# THE STATE OF ICT IN LESOTHO (2016)

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The International Telecommunication Union

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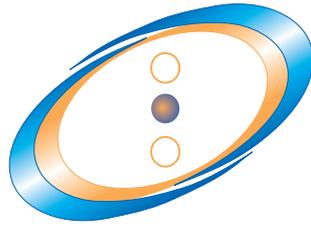
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A U T H O R I T Y

THE STATE OF ICT IN LESOTHO

Table of contents

Acknowledgements

Executive summary

While Lesotho has made significant progress towards its national vision of 2020, it faces several challenges as a small landlocked, lower-middle income country, with mountainous terrain and low population density outside of the capital, Maseru. The five-year National Strategic Development Plan (NSDP) 2012/13 - 2016/17 identified ICTs as the backbone of a modern economy, and contributing to the reduction of risks associated with urbanisation, poor infrastructure, poverty, unemployment and inequality. Yet, currently close to 65% of the population have not accessed Internet.

The purpose of this sector performance review is to establish a baseline for the telecommunications market in Lesotho, focusing on broadband - a system of high capacity, high speed and high quality electronic networks, services, applications and content - so as to assess its progress towards meeting the vision of the NSDP. In doing so, the review identifies the policy, regulatory and market bottlenecks inhibiting sectoral development and recommends policies and strategies to enable the take-off of broadband in Lesotho. This is achieved by undertaking both a supply-side and demand-side analysis of the market. The supply-side assessment of market performance in Lesotho is based on the benchmarking of core public policy indicators such as infrastructure expansion as well as affordable access to services and devices against a set of countries that are similar across a number of variables. The demand-side analysis draws from a nationally representative survey conducted late in 2016 by LCA and it measures ICT access and use. We know from this survey that access to the Internet in Lesotho now stands at 32.7% (see Part 2 below). On this basis, this study identifies bottlenecks in the markets and demand challenges inhibiting take up of the Internet in Lesotho, and makes recommendations to overcome these.

Lesotho fares well in terms of mobile phone penetration with 78.7% of Lesotho residents owning a mobile phone according to findings of the demand side survey. To measure penetration, mobile phone ownership is considered alongside mobile subscription levels. Among the 14 SADC countries, Lesotho is ranked fifth, having a mobile subscription rate of 100.94 with Botswana having the highest penetration rate at 169%, and the lowest being Malawi at 37.94% (ITU, 2016). As discussed below, these figures do not represent unique subscribers, but the number of active SIM cards in the country.

The findings of the demand-side survey shows that 30% of users have duplicate SIMs, which explains the lower individual mobile phone ownership figure in the demand-side report of 78.7%. About 95% of mobile phone owners are prepaid subscribers. It also shows that 4% of mobile phone owners in Lesotho are connected to South African networks.

The survey also demonstrates that, as it did with voice services, the mobile phone plays a significant role in enabling access to the Internet. Among the individuals who reported having used the Internet, about 85.5% accessed the Internet for the first time via a mobile phone. Nonetheless, the price of both devices and services constrains the uptake by non-users as well as the extent of use by users. Hence, the need to develop policies and regulations that assure affordable access to smart devices and services to the low-income earners. From the 2016 user survey we know that only 45% (that is, 32.72% of the entire population) of mobile phone owners have access to a smart device.

Intensity of use is reflected in the amount of time people spend using the internet and the volumes of data usage. Lesotho's international bandwidth per capita which provides some indication of current intensity of use is also far below Botswana, Namibia and Swaziland.

The survey results show that among those who have access to or use the Internet, the frequency of use is high. About 63% of Internet users browse the Internet almost every day, with about 17% connecting to the Internet at least once a week. However, 20% of Internet users only access it once in three months.

The Government of Lesotho, over the years, has been at the forefront of systematically implementing policies and regulatory guidelines of the Southern African Development Community (SADC). It established a converged sector regulator for telecommunications, broadcasting and postal services, and one of the few successful universal service funds on the continent. In line with global reform practice, the MCST is the policymaker and LCA is the implementing agency, with delegated powers of authority to administer rules. The Minister can issue policy directives (regulations) to LCA between policy cycles. There are high levels of coordination between them, with Government consulting LCA on policy issues and receiving input from LCA on policy and legislative reform.

Although the regulator's autonomy is statutorily constrained through the direct appointment of the Board and CEO by the Minister of Communications, Science and Technology (MCST), in practice the Lesotho Communications Authority (LCA) operates with relative autonomy. It enjoys considerable credibility within the industry and is recognised as the ICT sector authority by Government.

The Universal Service Fund (USF) has been particularly successful in delivering on its mandate. The USF has spent its full allocation of funds annually, soliciting additional funding from government for projects and with an administration cost of below 20% of total revenues. Over the last few years, the USF has supported the deployment of 46 base stations to remote areas and the connection of 40 schools to the Internet. As of 2016, 10 schools were provided with mobile labs and Internet access. In the forthcoming year, the USF will be shifting its focus to stimulate demand for broadband in a relatively high-cost, low-income country, by enabling greater uptake, including through the rolling out of public WiFi.

Lesotho was among the earliest of the SADC countries to reform their markets in the 1990s, converting their fixed and subsequently mobile network licences into technologically neutral licences able to offer converged services.

As in other African countries, fixed line subscription growth has been minimal growing from 22 200 prior to partial privatisation in 2000 to 40 570 in 2016. Mobile services on the other hand have grown exponentially, first with voice and subsequently data, though this is still a nascent market in Lesotho. The two network operators, Vodacom Lesotho (VCL) and Econet Telecom Lesotho (ETL), both have extensive networks in which they have invested significantly at various times. VCL has reaped the benefits of extensive investment in its backhaul and access networks over the past few years by being associated with a high quality network, a strategy that sustains its dominance with about 73% of the market in 2016. Although this had over the last 10 years eroded ETLs market share, ETL has seen a turnaround in the last year, clawing back some market share to reach around 23%. In 2012, the Lesotho Electricity Company, which operates a private communication network, was given a public licence which enabled its subsidiary, LECC to be a wholesale player in the transmission infrastructure market. LECC has since extended its dark fibre business across the country providing capacity to VCL and ETL, while linking its own substations.

In terms of creating a regulatory environment to achieve the primary objective of affordable access to communications, the regulator has introduced several licensing requirements for operators that have resulted in the extension of coverage. Together with network extension funded by the USF, there is coverage even in some of the remotest areas. The regulator has also sought to reduce end-user voice prices for through the mandatory reduction of termination rates. The glide path for this was very moderate and initially there was no pass through from the price reduction to end users as was happening in many other markets that were

relatively early introducers of wholesale market regulation. Although the MTR reduction enabled ETL to reduce its prices, ETL's prices are only 20c below VCL. Both companies' prices remained unchanged despite two further annual termination rate reductions. It was only in late 2016 that, after the cumulative effect of the reductions, perhaps together with ETL's consistently lower prices, which resulted in modest gains in market share, VCL introduced a dramatic reduction to its voice prices. This may also be attributable to VCL's awareness of the impact of voice and text substitutable data products such as WhatsApp into the market at a time when both operators' remain extremely dependent on voice revenues. With these cuts, voice prices in Lesotho compare well against the countries it is benchmarked against in this report, but remain relatively high in comparison with best performing markets in Africa.

Data prices on the other hand are relatively low compared with the benchmarked countries. At least part of the explanation for the relatively lower data prices is that both operators have benefited from their principal companies' extensive continental backbone, cross-border networks and participation in several of the undersea cables. VCL is able to benefit from the economies of scale of its pan-African network and ownership of the WACS and EASSy cables[1]. ETL's part-ownership by the Econet Wireless International, which also owns Liquid Telecom, the largest operator of terrestrial cross-border fibre optic networks, enables the use of its extensive fibre backbone and international bandwidth from SEACOM and EASSy. Some of the benefits of the lower international bandwidth cost to the companies are that prices for end-users are relatively competitive. Benchmarking demonstrates that Lesotho's data prices are lower than the average of similar, low population countries such as Botswana, Namibia and Swaziland, and roughly the same as South Africa. However, in comparison to continental leaders such as Kenya and Ghana, data prices are high.

Data prices sit near the continental average, with Lesotho coming in at 22nd on RIA's Africa Mobile Pricing (RAMP) Index[2] of 49 countries, far below several of the continent's best performers and competitive markets that have embraced the shift to data. More than 80% of the network operators' revenues in Lesotho continue to come from voice, providing a weak incentive for operators to drive the switch to data. The rapid increase in the demand for data by consumers in other markets, often stimulated by innovative product bundling, is only gradually having an impact on Lesotho as subscribers move towards Over the Top (OTT) services and away from expensive voice and SMS services. In one comparator country, Namibia, the dominant operator, MTC, offers unlimited SMS and voice minutes for a set price as a strategy to limit the impact of OTTs. Although there is customer freedom to construct bundles with open airtime in Lesotho, the lack of low-cost, high-value bundled services that are stimulating demand elsewhere across the continent suggests relatively ineffectual competition. Price sensitive consumers are able in this way to construct personalised products to meet their specific needs with the offerings of operators, but Internet take up and use is not being driven by the standardised but low-cost, high-value bundles available elsewhere on the continent. Limited product choice is characteristic of the duopoly in the retail services market.

The duopoly is also reflected in the wholesale markets for leased lines and Internet bandwidth, respectively. Internet bandwidth wholesale prices remain relatively high at around M7 000 per MB per second per month while a 1 Mbps leased-line costs around M1,500. The primary demand for wholesale services is from Network Services licensees providing Internet and data services (Internet Access Providers-IAPs) and the deregulated Internet Service Providers (ISPs). Ad hoc bandwidth increases received from international operators and passed through to service providers from time to time reducing the effective monthly price to as low as M2000 per mbps. This is comparatively low but IAPs indicate that it does not reduce their monthly costs for bandwidth and they are largely unable to utilise the additional bandwidth which is more than they need. IAPs,

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[1] EASSy, see http://www.EASSy.org/ownership.html [accessed January 2017]
[2] See www.researchICTafrica.net

who are dependent on purchasing facilities from the two network operators complain about unfairly high wholesale prices, particularly compared to what an IAP across the border in South Africa will pay. Rather than receiving the 'discounts' in the form of increased bandwidth that they cannot necessarily deploy; they want fair prices for the amount of bandwidth required by their businesses. LCA contends however that the IAPs network licences permit cross-border interconnection yet neither of the IAPs have done so. Exploitation of this licence condition may not be feasible, however because of the high cost locally of accessing cross-border services.

In an effort to facilitate regional integration and benefit through lower international bandwidth prices for Lesotho, the Government of Lesotho joined the African Union-Nepad initiative to connect the East Coast of Africa and several of the landlocked countries in East and West Africa to an undersea cable, EASSy. This move followed refusal by the only qualifying operator at the time, Telecom Lesotho, to participate in the EASSy project. The government of Lesotho invested in the EASSy cable through a special purpose vehicle, the West Indian Ocean Cable Company (WIOCC) and LCA was to hold the Government shares in trust. WIOCC also serves as an administrative arm for operating the EASSy cable. Following the efforts to get Liquid Telecom and subsequently VCL to take over the state's shares in WIOCC failed, the shares have remained with LCA. Efforts by LCA to dispose of the shareholding have been thwarted either by the WIOCC Board or the Government.

Although the cable is managed by WIOCC and LCA is not operationally involved - other than paying the annual operations and management fees - the shareholding in WIOCC creates a conflict of interest in the institutional arrangements for the sector with the regulator being both the referee and player in the market. It also undermines the powers of the Authority to exercise its administrative data collection duties as operators are reluctant to provide sensitive commercial data to what they view as, essentially, their competitor.

The potential for competition, and subsequent public good for which the investment in the EASSy cable was meant to create, has not yet been fully realized. This is because, firstly, for some time, there was no access to the capacity as the cable landed at the coast in Mtunzini (South Africa), there was no local Point of Presence (PoP) in Lesotho. When a PoP (also known as a virtual landing point (VLP)) was subsequently established, the service had some teething problems which IAPs feared might jeopardize their business. Among the concerns were the lack of local technical support for the network, and that the network was vulnerable to a single point of failure as there was no redundancy for the PoP. As a result, the IAPs have been compelled to continue purchasing the more reliable and stable connectivity from VCL or ETL.

With the threat of international bandwidth competition when WIOCC was introduced in 2012, data prices of the incumbents dropped significantly, but now it appears these have stabilised. The two network operators that have access to inexpensive, high-speed international bandwidth from their integrated regionally distributed network at internal cost, indicated that they were using WIOCC for redundancy purposes.

LCA conducted a market review in 2015 to establish dominance in the different market segments and particularly any abuse thereof. Cases of dominance were discovered in several markets but no remedies were implemented as no cases of abuse of the dominance were discovered nor reported. The IAPs are concerned about the wholesale prices for transmission facilities and international bandwidth and that they are unable to get relief from the regulator. However, LCA points out that the IAPs have not lodged any anti-competitive complaints with it.

Lesotho's Internet penetration is low at 33% compared to Botswana at 67% and Namibia at 62% (ITU 2016)[3], both of which have much higher income per capita than Lesotho. Since Internet access is mainly driven through mobile phone access, operators in Lesotho attribute the low uptake to high smartphone costs relative to low levels of income. However, countries with lower incomes per capita, such as Uganda and Tanzania, both have multiple competitors in the market and greater penetration no doubt leading to lower prices. The low internet penetration rate is partially explained by the price of data and the cost of smart devices, which are unaffordable for most people as indicated by the demand-side survey.

The price of devices is a factor since, based on the demand-side survey, over 40% of those not accessing the Internet indicated that the price of the devices prevented them from accessing the Internet. Apart from the unaffordable devices for those not using the Internet, another barrier to access is the price of data services. In the demand-side survey, nearly 40% of users indicated that the cost of data limited their use, and 23% of non-users indicated that it was the primary reason for them not accessing the Internet.

Making data more affordable is the primary demand stimulant from a policy and regulatory perspective. Currently, pricing and product offers reflect the lack of competition in the market. The limited number of bundled products and other innovative, small denomination high-value products that dramatically reduce the effective price of voice and data and allow smaller operators in more competitive markets to pressure dominant players, is not very evident in Lesotho. The continued dependence on voice revenues in the fast-changing data market reflects this lack of dynamism.

Key findings

- Mobile network coverage is extensive at 96% of inhabited areas, and phone ownership stands at over 79% of the population. However, mobile out-of-bundle voice prices remain relatively high despite the mobile termination rate reductions introduced in 2012. With the gradual glide-path, the positive effects on end-users were only seen in 2016.

- The relatively high voice prices, reflect the lack of competition in the voice market, with classical duopoly effects leading to these high voice prices.

- Lesotho compares better on data prices, being ranked in the mid-range of the African countries on the RAMP 1G Index. Affordability of devices and data services nevertheless presents a major barrier to the uptake of services and intensity of use. Only 33% of the population has access to the Internet, despite 3G coverage of over 90%.

- VCL is able to leverage its dominance of the mobile market by reinvesting in an extensive, high quality network that is able to further build its subscriber base. The dominance of ETL, particularly geographic dominance, in certain sub-markets of the wholesale national data transmission market, through ownership of an expansive optical fibre network, has affected not only the prices but also the availability of certain critical products, which has chilled service-based competition in the market.

- VCL and ETL are able to tap into the low-cost, high-speed international bandwidth of their principal companies and the undersea cables landing in South Africa, enabling them to offer integrated national and international services at more competitive prices that local providers who have to lease facilities at prices higher than the internal prices at which the network operators are able to acquire it.

- International bandwidth brought into the country through the acquisition of a stake in WIOCC by Government to provide a locally owned strategic resource that would also reduce international

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[3] The 2016 ICT Development Index (IDI) is constructed from 2015 data, though some is earlier than that. The higher figure for penetration rates from the IDI is a result of the measurement used for mobile broadband penetration, which refers to active mobile subscribers, (measure by active SIMs).

bandwidth prices has been unable to maintain the pricing pressure that saw international bandwidth prices come down with its entry into the market in around 2011. In particular, the price of retail dedicated bandwidth remains high at M10,000 for a 1 Mbps per month service by both ETL and VCL.

- There is a lack of domestic presence of WIOCC to manage the network effectively and ensure that the objective of joining the EASSy project, which is lower prices for good quality Internet access for citizens of Lesotho, is achieved.

- There is an institutional conflict of interest arising from the location of WIOCC shares in LCA that undermines its authority as a neutral party in the regulation of the sector.

Recommendations

Lack of competition appears to be inhibiting price and product innovation in the market that would stimulate demand for Internet access. Fundamental restructuring of the market should be considered since the 2016 determination by LCA found dominance in 11 of the 14 markets identified (but no anticompetitive practice). To overcome the extreme dominance in the fixed and mobile markets, the market should be restructured to create more competitive markets. Improved wholesale and services competition is important for creating positive outcomes in the sector. Hence, emphasis should be on enabling service-based competition.

LECC, a subsidiary of Lesotho Electricity Company (LEC), has been successfully rolling out dark fibre offering carrier-of-carrier services to other network operators. If LECC extends its business beyond the two network operators, to provide capacity to the smaller services providers, it would not only improve its own viability but be able to compete more effectively with these two vertically integrated network operators, but it could also enable the smaller players to extend out of Maseru into the wider Lesotho market, making their marginal business far more viable. In doing so, however, LECC would be competing with VCL and ETL which are able to offer a fully integrated bandwidth product with very low international bandwidth charges as a result of them receiving their bandwidth at internal cost to their companies. As things stand, LECC would be dependent on an external international bandwidth provider to offer the fully integrated services that VCL and ETL do.

Allocating state equity in WIOCC to the regulator to hold, as it has been done, produces a conflict of interest in that it makes the regulator a player in the market. This has a negative impact on the wholesale market. It is recommended that a feasibility of transferring the Lesotho share in WIOCC from LCA to LECC be explored. This would not only address the conflict of interest LCA faces but also provide an integrated international and national bandwidth solution to customers and compete on a more equal footing with ETL and VCL. WIOCC equity and capacity could be transferred to LECC, which already has a domestic common carrier licence and operates as an open access network on a cost-plus-recovery basis. This would be highly beneficial to the smaller service providers and may encourage greater use. The move would also allow LECC to offer integrated international and national bandwidth and compete more equally with VCL and ETL at the wholesale level. Subject to the necessary due diligences of all players and establishment of capabilities and resources, placing WIOCC shares in LECC would also address the need for the company to have local management by a company that has demonstrated its ability to profitably operate a common carrier business.

Enabling the entry of a new player in the mobile market may be the only way to remove the duopoly effects in the market. However, there are few incentives for anyone to invest in a small market with such extreme dominance by an efficient operator. Therefore, attaching a mobile licence to the integrated national and

international transmissions and national networks would enable the new entrant to compete more fairly against the incumbent operators that operate fully integrated mobile-fixed networks.

Various markets that are *de facto* monopolies require further review. The wholesale data transmission market appears to be such a market where critical entities such as IAPs and ISPs contend that unbundled leased-lines are priced too high. Otherwise, leased lines are offered at retail rates or they are bundled with services or facilities that they do not need or have already as part of their offerings. In addition, the prices of dedicated bandwidth are high. Although price reductions with significant discounts were lodged with LCA in October 2016, they still appear to be above some of the wholesale prices available for best performing SADC countries such as Botswana and Tanzania.

Regulation compelling vertically integrated operators who compete downstream with IAPs to charge the same for facilities and bandwidth as they charge themselves would overcome this bottleneck. More specifically, ensuring such access to wholesale facilities at fair prices and opening the services market to competition should have the effect of reducing the input costs for service providers, reduce barriers to market entry, increase competition and reduce end-user data prices, which, together with other demand-side stimulation strategies, should improve broadband penetration rates.

The fact that anti-competitive practices were not found in the market review does not mean that the significant market power that ETL has in fixed and national transmission network services market, and VCL in the mobile market, is not being used to consolidate those companies' dominance in the market with negative consequences for smaller players or late entrants. There are many signs of the outcome of this classical duopoly evident in the wholesale market, in the retail voice market, and the absence of product diversity and innovation in the market.

Acronyms and abbreviations

ARPU	Average Revenue Per User
CDMA	Code Division Multiple Access
CEO	Chief Executive Officer
EASSy	Eastern African Submarine Cable System
EIG	European Indian Gateway
ETL	Econet Telecom Lesotho
FTTH	Fibre-to-the-Home
GATS	General Agreement on Trade and Services
GB	Gigabyte
GDP	Gross Domestic Product
GSM	Global System for Mobile Communication
GPON	Gigabit Passive Optical Networks
HHI	Herfindahl-Hirschman Index
IAP	Internet Access Provider (licensed by LCA as Network Services licensee)
ICT	Information and Communications Technology
ISP	Internet Service Provider
ITU	International Telecommunication Union
LCA	Lesotho Communications Authority
LEC	Lesotho Electricity Company
LECC	LEC Communications
LTA	Lesotho Telecommunications Authority
MCST	Ministry of Communications, Science and Technology
MHz	Megahertz
MTR	Mobile Termination Rates
NDP	National Development Plan
NSDP	National Strategic Development Plan
OECD	Organization for Economic Co-operation and Development
OTT	Over The Top
PPP	Public Private Partnership
RAMP	Research ICT Africa Mobile Pricing
RIA	Research ICT Africa
SACU	Southern African Customs Union

SADC	Southern African Development Community
SAFE	South Africa Far East
SAT-3	South Atlantic 3
SIM	Subscriber Identity Module
SME	Small Medium Enterprise
SMS	Short Message Service
SMW3	South East Asia Middle East Western Europe 3
Tbps	Terabits per second
TEAMS	The East African Marine System
USD	United States Dollar
USF	Universal Service Fund
VCL	Vodacom Lesotho
WACS	West African Cable System
WASC	West Africa Submarine Cable
WI-MAX	Worldwide Interoperability for Microwave Access
WIOC	West Indian Cable Company
WTO	World Trade Organization
ZAR	South African Rand

PART A: Supply-side analysis

1. Introduction

In line with modern economies in the rest of the world, the Lesotho Communications Authority (LCA) has embarked on the development of broadband as a pillar for the universal access policy and fund, and is currently in the process of developing a new three-year Universal Service Fund strategic plan. In collaboration with the International Telecommunication Union (ITU), LCA commissioned Research ICT Africa (RIA) to undertake a performance review of the Lesotho ICT sector. This entails an assessment of policy outcomes against their intended objectives. It is done by conducting a comprehensive supply-side analysis of the market together with a nationally representative demand-side survey that focused on ICT access and use. It is only with this information that the exact points of policy intervention can be identified and strategies to address the gaps developed.

The purpose of the study is to establish a baseline for ICT sector performance in Lesotho, and propose policies and strategies that will support the transformation of the country towards a more knowledge-based economy. The focus is therefore on broadband. However, in order to achieve universal access to broadband, a baseline of the entire industry needs to be undertaken to establish where Lesotho is currently and to devise appropriate strategies to achieve its vision. For these reasons, the review looks at the entire ICT ecosystem. This holistic view reveals the linkages between policy and markets, the different elements of the value chain, and the impact of institutional arrangements on the market, to better inform evidence-based policy and regulation.

RIA worked closely on the supply- and demand-side studies with LCA. The supply-side analysis was dependent on the quality of data received by LCA from the operators. The authors would like to thank those who responded to the request for information and those who made themselves available for the invaluable interviews. However, data gaps exist in information required for the supply-side analysis and in some cases best effort with the available information and supposition has had to suffice.

2. Country context

Lesotho is 30 355 square kilometres in size, landlocked and encircled by South Africa. Its population is around 2 million and is homogeneous with 99.7% speaking Sesotho (English is used for conducting business). The Lesotho consists mainly of mountainous terrain and is the only country in the world that lies entirely above 1 000 metres in elevation, with over 80% of the country lying above 1 800 meters in altitude. Its sparse population and mountainous topography make infrastructural development, such as telecommunication networks, challenging. Because of its landlocked position and strong economic ties to South Africa, Lesotho's transport and communications network is interconnected with its only neighbour. Lesotho, also has a weak economy which generates USD2 billion a year in GDP. Its landlocked status, small population and rugged, mountainous terrain constrain the sectoral composition of growth made up of agriculture and mining, compared to the regional average. The largest contributors to GDP are finance, real estate, business and other services coupled with wholesale and retail trade. Communications contributed 7.3% to GDP in 2014 in conjunction with transport and storage (World Bank 2016).

The African Development Bank projected a growth rate averaging 4.9% over 2015–16 (AfDB 2016), although the World Bank's projected growth rate of 2.6% for Lesotho in 2016 may be more realistic due to weak growth prospects in South Africa, lower Southern Africa Customs Union (SACU) revenues and low global growth prospects (World Bank 2016). Inflation, at 5.6%, is projected to decline over the medium-term along with a moderate increase in private consumption due to wage increases.

Table 1: GDP by sector (Percentage of GDP at current prices)		
Sector	2010	2014
Agriculture, forestry, fishing and hunting	8.5	8.0
of which Fishing	…	…
Mining and quarrying	6.5	8.9
of which oil	…	…
Manufacturing	14.1	9.7
Electricity, gas and water	4.6	5.2
Construction	6.6	8.1
Wholesale and retail trade; repair of vehicles household goods; restaurants and hotels	9.3	11.4
of which hotels and restaurants	1.3	1
Transport, storage and communication	6.9	7.3
Finance, real estate and business services	17.4	17.9
Public Administration and Defence	12.7	10
Other services	13.4	13.5
Gross domestic product at basic prices / factor cost	100	100

Source: World Bank, 2016

Lesotho is a member of the Southern African Development Community (SADC), SACU, the New Partnership for Africa's Development (NEPAD) and the African Union (AU), each of which offer export development and trade opportunities. The country also enjoys preferential trade agreements with the European Union (EU) under the African, Caribbean and Pacific/EU protocols, and with the United States under the African Growth and Opportunity Act (AGOA). These trade agreements provide opportunities to address the constraints it faces as a small market.

Lesotho's Science and Technology Policy 2006–2011 notes that many of the opportunities and concessions offered under these partnerships have not been fully exploited because of low value-adding capacity and weak infrastructure. Since 2006, telecommunications infrastructure has developed considerably, with three international gateways offering access through South Africa to EASSy, WIOCC, Seacom and WACS. The national backbone and backhaul networks are relatively well extended across the country by the two national network operators, VCL and ETL, which have together rolled out extensive mobile networks with 3G coverage over 90% of the population.

While this has resulted in extensive uptake of mobile voice services despite relatively high prices, Internet penetration remains low by regional standards; even with the relatively low data prices. International bandwidth per user in Lesotho is only 3 862 bits per second compared to Namibia at 22 546 bits per second and South Africa at 1 476 730 bits per second (ITU, 2016).[4] One of the major factors contributing to this is the absence of local content.

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[4] *International Internet bandwidth* refers to the total used capacity of international Internet bandwidth, in megabits per second (Mbit/s). Used international Internet bandwidth refers to the average traffic load of international fibre-optic cables and radio links for carrying Internet traffic. The average is calculated over the 12-month period of the reference year, and takes into consideration the traffic of all international Internet links. If the traffic is asymmetric, i.e. if there is more incoming (downlink) than outgoing (uplink) traffic, the average incoming (downlink) traffic load is used. The combined average traffic load of different international Internet links can be reported as the sum of the average traffic loads of the individual links. International Internet bandwidth (bit/s) per Internet user is calculated by converting to bits per second and dividing by the total number of Internet users.

This report examines the factors contributing to the mixed policy outcomes in the country. It identifies the bottlenecks preventing the country from reaching the critical mass required for broadband to stimulate economic growth and development.

3. Approach to sector performance review

The approach adopted for this report views ICTs as an ecosystem of dynamic global and national governance institutions, markets, operators and citizens, with the health of each part of the ecosystem dependent on the other. Broadband is a critical element of this broader ICT ecosystem, which has been defined as a system 'of high capacity, high speed and high quality electronic networks, services, applications and content that enhances the variety, uses and value of information and communications for different types of users (South Africa 2013). The ecosystem approach emphasises both demand and supply side factors at play and this requires an overarching vision and integrated implementation plan.

In this context, the sector performance review measures policy outcomes in the ICT sector against national policy objectives – the primary policy objective in Lesotho being the universal access to affordable communication services for its citizenry. The cross-cutting nature of ICTs makes it no longer possible to assess the progress towards achieving national ICT objectives by examining the telecommunications sector alone. The ability of countries to harness the benefits of ICTs is dependent on the broader institutional endowments of the country, its absorptive capacity both in terms of human development and how conducive the policy and regulatory environment is for investment and innovation.

The policy, and ultimately law, determine the institutional arrangements that delegate powers to the dedicated sector regulator responsible for the implementation of the policy and the realisation, if the policy is successful, of the national objectives. The degree to which the regulator has the autonomy from government and industry to impartially implement policy is assessed. The institutional design of the national regulatory authority, the appointment process, and its capacity, both human and financial, all determine its ability to regulate effectively – a factor vital to creating a fair competitive environment, which the policy and law identify as the primary mechanism to deliver affordable access to enhanced communication services.

In order to create a competitive environment, several iterations of law have restructured the market from a public utility in the 1990s, liberalising first the mobile market and ultimately creating a horizontal, technologically neutral licensing regime to enhance competition. The degree to which the duopoly that resulted is able to deliver competitive outcomes is assessed in the report.

The diagnostic approach used in this report enables not only the measurement of the performance of the sector but also the factors determining positive or negative performance. As part of the diagnostic exercise, key indicators are benchmarked on the basis of carefully constructed components to provide greater analytical power than may be available in generalised rankings or indices. Benchmarking is a process of identifying ways to improve performance and integral to this process is identifying the cause of a country's performance. It facilitates the comparison between a specific set of relevant countries on the basis of a set of indicators. These indicators are selected on the basis of the policy issue being analysed in that they represent the outcomes of past policy interventions (or their absence). Countries selected for the benchmarking exercise are selected on the basis of similar characteristics – population size, land-locked, economic development, and economic communities, best performers, and so on. Depending upon the selection of countries, the comparison of an indicator may change from favourable to unfavourable. It is this supply side data together with demand side insights that provide the evidence base for specific points of interventions by policy makers and regulators.

Policy outcomes are assessed against the key indicators of the policy objectives:

Infrastructure: Infrastructure requires investment and fair competition provides an incentive for mobile operators to invest in infrastructure. The analysis measures both the extent and quality of infrastructure available in a country. The extent of infrastructure is measured by network coverage – how much of the population has access to mobile signal. The level of investment is further expressed as investment per subscriber.

Access: The category of access is defined by a set of indicators capturing the prevalence of mobile connection devices as well as Internet use. Access is linked to affordability because lower prices mean greater access and increased use.

Affordability: Price is a key indicator of the level of competition in the sector. The prices of mobile voice and data services are the starting point for any assessment of the sector's performance. If mobile voice and data prices are high in comparison to the benchmarked countries, then the causes of high prices need to be assessed. In most countries, the mobile voice market is maturing and prices have been in steady decline. In comparison, mobile data is a rapidly growing market and prices are far more volatile. In countries where both voice and data prices are high, there are usually significant obstacles to increased access and usage.

Usage: Usage measures the consumption of mobile services such as voice and Internet. Content is a difficult indicator to assess due to the global nature of the Internet: content is consumed from around the world. However, local content remains a critical indicator of use. With the known limited number of local websites and applications to assess user generated content, the analysis measures locally generated content by the number of Facebook users.

Competition: The competition component is in fact a policy instrument or means of achieving policy objectives rather than a policy outcome in and of itself. It is included as an indicator because it has been identified as such and therefore cuts across the other components for analytical purposes. Fair competition in the sector leads to reasonable returns on investment for operators and affordable prices for end users. Competition is measured by a concentration measure (the Herfindahl-Hirschman Index) but the degree to which it is present in a market determines the degree to which other indicators are progressing towards the attainment of national objectives.
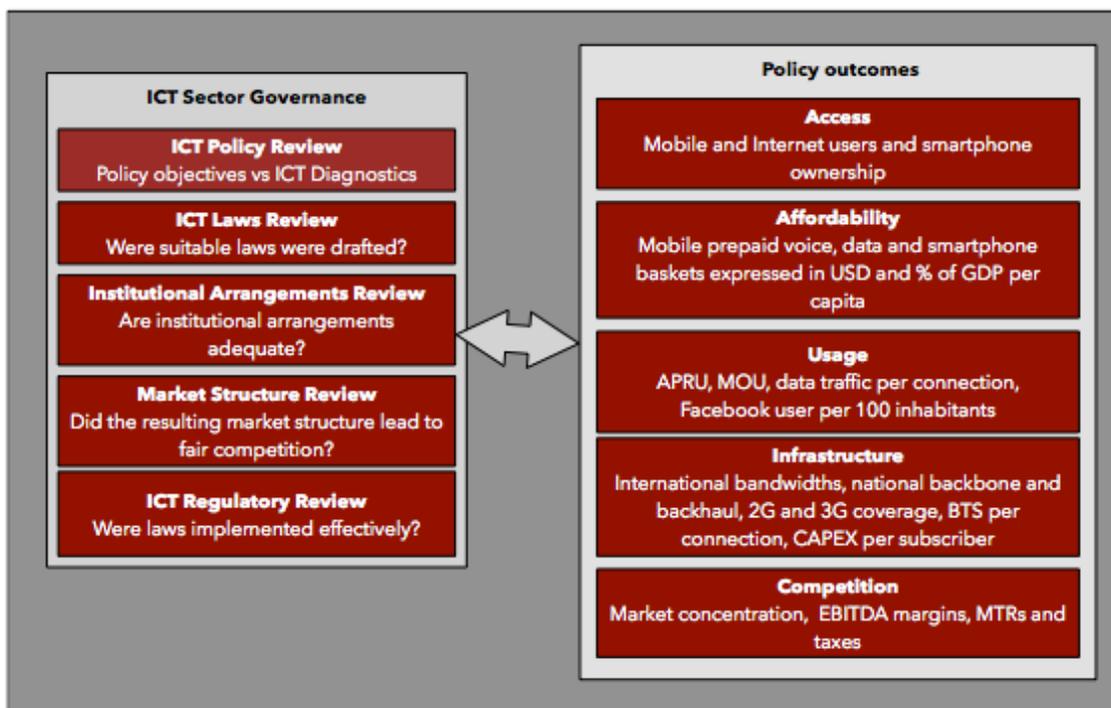
Figure 1: Analytical framework for sector performance review

4. Policy, legal and regulatory framework

The ICT and communications policy and legal domain has been dynamic within Lesotho over the last decade and a half. The market was liberalised in the late nineties and since then a slew of policy and legal interventions have taken place to keep on par with the fast pace of technological and structural evolution within the sector. Five broad policy documents and significant Acts for the ICT and communications sector are reviewed in this section; the Lesotho Telecommunications Policy of 1999, the ICT Policy of 2005, Lesotho's Communications Policy of 2008, the Communications Act of 2012 and the National Strategic Development Plan (NSDP) between 2012/13 - 2016/17.

4.1 Market liberalisation and the Lesotho Telecommunications Policy of 1999

The Lesotho Telecommunications Policy of 1999 was adopted to facilitate the process of policy reform and liberalisation of the telecommunications sector in accordance with the SADC protocol on Transport, Communications and Meteorology. The liberalisation was to take place in recognition of the sector as a stimulus to socioeconomic development, to take advantage of international technological development, and to create a stable and transparent framework to encourage investment in the sector whilst stimulating competition. The Telecommunications Policy of 1999 was set up to ensure the appropriate institutional framework for policy formulation, regulation and operations in the telecommunications sector.

In line with telecommunications reforms taking place globally at the time, a key mandate for the policy was the establishment of a communications authority, from which the Lesotho Communications Authority (LCA) was born. The other key objective of the policy was to expand network penetration and quality of service. In line with international trends at that time, the policy mandated the partial privatisation of the fixed network operator, the Lesotho Telecommunications Corporation (LTC) (LCA 2006). Despite initial increases in ICT access and the entry of a second mobile carrier Econet Ezi-Cel, (part of the Econet Wireless Group) which later merged with Telecom Lesotho (April 2008) to create Econet Telecom Lesotho (ETL), the outcomes failed to deliver on policy objectives. Access to fixed, wireless and Internet services remained limited,

especially in parts of the country where population density was low. The small market has also meant that the incentives for increased competition in network services were low.

ICT Policy 2005

The Government adopted the ICT Policy 2005, to ensure that Lesotho would be able to function as a fully integrated member of the information society. The ICT Policy of 2005 was meant to supersede the Lesotho Telecommunications Policy of 1999, taking the mandate of deploying ICT infrastructure further so that Lesotho's Vision for 2020 and poverty reduction goals could be achieved. At the time of policy formulation, less than 1% of the population had fixed broadband access, less than 3% owned a fixed telephone line, and mobile phone penetration was only almost 13% (ITU 2016).

The policy sought to define ICT and its role as the centre-piece for development, the goals of which were to:

- increase wealth creation and improve welfare through the adoption and use of ICTs;

- promote affordable universal access to ICT products and services;

- promote effective regulation of the sector by establishing rules that support competition;

- protect the consumer and create a level playing field among operators and encourage local and foreign investment in the ICT sector;

- increase ICT literacy levels in the country;

- coordinate the implementation of ICTs throughout the economy; and

- develop the human capacity in ICTs to meet changing demands of the national and global economy, to develop standards, practices and guidelines to support the deployment of ICTs and to provide mechanisms for empowering local participation of Basotho in the ICT sector.

The policy also listed the deployment of a national broadband backbone as one of its objectives, along with local content creation, and a strengthening of the ICT institutional, legal and regulatory framework. To achieve these goals, the policy outlined the roles of key stakeholders, including government, the regulator, the private sector, educational institutions, civil society, and international organisations and development partners. A comprehensive strategic framework was outlined for achieving the Government's broader development goals through ICTs, focusing on areas such as ICT infrastructure, e-Government, e-commerce, education and human resource development, health, and gender and youth. The policy never reached implementation and was overtaken by the 2008 Policy. Each of these areas has its own objectives, measures and initiatives outlined in the policy (see Ministry of Communication, Science and Technology 2005).

The policy lacked a clear and concise broadband plan for the country, which should include policy interventions on not only the supply side in relation to infrastructure but also demand stimulation measures, including affordability, skills and content development.

Lesotho Communications Policy 2008

Building on the 1999 and 2005 policy, the Lesotho Communications Policy adopted in 2008 established an updated institutional framework for the integrated regulation of the telecommunications broadcasting and postal sectors, the latter having not been covered by the initial policy of 1999. The updated policy seeks to address the challenges that remain despite liberalisation of the market a decade earlier, in particular access to fixed wireless and Internet services, which remained low, especially outside the capital, Maseru.

The aim of the Lesotho Communications Policy of 2008 was to provide the basis for a new Communications Act, (passed in 2012), which replaced the original LTA Act, and to lay the foundations for transformation and regulation of the postal sub-sector. The policy aims to achieve the following goals:

- Regulatory reform: Strengthening of the regulatory capacity of the Lesotho Communications Authority (LCA).

- Convergence: The policy is meant to reflect and promote the convergence of services and networks based on the Internet.

- Universal service: The policy will foster universal access to a diverse range of high quality communications services at affordable prices, including advanced networks in order to enable Lesotho to participate in the global information society.

- Competition: The policy is meant to promote a competitive communications market. In particular, the policy will facilitate the cooperative deployment and sharing of infrastructure, avoiding duplicative deployment of infrastructure and promoting service-based competition.

The converged regulatory regime proposed by this policy is consistent with the SADC Protocol on Transport, Communications and Meteorology and the WTO Telecom Reference paper. Through this updated policy, the Government established a universal service fund, to ensure that citizens had access to communication services regardless of geographic location or economic status; promote a coordinated approach to the regulation and broadcasting sectors, encourage private sector investment in network infrastructure, commercialise the post office, and ensure regulatory independence. The 2008 policy also adopts safeguards to prevent anti-competitive practices by entities with significant market power; adopts competitively neutral, transparent and non-discriminatory universal service criteria; makes licensing criteria publicly available; and adopts transparent procedures to facilitate agreements that allow for cost-based interconnection costs (see Ministry of Communication, Science and Technology 2008). The policy lay fallow for several years though and it was only in 2012 that the Communications Act was passed.

Communications Act of 2012

The Communications Act of 2012 sought to set out the terms for the regulation of the telecommunications, broadcasting and postal sectors.

Table 2: Policy and regulatory environment		
Regulatory area	**Purpose of policy**	**Outcomes**
Lesotho Communications Authority	• specifies the general duties and powers of the authority and details surrounding the organisation and operation of the Authority. • Minister shall appoint and may remove the chairman of the Board, as well as the CEO, bringing into question the extent of separation of powers within the regulator. • provisions on the finances of the Authority and liability insurance are included in the Act	Appointment process and powers bring into question the extent of separation of powers within the regulator
Competition management:	• provides for competition management regarding the classification of dominant licences, abuse of power, anti-competitive behaviour and competitive safeguards.	LCA has conducted a market review which found dominance 11 of the 14 markets identified, but it did not find abuse of dominance and thus no remedies have been applied. From other evidence gathered for this report a review of the competitiveness of in fixed line wholesale market seem necessary in the light of the prices and failure to offer basic services.
Interconnection:	• agreements involving a dominant player and individualised interconnection agreement clauses are all spelt out. Grounds for rejection of an interconnection agreement include charges that exceed the dominant licensee's cost including an allowance for a reasonable rate of return.	Seamless communication between competing networks
Universal Service Fund:	• rules under which the Fund is to be established, including financing and the operation thereof.	Established in 2009 and successfully implemented.
Broadcasting:	• covers broadcasting licensing including public, private commercial and community broadcasting services. • provides for the establishment of a Broadcasting Disputes Resolution Panel (BDRP) and a Broadcasting Code of Conduct.	Licensing regime exists as well as the BDRP (set up in 2013). Broadcasting rules also in place since 2004.
Postal Services:	• LCA is authorised to grant licenses for public and commercial postal services, under rules developed by it. Postage rates are regulated according to the act.	Implemented but no new licensees.
Enforcement and Transitional Proceedings:	• LCA is authorised to conduct investigations and initiate enforcement proceedings in the event of it having reason to believe a party has contravened the Act. Penalties are payable by guilty parties	Investigations have taken place in areas relating for the illegal use of spectrum and remedial measures have been taken, including the imposition of penalties. In the area of content broadcasting, enforcement proceedings have taken place in response cases broad to the BDRP.

4.2 Broadband draft policy - 2015

The draft National Broadband Policy - 2015, which recognises the importance of making broadband services available and affordable to the economy, was prepared but there has been no progress on its adoption. Failure to do so has meant that the relevant policy objectives have not been met. The policy further aims to ensure that the market for broadband services operates competitively to attract and sustain ongoing investment, market entry, and continued growth of broadband and other services in Lesotho. The policy also recognises the challenges that Lesotho is faced with, especially the huge investment costs needed to roll out communications infrastructure in rugged mountain landscapes, with an underdeveloped road and electricity networks, and sparsely populated rural areas.

The policy acknowledges the mobile sub-sector as the immediate source of competitive access which should be matched in terms of fixed infrastructure access, including backhaul. As such, the Government stipulates that it will only intervene and establish its own backhaul capacity if the private sector fails to do so in a timely manner and on reasonable terms, particularly in the highlands and rural areas. This is seen as a last resort and such government intervention, if required, will be in partnership with the private sector, such as through a public private partnership or a similar arrangement. Without implementation of this policy, these sound strategies cannot contribute to fulfilling policy objectives. The MCST, during interview, indicated that it intended to appoint consultants to assist with the development of an implementation strategy for the policy once adopted.[5]

4.3 Vision 2020 and the National Strategic Development Plan (NSDP)

Lesotho's Vision 2020 is a strategic document that identifies the long-term developmental objectives of the country. The vision is that:

> *By the year 2020 Lesotho shall be a stable democracy, a united and prosperous nation at peace with itself and its neighbours. It shall have a healthy and well-developed human resource base. Its economy will be strong; its environment well managed and its technology well established.*

The vision is based on several pillars of development including democracy, unity, peace, education and training, economic growth, gender equality and technological advancement. In its reference to technology, the document clusters together information, communications, science and technology.[6]

Lesotho's National Strategic Development Plan 2012/13 - 2016/17 recognises the importance of developing the ICT sector and its associated infrastructure[7]. The strategic objectives from the NSDP relating to ICTs are the following:

- *Improving of ICT infrastructure and access:* This is to be achieved through connection to the EASSy undersea network; reconstituting the national backbone; promoting investment in network infrastructure; facilitating infrastructure sharing; enhancing competition; and increasing customer choice, quality and competitive pricing of services[8].

- *Improving ICT literacy and increasing the extent of ICT use:* This involves ICT roll-out strategies for schools, community education and information programmes, promotion of private service provision (for example Internet cafes) and undertaking research to identify solutions to banking, health, public service

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[5] The MCST indicated late in 2016 that a company had been contracted to develop a broadband plan for Lesotho that would be finalised in the course of 2017.

[6] See http://www.gov.ls/gov_webportal/important%20documents/lesotho%20vision%202020/National_Vision_Document_Final.pdf

[7] See http://www.gov.ls/gov_webportal/important%20documents/national%20strategic%20development%20plan%20201213-201617/national%20strategic%20development%20plan%20201213-201617.pdf

[8] See the WIOCC sub-section below under 'Infrastructure' for details on implementation.

delivery. Private service provision approaches, such as Internet cafes, have quickly become dated. As mobile and smart technologies become increasingly widespread, the potential for alternative demand stimulation interventions has increased, making m-banking, m-health, and m-government services easier to deliver and within closer reach of the user.

- *Promote innovation and develop niche ICT sub-sectors:* This objective as listed in the NDP is unclear. The aim seems to address the critical demand stimulation dimensions of a successful ICT system to a modern economy. It takes an industrial competitive analysis, regulatory review and a national ICT industry development strategy to promote research in the ICT sector including skills-building. More effective ways of providing incentives and promoting innovation include stimulating local content creation and the creation of ICT research institutes, perhaps under a wing of LCA.

- *Facilitate smooth migration from analogue to digital:* This includes the installation of appropriate technology, and the development and implementation of public education programmes. Building of transmission infrastructure has been completed, but the country remains on analogue due to the failure of RSA to successfully migrate to digital. There is also a lack of readiness on the content side, and studio facilities only now under construction. Lesotho was more or less ready to switch from analogue to digital by the ITU 2015 cut-off, other than some remote areas that required road development to reach. Lack of readiness on the content and studio facilities side has also delayed switchover. However, being surrounded by South Africa, it has to wait for South Africa's delay switchover to take place before it can do so (Interview MCST: 2016).

- *Enhance e-Government services and institutions:* The aim of the plan is to consolidate/update the existing e-Government strategy, including alignment at central and local levels to undertake an institutional review, to facilitate accelerated and efficient implementation of the e-Government strategy, and to develop an e-Government implementation plan and multi-year budget. However, this has progressed very slowly and has not achieved the desired objectives. Given the impressive development in the telecommunication infrastructure, it was expected that by now the e-Government initiative would have made considerable strides towards its intentioned goals, but the few e-Government initiatives undertaken have become redundant and require a new integrated strategy (Maphephe 2013; Mathaha 2015).

Overall, ICT legislation, strategies and plans issued by the Lesotho Government are comprehensive; however, implementation remains challenge. The Government has made good on keeping the legislation and regulation in the sector up-to-date with technological developments and arising sectoral and market-related needs. The themes of infrastructure expansion, investment and human development, as well as universal access and use, still form the backbone of any forward-looking ICT policy in Africa. Although these are identified in several policies, and there appears to be some progress on the supply-side with successful mobile, and backhaul and backbone extensions, demand stimulation, which is the major driver of broadband take up to which the policy attests, shows little signs of progress.

Recommendation: Develop a clear broadband policy and implementation plan with clear strategies, and targets and budgets not only for infrastructure, service and quality of service, but also to address problems of affordability, digital illiteracy, the shortage of e-skills and higher-level professional skills, and content development constraints – all of which should be directly linked to sectoral targets.

5. Legal and Institutional Framework

Lesotho is a constitutional monarchy that became independent in 1966. Executive power is vested in the Government, led by a Prime Minister. The bicameral parliament consists of a 120-member National Assembly, and a 33-seat Senate, with 22 principal chiefs and 11 other members appointed by the King (United Nations 2004). The Parliament is responsible for the passing of all legislation, which is implemented by the line ministries and specialised agencies, such as the national regulatory authority in the communications sector, with delegated powers to introduce regulations or secondary legislation.

Lesotho has closely adhered to global telecommunications reform initiatives stipulated in the WTO GATS and supported by the International Telecommunications Union (ITU) and the international development banks. Its institutional arrangements reflect the prerogative of policy making to be that of Government and the location of this is the Ministry of Communications, Science and Technology (MSCT). A national regulatory authority, the Lesotho Communications Authority (LCA), was established in 2000 to regulate the telecommunications, broadcasting and postal sectors in acknowledgement of the convergence of delivery platforms in the sector.

5.1 Lesotho Communication Authority (LCA)

First established as the Lesotho Telecommunications Authority (LTA), the regulator had the mandate to regulate the communications sector in Lesotho through the granting of licenses to operators, promotion of fair competition, approval of tariffs, management of radio frequency spectrum, protection of consumers, approval of terminal equipment, and other such activities. In 2012, the name of the agency was changed to LCA with an extended mandate to manage the regulation of the postal sectors in addition to telecommunications and broadcasting.

According to the Communications Act No. 4 of 2012, LCA's mandate formally includes:

- promoting, developing and supervising the provision of efficient local, national, regional and international telecommunication services in Lesotho;

- taking all reasonable steps to promote network development, universal service and access to telecommunication services;

- ensuring the efficient and effective use of the radio frequency spectrum;

- promoting the range and quality of telecommunication services and other consumer interests;

- promoting efficient management and human resource development within the telecommunication sector;

- promoting private ownership of telecommunication operations;

- promoting sustainable and fair competition between telecommunication service providers;

- collecting and disseminating information for use by the industry, consumers and prospective investors;

- taking reasonable steps to promote telecommunication services that will satisfy reasonable demands of the least advantaged members of the communities for the provision of services such as emergency services, public call box services and directory information services; and

- representing Government, in consultation with the Minister of Communications, in international matters relating to telecommunications.

The 2012 Communications Act of Lesotho dictates that the Board of LCA directors (seven) members including the Chairman, with the CEO the only executive member) is appointed by the Minister and may be removed only by the Minister. The Board of LCA is responsible for recommending candidates for the Chief Executive Officer (CEO) position to the Minister who may then decide whether or not to appoint the candidate. The Board can likewise recommend the CEO be removed, but it is the Minister's prerogative to refuse such a recommendation.

The 2012 Act further stipulates the Authority's financial requirements, such as the need to submit an annual budget to the Minister responsible for communications and information, for information rather than approval. The annual budget illustrates the distribution and use of monies and fees collected by LCA as well as for any services, licences, penalties, grants, contributions or endowments received from other sources. The only further interaction with the arms of the Government entails the submission of an annual report that includes audited financial statement.[9]

Although the appointment of the Board and the CEO on the recommendation of the Board are approved by the Minister, the regulator currently operates without political interference.

Recommendation: To safeguard the autonomy of the regulator to implement national policy without state or industry interference, appointment of the Board should be made following the procedure prescribed in the Communications Act 2012. This will ensure a transparent nomination and appointment process. Nominees should be those demonstrated to be qualified and appropriately skilled for the job. The Board should be made responsible for the appointment and monitoring of the performance of the CEO, who should be the principal accounting officer for the institution. The Board and chairperson should not be removed from office until the end of their term, unless Parliament finds them unfit for office against a standing and transparent set of criteria.

5.2   The Universal Service Fund

In an effort to address the challenges of affordable universal access to ICTs, and voice services in particular, a dedicated universal service fund was established in 2009. The Communications Act 2012 extended the mandate of Universal Service Fund (USF), to include broadcasting and postal services. The USF seeks primarily to address the particular challenges Lesotho has in ensuring rural access to communication services. It executes its mandate based on Strategic Business Plans (SBPs) that follow a three-year cycle. The SBPs are developed under the Lesotho Communication Authority Act of 2000 and the Communications Act 2012. Annual contributions of 1% of net operating income from licensed network operators are payable to LCA. However, the Act provides for a levy of up to 2% of the net operating income. LCA also contributes 25% of its annual surplus.

The Act provides for a mandatory annual work programme to be adopted by the Fund and for the Fund to account for the use of its resources.   The Fund has adopted a three year planning cycle which forms the annual work programmes. Between 2009 and 2014, the strategic focus was on facilitating access to voice services in unserved and underserved areas. From 2014, the strategy shifted more to broadband. Both VCL and ETL were contributors to the Fund. They were also beneficiaries as they received subsidies to extend their networks to the unserved and underserved areas. Between 2009 and 2016, the programme benefited at least 110 000 people in 320 villages in rural areas of the country.. For the period 2009–2017, a total of 46 base stations were commissioned and five were under construction.

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[9] While the Act makes a provision for appropriations from Parliament to the LCA budget, the LCA has been financially independent of government since inception, other than a capital injection in 2000 for capital expenditure.

The Fund has also provided assistance to the Lesotho Internet Exchange Association during the implementation of the Lesotho Internet Exchange Point (LIXP) – established in 2011 with the objective of ensuring that local traffic is routed locally to improve performance and security in the event of a break in international links. However, due to the lack of local content and most websites hosted out of the country, these objectives are not currently being met.

The current SBP is for the three-year period from 2014/15 to 2016/17 and consists of the following objectives:

- Mobile network expansion in unserved areas: Half of the Fund's annual budget is allotted for this programme, the priority being to expand broadband to the rural areas. The operator demanding the lowest subsidy is awarded a network expansion project and, as of 2015/16, all infrastructure built should be of third generation technology or beyond. With the potential of duopoly behaviour and associated price setting, it is important that the regulator undertakes benchmarking studies to ensure the prices being proposed are cost based.

- Broadband and ICT development for the education sector: 40% of the Fund's annual project budget is allocated to broadband and ICT development for the education sector, focusing on unserved rural areas and underserved urban areas. The Fund works with the Ministry of Education and Training (MOET) to ensure that schools have access to ICT services and tools for learning. As of 2016, 40 schools were funded.

- Postal services: The postal service sector is a new area for the Lesotho USF. The Fund plans to allocate 5% of the USF budget to undertake a demand study, gap analysis and regulatory framework for the postal sector in order to determine a strategy to deliver universal postal service to the entire country.

Due to its nature, Lesotho is mountainous and a number of rural areas lack electricity and quality roads. Hence, in order to speed up the process of connecting the poor, the agency spends 20–25% of its budget on road and electricity infrastructure. Following the objectives of the 2014–2017 Strategic Plan, the Fund's budgetary allocation is as follows:

Figure 2: USF Budgetary Allocation
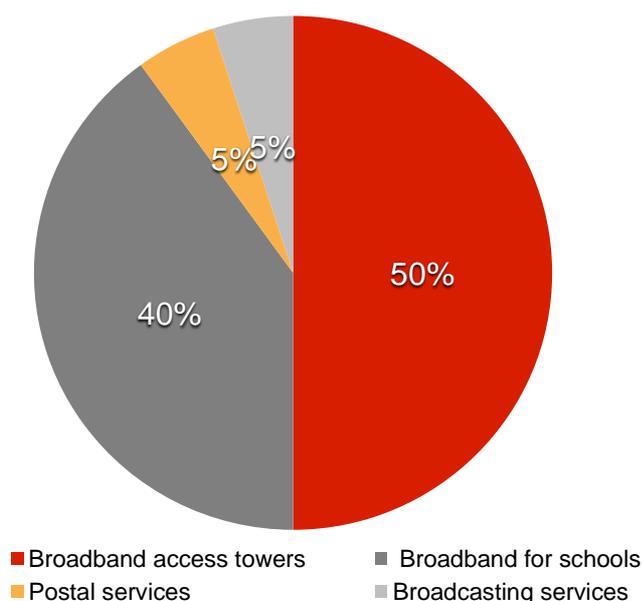
Source: LCA (2016), USF Strategic Plan 2014–2017

In 2013/14, the agency tilted its scope towards the development of infrastructure for broadband Internet with the support of the ITU. The project supported the purchase of WI-MAX equipment at the time that the

operators were already using that spectrum to roll out 4G/LTE services and, as a result, the equipment was never deployed. The multi-million contribution of the Fund to the project also did not yield any positive outcome. In the same year, the Fund experienced a higher demand for services in unserved areas than it was able to supply. This led to six projects for mobile network expansion being deferred to 2014/15 (Nthabiseng Pule interview with My Broadband 2014).[10] During the 2014–2017 planning cycle, the Fund anticipated revenue collection of between M11.5 million and M12.5 million per annum.

In 2016/17, the agency intends to complete five base stations, which will increase the number of completed base stations from 46 in 2016 to 51 base stations by the end of April 2017. In the same period, 10 schools were provided with mobile labs, with each lab consisting of 24 laptops, a projector and projection screen, and a storage cabinet for the laptops. The agency also trained teachers.

Although universal service agencies and funds have been introduced in many African countries during the reforms in the 1990s and the first decade of this century, these universal access strategies have largely not been successful. Funds collected from operators have gone unspent and universal services objectives not met. Lesotho is among the few countries in Africa and indeed around the world where the USF has spent its annual budget effectively. The agency has committed to using 80% of the funds on project expenditure and 20% on administration.

Table 3: USF Project and Administration expenditure			
Year	Income	Projects expenditure	Administration expenditure
2012	12.1	11.4	1.1
2013	12.9	15.5	0,8
2014	11.5	11.1	1.1
2015	13.25	8.9	1.7
2016	14.5	18.4	1.6
2017 (Projected)	11.4	12.4	2.3
Notes: Source:	1 LSM = 1 ZAR, specified in Millions of LSM (LCA, Strategic Business Plan , December 2016).		

The operators, VCL and ETL, which had benefited from the subsidy of base stations, argued that the USF had been effective.

6. ICT regulatory review

Key regulatory interventions with the industry, mainly based on the Lesotho Telecommunications Authority (now the Lesotho Communications Authority) Regulations of 2001, include:

- tariff and rates regulation;

- telecommunications licences regulation;

- numbering regulations;

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[10] See https://mybroadband.co.za/news/government/104991-untold-universal-service-agency-story.html

- spectrum allocation;
- radio communications and licences;
- interconnection; and
- licence fees.

These regulations have been periodically updated through the publication of rules via legal notice by the Authority. The amended regulations are reviewed on the next page.

6.1 Telecommunications licences

In line with enabling licensing regimes around the world, licences are technology neutral and allow operators to offer multiple services, as required by the business models, over the same infrastructure, subject to internationally agreed standards. Licences are non-transferable and LCA may amend a licence with due warning.

The turnaround time for an application is 90 days, during which time LCA may request additional information from the licensing applicant. LCA may choose to hold public consultations in respect of a licence application so that the public has the opportunity to comment.

As per the Lesotho Communications Authority (Licensing Fee) Rules of 2013, there are nine licensing classes for which the fee structure differs.

Table 4: Licence classifications		
License category	Type of authorization	Authorisation tenure
Content (radio and television)	Individual license	10 years
Applications (only those using numbering resource)	Class license	1 year
Network services	Individual license	15 years
Network infrastructure (facilities)	Individual license	20 years
Unified licence	Individual license	20 years
Private networks	Individual license	1 year
Short-term activities	Permits	Up to 90 days
Radio spectrum	Class license	1 year
Numbering resources	Class license	1 year

Source: LCA (Licensing Fee) Rules, 2013

The regulatory fees charged depend on the licence type[11]. For individual licences, the application and annual fee structure, inclusive of royalties, is currently as follows:

Table 5: Regulatory fees					
Category	Authorisation tenure	Application fee (Maloti)	Initial fee*(Maloti)	Annual fee (Maloti)	Royalty fee (NOI%)
Network services	15 years	50 000	140 000	-	3.5
Network infrastructure	20 years	50 000	140 000		3.5
Unified licence	20 years	50 000	140 000		3.5
Content	Broadcasting				
Commercial	10 years	10 000	20 000	11 300	-
Community	10 years	8 800	10 000	2 000	-
Private	10 years	10 000	15 000	10 000	-
Public	10 years	10 000	25 000	15 000	-
	Television				
Commercial	10 years	15 000	34 000		
Community	10 years	8 800	10 000		
Private	10 years	15 000	20 000		
Public	10 years	20 000	40 000		
Private network	1 year	10 000	-	Per evaluation	-

Source: LCA (Licensing Fee) Rules, 2013   *Once-off fee for period of licence (LCA 2017

Fees for other services, such as those subject to regulation and radio licensing fees such as telemetry, satellite, non-cellular land mobile services and aeronautical services, are provided separately. Penalties for non-compliance are determined by LCA and non-payment of fees can attract penalties that range from 10% to 75% of the outstanding amount, depending on the duration of non-payment. The IAPs (licensed as Network Services) were the main category of licensee that found fees onerous. Their view was that the licence and spectrum fees they were required to pay and the protracted process to obtain licences do not reflect the opportunities available in the small Lesotho and primarily Maseru market.

LCA points out that as in most SADC markets small retailers of Internet services, commonly referred to as ISPs, have been deregulated since 2013 and they have been given blanket approval to operate and only pay an annual fee of M2,000. The licences that the two main IAPs, Comnet and Leo are operating are network services licences that authorise cross-border interconnection. LCA points out however, that none of the licence holders had gone on to seek better opportunities for interconnection directly from RSA operators that their licences allow them to do. With regards to the high application fee of M50 000 IAPs paid for their licences, LCA indicated that this was to cover the costs of due process, which may include public hearings. The M140 000 licence fee IAPs paid was a once-off fee for a 15-year network services licence. LCA contends that this price is low for a network licence. It adds that in practice LCA does accommodate instalment payments.

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[11] The Authority reviews the licensing regime and fees on a four year cycle. The fees are currently under review and new fees applicable from 2018 for are expected to be published during the course of 2017.

It is difficult to compare the licence fees to other countries as they are all categorised somewhat differently. In Botswana where competition in services is being encouraged licence fees for Internet Service Providers, Data Service Providers and Private Network Licence are P10 000.00 for initial fee (Once-off fee) and a P3 000 annual fee. Others trying to remove barriers to entry have relatively small annual percentage of turnover charges of 1% or less. In South Africa the initial registration fee for an ECNS or ECS licence (not individual) is R10 500, but the renewal, amendment or transfer fee is only R5 200. There is an annual fee based on a sliding scale starting at 0.15% of gross revenue for companies below R50million go to a maximum of 0.35% for those over R1billion.

Recommendation: It is recommended that LCA investigate why so few ISPs are offering services considering the deregulation of retail Internet service provision in 2013 and whether the accessing of cost based facilities from operators is a bottleneck. In order to stimulate much needed competition in Internet service provision (electronic network and network services market) and to try and induce new players in what should be a low entry cost market with multiple players, the licence fees for Network Services licences should be reviewed during the current fees review and that the relatively high application and upfront licence fee be reduced and converted into an annual fee based on turnover. Creating an enabling environment for the entry of ISPs into this deregulated market would entail wholesale price regulation and mandatory infrastructure sharing.

6.2   Tariff and rates regulation

The current law, contained in the Act of 2012 and Administrative Rules of 2016, requires the dominant licensee to submit its tariff proposal for approval prior to launching products. While the law only requires dominant operators to file their tariff proposals, non-dominant operators are also expected to submit their tariff proposals prior to launching. This requirement has been established for monitoring purposes (Interview LCA, 3 December 2016).

The tariff filing must contain all information on rates charged for the service, non-price terms, and rights and remedies available to customers in the event of disputes. Such lodgings must be accompanied by all accounting and costing information on the part of the licensee that LCA may require.

The decision on whether the proposed tariff can be implemented lies with LCA. The Authority has committed to issuing the decision within ten days. However, in the event of a rejection, the dominant operator will be furnished with reasons, after which the dominant operator has the right to either withdraw the tariff or make requisite changes as proposed by the authority. However, if the regulator does not issue a decision within ten days, the licensee may proceed with the lodged tariffs.

Over and above lodging its tariff proposal, LCA requires the dominant licensee to publish all tariffs such that they can be accessible to the public. The regulations of 2001 also required licensees to provide LCA with changes in tariffs charged, which would consequently be made public by the Authority. All the tariff changes could be subject to the price cap regime determined by the Authority.

Recommendation: To address operators' concerns that the requirement to lodge tariffs constrains competitiveness, tariffs should by default be approved so that they can become operational, with the Authority having the prerogative to retrospectively disallow the tariffs if they are found to be anti-competitive, or to reduce consumer welfare significantly. Operators should also be required to deregister products that they no longer offer, so that LCA can monitor the range of products, especially essential facilities, available to users and consumers.

6.3   Numbering regulations

It is LCA's responsibility to plan, allocate and assign numbering resources in a way that is non-discriminatory and in harmony with the international numbering protocols, so that there are sufficient numbers for current and future use. Number allocation is done to identify:

- networks and network services;
- call routing and addressing;
- premium-rated services;
- toll-free numbers;
- call-share services;
- emergency services; and
- value-added services.

Number assignment is done on a first-come, first-served basis and assignees may not resell, reallocate or trade numbers to third parties. Assignees have the responsibility to manage all numbers effectively and efficiently, and to discontinue traffic to numbers whose service has been terminated or numbers withdrawn.

Number assignments are cancelled in the event of non-use within six months, non-payment of prescribed fees or violation of numbering rules.

LCA believes that, at this stage, the costs of number portability are likely to outweigh the benefits, as assessed by those countries that have implemented it (Interview LCA: October 2016).

6.4   Spectrum allocation and fees

The rapid expansion and adoption of mobile phones is critical to the broadening usage of mobile broadband services. Due to the dearth and high costs of fixed telephony services in Africa, the uptake of mobile broadband in Africa is among the highest globally. Given the key role played by mobile telecommunications in reducing the digital divide on the continent, the effective management of mobile infrastructure is crucial, in particular the way in which spectrum is managed and made available to telecommunications companies to fair compete and evolve their businesses.

Due to an increase in the sophistication of mobile devices, which is driving exponential consumption of data, the market has seen congestion of the allocated bandwidth. As a result, there is a growing demand for spectrum in African markets. The efficient and timely allocation of spectrum is critical to the development of the sector in developing countries. In Lesotho, LCA manages and controls spectrum in addition to matters relating to satellite orbit.. The country faces challenges of signal spillover due to being completely encircled by South Africa. However, the Authority has signed a memorandum of understanding with its South African counterpart to address spillage of GSM frequencies between the two countries.

While spectrum allocation is auctioned in some jurisdictions, without the spectrum crunch experienced in other countries, in Lesotho the regulator assigns what has been requested by the operators and charges it per MHz. In the criteria for approval of frequency allocations, LCA is required to consider the category of service for which the frequency is to be allocated, the availability of frequencies, the distribution of frequencies among commercial social, individual and other categories of users, the technical characteristics

of the equipment involved and the ability of this equipment to interconnect or interfere with other communications equipment and networks.

In the allocation of spectrum, LCA also takes into account all relevant international conventions, regulations and recommendations, and any applicable ITU, regional or sub-regional rules, as well as the need and location of spectrum in use by the Government.

In August 2014, LCA published its Radio Frequency Spectrum Management Guidelines and Procedures intended to govern the process of spectrum frequency monitoring allocation and planning. The principles underlying Lesotho's spectrum management include conformity to the ITU Radio Regulations standards and national frequency plans, technology neutrality, transparency, and the timely release of spectrum.

The policy guidelines allow for the protection of special radio services, frequency sharing, spectrum re-farming in which a licence does not confer ownership or permanent rights to use, and licence-exempt frequency bands in which short-range devices, emergency services, industrial, scientific, medical (ISM) and public protection and disaster relief bands are licence-exempt. The guidelines also allow for the physical relocation of radio transmission stations where necessary and occasional frequency assignments for research and development trials.

According to the spectrum management guidelines, LCA is required to carry out regular frequency monitoring to ensure efficient, economic and safe use of the frequency spectrum. This includes measuring the radio emission parameters of licensed transmitting stations, identifying unauthorised spectrum use and undertaking measures for the prevention thereof, verifying and determining the coverage areas, measuring the quality of service (QoS) parameters of the communication services, and measuring the electromagnetic field levels for public safety and the environment.

In terms of frequency allocation, LCA applies the first-come, first-serve assignment principle, and in the event of demand exceeding supply, the Authority may use any market-based approach deemed necessary. Where additional frequency is required within a band that has already been assigned, the onus is on the licensee to prove full utilisation of the initial allotment, and where a licensee is hoarding spectrum, LCA reserves the right to withdraw some or all thereof.

Table 6: Spectrum comparison				
Band	ETLbandwidth	VCL bandwidth	% ETL	% VCL
800/900	25	45	36%	64%
800 (EVDO)	20	0	100%	0%
1800	73,6	60,8	55%	45%
2100 (HSDPA)	20	30	40%	60%
10Ghz (WLL/WiMAX)	14	56	20%	80%
Total	152,6	191,8	44%	56%
Total (excl. 10Ghz)	138,6	135,8	51%	49%

As discussed above in the Licensing section, network service providers complained about high licence/spectrum fees, which they believe contribute to the high cost of services but network operators did

not highlight this problem and have no trouble in accessing spectrum. (Interviews Comnet, ETL, Leo, VCL, August 2016)

LCA awards spectrum on a first come, first serve basis. While this policy is intended to ease the accessing of spectrum to roll out services, a possible unintended consequence is that player/s with the most resources may hoard spectrum and close out new market entrants

As a tool to ensure efficient use of spectrum, LCA may consider using a competitive process to assign a value to spectrum. This may ensure its optimal use. Spectrum trading can then also be permitted to revalue spectrum constantly in line with changing market conditions. However, more successful operators will always be in a better position to buy spectrum and more likely to be in a position to get economies of scale and scope, that smaller service providers are unlikely to. Hence price should not only be the tool used to monitor efficient use of allocation and the Authority should continue monitoring spectrum use to ensure that all the spectrum that has been allocated is in use, particularly in rural areas.

Spectrum fees for licensees (except in the event of a waiver or discount) are as follows:

Table 7: Spectrum fees (LCA Rules – Licensing, Classification and Fees 2013)		
	Fee (Maloti)	
Description	Application	Annual fee
Fixed services: point-to-point link	1 300	1 400 per MHz
Fixed services: point-to-multi-point link	1 300	2 000 per MHz
Radio access network	10 000	11 300 per MHz
Amateur radio	250	Nil

Source: LCA (Licensing Fees) Rules, 2008

6.5   Infrastructure sharing

Under the Lesotho Communications Authority (General) Rules of 2015, LCA may require a licensee to share its communications infrastructure with another licensee on a first-come, first-served basis, through a cost-based pricing structure and non-discriminatory terms and conditions.

There are two types of infrastructure-sharing arrangements under the rules; first, infrastructure sharing designated by LCA, and second, undesignated infrastructure-sharing arrangements. In the event of designated infrastructure sharing, when a licensee wishes to share such infrastructure, it must submit a written request giving the parties 60 days to review and work out the terms, conditions and prices of the agreement. The agreement is to be reviewed by LCA and may be rejected under the likelihood of:

- regulatory, legal or rule violations

- substantial adverse effects on end-users

- market distortion

- substantially restricted competition in any Lesotho communications market.

Where infrastructure sharing is not designated by LCA, a licensee which wishes to share the infrastructure should submit a written request to the licensee controlling the infrastructure. The licensee controlling the infrastructure should determine whether or not a sharing agreement will be negotiated. In the event of the controlling licensee not willing to share the infrastructure, the licensee will be required to enter a sharing

agreement by LCA unless they can demonstrate that sharing is unfeasible; it is incompatible with the licensees legal or contractual obligations; it poses a risk of harming the licensees network or of reducing its quality of service; that the licensee lacks capacity to share or will require unused capacity within the next 24 months; or sharing would preclude the recovery of costs including a reasonable return on investment.

Generally, the view of the operators is that infrastructure sharing is working, but VCL pointed out that it would take time for the long-term impacts to be assessed. They believe that it might create a disincentive for investment, but concur that at this stage there is no evidence of this[12]. The ETL CEO also indicated that dual-path peering on IP transit could bring down prices dramatically.

7.   Market structure and financial analysis

7.1   Market structure

The telecommunications market in Lesotho is structured around two vertically integrated operators, the former incumbent ETL and VCL. Also operating in the market is LECC, which was issued an infrastructure licence for the provision of open access wholesale transmission services in 2015. These operators supply facilities to two independent network service licence holders (Leo and Comnet) which compete against them in the retail Internet service market. ETL and VCL operate international gateways that connect them to high-speed undersea cables through their affiliated companies, Liquid Telecom which is part of Econet Wireless International, and Vodacom South Africa.

VCL entered the Lesotho market in 1996 with the Government of Lesotho as a shareholder through its stake in the Lesotho Telecommunications Corporation. However, in 1999, Lesotho also began a privatisation process and its shares were sold. The Vodacom Group operates as a subsidiary of the Vodafone Group Plc, with 80% of its shares in VCL held by the Vodacom Group (South Africa) and 20% of its shares owned by the Lesotho-based Sekha-Metsi consortium.

Econet-Ezi-Cel Lesotho entered the market in 2002 and Econet Telecom Lesotho (ETL) was formed in 2008, following the merger between the Telecom Lesotho fixed network services and Econet Ezi-Cel Lesotho mobile network services in April 2008. When the South African energy company, Eskom Enterprises (Pty) Limited, sold its shares to Econet Wireless Global, Econet Wireless became a majority shareholder with 70% shareholding, while the Government of Lesotho retained 30%.

The merger between Telecom Lesotho and Econet Ezi-Cel Lesotho allowed ETL to become an integrated service provider, providing both fixed and mobile services, provided under separate fixed and mobile network service licences. ETL is now able to offer converged communications solutions for data, fixed and mobile communications, following trends seen in other parts of the world, and the same as the second operator VCL.

7.2   Fixed lines

Lesotho fares better than the sub-Saharan African average in terms of fixed telephone penetration, though this is far below the global average of 13.7% (ITU 2016). Rural connection rates have lagged way behind those of urban areas. However, ownership of fixed lines remains limited largely to the urban areas, mainly Maseru and to business customers.

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[12] VCL increased its investments by 15.59% from M181.5 million to M209.8 million during the period 2014–2016 (Interview Vodacom: 2016). ETL, although on a much lower scale, continues to increase CAPEX, with it rising by 15.59%, from M181.5 million to M209.8 million during the period 2014-2016 (ETL 2016).

Although both network operators are licensed to operate converged fixed and mobile networks, the bulk of the fixed line market remains with the incumbent fixed line operator, now ETL. The size of the fixed line market has remained stagnant since privatisation, and has even decreased in recent years from 53 000 in 2006 (2.74 per 100 people) to around 50 000 in 2015 (2.1 per 100 people) (ITU, 2016).

7.3   Mobile

In 2008, there were 599 500 mobile subscribers in Lesotho, but by 2016 this number had increased to almost 1.9 million – achieving a growth rate of around 216% in eight years. However, while the industry has experienced an exponential growth in subscriptions, there is substantial dominance in the market. As of 2008, VCL controlled around 82% of the market, while ETL controlled the remaining 18%. However, ETL seems to be regaining ground as it increased its market share to 23.6% in 2016 (LCA 2016). This has led to a reduction in VCL's market share to 76.4%. Pricing data from RIA shows that VCL was the most expensive over the period 2013–2015. Then VCL reduced its prices in Q1 2016 to become the cheapest operator. Although a market review undertaken by LCA in 2016 found VCL to be dominant in this market; it was not found to be anti-competitive and therefore no remedies were applied.

Table 8: Mobile subscribers						
Operator	Subscribers			Market share		
	2008	2012	2016	2008	2012	2016
Econet Telecom Lesotho	110 500	126 250	448 292	18,4%	18,9%	23,6%
Vodacom Lesotho	489 000	543 500	1 448 928	81,6%	81,1%	76,4%
Total market size	599 500	669 750	1 897 220	100%	100%	100%

Source: SADC Communications Environment Report 2013; VCL subscriber numbers from ITWeb 2015[13] and LCA 2016

7.4   Internet access providers

There are two IAPs in Lesotho operating as Network Services licensees. The authorisation includes the provision of Internet services, but has a larger scope than this, including local and international data services. Leo started with dial-up networks in 2003 and signed up 2 500 customers. It connected with leased lines to Ladybrand. Within three years this network was decommissioned and replaced with the current wireless network, which primarily services the Maseru CBD, the residential area of Maseru and the international airport (Interview Leo: 2016). Comnet was established in 1992, and by 1998 had started operating as an ISP. It operates its wireless network using the microwave and WiFi spectrum, and offers VOIP and cloud storage, as well as value-added services, to private enterprises (Interview Comnet: October 2016). Leo indicated that, as a specialised niche player, its profitability would be greatly enhanced by being permitted to resell the service of the network operators. However, both IAPs believe that preferential procurement rules for local suppliers would enhance the viability of IAPs. (Interview Comnet, Leo: October 2016).

The two companies offer complementary services, with Comnet focusing on the enterprise side of the business and Leo's fixed wireless installation more geared towards meeting the individual needs of small to medium business, and providing public Wi-Fi hotspots in all major hotels, as well as offering value-added services to its clients, to which it supplies end-to-end services such as server connections, desktop publications, domain name registration and off-site storage (Interview Leo: October 2016). Both

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[13] See http://www.itweb.co.za/index.php?option=com_content&view=article&id=152680 [Accessed 12 January 2016]

companies, previously dependent on servicing individual government departments and agencies, have been negatively affected by Government's decision to consolidate all government ICT services under the control of the MCST. They believe that they are not able to compete with big players for Government business involving large-scale contracts, as they do not enjoy the same economies of scale and scope (Comnet October 2016). The two IAPs also claim they are also unable to secure reasonably priced, unbundled leased lines to connect their potential business activities in different parts of the country. They believe clear and cost-based facilities leasing guidelines are required if they are to realise the national network potential of their licences.

Other challenges faced by the IAPs is the cost of international bandwidth and lack of access to low-priced network facilities, which puts them at a disadvantage relative to the two larger, vertically integrated players. LCA points out that IAPs are free to procure bandwidth and transmission services from anywhere in the world and not just WIOCC, VCL or ETL. On the other hand, IAPs point out that in the absence of their own ability to build their own domestic backhaul broadband infrastructure and last mile high-speed infrastructure, they would still be required to lease from others in order to connect to the cross-border providers. The IAPS might also need the muscle to build domestic facilities to a scale that would be profitable and they would be forced to lease what they find to be expensive infrastructure for their size businesses.

The IAPs also believe that, with the marginal businesses they run, they should not be required to contribute 1% of revenue related to their communications licences to the USF, on top what they regard as overpriced licence fees for their not very profitable businesses[14]. LCA responded by pointing out that, by contributing, the IAPs become eligible to apply to the USF for funding. This has been extended from network roll out to include data services such as public WiFi and this could easily exceed their 1% contribution (Interview LCA: 3 October 2016). IAPs believe this proposition does hold some hope for them.

The IAPs said there needed to be more consultative forums for stakeholders to engage with the regulator, in order for the regulator to understand their reservations, and to avoid having to 'guess what the regulator is thinking'.

Recommendation:

In order for competition in the provision of data services to take root, IAPs need to be able to access cost-based facilities from the network operators. Although VCL possibly carries greater traffic than ETL, ETL is the only fixed network in some parts of the country and is geographically dominant in many areas. LCA needs to issue facilities leasing guidelines that ensure that players in the market have cost based access to existing facilities in order to roll out their services beyond Maseru.

8. Infrastructure

According to the National Strategic Development Plan (NSDP) 2012/13–2016/17, an appropriate level of infrastructure should be developed that sets up a competitive business or investment environment and/or contestable markets through appropriate legal frameworks and a reduced burden of regulation, and that also improves the capacity for generating knowledge as well as innovation.

The required ICT infrastructure is made up of the appropriate connectivity infrastructure and international access, a significant density of computers and mobile phones, as well as wider access to sufficient

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[14] As IAPs are not required to provide costing data to LCA, nor was their costing data gathered for the market review undertaken by LCA in 2015-2016, IAP claims about the marginal nature of their business and the unaffordability of licence fees has not been verified.

electricity supply. For Lesotho to benefit fully from such development, the requisite technical skills and systems to manage this infrastructure must also be fostered.

8.1   National transmission networks

Connecting to broadband has historically been constrained by minimal fixed network infrastructure. To address these bottlenecks, network operators have deployed both a combination of wireless and fixed broadband infrastructure over the years. The backbone and access infrastructure are particularly important elements in the ICT ecosystem and major contributors to the cost of Internet access, especially broadband access.

Broadband expansion in the Lesotho has been following the regional trend of wireless access technology adoption which implies leapfrogging traditional fixed access technology. With the high cost of connecting homes to fixed lines, ETL invested in CDMA, on which it had 13 000 customers. This improved rollout to a certain level but the speed was not good enough for the emerging PC-dongle market and accessing spectrum at the right price was also found to be a problem. For this reason, ETL decided to start decommissioning CDMA and standardize on GSM. This process led to the right level of 3G infrastructure being reached in 2015, with some LTE sites being installed in Maseru. (Interview ETL, October 2016)

Significant investments have been made in GPON fibre primarily to service corporations, but fibre-to-the-home (FTTH) is also slowly running to some neighbourhoods. The greatest challenge is not the cost of infrastructure but the affordability of devices according to both operators. There were only 100,000 smart devices in 2016 in a population of 2.13 million (Worldbank, 2017). VCL introduced a low-cost Android Internet-enabled device: Smart Kicker, which retails for around M400. This has made significant inroads into the price-sensitive areas of the market but the cost of smartphones, even at this price, is seen as the major inhibitor of broadband uptake.

It is also a challenge to keep the data-enabled devices charged, with a dearth of power in many areas. In some areas, individuals have to pay M5 every time they want their device charged. ETL, to address some of these challenges, introduced a business line dealing in solar-power chargers. However, the margins were too small to sustain the business (Interview ETL, October 2016.). Other challenges, according to operators, are bringing down distribution costs to the hard to reach areas, which also have low population densities and no electricity.

LECC now has 600km of fibre laid, with 300km to be laid as part of an Indefeasible Right of Use (IRU) granted to VCL for 15 years. It also has substantial back to back contracts with ETL through regular wholesale bandwidth agreements mainly to the north-east of the country. It is taking dark fibre to Mohale's Hoek, a project which is in line with the African Development Bank sponsored e-Government project. The network is now extensive enough to provide attractive options for IAPs. There are substantial savings in IRU because of the longer term contracts, bring composite prices below USD9 000 per kilometre (Interview LECC, March 2017).

LECC gets their international bandwidth from Neotel. LECC believes it gets a good price because it does not get the internal discounts that VCL and ETL get from their integrated (international and national) bandwidth. Transferring WIOCC's shareholding and operations to LECC would allow it to offer integrated international and national bandwidth. This would enable LECC to compete fairly with the integrated operators and they might offer better wholesale prices to the IAPs.

8.2   International connectivity

Although landlocked, Lesotho has benefited from connectivity to the landing of several submarine fibre optic cables on the African east and west coasts of the continent, which saw bandwidth quadruple in 2012.

However, Lesotho's international connectivity (other than connectivity through satellite) depends entirely on its only neighbour, South Africa. A number of fibre optic links, including Maputsoe, Mabote (over powerline) and Maseru Bridge on the Lesotho side connect Lesotho with South Africa. This gives Lesotho access to several international submarine fibre optic cables with connectivity to Europe and the Far East, including South Atlantic 3/West Africa Submarine Cable/South Africa Far East (SAT-3/WASC/SAFE), SEACOM and the East Africa Submarine Cable System (EASSy).

EASSy was commissioned in July 2010, with an expected lifetime of 25 years and an international bandwidth capacity of 4.72 Tbps. The EASSy cable is a 10 000 km fibre optic submarine cable running along the east coast of Africa. The cable links South Africa and Sudan, with a further nine landing stations along the east coast linking 21 countries. It inter-connects with multiple international carriers and submarine cable networks for onward connectivity to Europe, North America, the Middle East and Asia, to provide shareholders and the region with access to worldwide telephony and Internet networks.

In an effort to benefit from lower international bandwidth prices, the Government of Lesotho joined the African Union-Nepad initiative to connect the East Coast of Africa and several of the landlocked countries in East and West Africa to an undersea cable, EASSy. The country became party to the EASSy cable MoU officially in 2005, but Telecom Lesotho (later ETL), the only operator with an international gateway at the time, which the Government believed would own the shares in the cable, declined to participate. It was decided that the stake would be held in trust for the country by LCA. Lesotho participates in EASSy through the West Indian Ocean Cable Company (WIOCC). WIOCC is a special purpose vehicle created to enable parties that lacked the capital to participate in the EASSy cable, to have a stake. The company also serves as an administrative arm for operating the EASSy cable. Following the efforts to get both Liquid Telecom, and later VCL, to take over the WIOCC shares failed, the holdings remained with LCA in trust. Several other efforts by LCA to dispose of the shareholding have been thwarted either by the WIOCC board or Government.

Following the launch of the service by WIOCC, Internet access prices have gone down. However, the goal of ensuring lower prices and better quality of international bandwidth seem to have only been partially realized because the IAPs, in particular, still complain about the cost and quality of international bandwidth. Essentially all Internet activity requires international bandwidth as there is limited local content. Historically the IAPs have been supplied international bandwidth by ETL as the former incumbent, and later had the choice to be supplied by VCL when VCL obtained an authorization to operate an international gateway and subsequently a Unified Licence. However, wholesale prices remained high. IAPs had anticipated that the cable could bring a difference to the wholesale market by being an alternative source of international bandwidth for them. However, the IAPs have not been able to benefit from this development because of the quality issues mentioned earlier.

To further illustrate the problems with quality, ETL cited high levels of network failure with WIOCC and utilises the international capacity of sister company Liquid Telecom, which access EASSy, WACS and SAT-3. The international bandwidth price ETL is getting from WACS/Liquid on its international portion was

said to be reasonable. However, it is the 400 km[15] (in side RSA from Gauteng to the border) of fibre optic cable into Maseru for which they are being '... held to ransom' like other landlocked countries. ETL's CEO said dual path peering on IP transit could dramatically bring down prices.[16].

In order for the benefits for investing in WIOCC to accrue for the country, there must be adequate local technical support the infrastructure must be robust and well diversified, and the service be of level of quality required by service providers.

Recommendations: The placement of state equity in WIOCC in LCA produces a conflict of interest that the regulator has been aware of, in that it technically makes the regulator a player in the market, and which has prompted several efforts by LCA to dispose of it. Besides this impacting negatively on the basic collection of administrative data that LCA requires to regulate effectively, and because of operators' reluctance to provide confidential information to what they deem to be their competitor, this has a negative impact on the regulation of the critical wholesale market.

The state-owned WIOCC equity and capacity could be transferred to the state-owned LECC, which already has a domestic common carrier component, and operated as an open access network on a cost plus recovery basis. This would be competition enhancing, highly beneficial to the market and may encourage greater use. This could address the need for WIOCC to have a local management presence that has network management experience. It would also remove the current conflict of interest faced by LCA as both regulator and player in the market. This is manifested in, as some stakeholders pointed out, the legal requirement that it regulate quality of service by operators, which in the case of the WIOCC would mean LCA regulating itself.

In the disposal of the state-owned stake in WIOCC and transfer to LECC, the context of the regulator and the regulated entities is also an important consideration. LCA obtains it's funding from licensees by way of regulatory fees. To maintain fairness among licensees, the stake held by LCA in WIOCC should be transferred to LECC if LECC is willing and able to take it up and to cover the cost of participation that LCA has been incurring over the years (operation and maintenance). LECC should also be willing to cover any costs of participation going forward. The two entities could agree on a payment plan to facilitate fast transfer. In the case where LECC is not willing or is unable to take up the asset, it should be sold to the highest bidder locally. If that fails, it should be sold to the highest bidder internationally.

8.3   Mobile coverage

According to a statement by VCL's CEO in early 2016, VCL had 3G coverage throughout the country as well as newly-launched 4G coverage. The 3G coverage stood at roughly 90% of the population, and by October 2016 there was at least one LTE base station in each district (VCL interview October 2016). Despite this coverage, mobile broadband penetration remained relatively low at 28% (LCA 2016), (37% ITU 2016) as indicated above. Both ETL and VCL attribute this to the high cost of devices, and certainly this is a factor, as indicated in the demand side survey, but the cost of data is also a barrier to access and use, as are e-skills.

Despite this, the 2016 demand side survey (Part B) shows that 45% of people with a mobile phone in Lesotho have a smart phone, and this is not particularly low for the region and not at all low by continental comparison. VCL introduced a low-cost Android Internet-enabled device: Smart Kicker, which retails for

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[15] Being landlocked, Lesotho has to rely on backhaul facilities in South Africa, and prices of the service on this leg compound into the total prices that operators had to pay for bandwidth.
[16] The current topology of the WIOCC network within Lesotho depends on a single point of presence (only one data centre for interconnection) making its clients extremely vulnerable to complete cut off.

around M400. This has made significant inroads into the price-sensitive areas of the market but the cost of smartphones, even at this price, is seen as the major inhibitor of broadband uptake.

9.   Access and use

Balancing investment incentives for network roll-out with the regulatory interventions needed to ensure positive consumer welfare outcomes is a challenging task even for the most sophisticated regulator. Getting this balance right means that a rapid uptake of new services needs to take place together with the high infrastructure coverage of the population and country. This is measured by the number of users of these services and the extent or intensity of their usage. Supply side indicators for this are acquired from subscriber numbers, average revenues per user (ARPU), minutes of use (MOU), and data traffic per connection. Far more accurate and in-depth data can be elicited from demand side surveys of users and non-users (See Part B).

Table 9: Lesotho benchmarked against Ghana, Kenya, Tanzania and Uganda				
Access	Country-level indicator	Traffic light	Comparison average	Source
Active SIM cards per 100 inhabitants	100,94		84,16	ITU, 2016
Individual Internet users per 100 inhabitants	16,07		23,42	ITU,2016
Mobile broadband penetration	37,7		25,9	ITU,2016
Landlines per 100 inhabitants	1,91		16,3	ITU, 2016
Key	Green=Good, Yellow=Average and Red=Poor			

Table 10: Lesotho benchmarked against Botswana, Namibia and Swaziland				
Access	Country-level indicator	Traffic light	Comparison average	Source
Active SIM cards per 100 inhabitants	100,94		86,05	ITU,2016
Individual Internet users per 100 inhabitants	16,07		26,7	ITU,2016
Mobile broadband penetration	37,7		48,05	ITU,2016
Landlines per 100 inhabitants	1,91		6,2	ITU,2016
Key	Green=Good, Yellow=Average and Red=Poor			

Table 11: Lesotho benchmarked against South Africa				
Access	Country-level indicator	Traffic light	Comparison average	Source
Active SIM cards per 100 inhabitants	100,94		164,51	ITU,2016
Individual Internet users per 100 inhabitants	16,07		51,92	ITU,2016
Mobile broadband penetration	37,7		59,5	ITU, 2016
Landlines per 100 inhabitants	1,91		7,72	ITU,2016
Key	Green=Good, Yellow=Average and Red=Poor			

Lesotho's mobile broadband penetration is lower than that of similarly populated countries such as Botswana and Namibia. The country mobile broadband penetration is below 40%, while that of Botswana is at around 70%. VCL claims that the low mobile broadband adoption is due to lower smartphone penetration, which it claims stands at 10%. However, GSMA reports a relatively high smartphone penetration of 24% compared to South Africa's 34%. This is somewhat problematic, as it is difficult to know the true penetration of smartphones in Lesotho. Therefore, this makes LCA 2016 demand survey a very important and reliable source of information.

In contrast to the administrative data received from the ITU (2016), a demand-side survey conducted by LCA, working with Research ICT Africa, in 2016 shows that 78.7% of the Lesotho residents own a mobile phone. The survey shows that 95% of these mobile phone owners are prepaid subscribers. It also shows that about 4% of mobile phone owners in Lesotho are connected to South African networks.

The study further shows that access to the Internet at 32.5% of the population is currently considerably higher than the IDI (ITU 2016). Most importantly, the survey shows that mobile phone devices play a significant role in bridging the digital divide. Among the individuals who reported having used the Internet before, about 85.5% accessed the Internet for the first time via a mobile phone – hence the need to develop policies that ensure low-income earners have easy access to mobile phones. The estimates in Table 13 should not be read as penetration rates, but rather the share of device use among those who access Internet.

Table 12: Share of device used to access Internet	
Mobile phone	87,1%
IPad/tablet	6%
Laptop	0%
Desktop	10%

A concerning issue is that 67.5% of the population have not accessed Internet before. This remains a challenge on which both policy makers and LCA should put more emphasis. The importance of mobile phones is further pronounced in Table 14. Among those who accessed Internet in the past three months, 87.1% of the people used mobile phones. The country mobile broadband penetration rate stands at 32.5%.

Table 13: Lesotho benchmarked against Botswana, Namibia and Swaziland				
Usage	Country-level indicator	Traffic light	Comparison average	Source
Average revenue per user (blended ARPU)	4,43		6,50	Regulatory authorities report
Minute of use (MOU) per active SIM	81		55 (compared with Swaziland)	Regulatory authorities report
International bandwidth Bit/s per Internet user	3 862		11 992	ITU 2016

Table 14: Lesotho benchmarked against South Africa				
Usage	Country-level indicator	Traffic light	Comparison average	Source
Average revenue per user (Blended ARPU)	4,43		6,95	Regulatory authorities report
Minute of Use (MOU) per active SIM	81		136	Regulatory authorities report
Facebook users per 100 inhabitants	22,8		147 630	ITU 2016

High prices usually have an impact on consumers' decision to use a particular product. Consumers are reluctant to spend money on such products when prices are high. The average revenue per user (ARPU) is small relative to comparative countries, and this result coincides with the low access results in the above diagnostic. The rule of thumb is that a decrease in price leads to an increased in use, so the impact of high prices is reflected in this section as consumers spend less on communication due to high prices. Lesotho's Internet use is far below the average in Botswana, Namibia and Swaziland.

The survey results show that among those who have access or use the Internet, the frequency of use is high. About 63% of Internet users browse the Internet almost every day, with about 17% connecting to the Internet at least once a week. However, 20% of Internet users only access it once in three months.

Compared with many other SADC countries, Lesotho fares well in terms of mobile penetration, where mobile penetration is defined as the number of active SIM cards per 100. Among 14 SADC countries, Lesotho is ranked fifth, with Botswana having the highest penetration rate at 169%, and the least penetrated country being Malawi at 35.34% (ITU Statistics 2016).

Figure 3: Mobile phone penetration in SADC Countries
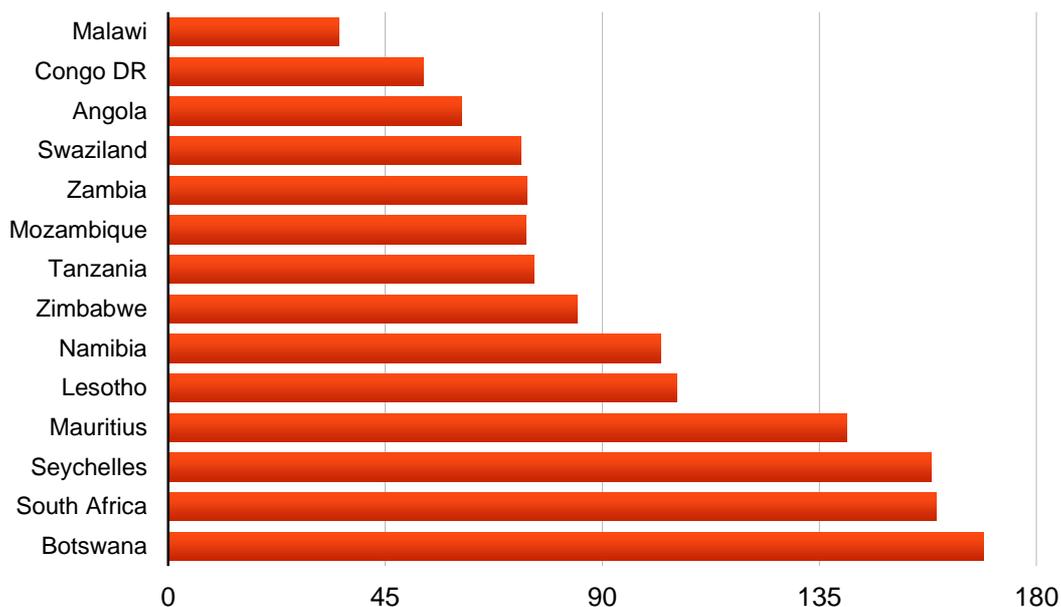
Source: ITU Statistics, 2016

10. Affordability

It is known from surveys conducted across the continent over 10 years that the primary determinant of access and use is price – the price of devices and the price of services .The question that then arises is whether the price of services reflects the real costs of delivering the service under the difficult conditions identified for Lesotho. Services can only be made affordable to the majority of people through subsidies, aggregation of demand at public access points, or lower prices for services. As discussed, in the absence of a costing study, benchmarking is a useful way of assessing whether mobile (voice and data) is affordable in comparison to other countries. To do this analysis, RIA uses the only, quarterly updated, comprehensive mobile pricing database of global south countries in the world. The data in the mobile pricing database is collected by RIA every quarter and covers 91 countries in Africa. RIA measures the cost of communication by mapping African mobile prepaid pricing trends with a voice and SMS basket, the RIA 1GB data basket and a Bundled Value for Money Index. Both the voice and SMS basket and the 1GB basket methodologies calculate the minimum price for consumers in the African market.

Methodology:

Voice/SMS basket (OECD basket): 30 voice calls for a total of 50 minutes and 100 SMSs per basket per month.

1 GB basket: Monthly cost of 1 GB data based on prepaid data top-ups or bundled top-ups.

Both baskets are converted to USD for comparison across African markets.

The voice/SMS basket pricing information shows that price competition among mobile operators is minimal. Prices have closely followed each other, with VCL charging higher prices over the period 2013 Q1 to 2015 Q4. However, in Q1 2016, a period that coincided with a dip in VCL subscriptions, VCL significantly reduced its voice/SMS prices from M159 to M111 to become the cheapest service provider in the market.

Figure 5: Prepaid voice prices (OECD basket) Maloti

	2013 Q1	2013 Q2	2013 Q3	2013 Q4	2014 Q1	2014 Q2	2014 Q3	2014 Q4	2015 Q1	2015 Q2	2015 Q3	2015 Q4	2016 Q1	2016 Q2	2016 Q3
ETL	143	143	143	138	138	138	134	134	134	134	134	134	134	134	134
Vodacom	164	164	164	159	159	159	159	159	159	159	159	159	111	111	111
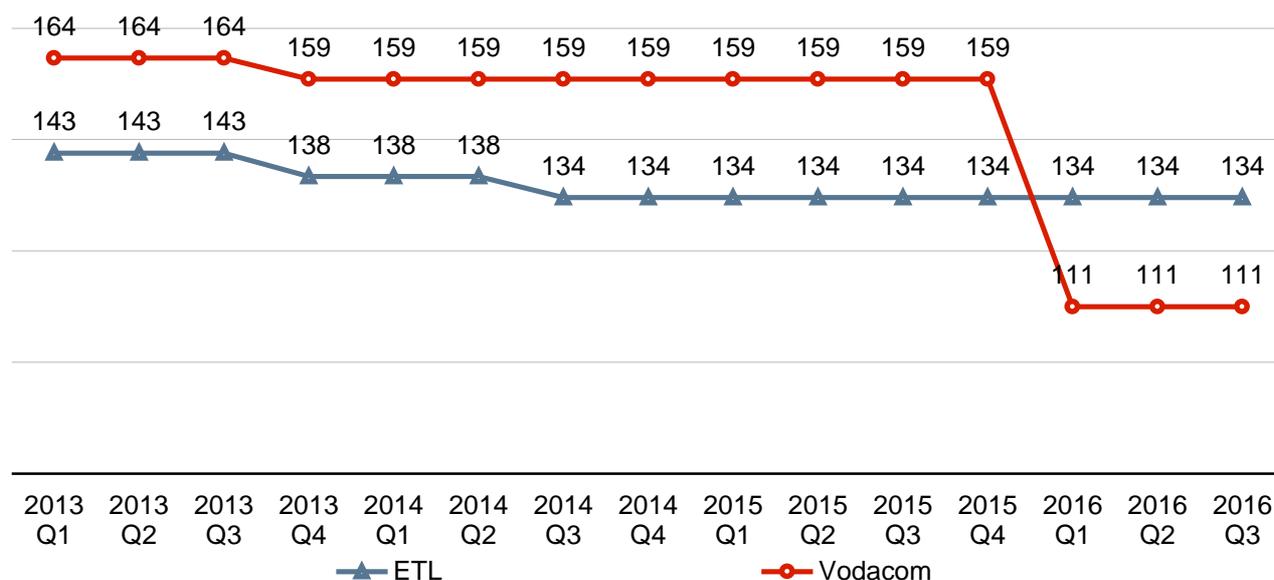
Source: Research ICT Africa Mobile Pricing (RAMP)

The pricing database is also an input into two unique pricing baskets that provide insight into the maturity of the sector in each country: the Value for Money Index and the Smartphone Index. These indices are data-intensive, which means that they emphasise data connectivity over voice and SMS. As the mobile world moves towards OTT pricing, these indices are going to become increasingly important tools to measure the health of the mobile ecosystem.

If prices are competitive, (in other words, prices are lower than in comparable countries), then other components, such as access, competition, usage and infrastructure should all be competitive as well. If prices are not competitive, then each component of the ecosystem needs to be analysed in order to discover the obstacles to improved access and use.

For the purposes of this study, Lesotho is benchmarked against three groups of countries in Africa:

- countries with the best scores: Kenya, Ghana, Uganda and Tanzania. These countries were selected because they have some of the lowest prices in Africa;

- countries of similar population sizes: Namibia, Botswana and Swaziland. Botswana and Namibia are small population countries with prepaid innovations and therefore relevant markets. Swaziland is also small and dominated by South Africa; and

- the neighbouring country: South Africa.

These countries also represent a wide range of incomes as measured by GDP per capita at current US dollars. Two of the countries have incomes below that of Lesotho, while the remainder have incomes that are higher.

Table 15: GDP per capita	
	2015 (USD current prices)
Uganda	705
Tanzania	879
Lesotho	1067
Kenya	1377
Swaziland	3200
Namibia	4674
South Africa	5724
Botswana	6360

On every indicator that forms part of the affordability component, Lesotho is expensive relative to major telecommunication markets in East African countries.

Table 16: Lesotho benchmarked against Ghana, Kenya, Tanzania and Uganda				
Affordability	Country-level indicator	Traffic light	Comparison average	Source
Mobile prepaid voice basket (USD)	7,86		3,64	RIA
Dominant operator: Mobile prepaid voice basket (USD)	7,86		4,71	RIA
Mobile prepaid 1 GB basket (USD)*	7,11		4,13	RIA
Mobile prepaid 1 GB basket (USD) Dominant Operator	7,11		6,01	RIA
Mobile prepaid smartphone basket (USD)	94,7		31,98	RIA

When comparing Lesotho to similarly populated countries, voice prices are roughly the same and data is cheaper.

Table 17: Lesotho benchmarked against Botswana, Namibia and Swaziland				
Affordability	Country-level indicator	Traffic light	Comparison average	Source
Mobile prepaid voice basket (USD)	7,86		7,32	RIA
Dominant operator: Mobile prepaid voice basket (USD)	7,86		7,32	RIA
Mobile prepaid 1 GB basket (USD)*	7,11		15,82	RIA
Mobile prepaid 1 GB basket (USD) Dominant Operator	7,11		15,82	RIA
Mobile prepaid smartphone basket (USD)	94,7		75,1	RIA

A voice basket is more expensive in Lesotho than in its neighbour South Africa, but not for the mobile prepaid 1 GB basket, where the prices are the same.

Table 18: Lesotho benchmarked against South Africa				
Affordability	Country-level indicator	Traffic light	Comparison average	Source
Mobile prepaid voice basket (USD)	7,86		5,71	RIA
Dominant operator: Mobile prepaid voice basket (USD)	7,86		5,71	RIA
Mobile prepaid 1 GB basket (USD)*	7,11		7,07	RIA
Mobile prepaid 1 GB basket (USD) Dominant Operator	7,11		8,85	RIA
Mobile prepaid smartphone basket (USD)	94,7		55,15	RIA

1GB of out-of-bundle at M2.00 per MB, or M2,048 per GB per month, and both operators charge the same for out-of-bundle data. This translates to USD146 for 1GB of data per month. This means that data is much less affordable for those who do not know how to buy bundles.

The smartphone basket is a basket from the perspective of a smartphone user using predominantly OTT for communication. It is based on 100 minutes of voice calls, 100 SMSs and 1 GB of data a month and therefore represents an average user. For the smartphone basket, an OTT user does not care whether calls are on-net or off-net and whether they are peak or off-peak. Most communication is done using OTTs anyway (OTTs are applications like Skype or WhatsApp). No assumption is made on the allocation of calls and SMSs, and the quantities are simply multiplied with the average minutes and SMS costs.

The smartphone basket price shows that Lesotho is considerably more expensive for the type of data-intensive services that customers are demanding in other countries. Lesotho is stuck in the traditional model of providing mobile services, while the comparator countries have moved towards new IP-based models of pricing.

Relative affordability

The cost of voice/SMS is low in Lesotho – representing about 0.04% of average income in Lesotho (based on GDP per capita), while the 1 GB cost represents about 0.03% of GDP per capita. Using survey data on salaries, mobile voice/SMS and 1 GB of data represent about 3% of an average monthly salary in Lesotho. Segmenting income data into professional, technicians and manufacturing professions, workers in the manufacturing industry spend 11.59% of their average monthly income on mobile voice/SMS services and around 10.5% on 1 GB basket of data. This information provides powerful information about affordability of telecommunication products to different income groups.

Figure 5: Monthly communication expenditure as % of average monthly income
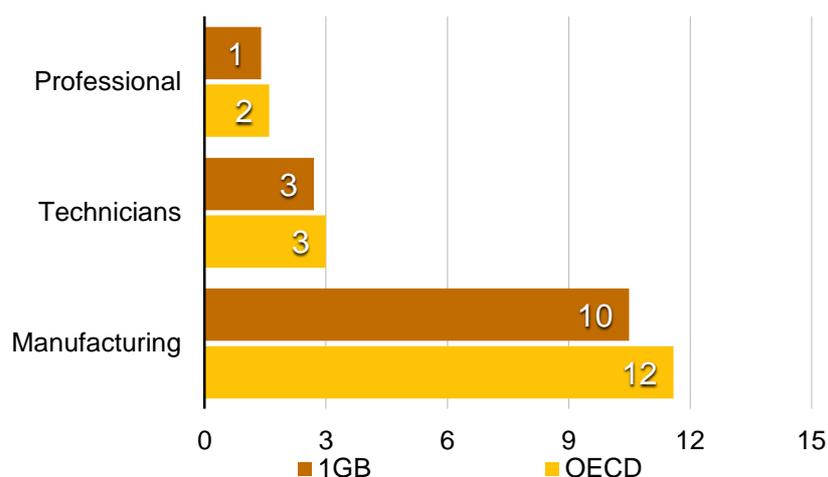
Source: RIA calculation based on RAMP database and Lesotho Labour Force Survey

11. Competition

The telecommunications industry is oligopolistic in nature with fewer operators and is susceptible to collusion. If left unregulated, the market has a potential of charging high prices and producing sub-optimal outcomes (i.e. output that is lower than would be the case in a competitive market). Pricing strategy revolves around three main points: Cost and profit objectives, consumer demand and competition. Prices are expected to be lower in competitive markets.

Table 19: Lesotho benchmarked against Botswana, Namibia and Swaziland				
Competition	Country-level indicator	Traffic light	Comparison average	Source
Market concentration (HHI)	0,63		0.77	Regulatory authorities report
Number of mobile operators (excluding MVNO)	2		2	Regulatory authorities report
Market share of largest mobile operators	76,30		83	Regulatory authorities report

Table 20 Lesotho benchmarked against South Africa				
Competition	Country-level Indicator	Traffic Light	Comparison Average	Source
Market concentration (HHI)	0,63		0.36	Regulatory reports and operators' annual reports
Number of mobile operators (excluding MVNO)	2		4	Regulatory reports and operators' annual reports
Market share of largest mobile operators	76,30		46,46	Regulatory reports and operators' annual reports
Highest MNO EBITDA margin in country	47		40,66	Regulatory reports and operators' annual reports

Any market with a HHI greater than 0.25 is regarded as highly concentrated, which is the case in Lesotho with a HHI value of 0.63 – a value that shows the telecommunications market in Lesotho is closer to a monopoly. Relative to comparative countries with moderate competition, there are two operators in Lesotho, while on average there are six operators in East African countries and four operators in South Africa. Compared with all comparative countries, the market share of the biggest operator in Lesotho is large, at around 76.30%, but below average as shown in table 20.

Competition in the voice market is a cause for concern in Lesotho. The lack of competition is likely to have a negative impact on prices. When a market is highly concentrated, firms with market power have the potential to charge high prices, making it difficult for consumers to access services, as is the situation in Lesotho. Due to high prices, the market is automatically segmented with the low-end consumers marginalised from services or the optimal use of services.

The data market, on the other hand, compares favourably to neighbouring countries, with data prices that are the same as South Africa and much cheaper than Namibia, Swaziland and Botswana. East African countries are the market leaders on data pricing on the continent and this is where Lesotho compares poorly.

Market review

The primary means to achieve affordable access to the full range of communication services, and the basis for regulation of the market, is competition. Regulators use market reviews to establish the competitiveness of markets currently and the positioning of operators to enter and dominate future markets. Market shares are a useful first indication of the dominance of each firm on the market in comparison to the others and are often used as a proxy for market power. Although a high market share alone is not sufficient to establish the possession of significant market power, it is unlikely that a firm without a significant share would be in a dominant position. In other jurisdictions, the European Commission, for instance, the commission's view is that the higher the market share and the longer the period of time over which is held, the more likely it is to be a preliminary indication of dominance. The European Commission procedures for assessing dominance are: A firm with a market share of no more than 25% is not likely to enjoy a dominant position; a firm with market shares of over 40% raises concerns, and over 50% is said to have a dominant position if its market share has remained stable for a long time.

Critical to assessing dominance is the definition of relevant market. A comprehensive assessment of dominance requires explanation of product and geographic market. The relevant product market is made of all products/services which consumers/subscribers consider to be a substitute for each other due to their characteristics, their price and their intended use. The relevant geographic market is an area in which the conditions of competition for a given product are homogenous.

A market review needs to assess not only if there is abuse in the market however, but ability of an operator to leverage their dominance in the market. This may stifle consumer demand and generate efficiency losses and harm the public interest. Firms with significant market power or dominance may implement strategies, including reducing prices below cost for a period of time that further reduce competition and enhance their position in the market, and can even force competitors out of the market.

In line with this regulatory practice, LCA carried out a study in 2015 to develop a competition management regime (CMR). A market review was conducted in 2015, resulting in the Determination on Market Classification and Dominance in 2016. The markets listed align with the 2007 EU definition of markets and identifies 14 potential markets. ETL is found to be dominant in 11 markets: Access to the public telephone network at a fixed location (retail), call originating on the public telephone network provided at a fixed location (wholesale), physical infrastructure access at a fixed location, (wholesale), broadband access at a fixed location (wholesale), terminating segments of leased lines (wholesale), voice call termination on individual mobile networks (wholesale), voice call services from a fixed location (retail), broadband Internet access from a fixed location (retail), leased line services (retail), trunk segments of leased lines (wholesale), while VCL is dominant in mobile access and call origination (wholesale), voice call termination on individual mobile networks (wholesale) and mobile services (retail).

The Determination on Market Classification and Dominance in 2016, referred to above, also lists remedies for each market in which SMP is found, but as the findings did not establish abuse of dominance, no remedies were applied.

With the asymmetries of information between the regulator and the operators and in the absence of cost studies, the application and enforcement of remedies is difficult. Benchmarking key indicators against other similar markets can provide an assessment of policy outcomes. The process of benchmarking goes beyond just describing the relational position of one country against another, but is also used to identify the factors determining them, in order to propose remedies.

Operators in Lesotho enjoy significant market power in distinct markets. The ETL enjoys monopoly in all fixed relevant markets and the mobile data market while VCL enjoys significant market power in mobile voice and SMS. LCA determination on SMP together with some of the findings of this report, indicate the need for a new review of markets especially with extreme national dominance or geographic dominance and in fact monopoly provisioning (only one provider of product or product with a geographic market).

RECOMMENDATION: *A new market review needs to assess not only if there is abuse in the market however, but also the ability of an operator to leverage their dominance in the market. In the interim, LCA must ensure that it gets adequate pricing (and other) information, (particularly wholesale pricing) to deal with the relatively high voice and data prices in Lesotho and the low broadband penetration rates resulting from inadequate competition, among other factors. Market power exercised by a dominant firm, may result in prices that are higher than competitive price levels. This may stifle consumer demand and generate efficiency losses and harm the public interest. On the other hand, firms with significant market power or dominance may implement strategies that further reduce competition and enhance their position in the market.*

12. Key findings

- Despite extensive 3G and some 4G coverage in Lesotho, not only does Lesotho have amongst the lowest levels of broadband penetration as measured by the ITU in terms of number of active subscribers in the region, but it has by far the lowest use of broadband in terms of intensity of use; less than half of the next-poorest country benchmarked (measured in bytes per individual in the country).

- Lesotho's data prices are low when benchmarked against other small population or landlocked countries, but high by continental best-performers, and about average in the Africa-wide RAMP Index. This reflects space for improved data affordability and broadband access. Out-of-bundle prices, which are the default prices that affect the less price sensitive users, are particularly high for both voice and data.

- Although there have been significant investments by both operators, particularly by VCL in recent years, which has resulted in comprehensive coverage of the country, Lesotho is not enjoying the benefits of competition espoused in its policy. The market is structured around two vertically-integrated network operators, VCL and ETL. The market over the last few years has become increasingly concentrated, with the IAPs marginalised. The structure of the market and the dominance of VCL in the mobile and ETL in the fixed market is not conducive to fair competition.

- There has not been adequate ex ante regulatory intervention to level the playing field. Where this has been done such as in the mobile termination rate market, though very incremental, has ultimately had positive competitive outcomes with the price of voice calls dropping eventually in 2016.

- The key characteristics of duopolies, price setting and limited product innovation, are evident in the market. The restructuring of the market through the introduction of additional wholesale providers in the international market when the State bought into the WIOCC cable and through the licensing of LECC to provide wholesale capacity to operators have not had competition-enhancing effects anticipated.

- VCL and ETL are both owned, partially, by continental operating companies and are able to leverage economies of scale and scope with considerable benefits for the Lesotho market. This is particularly true for international bandwidth, but is also true for their business planning and systems.

- Extensive economies of scope and scale from continental operations, together with market dominance by vertically-integrated operators and a lack of wholesale data price regulation, render small Internet access/service providers (IAPs and deregulated ISPs) powerless to compete.

- The duopoly effects mean that there is little product innovation in the market to address issues of service affordability and stimulate demand. Unlike other countries in Africa, there are no bundled prepaid products where voice, SMS and data are bundled together on offer. Operators offer these bundles to retain customers on their traditional services by bundling them into their data services as strategy against voice and text substitution by OTT services such as WhatsApp and Skype. The significant share of voice revenues compared to data for both operators, which is shifting rapidly in leading African markets, is further testimony to this.

- Spectrum is allocated on a first-come-first-serve basis. Although this is not preventing other players from getting spectrum as there is an excess of spectrum in most bands, even high demand bands, smaller players and less profitable companies are unable to take up such opportunities citing high spectrum prices.

- Wholesale bandwidth prices, required by smaller service providers are high though VCL and ETL do seem to pass through some of the ongoing price reductions in the wholesale international bandwidth market by indirectly reducing prices with the provisioning of increased capacity as this makes the effective price considerably lower. Service providers do not necessarily need additional capacity and would prefer to negotiate lower rates and volume discounts. The wholesale market for international bandwidth needs to be reviewed.

- WIOCC, the international undersea cable, has not met the objectives of ensuring access to high-speed, low-cost bandwidth, although the threat of it may have originally resulted in reduction of international bandwidth prices. The primary cause for the poor quality is the lack of domestic presence in managing the cable. As a result, players are reluctant to utilise the cable, negatively affecting the ability of the cable to act as a competitor to international connectivity provided by mobile operators and to place pricing pressure on them.

- The holding of state-owned WIOCC stake by LCA creates a conflict of interest with the regulator being both a player and referee. Although in practice it appears that the management of the network is entirely handled by WOICC externally, the perception that the regulator is able to gain insight into the activities of its competitors or protect its interests, undermines the effectiveness of LCA as a neutral regulator.

- LCA enjoys credibility amongst industry and Government and, although it is considered as the industry authority, and in practice it functions effectively, statutorily it requires the institutional autonomy to implement national policy without potential government or industry capture.

- The USF has been highly successful in supporting the operators in reaching the more uneconomic areas of the country. Its focus on extending access by subsidising mobile base stations has been successful. However, the USF needs to adapt to changing international trends emphasising data connectivity, and importantly, use. This is the key to addressing inequalities which amplify digital inequality.

- Lesotho has not had a broadband policy to drive the development objectives of the country. The ICT Policy of 2005 was a comprehensive document that was intended to enable the country to realise the goals in the 2020 Vision. However, it has not been implemented since 2005. Apart from this, although there were plans for the finalization of a broadband policy in 2016, the importance of finishing it expeditiously cannot be overemphasised.

- While the Communication Policy 2008 is aligned to global and regional reform initiatives, there are significant implementation gaps. Centrally, this includes the creation of a competition framework in which to regulate the sector. Although a market review was undertaken, the dominance found in 11 of the 14 markets tells much about the lack of effective competition in the market. The fact that anti-competitive practices were not found does not mean that the significant market power that ETL has in the fixed market and VCL in the mobile market is not being used to consolidate those companies dominance in the market with negative consequences for smaller players or late entrants. There are many signs of the outcome of this classical duopoly evident in the wholesale market; in the retail voice market; and the absence of product diversity and innovation in the market.

13.   Recommendations

- The wholesale market should be reviewed again to understand the effects of dominance better in the market and the impact on other markets. The lack of cost based leased lines and the high cost of dedicated bandwidth to smaller service providers have a chilling effect on competition and limits market entry, as do high licence fees. This will also permit the identification of dominance in existing and new emerging markets. The review needs to assess not only if there is abuse in the market but the ability of an operator to leverage their dominance in the market to position themselves in a stronger position. In the interim, LCA must ensure that it gets adequate pricing (and other) information, (particularly wholesale pricing) to deal with the issues of affordability in Lesotho and other interventions that can stimulate demand.

- To deal with the extreme dominance and the effects of duopoly in the market, the introduction of a network operator, vertically integrated in a way similar to ETL and VCL, should be considered. To make entry attractive to the late entrant in this very small market and to be able to compete effectively with the extreme dominance of VCL in the mobile market and ETL in the fixed, a third mobile network licence could be attached to the proposed transfer of shares and operations of WIOCC to LECC. This would make LECC an integrated national and international operator.

- Although there appears to be adequate spectrum and operators are not denied spectrum, nor do the larger players complain about the prices (which seem equivalent to some other countries in the region and quite low by international benchmarks, though the Lesotho market is much smaller), the dominance of VCL's spectrum holdings reflects its ability to expand its reach and therefore its quality and attract users (as indicated by VCL being the preferred provider because of the extent of the network and there being more ETL users with a second VCL SIM card). Positive discriminatory pricing that discounts spectrum for small players who are not first to market or are covering underserved areas, should be implemented. Regulated spectrum trading should be permitted for the market to self-correct.

- Implementation of e- and m-government services, responsive to the needs of the citizenry in both Sesotho and English, would not only modernise and make more efficient government, but could stimulate local content and apps production and demand for broadband. Integrating such public services and apps with other access and use strategies such as free public Wi-Fi or accessing e-government service for free on commercial public Wi-Fi could go a long way to contributing to bring the citizenry on-line.

- To safeguard the autonomy of the regulator in implementing national policy without state or industry interference, the Board of LCA should be appointed in line with procedure as outlined in the Communications Act 2012. Nominees should be those demonstrated to be qualified and appropriately skilled for the job. The Board should be made responsible for the appointment and monitoring of the performance of the CEO, who should be the principal accounting officer for the institution. The Board should not be removed from office until the end of their term, unless Parliament finds them unfit for office against a standing and transparent set of criteria.

- The conflict of interest resulting from the shareholding of LCA in WIOCC needs to be ended by the WIOCC shares being moved out of the regulator. This could be addressed by transferring the shares and operations of WIOCC in Lesotho to LECC.

- With the high levels of coverage enjoyed in Lesotho, and the very high levels of commercial profitability enjoyed by the dominant operator who has been the primary beneficiary of the USF, the Fund should

focus its attention on strategies that will stimulate and support increased broadband access and use. Innovative, alternative universal strategies such as: demand-aggregation at government buildings to provide free public Wi-Fi, self-provision of community access through the deployment of unused spectrum, and accessing low-speed Internet for free, are emerging elsewhere on the continent and should be investigated. It is also necessary to extend the range of players eligible to apply to the Fund for grants to stimulate broadband uptake through the deployment of free or low-cost services, develop content, or provide e-literacy training. This may also have the effect of stimulating local ICT business development.

PART B: Demand-side analysis

1. Introduction

As highlighted in Part A, despite relatively good mobile broadband coverage and not very high broadband prices, broadband take up in the country is extremely low. General assumptions around the lack of affordability of communications services for average citizens may be supported by evidence but there are many countries with lower GPDs per capita, such as Uganda, which have much higher broadband penetration. Broadband penetration is the number of broadband users expressed as a percentage of the total population. Broadband is defined as a system of high capacity, high speed and high quality electronic networks, services, applications and content that enhances the variety, uses and value of information and communications for different types of users. From supply-side data and analysis, it is not possible to establish the reasons for this or to understand the variable inequalities in relation to gender, income, education or urban or rural location. Without these insights, it is difficult to identify the exact points of policy and regulatory intervention to redress digital inequality.

To better understand the demand-side market dynamics and how to stimulate demand, Research ICT Africa (RIA) was commissioned in 2016 by the Lesotho Communications Authority (LCA) in partnership with the International Telecommunications Union (ITU) to conduct a demand-side analysis of the ICT market (Part B) to complement the supply-side analysis (Part A) undertaken. The demand-side study, the fieldwork for which was undertaken by LCA, took the form of a nationally representative ICT access and use survey at the household and individual user level, to assess and understand the access levels, as well as the manner and extent to which people make use of ICTs, and the challenges faced by both users and non-users.

While the focus of the research was on broadband, the questionnaire was designed to capture ICTs in their entirety, looking at access to and use of computers, mobile phones and the Internet, to ensure that the ITU's core ICT indicators were captured.

The sampling for the study was done by the Lesotho Bureau of Statistics (BoS) on behalf of LCA, whilst the actual listing of households during the fieldwork was done by LCA team of enumerators.

2. Sampling, listing and weighting

The Primary Sampling Units (PSUs) were done from a master frame obtained from the 2016 cartographic exercise conducted by the BoS. Enumeration Areas (EAs) were randomly selected, having been grouped by district. The Probability Proportional to Size (PPS) technique was used to select the EAs from the respective districts. Five different allocation methods, namely PPS, Equal Allocation, Markwardt Allocation, Power Allocation and Kish, were used to conduct comparisons between strata and to determine the number of PSUs to be taken from each stratum. The sample was explicitly allocated to the districts, and then distributed to the three settlements – urban, peri-urban and rural.

A sample size of 2 025 households was selected from a total of 135 EAs across the country. The sample size determination of 2 167 households was designed with an aim to yield estimates at 95% level of confidence. Also, because of a tendency for neighbouring households to provide similar answers to questions asked, the clustering effect (intraclass correlation) was set at 10% and a fixed number of 15 households on average were interviewed in each EA.

The listing was performed for each selected EA and all households in each EA were listed. The households to be interviewed were randomly selected from this list. Individuals aged 15 and older were eligible for selection from each of the selected households. All eligible individuals were listed and a Simple Random Number

Generator application installed on all devices was used to select the individual to be interviewed from each household.

Household and individual weights were calculated and applied to the data for analysis, to ensure that the sample used in the survey was nationally representative.

Figure 1: Map of Lesotho at the district level
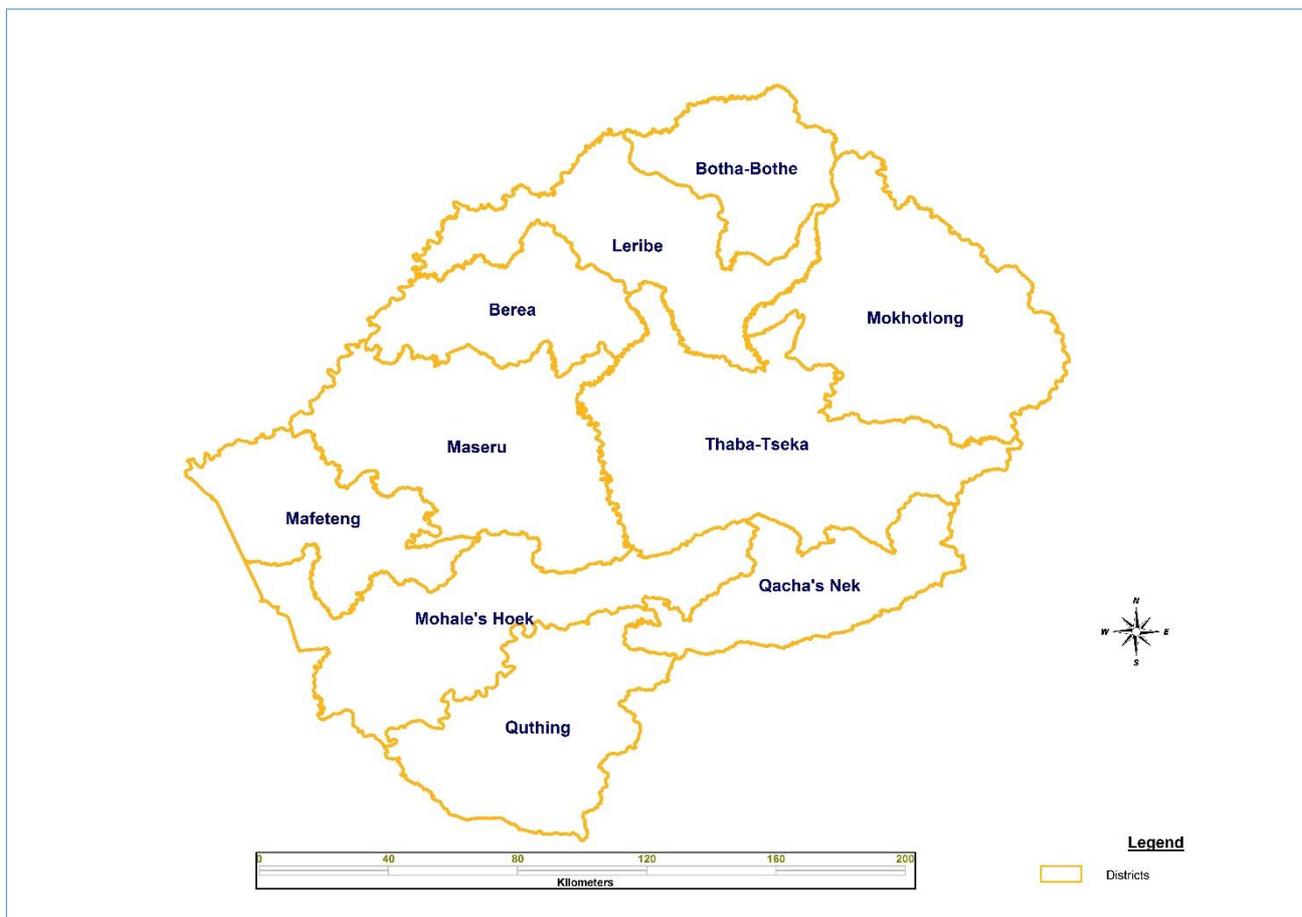
Source: LCA, 2017

The survey was conducted in 10 districts of Lesotho. The study captured a total of 2 167 households. In each household, the study collected information about the household head, household members, and access to electricity and information and communication technologies (ICTs), such as telephones, mobile phones and computers. The study also collected information on household access to financial services. Furthermore, the study collected detailed information on one member of the household in terms of his or her access and usage of ICTs. Simple random sampling was used on the household members to select one individual to interview. The personal interview method was applied because it enables data collection to be collected in a timely manner and it also enables the creation of personal relationship for future studies. The study used Fulcrum, which is a mobile phone data collection application that allows for real-time capturing of data. A combination of these data collection methods resulted in a high (100%) response rate and rigorous on-the-spot data capturing.

The 10 districts are: Berea, Botha-Bothe, Leribe, Mafeteng, Maseru, Mohale's Hoek, Mokhotlong, Qacha's Nek, Quthing and Thaba-Tseka (See Figure 1).

Although the sample is designed to guarantee representativity at the national level, the district-level data appears to be indicative of developments at the district level. The bias, measured as the difference between the actual and the sampled population per district, is less than 7%. The share of population living in rural areas in the whole sample is about 53%, with 39% of respondents living in urban areas and only 8% residing in peri-urban areas.

The distribution of the sample across the districts is as follows:

Table 1: Distribution of respondents across districts			
District name	Respondents (%)	Population estimate (2016)	Difference (bias)
Berea	12.51%	14.45%	−1.94%
Botha-Bothe	5.08%	5.56%	-0.48%
Leribe	14.64%	17.48%	−2.84%
Mafeteng	9.98%	9.68%	+0.30%
Maseru	27.60%	20.56%	+7.04%
Mohale's Hoek	8.56%	9.56%	-1.00%
Mokhotlong	5.00%	5.57%	-0.57%
Qacha's Nek	3.73%	3.37%	+0.36%
Quthing	5.03%	6.83%	-1.80%
Thaba-Tseka	7.87%	6.89%	+0.98%

Notes: Population estimates were calculated using data from BoS

Table 2: Share of households by settlement	
Urban	38.72%
Peri-urban	7.60%
Rural	53.68%

3. Household-level indicators

This section presents the findings from the households regarding access and use of ICTs by the family members. This information was sought from the household head or their proxy if not resident at that time.

More than half of all households (52%) were headed by women. This is not surprising considering the high numbers of migrant workers in the population, who work in South Africa and in the country, mainly in Maseru.

Table 3: Gender of household head	
Gender	**Respondents (%)**
Female	51.61%
Male	48.39%

One of the contributing factors to the low level of ICT use in Lesotho is that half of the households in the country have no access to electricity. Among the 47% of households that have some form of electrical supply, 34.5% are connected to the main electricity grid, 11.3% use solar and the remaining 1% use a generator or are connected through a neighbour.

In terms of household ICT assets, only 1.9% of households indicated that they have a fixed-line telephone, while 16.6% stated that they have a mobile phone. Radio is still common among households, with 52.8% of households indicating that they have a radio.

Table 4: Household indicators		
Electricity connection	No electricity	53.14%
	Connected to main electricity grid	34.49%
	Generator	0.94%
	Solar	11.30%
	Neighbour	0.13%
Household ICT assets	Fixed line	1.89%
	Radio	52.78%
	Television	29.47%
	Satellite decoder	72.58%
	Desktop	2.96%
	Laptop	6.30%
	Tablet/iPad	1.74%
	Mobile phone	16.56%
Non-ICT assets	Refrigerator	24.32%
	Electric/gas stove	64.81%

Table 5: Household ownership and use of ICT devices by district						
District name	Telephone	Household mobile phone	Radio	Television	Computer	Laptop
Berea	4.10%	17.29%	61.38%	34.28%	3.17%	7.02%
Botha-Bothe	0.98%	13.07%	51.51%	20.94%	1.70%	2.63%
Leribe	0.85%	14.98%	52.59%	26.71%	0.68%	3.78%
Mafeteng	2.45%	21.14%	56.48%	36.09%	3.86%	5.77%
Maseru	3.05%	18.51%	63.31%	47.50%	6.57%	12.80%
Mohale's Hoek	0.94%	15.73%	48.85%	16.96%	1.34%	2.92%
Mokhotlong	0.00%	15.12%	32.60%	4.19%	0.00%	0.88%
Qacha's Nek	0.84%	9.89%	41.18%	29.23%	1.60%	3.81%
Quthing	0.00%	17.77%	33.32%	7.70%	0.00%	2.20%
Thaba-Tseka	0.00%	12.22%	36.69%	4.55%	0.00%	1.08%

Fixed-line tele-density in Lesotho is low: 1.9 households per 100 households have fixed-line connections. The use of fixed line in some districts, such as Mokhotlong, Thaba-Tseka and Quthing is very low, with majority of these places' residents having no fixed-line connections. Estimated computer density is low at only three per 100 households. However, laptop penetration is slightly higher than computer density at about 6%. Most people who own laptops and computers live in Maseru. A small proportion of residents in Mokhotlong and Thaba-Tseka own laptops, while ownership of computers in Mokhotlong, Thaba-Tseka and Quthing is negligible.

Radio density is much higher than that of all the devices used. About 53% of households own a radio. Thaba-Tseka, Mokhotlong and Quthing still have the lowest adoption of radio. Television ownership is lower than radio ownership at 30 households per 100. Similarly, the share of households that own a Television in the same three districts, Thaba-Tseka, Mokhotlong and Quthing, remains low. Overall, the adoption pattern of radio and television among the districts is more or less similar. The television penetration is at 29.47% and is higher than the household mobile phone density, which is estimated at 16.5%. A disaggregation by household-head gender shows that female-headed families are more likely than male-headed families to have ICT devices. However, male-headed households are more likely than female-headed households to have a mobile phone and a computer.

Table 6: Household ownership and use of ICT devices by gender						
Gender	Telephone	Household mobile phone	Radio	Television	Computer	Laptop
Male	1.59%	18.37%	51.97%	28.11%	2.94%	5.82%
Female	2.12%	14.98%	54.20%	31.08%	2.82%	6.80%

About 5% (4.6 %) of urban households have fixed-line connections. A negligible number of rural and peri-urban areas are connected to fixed-lines – 1.14% and 0.05% respectively. About 13 in 100 residents of urban areas own a laptop, while about 8 in 100 residents of peri-urban households own a laptop. Very few households own a laptop in rural areas. Radio seems to be the most popular communication medium in Lesotho. About 62% of urban households have a radio, followed by peri-urban and rural households at 57.3% and 45.4% respectively. However, a divide is observed in television ownership. While about 54% of households in urban areas and 40.7% in peri-urban areas have television sets, only 10.2% of rural households have television sets.

Connection to the fixed Internet at household level is very low with 3.6% of households stating that they have Internet connection at home. Though the share of households with Internet connection is minimal, more than 80% of these households use a mobile phone to connect to the Internet, 13.9% use a USB modem or card, and 2.5% use fibre or ADSL connections.

Table 7: Internet connectivity		
Internet connection at household level	Households with Internet connection	3.57%
	Use of mobile phone	83.68%
	USB modem/card	13.86%
	Fibre/ADSL	2.43%

The main reason for not having a household connection is 'not knowing how to use the Internet'. Another reason cited by about 21% of households with no Internet connection, is that the 'cost of equipment is too high'. A further 16.6% stated that they 'have Internet access elsewhere'. In terms of availability, only 6.6% of households indicated that not having the Internet at home was because that facility is not available in their area.

About 7% (6.7%) of urban households have Internet connection, while about 6% of peri-urban households have fixed Internet connection. A small proportion (0.9%) of rural households has fixed Internet. However, there is no significant sex difference in the adoption of fixed Internet by household head. The mean amount spent by each household on the Internet is M115.74 a month.

Figure 2: Main reasons cited by households for not having Internet connection

Percentage of Households
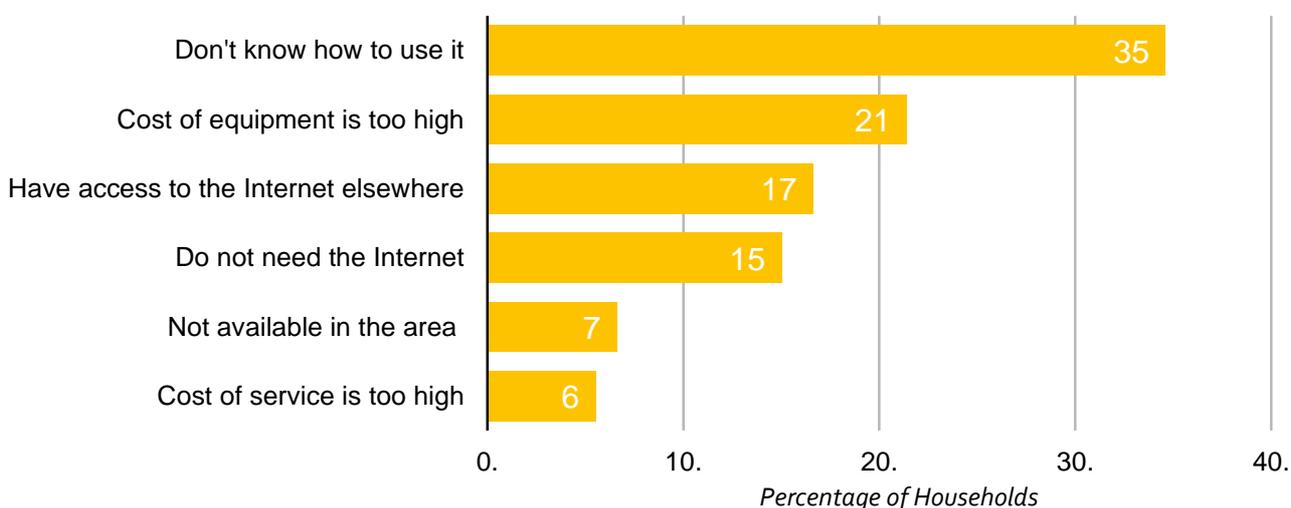
4. Demographic breakdown of the individual user survey

This section, and sections 5 to 10 present findings on access and use of ICTs from the randomly selected individuals in each household.

When disaggregated by gender the study sample had 72.78% females and 27.22% males[17]. The age brackets of individuals interviewed were slightly more evenly distributed, although the majority are of school-going or university-going age. Only 31.54% are either employed or self-employed, and of this percentage, 55.82% are employed full-time.

Primary school is the highest educational level attained by most individuals, both nationally and across the sexes. About 45% of individuals had attained primary-level education, while 28.15% had not completed primary school, but had attempted it. About 15% of individuals had secondary education as the highest level of education attained. Very few individuals had attained a tertiary level of education.

About 30% of the individuals interviewed were engaged in unpaid housework, whereas 24.41% were unemployed during the six months prior to the survey. Only around 18% of individuals indicated they are employed, and 14% are self-employed. A larger share of female respondents, are engaged in unpaid housework (34.70%) and a larger proportion of male respondents are employed (23.87%).

Table 8: Highest education level attained			
Level of education	National	Male	Female
None	4.78%	10.80%	2.52%
Attempted primary	28.15%	31.37%	26.94%
Primary	45.00%	32.91%	49.52%
Secondary	14.94%	15.53%	14.71%
Vocational training	4.75%	6.09%	4.24%
Tertiary (diploma/certificate)	2.12%	3.16%	1.74%
Tertiary (Bachelors)	0.27%	0.15%	0.31%

5. Access and ownership of mobile phones

As of 2016, about 99.7% (ITU 2016) of the world population was connected to mobile telephony networks (ITU 2016). However, only 13.7% of the world population had access to the fixed-line telephones. The high adoption of mobile phones and the migration of technologies from fixed to portable devices did not only occur in developed countries, but has also occurred in developing countries. For instance, as of 2015, the mobile subscription rate stood at 100.94% in Lesotho, while fixed-line subscriptions were at 1.09% (ITU 2016). The survey results show that the use of active SIM cards (subscriptions) as a measure of penetration overestimates real penetration levels. While the ITU reports mobile subscriptions to be at about 100%, the survey results show that mobile penetration in Lesotho is at 78.65%. The problem with the mentioned statistic is that it equates each SIM with an individual subscriber. This is mainly due to the pervasive use of

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[17] A larger number of females were interviewed in the survey, which is not a representation of the actual gender figures in Lesotho. However, checks were conducted to ensure that this skewness towards a larger number of females being interviewed was not a bias introduced by the enumerators.

multiple SIM cards by subscribers in developing countries to enjoy the best offerings from different network providers or even free starter-pack promotions from the network they are on.

The survey results show that about 69% of mobile users in Lesotho own one SIM card: considerably lower than the unique subscriber figure of about 105% provided by the operators and used in the administrative data of the regulator and the ITU, which measures each active SIM as an individual subscriber. Two SIM cards are used by 27% of users but only 3% own three SIM cards (see Table 9). This suggests that nearly a third of users have a second card, probably for access to the other network to enjoy on-net prices or to enjoy the coverage of another network that their primary operator may not provide. Of the men who own a mobile phone, 33% own more than one SIM card. Of the women who have mobile phones, 29.81% own more than one SIM card. Interestingly, the results show that 30% of mobile phone owners who are younger than 45 years, own more than one SIM cards, which may be because of SIM cards being passed down by family or friends to children or caregivers, or people possibility not in formal employment.

Table 9: SIM card ownership			
Number of SIM cards	Percentage	Male	Female
1	68.99%	66.07%	70.11%
2	27.25%	28.93%	26.61%
3	3.39%	4.48%	2.98%
4	0.33%	0.38%	0.31%
5	0.04%	0.13%	0.00%

The results further show that about 43% of respondents who indicated ETL as their primary network service provider own two SIM cards. However, only 25% of VCL customers own two SIM cards, while 72% own one SIM card. These results could be due to several factors. Reasons for high numbers of ETL customers owning multiple SIM cards could be to obtain better, cheaper or promotional packages, to take advantage of on-net prices on VCL, which has the much bigger customer base, better coverage in some areas, or is perceived to have better quality. Mobile phone ownership at national level stands at 78.7%. Disaggregation by sex shows that 80.1% of males and 78.1% of females own a mobile phone. Despite operators identifying the lack of smartphone as a barrier to the take up of data services, close to 45% of mobile phone owners indicated that they have smartphones capable of browsing the Internet and this figure is similar across the sexes. These figures are confirmed by the similar share of mobile phone owners who indicated that their devices can access Facebook/WhatsApp.

Table 10: Ownership and access				
		National	Male	Female
Ownership of ICT devices	Desktop	11.83%	8.21%	13.76%
	Laptop	25.20%	28.79%	23.30%
	Tablet (iPad, Galaxy tab, and so on)	7.84%	5.45%	9.10%
Mobile phone	Ownership of a mobile phone	78.65%	80.08%	78.12%
	Mobile phone capable of browsing the Internet	44.54%	44.98%	44.37%
	Mobile phone capable of accessing Facebook/WhatsApp, and so on	45.3%	45.4%	45.3%

5.1 Mobile ownership by location

A disaggregation of respondents by location shows that mobile phone penetration is high across each stratum. About 87% of respondents in the urban areas own a mobile phone. Similarly, a large proportion of peri-urban dwellers (88.23%) own a mobile phone, with about 72% of respondents who live in rural areas also owning a mobile phone. About 88% of female respondents living in urban areas, 86.35% of female respondents living in peri-urban areas and 71.41% of those living in rural areas own mobile phones.

Table 11: Mobile penetration by location			
Mobile ownership	Urban	Peri-urban	Rural
Yes	86.91%	88.23%	72.13%
No	13.09%	11.77%	27.87%

There is no significant difference between males and females in terms of ownership of mobile phones. In comparison, residents of rural areas are less likely to own a mobile phone than those who live in urban and peri-urban areas. This is likely to reflect lower income and literacy levels in rural areas and correlate with lower education levels.

5.2. Mobile ownership by age

An analysis of the mobile phone adoption by age category shows that mobile phone adoption is high across all age categories. The probability of mobile ownership increases with age up to 35 years and then it begins to gradually decline.

Table 12: Mobile ownership by age category		
Age category	Own a mobile phone	Do not own a mobile phone
15 - 24 years	79.71%	20.29%
25 -34 years	87.29%	12.71%
35 - 44 years	83.49%	16.51%
45 - 54 years	83.28%	16.72%
55 - 64 years	73.11%	26.89%
65 years and above	53.34%	46.66%

The ownership of other devices is much lower in comparison to mobile phones. Only a quarter of the population (25.20%) owns a laptop, while 11.8% owns a desktop and only 7.84% owns other mobile devices such as tablets/iPad. The sex-disaggregated data show more women are in possession of tablets/iPad and desktop computers compared to men. On the other hand, more men own laptops in comparison to women.

5.3. Mobile ownership by education

A disaggregation of mobile phone ownership by education shows that there is a strong correlation between education and mobile phone adoption in Lesotho (A Logit model is used to test this relationship). About 98% of individuals who completed tertiary education own mobile phones, and 92% of individuals with a secondary certificate own a mobile phone. However, the results show that in comparison to other groups, people with no primary education certificate are less likely to own a mobile phone. While 34% of people who do not have a primary certificate do not have a mobile phone, the number of people who do not have a mobile phone significantly declines as the highest level of education attained by an individual increases.

Table 13: Mobile phone ownership by education		
Education	Own a mobile phone	No mobile phone
Less than primary	65.47%	34.53%
Primary	80.99%	19.01%
Secondary	91.57%	8.43%
Tertiary	97.58%	2.45%

5.4 Determinants of mobile phone ownership

The study adopts a logistic regression to investigate the determinants of mobile phone ownership in Lesotho (See Annex 2). It is assumed that individuals have two choices, either to adopt a mobile phone or not. The decision to adopt a mobile phone is determined by individual and household characteristics. In the first stage,

we estimate an individual's decision to adopt a mobile phone. The estimation is conducted using full survey data.[18]

Following existing studies, the report uses both individual and household variables to investigate the determinant of mobile phone adoption in Lesotho.

The variables used in this study can be categorised into individual, household and location variables. The report considers income, gender, age, educational level and family background as the main variables. This is because we hypothesise that the main drivers of mobile phone adoption and Internet use lie in the ability to pay for the services (affordability). It is hypothesised that low-income households find it difficult to access and use the Internet due to high prices. For instance, about 40% of respondents stated the cost of Internet use is the main prohibitive factor. Of those who never use the Internet, 23% stated that the reason they cannot use the Internet is due to high unaffordable prices.

Table 1 in Annex 2 presents the estimation results of a logit regression. The dependent variable is a 0-1 categorical variable, taking 1 if the respondent owns a mobile phone and 0 if the respondent does not. The main variables of interest are gender, age, income, educational level, marital status and location. These are the main explanatory variables for investigating the mobile phone use gap. The estimation strategy also controls for household variables such as radio and telephone ownership, and access to a bank account.

..The estimation of a Logit model for the adoption of mobile phones used two approaches. The first approach did not control for income by excluding it in the model and the results are presented in column (2) of Table 1 (Annex 2). The reason behind the omission of this variable is due to its collinearity with education and employment status. The second approach controlled for income by including it in the model. This was to check for the robustness of the model and the results for this approach are presented in column (3) of Table 1 (Annex 2).

The estimation of a logit specification in column (2) shows that individuals aged between 25 and 45 years are more likely to own a mobile phone than those who are younger than 25 years. However, the results show that there is no significant difference in ownership of mobile phones between individuals younger than 25 years and those older than 45 years.

There is no gender gap in the adoption of mobile phones. However, individuals who live in urban areas are more likely to have a mobile phone than residents in rural areas. The results also show that those who come from wealthier households are more likely to own a mobile phone than those who live in poor households. Living in a household with members who have access to a bank account increases the probability of an individual owning a mobile phone. Furthermore, individuals who live in households that own a radio are more likely to have a mobile phone compared to their counterparts who live in households with no radio ownership. We find telephone, electricity and piped water into the house to be insignificant determinants of mobile phone adoption.

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[18]Existing studies have found that demographic factors such as income, gender, location and education are significant determinants of mobile phone adoption. For instance, Deen-Swarray, Gillwald, Khan and Morrell (2016) which finds that education and income are the primary determinants of gender inequality in access and use of mobile phones. Grzybowski (2015), and Mothobi and Grzybowski (2017), control for gender, age, professional activities, household size, the type of dwelling and income groups to investigate determinants of mobile phone adoption. These variables have been found to be the main explanatory variables in the social divide analysis. Social divide in the context is explained as the gap between information rich and poor in each nation. The same variables have also been used in explaining the democratic divide. The term 'democratic divide' is commonly used to signify the difference between those who do and do not have access to or use the panoply of information resources to engage, mobilise and participate in public life. Before the introduction of mobile phones these distinct divides used to exist among the industrialised and the developing countries. Due to poor or non-existent fixed-line services, most of developing residents could not access information through the Internet. However, access to mobile phones has drastically changed the standard of living in many developing countries by saving wasted trips, providing information about prices or serving as conduit to banking, health care and other services (see for example, Aker and Mbiti (2010), as well as Mothobi and Grzybowski (2017)).

Education is a significant determinant of mobile phone adoption. Respondents who have finished primary, secondary or tertiary schooling are more likely to own mobile phones than those with no educational certificates. Our results are robust and even after controlling for income, which seems to be problematic, most of the explanatory variables retain their significance level. However, when we control for income (column (3), estimation (2)) we find that married individuals are more likely to own a mobile phone than those who are not married. This is the only variable that changes its significance due to the introduction of income. We find that income is not a significant determinant of mobile phone adoption in Lesotho. These results reflect the high levels of mobile phone adoption in developing countries.

5.5. Choice of mobile operator

About 95% of mobile phone owners reported that they have a pre-paid SIM card. About 5% have a South African SIM card, and only 0.3% stated that their main SIM card is post-paid. The survey results show that VCL is a dominant player in the market in terms of subscriptions, a result that corroborated the supply-side data. VCL is the primary operator of 84.8% of those with a mobile SIM or phone, while 11% have ETL as their main operator and 4.3% use an SA network as their main operator.

Figure 3: Reason for choosing operator

Reasons for choosing operator

Percentage of Individuals
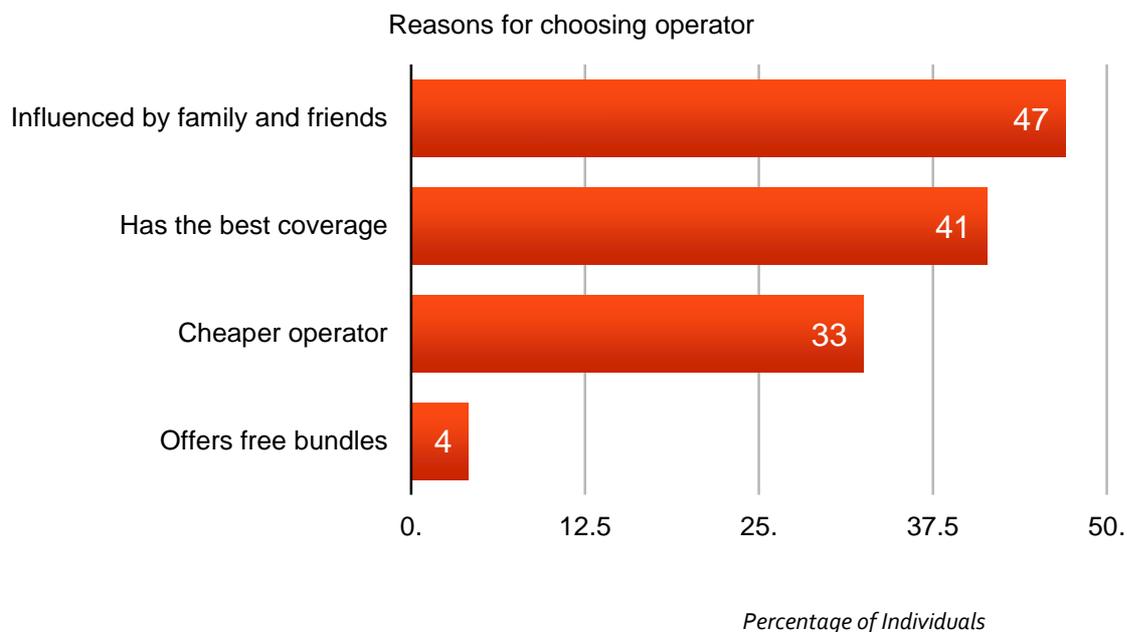
Respondents were asked to state the reasons why they chose a network to be their main operator. Close to half the users stated that it was the influence of family and friends (the club effect) that made them decide on the main operator they currently use for their mobile connection. About 41.4% indicated that their decision for a main operator was based on coverage, whilst 32.5% made the choice based on cost. Less than 5% stated that their choice of a main operator was due to the offer of free bundles.

5.6.   Mobile phone use

Although mobile phone penetration is high in Lesotho, there is some evidence of a gap in mobile phone use. A larger proportion of rural area dwellers are excluded from the benefits of mobile technologies than people living in urban areas. The results of the survey provide evidence that Lesotho has not yet taken full advantage of the potential that mobile phones hold for poor communities. For instance, mobile phone-based financial transactions are very low in Lesotho. This section looks at this and how individuals use ICTs, particularly their mobile phones and the Internet.

Access to mobile phones can dramatically improve the standard of living by reducing transaction and transport costs, providing information about prices or serving as a conduit to banking, health care and other services. This is observed in the Lesotho mobile market.

Being the device most used, the activities that individuals conduct most on their mobile phones are presented in Figure 4. Using mobile phones to make international calls is seen to be the activity most performed on the mobile phone. About 65% of individuals indicated that they access government services on their mobile phones. The next top three most activities performed on mobile phones are related to entertainment – namely 'listening to music/radio', 'taking photos or video clips' and 'playing games'. To a lesser extent, people use their mobile phones to roam when outside Lesotho (22.0%) and to report crime (18.8%).

Figure 4: Main activities for which a mobile phone is used
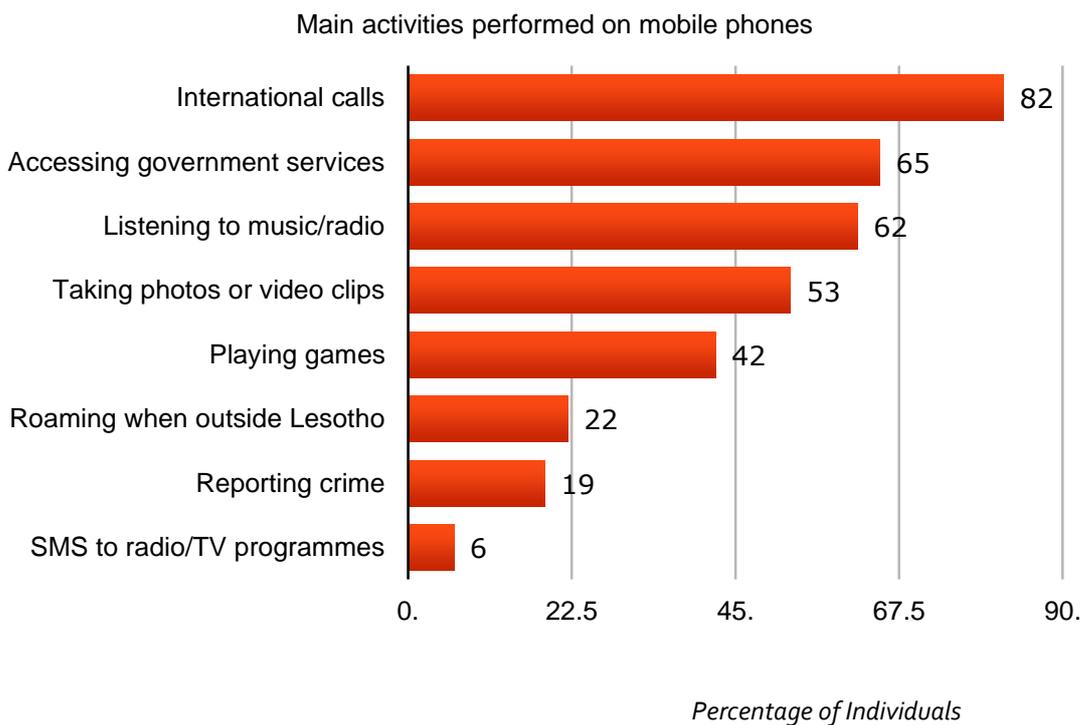
5.7.   Benefits of mobile phone use

The mobile phone is seen to have contributed positively towards enhancing the lives of people. Most people indicated that through the use of the mobile phone, 'they are able to check on the safety of their loved ones and know where they are', 'they are able to save on travel time and cost', 'makes them feel more secure and safe' and 'their family is better off', among others.

| Table 14: How mobile phone use enhances the lives of users	
Makes the family better off	91.94%
Save on travel time and cost	96.05%
Get help with finding work	55.15%
Get more done during the day	85.06%
Feel more secure/safe	95.48%
Check on safety of loved ones and know where they are	97.14%
Find out about safety issues and alert people	76.26%
Provides health/services information	63.14%

6. Internet penetration

Broadband Internet access in general, and mobile broadband in particular, is becoming increasingly important to national economies and the personal lives of users. As of 2016, about 11% of the world's population had access to fixed broadband. While 30% of developed countries had access to fixed broadband, only 8.2% of developing countries had access to it (ITU 2016). However, while most low-income earners are not connected to fixed broadband, the introduction of mobile broadband services has the potential to reduce the digital divide and give the poor an opportunity to connect to the Internet.

There is evidence that in developing countries broadband adoption is slower in rural areas than was the case with mobile phone adoption. According to the ITU (2016), about 90% of the population in developed countries is connected to mobile broadband, while only 40.9% of the population in developing countries can access mobile broadband.

Figure 5: Share of Internet use
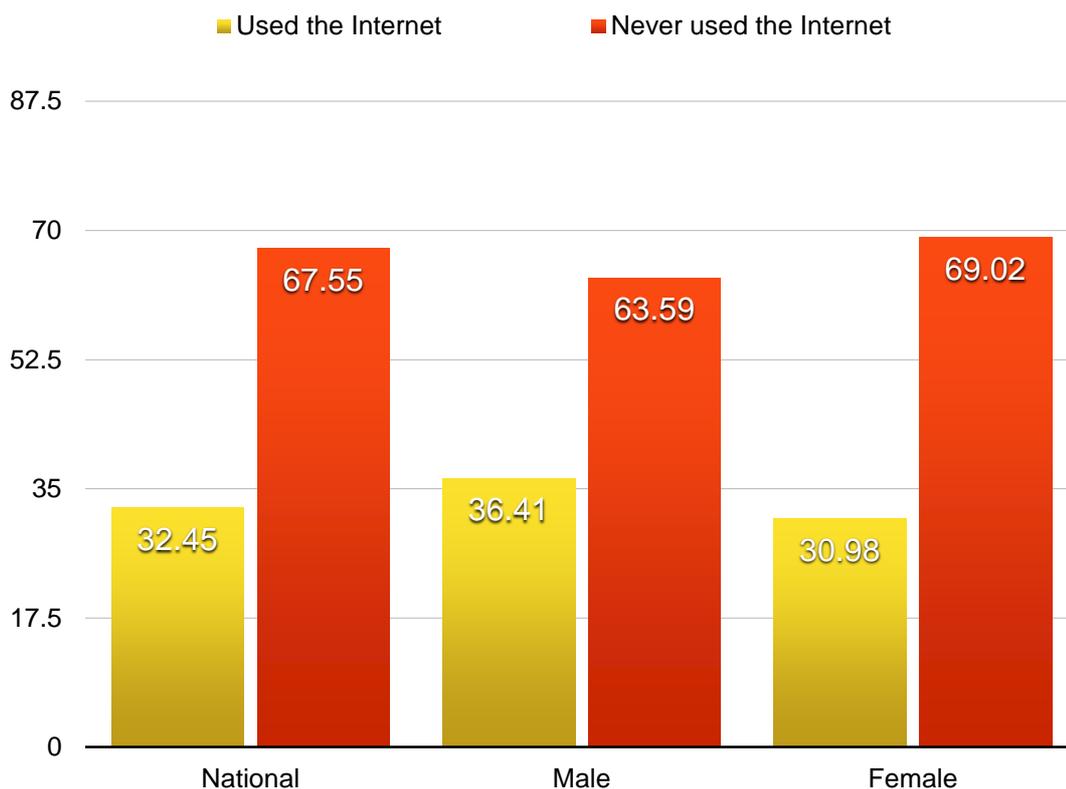
The study finds that 32.45% of people in Lesotho have used the Internet. When data is disaggregated by sex, slightly more men than women use the Internet. About 36% of males have access to the Internet, while 31.0% of females have connected to the Internet. The findings show that education, and not income levels, could be the source of the digital divide. While generally women are more educated than men, most of the women have only attended up to secondary education, with more men having finished either vocational or tertiary education (see Table 8). However, it should be noted that number of individuals with tertiary education is low.

The results further show that about 83% of rural dwellers are not connected to the Internet, while about half of the urban areas are connected. These results may seem surprising given the good connectivity of Lesotho. However, this digital gap can probably be explained by the un-affordability of services and devices and the literacy rate, therefore this has been tested and the results reported below. The digital divide may also be explained by lower levels of mobile phone adoption in rural areas. While about 90% of urban area residents own mobile phones, 72.3% of rural residents own mobile phones and a much smaller number own smart phones. This shows that even though mobile phones have the potential to enhance the lives of individuals, digital inequality is in fact being amplified as an urban elite can benefit from being online while most of the population are left offline or only able to be online intermittently and for short periods in Lesotho. Several factors could be at play here, both from the supply and the demand side.

6.1. Mobile Internet

A household and individual survey conducted across 12 African countries in 2012 found that most people across African countries were accessing the Internet through their mobile phones (Stork, Calandro and Gillwald 2013). The study revealed that the first point of access to the Internet by most Internet users is the

mobile phone. At the national level as well as across sexes, more than 80% of individuals indicated that they used their mobile phones to first gain access to the Internet. This is the case in Lesotho too.

Figure 6: Device through which Internet was first accessed in Lesotho

Device used to first access the Internet
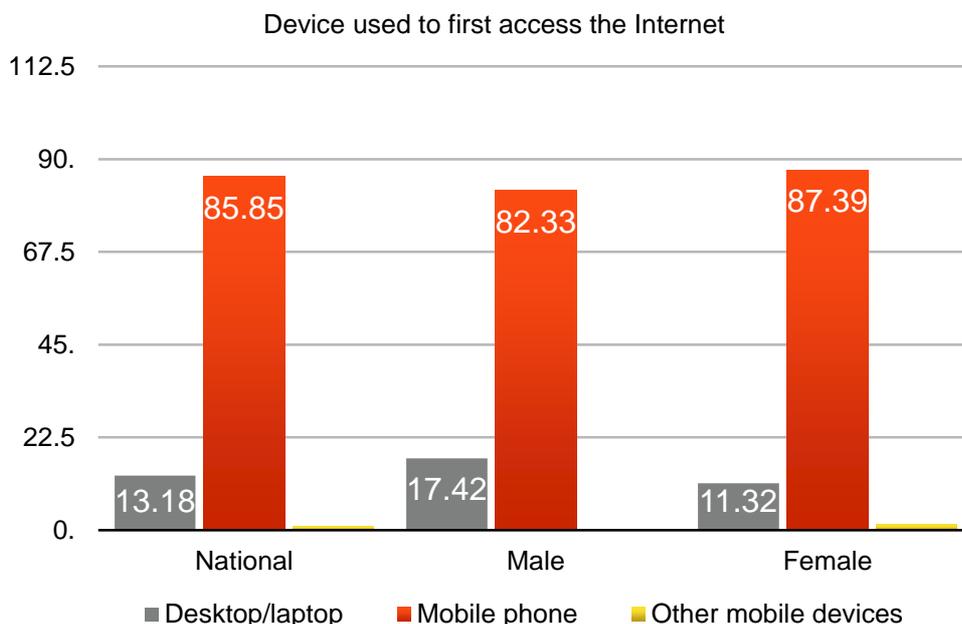
The mobile phone continues to be the device most used to access the Internet at the national level and across the sexes. Although there is minimal use of other devices by individuals to access the Internet, the desktop/laptop follows the use of mobile. A wide margin is recorded, as about 86% of individuals use their mobile phones to access the Internet compared to 13% who use their desktop/laptops, 10.1% who use a desktop and 1% who use other mobile devices (either an iPad or a tablet).

Over half (52%) of Internet users have been using it for a period that ranges between 1 and 5 years whereas a third (30%) used Internet for over five years. The proportion that used Internet for less than 1 year constituted 18%.

6.3. Places of access

In terms of place of access, individuals are found to access the Internet mostly at home (about 45%) whether on a fixed connection or a mobile device, and this is similar for both males and females. Access through public Wi-Fi in government buildings, community centres and other public places, is another place of access for some individuals, with 17.8% indicating they access the Internet at such places. About 15% of individuals still use the Internet café to access the Internet, while 13.7% access the Internet at their place of work. A place of education is the least used to access the Internet in comparison to the other places.

For male respondents, the Internet café is the second most used place to access the Internet, followed by public spaces using public Wi-Fi. In comparison, female respondents use a public space (public Wi-Fi) more, followed by place of work to access the Internet. Whereas 28.0% of men use the Internet café to access the Internet, only 10.4% of women use the Internet café as a point of access.

6.4. Uses of Internet

About a third of the population have used the Internet and of these, 46.7% stated that 'social networking' was the main reason that led them to use the Internet for the first time. The use of the Internet for educational

purposes comes in second as the reason for first using the Internet, but at only around half the number coming online for social networks purposes. About 14% indicated that it was instant messaging that made them first use the Internet, while 8.2% indicated that it was the need for entertainment that led them to use the Internet for the first time.

Figure 7: Main reasons that led to the use of the Internet
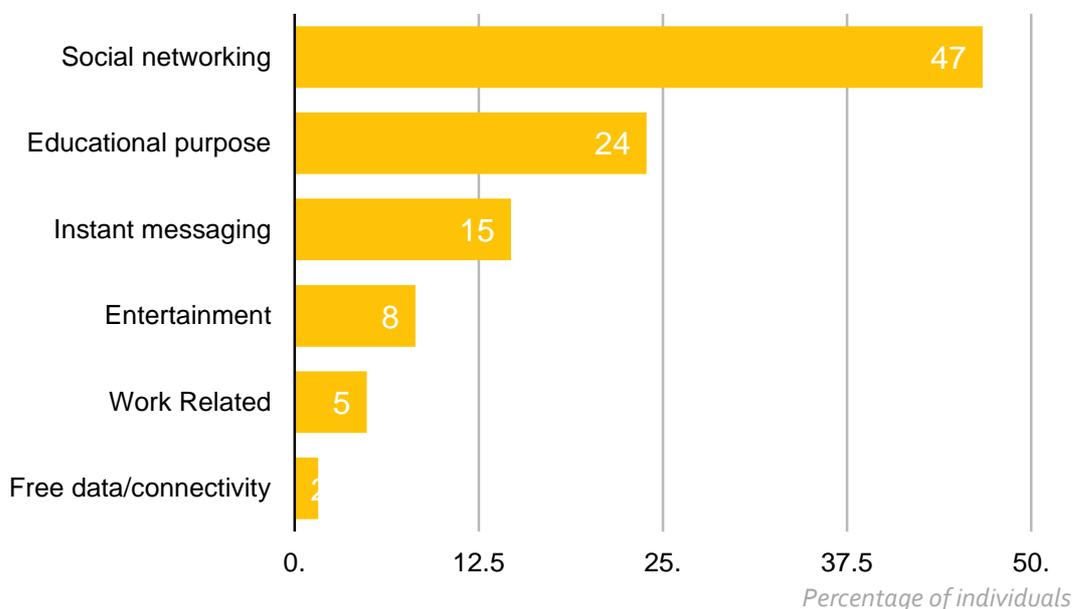
Social networking, continues to be the activity most performed on the Internet. About 86% indicated that they perform social networking activities when they go on the Internet. This is followed by instant messaging with 74.8%. Downloading music/videos and conducting fact checks or looking up word definitions are also activities performed on the Internet by more than half the respondents. Obtaining information about health-related issues and services also seems to be a popular activity among the online activities that individuals engage in on the Internet.

Figure 8: Main activities performed on the Internet
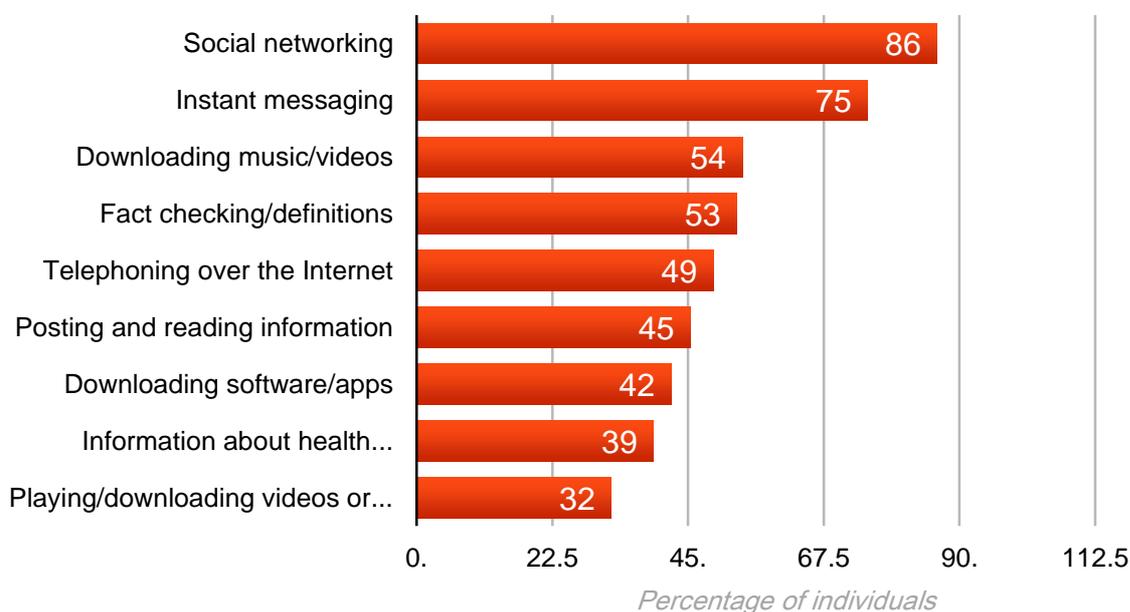
6.5.   Social media

Table 15: Social media		National	Male	Female
Social media	Use social media	86.01%	81.23%	88.11%
	Use pseudonym to sign-up	19.40%	23.06%	17.92%
	Use real name to sign-up	78.27%	70.54%	81.40%
	Use both real name and pseudonym	2.33%	6.39%	0.68%

About 86% of individuals use social media and there are more women than men that use it. Anonymity does not seem to be a big issue with 78.3% of people indicating that they use their real names to sign-up on social media. The results show that more women sign-up using their real names. Only 19.4% of individuals indicated that they use a pseudonym to sign-up on social media, with more men than women using a pseudonym.

Individuals seem to be a lot more comfortable discussing religious matters and health issues on social media. Sexual matters and political matters are the issues that individuals feel most uncomfortable discussing on social media.

Figure 9: How individuals feel about discussing certain issues on social media
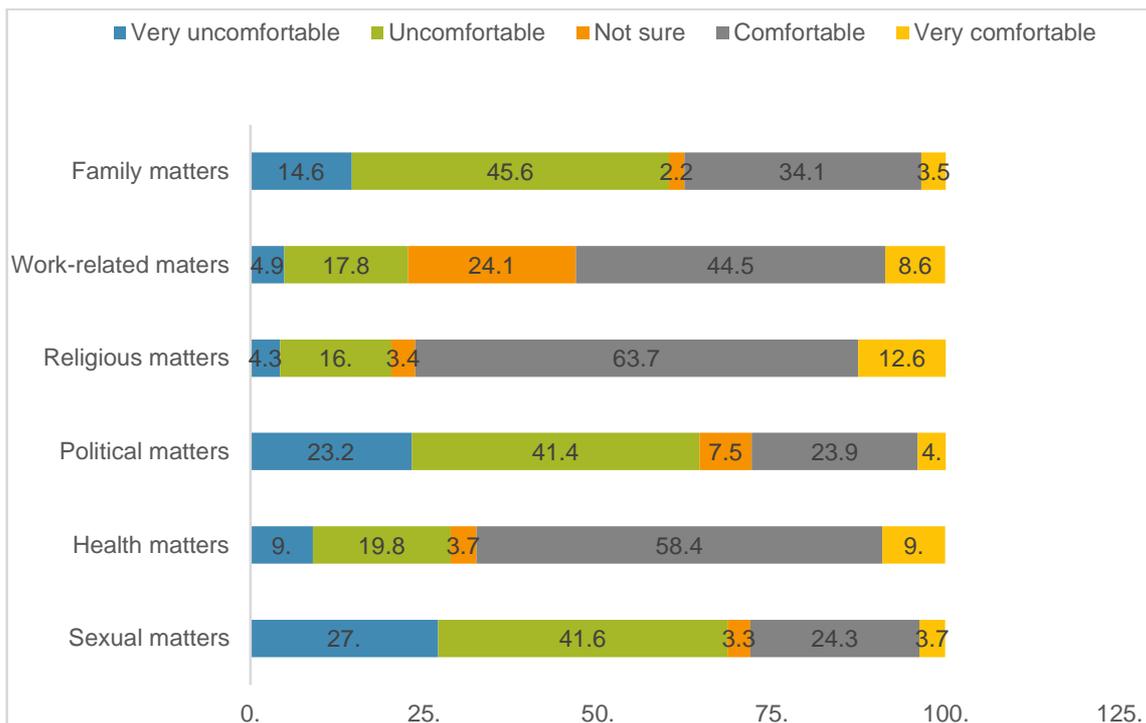
6.6.   Determinants of Internet use

As with the estimation strategy employed for mobile phone adoption, the full survey sample is used to investigate the determinants of Internet use in Lesotho. The adoption gap with the Internet is more pronounced than the mobile phone adoption gap. All variables except gender, piped water, radio, telephone and settlement (urban/rural) are statistically significant.

The results show that individuals who own mobile phones are more likely to use the Internet than those who do not own mobile phones. As mobile phones have the potential to improve the livelihoods of poor communities by providing them with access to services that they could not access before, these results are critical to policy makers in Lesotho, as they show that the conduit to achieving high Internet use lies in mobile broadband.

In relation to adoption, people aged between 25 years and 45 years are more likely to have a mobile phone compared to those who are younger. Older residents are less likely to use the Internet than respondents younger than 25 years.

Internet demand rises with the education level of any society. A more-educated society has higher Internet demands, while a less-educated society has lower Internet demands. Generally, while mobile phone use does not require any form of education, the use of some applications does require certain minimum skills. Like the findings in the mobile phone adoption section, the survey shows that education is a significant driver of Internet use. Respondents with some form of schooling are more likely to use the Internet than those that have who have no primary certificate.

The findings show that individuals with high incomes are more likely to use the Internet than those with low incomes. This result raises the issue of affordability. This study confirms this to be the case. However, there are several other equally significant factors. Married individuals for example are less likely to use the Internet compared to unmarried individuals.

7. Desktop computer use

The use of computers (Desktop or Laptop) is comparatively low. Over 80% of the respondents stated that they have never used a computer. The share of women who have never used a computer is higher at about 82% compared to men at 74.8%. However, the figure can be considered high across both sexes. Of those who have used a computer, a higher proportion (10.1%) stated they do so occasionally, while only 5.8% indicated that they use a computer daily.

Table 16: Computer use		National	Male	Female
Use of a computer	Never used one	80.27%	74.84%	82.30%
	Use it occasionally	10.15%	11.02%	9.82%
	Use it once a month	0.86%	1.03%	0.80%
	Use it once a week	2.89%	3.84%	2.53%
	Use it daily	5.84%	9.27%	4.55%

The difference between Internet users (32.5%) and computer users (19.7%) illustrates the broadband gap that used to exist when African users had to rely solely on unaffordable computers and fixed-line broadband access. The introduction of mobile phones, and more specifically smartphones, has demonstrated the potential to close this access gap and improve broadband penetration. These results, therefore, show the importance of mobile phones in connecting previously marginalised residents.

8. Financial transactions using ICTs

Over half the population (50.7%) do not use any form of mobile money services for transacting financially. The proportion of the population that uses mobile money constituted 43.2% while the use of mobile banking is still low at around 2.0%. Low levels of platform use could be due to low levels of mobile Internet take up. About 95% of mobile phone users stated that using mobile phones reduces travel time and helps them to save costs, and about 85% of mobile phone users stated that mobile phones increase their productivity by allowing them to do more in a day.

For those who use the Internet, a few engage in financial activities when online. About 10% indicated that they do Internet banking and about 8% stated they engage in online 'stokvels' (e.g. MMM). Online betting and financial transactions with government organisations are fairly limited among Internet users – only 3.7% and 3.8% respectively.

Table 17: Using ICTs to conduct financial activities		National	Male	Female
Use of mobile money services	No	50.69%	53.83%	49.49%
	Yes, mobile banking	1.99%	2.08%	1.95%
	Yes, mobile money	43.17%	39.65%	44.52%
	Yes, both	4.15%	4.44%	4.04%
Using the Internet for…	Online *stokvels*	7.55%	9.33%	6.77%
	Online betting	3.70%	9.70%	1.06%
	Transaction with government organisations	3.83%	6.65%	2.58%
	Internet banking	9.77%	11.13%	9.18%

9. e-Services

The policies in many countries draw on evidence from around the world of the benefits of adopting technologies for provision of education, health and other government services. The benefits of e-government applications can include cutting costs, as well as improving processes and information flow, with a huge potential for improving customer service to citizens. In June 2013, the Government of Lesotho took an initiative to roll out e-government services – an initiative that was budgeted at USD8.55 million and was expected to be finalised by 2018. However, the implementation has been delayed and e-government services are limited. As a result, only about 4% of the population are using the available e-government services to transact with the government and only 9% accessing services through any platform. Only 11% of the population have used the service to download or upload documents on a government website.

Table 18: The use of e-government services	
Online services	Adoption (%)
Downloading and uploading documents	11.26%
Financial transactions with government	4.20%
Requesting government services	9.61%

The results show that mobile phones are the most-used technology for accessing e-government services which means the Government needs to prioritise m-government services. About 62% of those who have used e-government services to download and upload documents, used mobile phones. This shows that mobile phones play a critical role in taking services to the people.

Table 19: The use of e-government services by devices			
Online services	Desktop/Laptop	Mobile Phone	Other mobile devices
Downloading and uploading documents	36.00%	62.67%	1.33%
Financial transactions with government	46.43%	53.57%	
Requesting government services	35.94%	62.50%	1.56%

While education is one of the key sectors to benefit from developments in the digital economy, Lesotho has not yet realised these benefits. The adoption of e-educational services in Lesotho is very low. Only 28% of the population uses the Internet for educational research, while 22% uses it to access free education. The adoption of online education however is average, with about 30% of the population using Internet for online education. Online education in this context refers to using Internet services to access live/streamlined educational content or watching educational videos. The use of the Internet to access or download electronic books in Lesotho is 23%.

Table 20: E-educational services	
Educational services	Adoption (%)
Electronic book	22.82%
Online newspaper or magazine	26.28%
Distance learning	8.26%
Research	28.08%
Free education	21.62%
Online education	30.93%

The low levels of adoption of broadband services for educational purpose indicate that Lesotho is not yet benefiting from the potential of the available technologies to provide cheaper and efficient services. The rapid technological changes in information and communication technologies have brought about rapid changes in skills and knowledge requirements. Today the world does not only depend on the traditional teaching systems, but rather students have the opportunity of accessing educational content online. The low adoption of the e-educational services in Lesotho implies that Lesotho is not optimising the opportunities arising from being connected to the global information society.

Table 21: The use of e-educational services by devices			
Online services	Desktop/Laptop	Mobile phone	Other mobile devices
Electronic book	25.66%	73.66%	0.66%
Distance learning	43.64%	54.55%	1.82%
Research	25.13%	73.80%	1.07%
Free education	26.39%	72.92%	0.69%

Similarly, mobile phones are also the main device used to access e-educational services. About 74% of those who access electronic books on the Internet also use the Internet for research purposes, and those who use the Internet for free education use mobile phones.

Another sector that has seen significant transformation due to improvements in technologies, especially mobile phones, is the health sector. The use of mobile phones to deliver health services provides several opportunities to enhance health care reducing expenditure. The services are not only beneficial to the Government, but they can also reduce transport and transaction costs associated with diagnosis or treatment at distant health facility. With limited options of e-health services in Lesotho only about 38% of those accessing the Internet indicated that they access e-health services using mobile phones.

10. Limitations and barriers

This section looks at both users and non-users of mobile phones and the Internet. The first section looks at the factors that prevent users from using these ICTs as much as they would like to. The second section focuses on non-users and the reasons behind their non-use of mobile phones and the Internet.

10.1 Limited use

Of the individuals who use mobile phones, 37% indicated that nothing hinders their use of the mobile phone. On the other hand, 27.8% stated that it is the high charges for airtime that makes them minimise their use of the mobile phone. Lack of coverage (15.3%) and lack of electricity (15.2%) are two other main factors that users indicated hinder their use of the mobile phone. Both men and women, at 26.2% and 28.4% respectively, also cite the price of airtime as the main factor preventing more use of the mobile phone.

Figure 10: Factors limiting use of the mobile phone

Percentage of Individuals
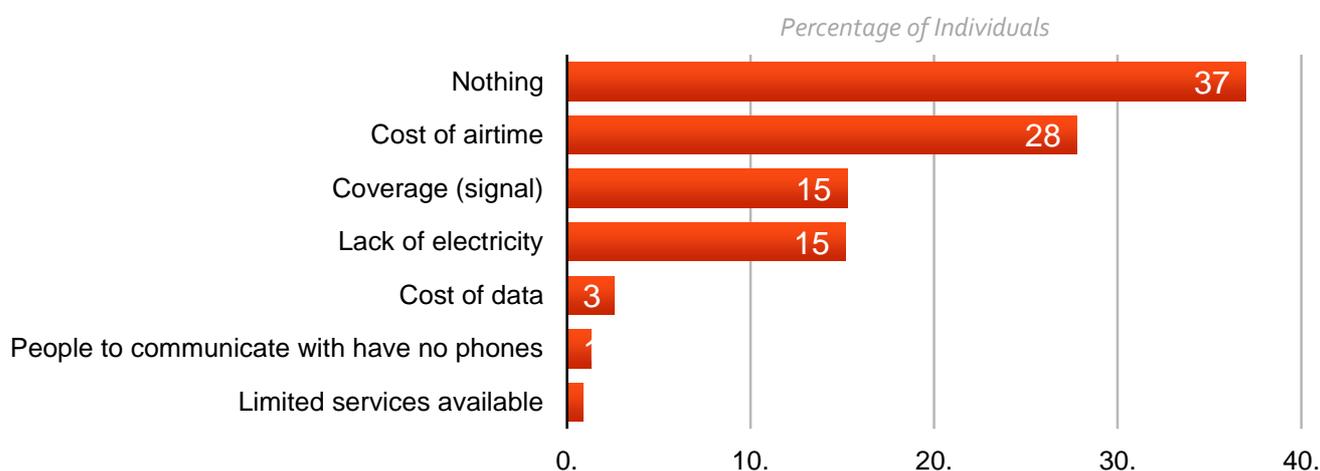
Price is also cited as the main limiting factor for Internet use. About 40% of individuals indicated that the Internet is 'too expensive to use' and therefore they limit the time spent online. Another factor affecting Internet users is speed, which 20.7% indicate is slow, thus preventing more use of the Internet.

Even though Sesotho is the language commonly spoken by most households in Lesotho, the 'lack of local language content' on the Internet does not seem to pose much of a hindrance to users.

Figure 11: Factors limiting the use of the Internet
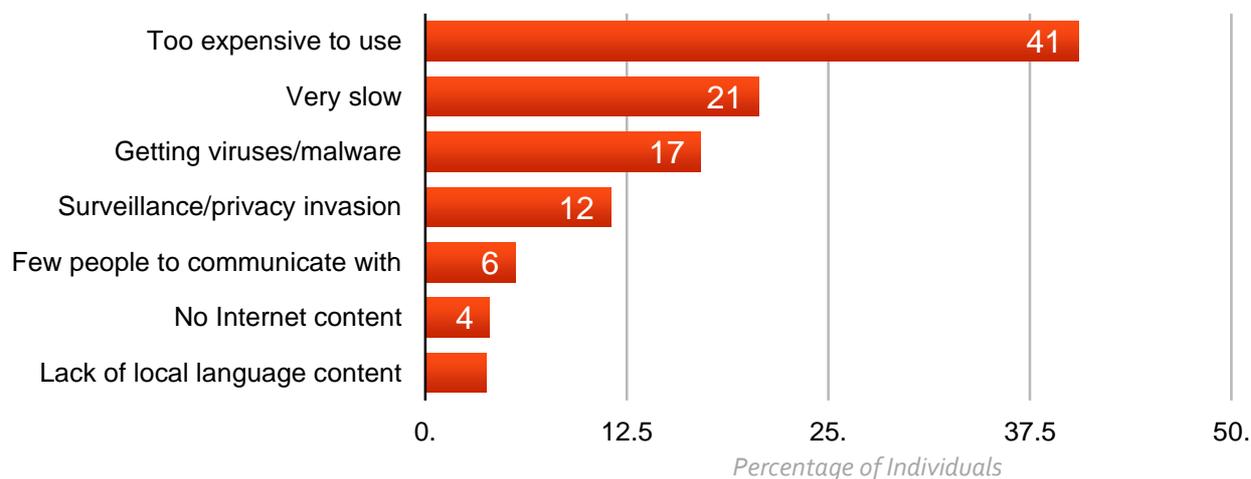
10.2 Affordability

Most individuals stated that they decide on how much they can spend on their mobile phone use when the need arises. About 42% stated that they buy airtime whenever they have money, with only about 9.8% stating that they give themselves a monthly budget.

There does not seem to be much of a difference on what activities people will engage in more if there was a decline in data prices. However, slightly more people, about 48%, stated that they would 'send more messages via Internet' while about 47% stated they would 'use more social media' if the prices of data were to fall.

Table 22: Financial issues regarding mobile phone use		National	Male	Female
Decision on how much to spend on your mobile phone use	I give myself a monthly budget	9.75%	12.35%	8.75%
	Whenever I have money I buy airtime	42.64%	43.22%	42.41%
	When need arises I decide how much I can afford	46.61%	43.19%	47.92%
	I subscribe to a monthly plan with bundled minutes	1.01%	1.24%	0.92%
Drop in data prices	Use more social media	47.76%	48.41%	47.54%
	View and download more content (video, music, etc.)	44.23%	46.42%	43.37%
	Make more calls via Internet (e.g. WhatsApp, Skype)	43.90%	45.03%	43.54%
	Send more messages via Internet (e.g. WhatsApp, Facebook)	48.72%	48.44%	48.91%

Affordability is one of the factors that inhibits mobile phone users from using the Internet. Using five quintiles of the disposable income, the survey results show that the majority of low-income earners do not use the Internet and do not own a mobile phone.

Table 23: ICT access by income quintiles			
Income quintile	Internet	Mobile phone	Smartphone
1	19.3%	31.9%	34.0%
3	26.1%	83.4%	46.9%
4	40.6%	86.0%	57.9%
5	51.0%	89.3%	41.3%

Note: There are no respondents who fall in the second income quintile.

10.3   Non-use of mobile phone

In terms of non-users, the study finds that the reason most cited by individuals for not having a mobile phone is related to affordability issues, which may stem from high costs. About 46% of individuals indicated that they do not have a mobile phone because 'they cannot afford it'. Respondents were asked to state the amount they would be willing to pay for a mobile phone. The mean willingness to pay is M303.13, with a range of M2000. The minimum value for the willingness to pay for a mobile phone is zero. Omitting the 5 respondents who reported their willingness to pay as zero, raises the minimum willingness to pay for a mobile phone to M12.00. On the other hand the maximum willingness to pay for a mobile phone is M2 000. However, comparing the average willingness to pay to the average income of respondents who do not own a mobile phone shows that the average income (M109.93) is less than the willingness to pay average. Around 34% of respondents gave their phones being broken as the reason for not having a mobile phone, which indicates that they had owned and used a mobile phone before. Only 8.7% of respondents cited 'no electricity' as a reason for not owning a mobile phone, while 5.1% claimed they do not have a phone because the one they had previously was stolen. Five percent of respondents mentioned lack of coverage as a reason for not having a mobile phone. This trend is similar across the sexes, with both males (42.6%) and females (46.4%) citing affordability as the main reason why they do not own a mobile phone.

Figure 12: Main reasons cited for not having a mobile phone

Main reasons for not having a mobile phone

Reason	Percentage
Cannot afford it	46
Broken	34
No electricity	9
Stolen	5
No coverage	5

Percentage of Individuals
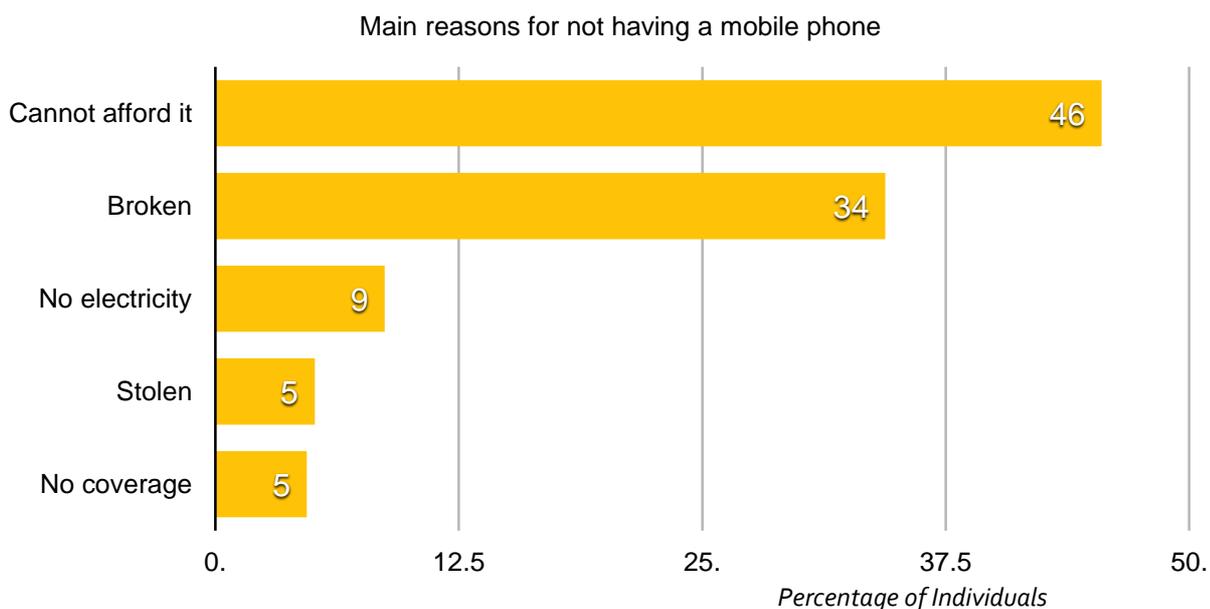
10.4   Profiling non-Internet users

Profiling people who do not use Internet is an important policy exercise. The survey asked respondents who do not use the Internet to state their reasons for not using the Internet. About 60% of Internet users stated that they do not know how to use it. The results further show that the lack of devices that connect to the Internet is a significant impediment to Internet adoption and use. While a few people do not connect to the Internet due to privacy issues, not being allowed by spouses and because they do not have time, the study shows that affordability and low levels of education are the major factors of digital exclusion.

Figure 13: Main reasons cited for not using Internet

Reason	Percentage
Parents/Spouse do not allow it	3.6
Worried about privacy	5.86
No time/busy	6.86
None of my friends use it	16.86
Internet too expensive	23.32
No Internet connection	26.18
Don't know how to connect	29.85
No interest/not useful	31.51
No computer/device	49.7
Don't know what the Internet is	58.63
Don't know how to use the Internet	60.16

Percentage of Individuals
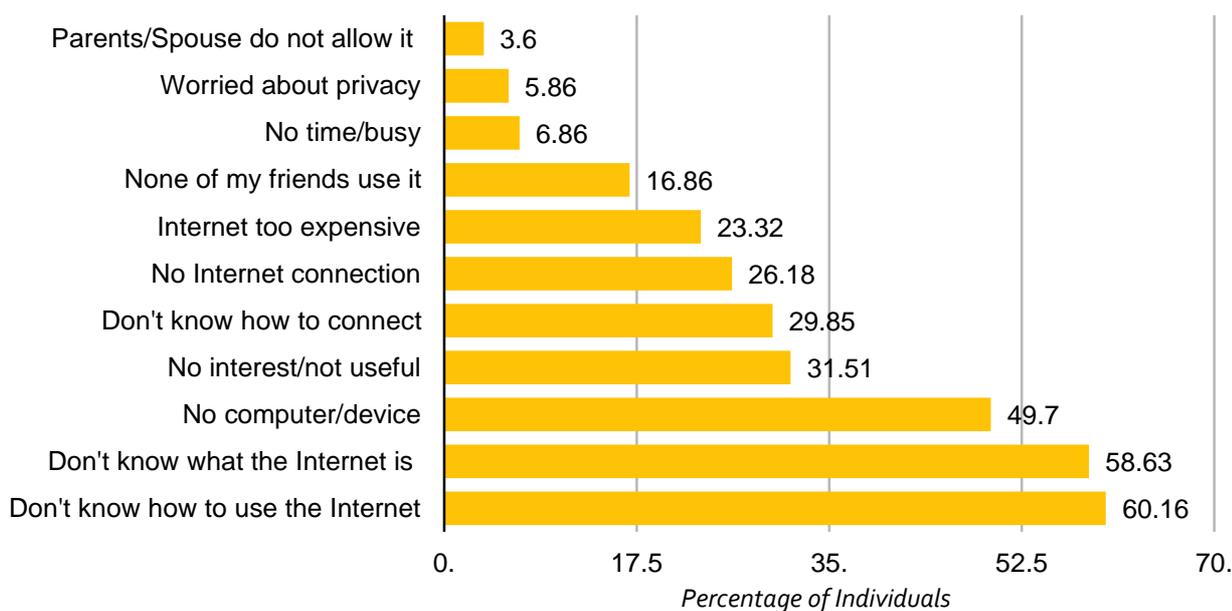
The lack of e-skills is evident in the reasons cited for not using the Internet. Close to 60% of respondents indicated that they do not know how to use the Internet. This was also the main reason cited by both sexes,

with 64.1% of men and 57.8% of women stating that they do not know how to use the Internet. More than 50% of individuals still maintain that they do not know what the Internet is.

Although about a fifth of the respondents stated cost as the reason for not using the Internet, this figure is comparatively lower to the other reasons cited, which are mostly associated with lack of skills or knowledge.

Only about 28% of individuals not using the Internet indicated that they would use it 'if it was available close by for free'. This figure is relatively low, an indication that it is not mainly the cost issue that is responsible for non-use of the Internet. The other factors cited above seem to be the main contributing aspects. Of those who stated that they would use the Internet if it was available for free, the majority indicated they would use it at 'community centres'. About 70% of individuals said that they would use it in 'public transports', while 69.0% indicated they would use the Internet at 'school/university' and in 'public buildings using public Wi-Fi'.

Table 24: Use of Internet if it were available for free				
		National	Male	Female
Would you be interested in using the Internet if it was available for free (Wi-Fi hot spots) close to where you live?		28.6%	31.1%	27.7%
If the Internet was available for free, where would you use it?	Public library	54.7%	56.5%	54.0%
	School/University	69.0%	68.3%	69.2%
	Community centres	75.9%	78.7%	74.8%
	Public buildings	69.0%	76.0%	66.3%
	Public transport	70.6%	77.9%	67.7%
	Malls/Restaurants/Cafes	64.4%	71.9%	61.5%
	Post office	62.6%	69.2%	60.0%

The results show that close to 90% of Thaba-Tseka residents do not use the Internet, followed by around 80% in Mokhotlong and Quthing. Mohale's Hoek and Qacha's Nek also have low adoption of the Internet, with more than 70% of the residents not connecting to the Internet. About two-thirds of Botha-Bothe, Leribe and Berea residents do not use the Internet. These results provide insight into the locational aspects to the digital divide in Lesotho. A large disparity is observed across districts in terms of Internet use. Compared with other districts, Maseru has the fewest number of non-Internet users. About 54% of Maseru residents have not used the Internet. On the other hand, a larger proportion of Thaba-Tseka residents, about 88%, have not used the Internet before. Comparing the average of non-users in each district to the overall average of non-users (67.50%), four districts -Leribe, Berea, Maseru and Mafeteng - fall below the overall average. When restricting the sample to those districts that fall above the average mean, the overall average for people in Lesotho who have never used the Internet becomes 77.17%. In other words, only 22.83% of people living in six districts use the Internet.

Table 25: Internet use by districts	
	Non-Internet users
Botha-Bothe	67,87%
Leribe	66,65%
Berea	64,62%
Maseru	53,61%
Mafeteng	66,91%
Mohales Hoek	77,73%
Quithing	81,77%
Qachas Nek	73,63%
Thaba-Tseka	87,39%
Mokhotlong	84,97%

This shows that most people living outside urban areas do not use the Internet. For instance, the results show that about 83% of rural dwellers do not use the Internet. This percentage is far above the overall percentage for non-Internet use (67.5%). On the other hand, about 61% of residents in peri-urban areas have never used the Internet, which is well below the national figure. While the average number of non-users is lower than the national average, the proportion of non-Internet users is very high, at 46%. The results further signify the importance of mobile phones as a device that enables use of the Internet. About 72% of non-Internet users do not own a mobile phone.

Table 26: Non-Internet users by location		
Location	Never used the Internet	Used the Internet
Urban	45.66%	54.34%
Peri-urban	61.08%	38.92%
Rural	82.40%	17.60%

11. Conclusions and recommendations

The deployment of mobile telecommunications overcomes the main barriers to economic and social exclusion in developing countries. Mobile phones provide access to services that were previously unavailable to low-income households, such as mobile phone-based financial, agricultural, health and educational services, and access to simple communications.

With the introduction of innovative products, such as OTTs offering cheap substitutions for traditional voice and text services, low-entry barrier banking applications for the unbanked and other mobile service applications, policy makers need to shift focus from the adoption of mobile phones to the use of broadband services. While mobile ownership is high, it is not in excess of 100% as indicated in the supply-side data from operators used by the ITU, though nearly 80% of Lesotho residents own a mobile phone. The discrepancy in these numbers is explained by the multiple SIM cards that are counted by operators and therefore in the administrative data supplied to the ITU as unique subscribers. This highlights the importance of demand-side data for evidence based policy formulation. This is the only way to ascertain access and use of information in pre-paid mobile markets. This applies to other demographic data critical to understanding digital inequality, such as gender, income and urban or rural location.

There is no gender gap in the adoption of mobile phones, but low-income earners are less likely to own a mobile phone compared with high-income earners. The study also shows that individuals who come from wealthier households are more likely to own a mobile phone than those who come from poorer backgrounds. Similarly, individuals living in rural areas are less likely to own a mobile phone than residents in urban areas.

A disaggregation of mobile phone ownership by education shows that there is a strong correlation between education and mobile phone adoption in Lesotho. The study finds that respondents who have finished primary, secondary or tertiary schooling are more likely to own mobile phones than those with no educational qualification.

Although mobile phone penetration is high in Lesotho, there is some evidence of a gap in mobile phone use and this can mostly be attributed to low skill levels, which limit how people use their mobile phones. Yet, there is good mobile broadband coverage in Lesotho, Internet penetration is low. Although mobile phone penetration is high in Lesotho, only 45% of mobile phone users reported having smart devices, which allow them to access the Internet. Around 68% of residents in Lesotho have never used the Internet. Most people who have never used the Internet reside in the rural areas. Affordability seems to be the main burden preventing Lesotho residents from connecting to the networks. Most respondents who cannot access the Internet could not do so either because the device or the service is too expensive for them.

Furthermore, education seems to be the main inhibitor to access of Internet with most residents stating that they do not know what the Internet is, they do not know how to use the Internet or they do not know how to connect to it using their devices.

The findings show that individuals with high incomes are more likely to use the Internet than those with low incomes, which highlights the issue of affordability. However, only about a quarter of people who do not use the Internet indicated that they would use it 'if it was available close by for free'. This figure is relatively low, which is an indication that cost is only one factor responsible for non-use of the Internet. There are other factors such as the knowledge and skills gap that are contributing factors.

The mobile phone is the main point of access to the Internet at the national level and across sexes, with most attesting that they first accessed the Internet through their mobile phones. Most Internet users in Lesotho are late adopters and this aligns with evidence in other developing countries where mobile phones are the devices most used to access the Internet.

Most individuals indicate that they access the Internet from home connections. While access through public Wi-Fi in government buildings, community centres and other public places is slowly growing, institutions of learning seem to be used the least to access the Internet. This is an obvious point of intervention for policy. With global evidence of the return on investment of connecting schools and the positive multipliers for communities and families of school going children with access to the Internet the connection of schools

should be made a priority (with the necessary curriculum and teacher support) and with every connection the marginal cost of attaching to that connection free public Wi-Fi is negligible. The only operating costs could be supported by USF, contributions by operators in lieu of USF obligations or by community.

Social networking remains the major driver of Internet take up, the majority of people reported social networking as the main activity they perform when they go online. While mobile money seems to be picking up in Lesotho, it remains limited with most people not making use of any form of mobile money services to transact financially. E-government services do not seem common in Lesotho, with only a limited share of the population using the available e-government services. These services need to be developed to stimulate demand by creating local content and bringing more people online and allowing them to benefit from the services and opportunities that the Internet can provide.

The policy implications arising from the demand side findings are that while policy intervention to restructure the market and ex ante regulation of wholesale services to make it more competitive as proposed from the supply-side analysis, if done effectively will bring down price, there are much greater human development challenges in Lesotho to bringing people on line. To enable citizens to, not only, access the Internet but use it optimally will require national strategies that cut across government departments, the public, private and community sectors requiring high levels of state co-ordination to enable the delivery of services through competitive service provision that is affordable to people and will enable them through the provision of the necessary skills to harness the potential of Internet to meet the objectives of the national development plan.

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Part A: Appendix 1 - Interviews

Comnet:	Maime Nthathakane – Managing Director
	Shawn Swart
Econet Telecom:	Leon de Fleuriot – CEO
	Nthabiseng Motjolopane – Head Legal and Regulatory/Company Secretary
LCA:	
	Tšeliso 'Mokela – CEO
	Nthabiseng Pule – Executive secretary, USF
	Moliehi Makhele
Leo:	Jim Lundberg
MCST:	Lebusa Letlotlo – Director-General ICT
	Khiba Masiu - Director ICT
Vodacom:	Liphethiso Mahanetsa – Legal and regulatory
	Deon Govender

Part A: Appendix 2 - Measurement definitions

Indicator	Definition
Mobile prepaid 1 GB broadband basket (USD)	The mobile prepaid 1 GB broadband basket consists of a prepaid data package – for a mobile phone – of 1 GB, valid for at least 30 days. If no operator provides a 1 GB bundle, smaller data packages are collated to make up 1 GB.
Mobile 1 GB basket % of GDP/capita per month	To add the dimension of affordability, the mobile broadband basket is divided by GDP per capita in US Dollars to provide an indication of the cost of broadband data as a percentage of income.
Effective price (USD)	Effective price is the blended average Revenue Per User (ARPU) divided by Minutes of Use per connection and is an estimate for the average price paid by subscribers of a network. See definition of ARPU and MoU further down. Blended ARPU contains also non-voice revenues and the effective price is therefore only an approximation.
Mobile prepaid voice basket (USD)	The mobile prepaid voice basket refers to the price of a standard basket of mobile monthly usage for 30 outgoing calls per month (on-net, off-net to a fixed line and for peak and off-peak times) in predetermined ratios, plus 100 SMS messages and converted into USD.
Mobile prepaid basket % of GDP/capita per month	To add the dimension of affordability, the mobile prepaid voice price basket is divided by GDP per capita per month in US Dollars to provide an indication of the price basket as a percentage of income.
Value for Money Index (VMI)	RIA created the VMI as a means to capture the value of combined data, SMSs and voice packages on offer. Given the complexity as well as increased number of products on the markets, only bundles offering data combined with voice and SMSs or, data and voice, or data and SMSs are captured. Previously RIA used the OECD price basket to capture and assess voice and SMS bundles. Blended packages that include data, however, cannot be captured on the OECD basket given the different in-bundle and out-of-bundle prices. Adding data to voice baskets does not reflect the value for data use accurately. VMI measures the value a customer gets for bundled minutes or SMSs and data per month. OECD usage baskets that RIA uses for prepaid products are based on minute, SMS and data tariff capturing the monthly basket cost. The VMI complements this as it calculates the value for the blended bundle, beyond monthly basket cost.
Smartphone basket	This indicator is a user basket from the perspective of a smartphone user using predominantly OTT for communication. It is based on 100 minutes of voice calls, 100 SMSs and 1 GB of data a month and therefore represents an average user. An OTT user does not care whether calls are on-net or off-net and whether they are peak or off-peak. Most communication is done using OTTs anyway (OTTs are applications like Skype or WhatsApp). No assumption is made on the allocation of calls and SMSs, and the quantities are simply multiplied with the average minutes and SMS costs.
Individual Internet users per 100 inhabitants	Individual Internet users per 100 inhabitants refers to the proportion of individuals that used the Internet in the last 12 months. This figure is estimated by the ITU and is not based on household surveys.
Active SIM cards per 100 inhabitants	Active SIM cards per 100 inhabitants are the total number of mobile connections per 100 inhabitants. The figure includes M2M and duplicated SIM cards and is thus higher than actual subscribers.
% of mobile owners with smartphones	A smartphone is defined as a mobile handset enabling advanced access to Internet-based services with computer-like functions and running an operating system such as Android, iOS, Windows Phone and BlackBerry. The % of mobile owners with smartphones is calculated by taking the average number of smartphone users over the last four quarters and dividing by the total number of mobile connections.
Average revenue per user in USD (blended ARPU)	Average Revenue per User (ARPU) is the total revenue of all operators divided by the total number of connections. It is blended ARPU because it includes all subscribers – both prepaid and contract subscribers. The ARPU shown here is the average ARPU over the last four quarters.
Facebook users per 100 inhabitants	Facebook users per 100 inhabitants is calculated by dividing the total number of Facebook users in the country by the total population and multiplying by 100.

Indicator	Definition
Data traffic per connection (highest operator)	Highest data traffic per connection is calculated by taking the operator with the highest ratio of data traffic transferred over its mobile network divided by number of connections.
Highest minutes of use (MOU) per connection	Minutes of Use (MoU) per connection is defined as the total number of minutes, including incoming, outgoing and roaming calls, transferred over the mobile network in the period per connection. Highest MoU per connection is calculated by taking the operator with the highest average MoU per connection over the last 4 quarters.
International bandwidth per user (kbps)	International bandwidth refers to the amount of data transfer capacity to and from a country to the rest of the world. It is calculated by adding the capacity of all international data lines (such as undersea cables) and then dividing by the total population.
Connections per base stations	Lowest number of connections per base station among operators: The connections per base station are calculated by dividing the average number of connections for the country in the last four quarters by the total number of base stations in the country.
% Population covered by mobile signal	Percentage of the total population that lives in an area where mobile phone calls can be made, which are covered by a mobile network signal. Less than 75% coverage is a red signal, between 75% and 95% is an orange signal, and greater than 95% is a green signal.
Country level investment per subscriber in USD	Country level MNO investment per subscriber in USD is the sum of all capital investment (CAPEX) for the last four quarters for all operators. This is divided by the total number of active SIM cards in the country.
Market concentration (HHI)	Market concentration is measured by the Herfindahl-Hirschman Index (HHI). The HHI is calculated by squaring the market share of each firm competing in a market, and then summing the resulting numbers. The indicator used here is the average of the last four quarters. A score of greater than 5 000 is a red signal, between 2 500 and 5 000 is an orange signal, and less than 2 500 is a green signal.
Interconnection: Mobile Termination Rates (US ¢)	Interconnection: The mobile termination rate is the wholesale rate that mobile operators levy on each other for terminating calls on their networks. A MTR of greater than 4 cents is a red signal, between 2 and 4 cents is an orange signal, and less than 2 US cents is a green signal.
Highest MNO EBITDA margin in country	The EBITDA margin is the total operating profit in the period, before interest, tax, depreciation and amortization, expressed as a percentage of total revenue. The highest MNO EBITDA margin is calculated by taking the operator with the highest average EBITDA for the last four quarters. An EBITDA margin that is higher than 50% is a red signal, between 35% and 50% is an orange signal, and less than 35% is a green signal.
Mobile-specific taxes / TCMO	Mobile specific taxes include taxes such as VAT, special taxes on mobile devices, special excise taxes on mobile usage, and other mobile-specific taxes such as SIM activation taxes. The Total Cost of Mobile Ownership (TCMO) consists of all price components associated with owning a mobile phone and purchasing mobile phone services. These cost components include handset costs, connection costs, and average costs for calls, SMS and data usage, including the taxes levied on them. Mobile specific taxes are divided by the TCMO.

Part A: Appendix 4 - Corporate tax rate

Africa	Corporate tax rate
Algeria	23,00
Angola	30,00
Botswana	22,00
Cameroon	33,00
Chad	40,00
Congo	35,00
Egypt	25,00
Equatorial Guinea	35,00
Ethiopia	30,00
Gabon	35,00
Ghana	25,00
Guinea	35,00
Ivory Coast	25,00
Kenya	30,00
Lesotho	**25,00**
Libya	20,00
Madagascar	20,00
Malawi	30,00
Mauritania	25,00
Mauritius	15,00
Morocco	30,00
Mozambique	32,00
Namibia	33,00
Nigeria	30,00
Rwanda	30,00
Senegal	30,00
Seychelles	33,00
Sierra Leone	30,00
South Africa	28,00
Sudan	35,00
Swaziland	27,50
Tanzania	30,00
Tunisia	25,00
Uganda	30,00
Zambia	35,00
Zimbabwe	25,75

Africa	Corporate tax rate
Average	28,95

Source: Trading Economics, available at http://www.tradingeconomics.com/zambia/corporate-tax-rate, updated on 8th July 2016

Part B: Appendix 1 - Methodology

This section presents the methodology used for the Broadband Study in Lesotho. This includes the Household and Individual level of the ICT Access and Use Survey. The survey provides demand-side data that has been gathered at the national level through the representative surveys of individuals and households. The demand-side measures and findings from these surveys are incorporated with the supply-side assessment of the policy and regulatory environment to provide an overall assessment of the ICT sector in Lesotho.

Sampling

The Primary Sampling Units (PSUs) were drawn from a master frame obtained from the 2016 Cartographic exercise conducted by the BoS. Enumeration Areas (EAs) were randomly selected, having been grouped by district. The Probability Proportional to Size (PPS) technique was used to select the EAs from the respective districts. Five different allocation methods, namely PPS, Equal Allocation, Markwardt Allocation, Power Allocation and Kish, were used to conduct comparisons between strata and also to determine the number of PSUs to be taken from each stratum. The sample was explicitly allocated to the districts, and then distributed to the three settlements – urban, peri-urban and rural.

A sample size of 2 025 households was selected from a total of 135 EAs across the country. The sample size determination of 2 025 households was designed with an aim to yield estimates at 95% level of confidence.

Listing

The listing was performed for each EA and all households in each EA were listed and the households to be interviewed were randomly selected from this list. Individuals aged 15 and older were eligible for selection from each of the selected households. All eligible individuals were listed and a Simple Random Number Generator application installed on all devices was used to select the individual to be interviewed from each household.

Step 1: The Master frame obtained from the 2016 Cartographic exercise was used to draw the sample based on district level and further into urban, peri-urban and rural settlements.

Step 2: EAs were sampled for each stratum. A total of 135 EAs were sampled.

Step 3: A listing of all households within an EA was done and this served as a secondary sample frame for the random selection of households.

Step 4: 15 households were randomly selected from each EA.

Step 5: An individual, 15 years or older, was randomly selected from each household.

Sample size

A total of 2 025 households were selected from 135 EAs across the country, with about 15 households interviewed from each EA. The following were considered in drawing the sample and determining the size:

- Desired level of accuracy: Confidence level of 95%

- Absolute precision (tolerable margin of error) set at 3.56%

- Clustering effect (intraclass correlation) set at 10% – to take into consideration the possibility of neighbouring households providing similar answers to questions.

Survey tool

The survey tool was designed to align with global standards, specifically the International Telecommunications Union (ITU) manual for Measuring ICT Access and Use by households and individuals, including all indicators required by the Partnership on Measuring ICT for Development with its mandate from the World Summit on the Information Society (WSIS). Other relevant indicators that attempt not only to assess access and use but also to understand the factors of marginalisation from ICTs complemented these indicators. These additional indicators include willingness and ability of non-users to pay for services; multiple SIM card ownership; and Internet adoption with a focus on mobile Internet.

The household and individual survey questionnaires were programmed for android devices, which were set up to automatically identify the coordinates at which the interview was conducted so that error reporting was prevented as much as possible, and tested for any bugs.

Weighting

Two weights are constructed for households and individuals. The weights are based on the inverse selection probabilities and gross up the data to a representation of the provincial level when applied.

Household weight:

Household Selection Probability:

EA Selection Probability:

Individual Weight (Individuals 15 years+):

Where:

 = design weight compensation for over-sampling and under-sampling of EAs;

 = number of households in strata

m = target number of EAs for each strata

i = number of household members interviewed

Part B: Appendix 2 - Models

We assume that an individual derives a linear utility from having a mobile phone or using a mobile service given by:

$$U_i = X_i\beta + \varepsilon_i$$

where *X* denotes a vector of individual attributes such as gender, marital status, age group, level of education and employment; household characteristics such as disposable income, access to electricity, radio, TV, satellite TV, computer, bank accounts and fixed-line telephone and is the error term which is assumed to be extreme value distributed. The probability that individual decides to have a mobile phone, *y=1*, is given by:

$$P_i\left(y_i{=}1\right) = \frac{\exp\left(X_i\,\beta\right)}{1+\exp\left(X_i\,\beta\right)}$$

and the probability of not having a mobile phone is denoted by *P(y=0)=1-P(y=1)*. The probability of using a particular mobile phone service conditional on having a mobile phone, can be written analogously. Assuming that the decision of all individuals in the sample is independent, the cumulated log-likelihood function can be written as:

$$l(\theta) = \sum_{i=1}^{N} y_i \, \log(P_i)$$

The vector of all parameters, which are estimated using maximum likelihood estimator, is denoted by theta and beta.

Table 1: Logit model specification for adoption of mobile phone		
	Estimation 1	Estimation 2
VARIABLES	Mobile phone	Mobile phone
Age>25 & <=35	0.480**	0.181
	(−0.186)	(−0.273)
Age>35 & <=45	0.612***	0.574*
	(−0.206)	(−0.331)
Age>45 & <=55	0.276	0.099
	(−0.219)	(−0.335)
Age>55 & <=65	−0.121	−0.256
	(−0.204)	(−0.313)
Age>65	−0.753***	−0.798***

Table 1: Logit model specification for adoption of mobile phone		
	(−0.189)	(−0.288)
Log (income)		−0.0281
		−0.068
Married	0.103	0.372**
	(−0.123)	(−0.188)
Urban	0.393**	0.298
	(−0.157)	(−0.23)
Electricity	0.13	−0.007
	(−0.173)	(−0.244)
Piped water in the house	1.007	0.8
	(−0.617)	(−0.768)
Radio	0.339***	0.316*
	(−0.121)	(−0.182)
Male	0.0675	0.0594
	(−0.131)	(−0.195)
Telephone	0.014	0.704
	(−0.775)	(−0.822)
No bank account	−0.526***	−0.711***
	(−0.125)	(−0.193)
Primary	0.476***	0.388*
	(−0.137)	(−0.213)
Secondary	1.396***	1.288***
	(−0.256)	(−0.362)
Tertiary	1.482***	1.458**
	(−0.485)	(−0.652)
Constant	681	127
	(−1.598)	(−1.747)
Observations	2162	1301

VARIABLES	Internet
Table 2: Logistic regression results for Internet use	
Mobile phone	1.233***
	(−0.312)
Age>25 & <=35	−0.890***
	(−0.214)
Age>35 & <=45	−1.661***
	(−0.248)
Age>45 & <=55	−3.031***
	(−0.372)
Age>55 & <=65	−4.856***
	(−0.624)
Age>65	−5.424***
	(−1.001)
Log (income)	0.302***
	(−0.0672)
Married	−0.598***
	(−0.185)
Urban	0,339
	(−0.224)
Electricity	0.474**
	(−0.214)
Piped water in the house	0,708
	(−0.434)
Radio	0.0337
	(−0.178)
Male	0.315

Table 2: Logistic regression results for Internet use	
	(−0.195)
Telephone	0.0321
	(−0.612)
No bank account	−0.392**
	(−0.181)
Primary	1.323***
	(−0.26)
Secondary	2.688***
	(−0.295)
Tertiary	4.579***
	(−0.513)
Own house	−0.558**
	(−0.227)
Occupy for free	−0.624**
	(−0.312)
Constant	−3.152**
	(−1.333)
Observations	1 301

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