budget is increasing, actual spending is declining (2019).

Figure 12: Health sector overview: public spending as percentage of government expenditure in select countries



Source: UNICEF (2019)

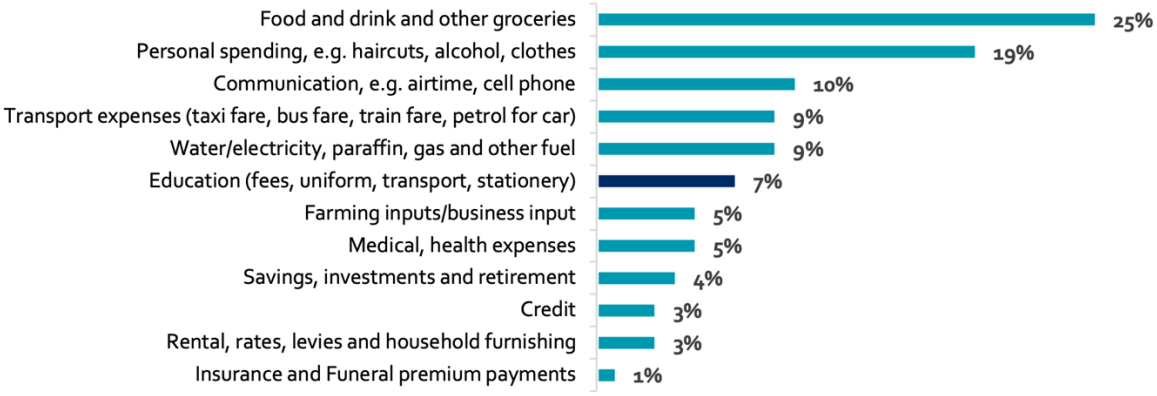
Quality of infrastructure is an issue. In Eswatini "a significant proportion of the infrastructure and equipment of the health sector in the country is in a poor state of repair" and USD145 million is estimated as required to update the infrastructure (Magagula, 2017). Findings from a pilot assessment on gaps in healthcare delivery in the 10 clinics reviewed included "shortage of equipment" and "provision of non-communicable disease medicines" (Magagula, 2017). For hospitals in particular, a study found that the three referral hospitals in the country had inadequate space, electricity and water (Pigoga, et al., 2020). Thus, there are severe supply constraints in the healthcare system in Eswatini, in terms of reach as well as quality of care.

Digitalisation currently limited. As in other sectors of an economy, the health sector in Eswatini is faced with the need to adapt and integrate ICT in delivering health services. Coming from a background of health information management that was largely characterised by paper-based data management systems, the Ministry of Health (MoH) appears to have embraced the role that ICT plays in revolutionising the collection, processing, storing analysis and reporting of health information for policy, programmes, health service delivery and research. While the MoH has developed a roadmap for investments in ICT for Health Services in the form of the Kingdom of Swaziland eHealth Strategy 2016–2020, the impact of this strategy is unclear, and there is little evidence of significant digital integration or innovation within the health sector.

6.2 Household engagement with the healthcare system

Relatively high household budget spent on healthcare. The average adult spends USD8.65 a month on medical and health expenses, out of a total monthly expenditure of USD173. This means that the average Swazi spends 5% of their monthly expenditure on medical and health expenses (Figure 13). However, 58.9% of total households live below the poverty line of USD65 per person per month and USD8.65 for medical and health expenses would represent 13% of their monthly expenditure (FMT, 2019).

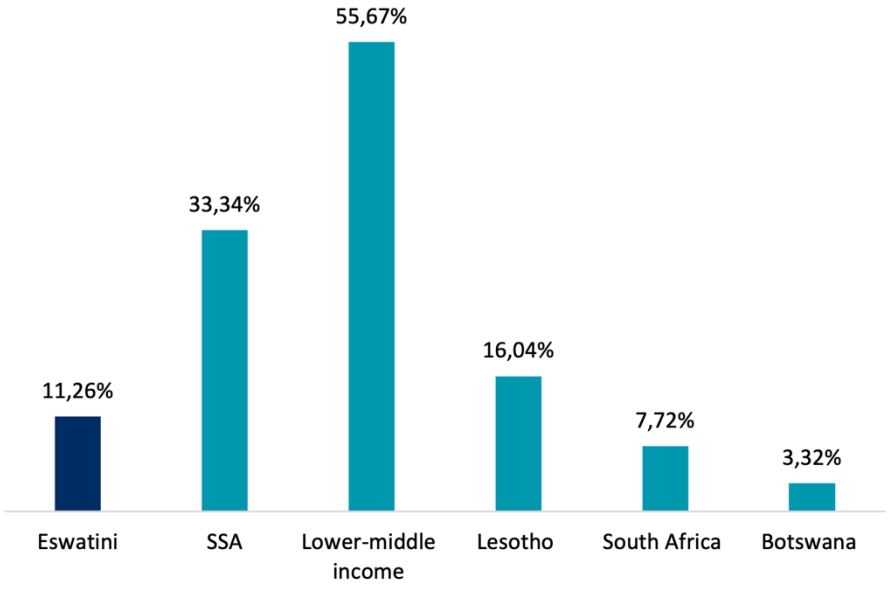
Figure 13: Education market overview: expenditure on health as percentage of total household expenses



Source: FMT (2019)

Relatively low out-of-pocket medical expenses. According to the World Bank's estimates, 11.26% of health expenditure for Swazis was out of pocket in 2018. This is low compared to the average portion of expenditure for SSA (33.34%) and lower-middle-income countries (55.67%). Eswatini's rate is also lower than Lesotho's (where the population spends 16.04% of their health expenditure on out-of-pocket expenses) but higher than the rates for South Africa and Botswana, which are 7.72% and 3.32% respectively (World Bank, 2021).

Figure 14:Health market overview: Out-of-pocket expenditure (% of current health expenditure)



Source: World Bank (2021)

Limited role for health insurance in expanding access to private healthcare. There are government-subsidised health services available in Eswatini, but 41.7% of patients choose private healthcare instead. Health insurance take-up is 8%, which is the second lowest in product take-up after motor insurance (FMT, 2019). Meanwhile, "16% of savers save towards medical expenses and nearly 8% of borrowed credit is used for medical expenses" (Thom, et al., 2014).

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

A scan of global best-practice models identified two potentially relevant types of digitally enabled delivery models in the health sector: **telehealth** and **mHealth**. These models contribute to SDG 3 by providing individuals with access to the tools, human resources and products needed to diagnose and treat health conditions and promote long-term health and wellbeing. Table 25 outlines an international example for each health model, noting the cost and reach.

Table 11: Examples of mHealth models, including costs and reach

Model	Provider	Country of origin	Cost to consumer	Reach
Telehealth	Vula	Eswatini	Free (Software as a service)	99,100 users[18]
Telehealth	Hello Doctor	South Africa	USD3 per month (subscription) + Consultation fee	> 500,000 users
mHealth	Totohealth	Kenya	USD0.25 per month (subscription)	39,000 users

Source: Ugwuede (2020); The Guardian (2018); Vallie (2017), Harambeans (2018)

[18] Total users across Eswatini, Namibia and South Africa

Below, each model is outlined in turn, noting what examples, if any, are found in Eswatini at present.

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 12).

Table 12: 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)

Telehealth a timely response to COVID-19. Using technology to deliver healthcare has several advantages, including cost savings, convenience, and the ability to provide care to people with mobility limitations, or those in rural areas who do not have access to a local doctor or clinic. For these reasons, telehealth has become even more essential during the coronavirus (COVID-19) pandemic. Fears of spreading and catching the virus during in-person medical visits have led to a greater interest in, and use of, technology to provide and receive healthcare in this way. The telehealth model may also be beneficial to frontline healthcare workers as a way of connecting them with medical practitioners from other locations and providing access to health-related content and digital tools that can improve their own understanding and better equip them to tackle the health challenges faced by the country. When used by healthcare practitioners, the models are referred to as telemedicine.

Limited examples identified in Eswatini. The desktop research and consultations identified two telehealth examples in Eswatini, namely the Vula e-referral app, as outlined in Box 5 and the Clinic Group[19].

Box 5: Vula

Founded in 2014, Vula is a mobile app that connects health workers in rural and underserved areas to specialists. In 2016, Vula 2.0 launched with an improved interface and additional specialties (currently 14 specialties).

The aim of the app is to give health workers – particularly those in remote rural areas – a tool that helps to get patients quick and efficient specialist care. Vula puts primary healthcare workers directly in touch with on-call specialists, making the referral process much quicker than by fax or phone. The Vula app can be used asynchronously (offline); however, when online it uses 20 times less data than

[19] The Clinic Group provides private healthcare services to people residing in Eswatini. They have recently begun offering telemedicine service which are conducted via secure video and audio connections, typically on a mobile device or computer. More specifically, it refers to online consultations (video calls) with doctors affiliated with the Clinic Group, which are done through a secure web application. Currently the consultation fee for specialist is around USD27 while the fee for General practitioners consultation will be around USD20.

WhatsApp due to the data optimisation function built into the app. This is a particularly useful feature in markets where data costs can be prohibitively high, such as Eswatini.

The Vula app is free to use, as it operates on a software-as-a-service model, meaning that the cost burden falls on the public health administrator rather than on the consumer.

To date, the Vula mobile app has helped over 93,000 patients, and data shows a 31% reduction in unnecessary referrals to tertiary hospitals. The app serves over 6,100 registered health workers on the Professional Network, and over 1,096 health facilities. The online dashboard enables monitoring, evaluation and clinical oversight of previously unseen data. Human resources are allocated in an evidence-based manner, and health companies have access to health workers on an app they use at work.

Source: Vula (2021)

Legal, ethical and regulatory considerations. Offering patient care over a distance and possibly from another country raises issues such as liability, licensure, jurisdiction, quality and continuity of care, confidentiality, data security, consent, authentication and remuneration. In many countries in SSA, these issues are still largely unaddressed, making it difficult to provide and govern these services effectively in a particular jurisdiction. The potential cross-border nature of this model also raises the matter of licensure, i.e. does the physician who provides a telemedicine consultation from another country have to be licensed to practise in the country of the patient and the referring doctor? This and related questions still need to be confronted in regulations if telehealth is to become a more widespread and safer digital model in SSA.

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.

Questions regarding sustainability. Although there has been a proliferation of mHealth pilot projects across the continent, a large proportion of these projects are unsustainable and often expire once initial funding is exhausted. For example, in Uganda alone there were 23 mHealth initiatives in 2008 and 2009 that did not scale up after the pilot phase. Therefore, business models and funding schemes for mHealth need to be reviewed to support the scale-up of effective pilots. Conflicting health system priorities may also slow down the scale-up of successful mHealth interventions in resource-poor countries (Folaranmi, 2014). Moreover, there is no standardised regulatory framework to support scalability of m-heath models.

No precedent in Eswatini, but several examples across the continent. The research did not identify any existing mHealth providers in Eswatini. This model is found in other countries in SSA, however; for example the Kenyan Totohealth[20], which has reached more than 39,000 subscribers via its SMS and pre-recorded voice messages (The Guardian, 2018), and MomConnect in South Africa (see Box 6).

[20] Totohealth is a digitally enabled education model using mobile technology to detect child-development abnormalities and to improve access to maternal and child health information for the marginalised communities using mobile technology.

Box 6: MomConnect

MomConnect is a flagship programme of the South African National Department of Health that has reached over 1.5 million pregnant women.

Using mobile technology, MomConnect provides pregnant and postpartum women with twice-weekly health information text messages as well as access to a helpdesk for patient queries and feedback. In just three years, MomConnect has been taken to scale to reach over 95% of public health facilities and has reached 63% of all pregnant women attending their first antenatal appointment. The helpdesk has received over 300,000 queries at an average of 250 per day from 6% of MomConnect users.

The service is entirely free to its users.

The rapid deployment of MomConnect has been facilitated by strong government leadership, and an ecosystem of mobile health implementers who had experience of much of the content and technology required.

Source: Mehl, et al. (2018)

6.4 Feasibility assessment

Table 13 summarises the feasibility assessment of the two digital models identified for the health space. The table also includes an assessment of the public healthcare system as a baseline that could be supplemented by the two digital models.

Baseline: public healthcare. At present there is universal free access to primary-level public healthcare services in Eswatini, resulting in this option being highly affordable as is captured by the three out of three ticks. Further, public health facilities are relatively evenly distributed, with up to 85% of the population living within a radius of eight kilometres from a health facility. This makes public health facilities reasonably accessible. However, as tertiary care is limited in Eswatini, the public sector is only rated two out of three ticks for accessibility. The current regulatory framework is supportive of the public healthcare system,

making the baseline highly feasible from a regulatory perspective. Though public healthcare is not directly competing with private industry, the scale of the public healthcare system means that it is awarded three out of three ticks on the last criterion.

Table 13: Feasibility assessment of health models

	Telehealth/medicine	M-health	Public healthcare
	• Limited to Eswatini • Remotely extending the reach of healthcare practitioners • Improved access and use of existing human resources • Reduce time and cost for consumer	• Enables remote health data capture, diagnosis and information sharing • Preventative healthcare solutions • Build local capacity to address health issues	• Tertiary care need to travel to SA • Universal Healthcare Coverage is widespread
Affordability	✓✓	✓✓✓	✓✓✓
Access	✓	✓	✓✓
Regulatory feasibility		✓✓✓	✓✓✓
Market dynamics	✓	✓	✓✓✓
			✓ Low ✓✓ Medium ✓✓✓ High

The feasibility assessment for each model is explained below.

Telehealth

Affordability: Public versus private healthcare likely to impact affordability of digital models. The telehealth/telemedicine model makes use of digital technology to reorganise existing health resources more efficiently for patients and medical practitioners. However, a potentially significant cost driver associated with this model is the reliance on the real-time expertise of

healthcare practitioners, which may make this model unaffordable for lower-income users. Using Eswatini's Clinic Group platform, for example, an individual could still expect to pay around USD20 for a consultation with a General Practitioner and USD27 for a Paediatrician or Dermatologist, both relatively high sums within the Eswatini context. This cost barrier may possibly be overcome in cases where the telehealth model is linked to the public healthcare system, as basic healthcare is provided as a free service. Moreover, stakeholder consultations indicate that this type of model may incorporate a software-as-a-service approach, which places the cost burden on the health institution rather than the customer[21]. For these reasons, this model has been allocated two out of three ticks for affordability. The feasibility assessment indicates around 61,669 users could afford a USD1 monthly subscription for a health-tech product.

Access: Telehealth increases reach of healthcare practitioners in other markets but is limited in Eswatini. In Eswatini, access to telehealth and telemedicine is limited, as there aren't many players in the market who offer this service. Where these platforms are found in other countries in the region, they improve access and create efficiencies around the use of existing human resources, and they remotely extend the reach of healthcare practitioners. Currently, smartphone penetration in Eswatini stands at 54%, while the remaining mobile phone usage is feature or basic phones. Therefore, in cases where telehealth models rely on mobile apps, such as the Vula e-referral app, accessibility for households without a smartphone becomes challenging, undermining their scalability in the short term. Furthermore, the telehealth model may require users to be near a clinic or an intermediary health facility that can collect data and interpret the diagnoses of doctors on behalf of the patient. This may erode accessibility, and therefore this model receives one out of three ticks for accessibility.

[21] In a software-as-a-service model, a sponsor is needed so that use can be free of charge for the end-user. This is as opposed to a fee-for-service model, where the end-user pays per service.

Regulatory feasibility: No dedicated framework. A scan of global best-practice models in the health space suggests that there are a number of regulatory considerations in telehealth and telemedicine. Regulators are concerned over the medical ethics over healthcare officials not seeing the patient in person, as well as the protection of consumer data. According to the 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 Eswatini, there is no general data protection framework as yet. There are several laws and regulations that address aspects of data privacy. These include the establishment of a right to privacy in the Constitution of Swaziland Act No. 1 of 2015, and the Swaziland Communications Commission (Consumer Protection) Regulations, 2016, issued pursuant to the Swaziland Communications Commissions Act of 2013. The Data Protection Bill No. 21/2017 is currently within the parliamentary process and aims to collate all existing data protection legislation. However, this bill has not yet been promulgated into law. The eHealth Strategy 2016–2020 also does not explicitly address telehealth. This raises a question around the extent to which digitally enabled delivery models such as the telehealth model would have sufficient oversight in the Eswatini context (Data Guidance, 2020). All in all, this model receives two out of three ticks from a regulatory feasibility standpoint, as there is no explicit prohibition of this model in existing regulation; however, this is countered by a lack of clear data and consumer protection legislation.

Market dynamics: Limited scale and players in the Eswatini market. The roll-out of telehealth in Eswatini would be supported by the availability of basic infrastructure such as broad access to electrical power through the national grid, extensive cellular network coverage and broadband internet service. However, there is very little telehealth activity in the market, which is likely indicative of challenges to the scalability of telehealth models in the Eswatini market, given the small population. The market may also face demand-side barriers in the form of a lack of openness of individuals to shift away from face-to-face health solutions. A further consideration is the cost drivers for this model, namely the subscription cost and the consultation fees charged by doctors for their services. On the assumption that affordability constraints

would mean that such costs could not be allocated to end-users, it would require there to be a sponsor for software as a service. This adds additional partnership complexity. Hence telehealth receives only one out of three ticks for market dynamics.

mHealth

Affordability: mHealth can be an affordable digital health solution. M-health, 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, as indicated in Table 27 for example mHealth initiative Totohealth charges users only USD0.25 per month to access its service. In South Africa, MomConnect has absorbed the costs to end-users, making it a free service. The fact that mHealth can be provided via USSD and SMS, rather than via an app also reduces the need for data access – a factor that is particularly relevant in Eswatini where data costs are among some of the highest in Africa. For these reasons, this model has been assigned three out of three ticks for affordability as part of the feasibility assessment.

Access: mHealth increases access to simple health solutions in other markets. mHealth models can be provided through SMS and USSD channels. This increases 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 in Eswatini currently limit accessibility for consumers. For this reason, this model has been assigned one out of three ticks for access.

***Regulatory feasibility*: No regulatory barriers per se.** As with telehealth, there is no dedicated regulatory framework pertaining to mHealth in Eswatini and mHealth is not explicitly covered in the Government's e-health strategy. While this may facilitate market entry and operation, it also 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 this is countered by a lack of data and consumer protection legislation.

Market dynamics: The market conditions in Eswatini appear to lend themselves to the mHealth model. First, the mHealth model is geographically agnostic, relying on USSD and SMS channels rather than mobile internet, which is not as ubiquitous as mobile network coverage. Secondly, there is a clear need for low-cost alternative solutions that help to address the existing gaps in the healthcare sector. Finally, the digital payments landscape in Eswatini may be becoming more enabling of digital health models such as mHealth, or for payment of health services more broadly. However, as with telemedicine, scalability may be a challenge given the small population. Furthermore, the fact that there are no players in this market niche yet may be indicative of a lack of perceived opportunities. It is likely that, as with telemedicine, mHealth models may face considerable demand-side barriers to adoption, as people may still expect face-to-face healthcare services. As a result, this model is assigned one out of three ticks.

6.5 Recommendations for Eswatini's health sector

As in other sectors of the economy, the health sector in Eswatini is faced with the need to adapt and integrate ICT in delivering health services, but it remains largely underdeveloped and difficult to effectively navigate where digitally enabled service delivery is concerned. At present, there is little evidence of extensive and sustained activity in this space related to digital innovation. There may be a number of reasons for this, such as a lack of supervisory and regulatory capacity for the adoption of technological and software solutions, poor internet beyond urban areas and consumer awareness of, and ability to use, digitally enabled health models.

Table 14: Key recommendations in the health sector

Proposed solution	Telehealth/mHealth

Partnership opportunity	• Exploring MNO partnership for mHealth • Vula app for telemedicine
Intervention areas	• Consumer and healthcare education campaign • mHealth market making • Coordination and onboarding of healthcare works and clinics to Vula app

Advocacy on benefits of digital health. Considering the current state of healthcare in Eswatini, it may still be some time before there is significant uptake and usage of digitally enabled delivery models. In the interim, however, it is important to consider what steps can feasibly be taken to begin preparing individuals and households for this scenario. There may be an opportunity for FinMark trust to introduce the Ministry of Health in Eswatini to similar initiatives that have been implemented by neighbouring countries as an opportunity to share insights and learnings. For example, the Department of Health in South Africa has implemented several national digital health systems based on the mHealth model, including MomConnect and B-Wise[22].

Market-making role for mHealth. Should FinMark Trust want to directly facilitate the introduction of digital models in the health space, the mHealth model may be the best model to consider for the Eswatini market. The reasons for this are that:

- It has low tech requirements, making it more accessible to a larger segment of the population.

22 The Department of Health in South Africa has launched the B-Wise mobi-site, to help young South Africans seeking medical advice to get information straight from health professionals. B-Wise has allocated times when users will be able to chat live with experts such as psychologists and nutritionists, and general practitioners. To access the site, users have to register so that they can read factual information, view real stories, participate in polls and find their closest clinic.

- It is geographically agnostic and can be operated in most parts of the country.
- The lower cost to set up and the variations in services that can be offered make it a more scalable option for this market than telemedicine, at least initially.

In supporting mHealth market development, FinMark Trust would need to fulfil a market-making role, given the absence of existing models. This would require achieving policy buy-in (building on the initial advocacy as outlined above), as well as advocating for the benefits of introducing an mHealth model with a core local partner already active in digital delivery – such as MTN, given its existing experience on the education side. In Lesotho, for example, the leading MNO has been a key driver of mHealth initiatives. Once buy-in has been achieved, the need for targeted technical assistance can also be scoped out.

Telehealth for healthcare practitioners. In telehealth, the recommendation is to focus on healthcare practitioners rather than end-users. Telehealth can help to make more efficient use of existing human resources. It can make doctors accessible in rural areas and help to provide training to medical professionals. A possible scenario for the Eswatini market is where practitioners or nurses at rural clinics utilise telehealth services to capture patient data and symptoms in real time in a digital format, using tools built into the telehealth software, including video or photo capabilities and diagnostic applications. This data can then be sent to specialists for remote assessment and the diagnosis returned to the clinic once completed. The end-user in this case is therefore the healthcare worker rather than the patient. This would require both the doctor and the clinic worker to have smartphones or internet-based mobile devices that can process larger amounts of data than a typical feature phone. An example of this is the Vula e-referral app, which has limited operations in Eswatini. A possible opportunity here is to support this initiative by connecting them with rural clinics to onboard and train additional healthcare workers and specialists. The fact that the end-user is a healthcare worker rather than a private individual would make it easier to coordinate. However, a public or donor funding partner would need to be onboarded to sponsor the model, as no end-user fees would apply.

7 Conclusion

This report assessed the scope for digital delivery to enhance access to education, energy and health in Eswatini. While the research suggests that access can still be improved across all three focus sectors, there is already a solid baseline of basic service delivery, especially in the energy sector, where the national grid has achieved noteworthy levels of access when compared to other countries in the region.

Though none of the global best-practice delivery models outlined in this report are yet operating at scale in Eswatini, the consultations and stakeholder workshop indicated an acknowledgement by public-sector and private-sector players alike of the potential for these models to play a greater role in improving the basic services ecosystem in the country. In Eswatini's favour is a relatively high rate of digital readiness, including smartphone adoption and broad ICT coverage, coupled with high levels of financial inclusion. Barriers include a small market that limits scalability, high rates of poverty that hamper the financial viability of a number of digital innovations and a lack of dedicated regulation to effectively drive and supervise a harmonised digital strategy – while the Electricity Masterplan and the Rural Electrification Programme does make room for alternative providers in the energy space, the most recent eHealth Strategy[23] has not been followed up by a revised plan for the coming years, and both health and education sector policy and regulatory frameworks are still driven by public service provision.

In the energy space, the already extensive national grid network presents an opportunity to improve access to electricity by focusing on auxiliary services such as payments and introducing smart appliances to better manage household consumption. The need for alternative (SHS or mini-grid) models is less pronounced in Eswatini than in other countries in the region, given the extensive reach of the grid. Nevertheless, there is a potential market systems facilitation role for FinMark Trust in leveraging mini-grid pilots for test-and-

[23] Kingdom of Swaziland eHealth Strategy 2016–2020

learn purposes and in facilitating dialogue around that, as well as in brokering introductions for establishing partnerships that would see SHS or mini-grid providers from elsewhere in the region entering the Eswatini market.

In education, there is scope to explore the potential for digital content to supplement traditional forms of learning, building on the existing pilot by MTN.

In health, we identify fewer direct opportunities, as there is little evidence of extensive and sustained activity related to digital innovation. Here, there would be need for a market-making role: advocating for the role of digital in extending reach or building efficiencies in service delivery and getting this topic onto the policy agenda. There may also be scope for showcasing the one model already on the market and seeking ways to support that to scale.

Across all three sectors, digital payments are likely to play an increasingly important role in enhancing access to basic services going forward. It will, however, be important to foster ongoing public–private dialogue for enabling environment and partnership building across the digital payment, financial inclusion and basic services spheres to ensure that the right balance of cost, sustainability and access be achieved.

Appendix

Market potential assessment assumptions

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

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, the income brackets in the data were adjusted using inflation. 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, solar home systems (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: USD6.40 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, including Sunfire Solutions, The Solar Company, African Clean Energy, Suntransfer, Zonful energy and Solar Works.

    - 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. However, many services that have free access have additional costs, which are carried by the user, and these vary considerably, making it difficult to estimate the size of these markets. Therefore, a USD1 subscription service was chosen, as this is sufficiently close to the cost of many subscription services that are available in these sectors.

- A SEPARC study was used to estimate the portion of household and individual income that is allocated in various expenditure categories, differentiating between urban and rural, including utilities (6% urban, 3% rural), education (7% urban, 10% rural) and health (1% urban, 3% rural). The assumptions that they draw on to calculate CPI includes a breakdown of expenditure categories, which is kept up to date.

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 inflation and convert to dollars.
- Adjust the income grid further by reducing cells to reflect access to feature or smart phones (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. The total is calculated by following the steps above for rural and urban adults separately and then adding the totals for urban and rural together.
- 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:** Less than 7,825 users could afford a Tier 1 SHS based on their likely income, access to a phone, product cost and available income for electricity consumption.
- **Education:** 388,530 to 470,709 users could afford a USD1 monthly subscription for an edtech product.
- **Health:** 43,201 to 61,669 users could afford a USD1 monthly subscription for a health-tech product.

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

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