Capacity Building, Review and Update of the voice and data services access gaps in Kenya

PART II

UPDATED VOICE AND DATA SERVICE GAPS

Submitted to

COMMUNICATIONS AUTHORITY OF KENYA

UKaid
from the British people

FINAL REPORT

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Acronyms / Abbreviations

2G	Second Generation Mobile Communications
3G	Third Generation Mobile Communications
4G	Fourth Generation Mobile Communications (See also LTE)
BTS	Base Transceiver Station
CA	Communications Authority of Kenya
CAPEX	Capital Expenditure
CSP	Content Service Provider
FCDO	Foreign Commonwealth Development office
GIS	Geographic Information System
GPS	Global Positioning System
GSM	Global System for Mobile Communications
ICT	Information and Communications Technologies
ICTA	The ICT Authority
KALRO	Kenya Agricultural & Livestock Research Organization
KENET	Kenya Educational Network
KETRACO	Kenya Electricity Transmission Company
KICD	Kenya Institute of Curriculum Development
KNBS	Kenya National Bureau of Statistics
KPLC	Kenya Power and Lighting Company (Kenya Power)
LTE	Long Term Evolution (denotes the Mobile 4G technology)
MoEST	Ministry of Education, Science and Technology
MoICT	Ministry of Information & Communications Technology
NOFBI	National Optical Fibre Backbone Infrastructure
NSP	National Service Provider, Tier 1 or Tier2 licensed operator
OPEX	Operating Expenditure
PwD	Persons with Disabilities
UA	Universal Access
UNCRPD	UN Convention on the Rights of Persons with Disabilities
UNESCO	United Nations Education, Scientific & Cultural Organisation
US	Universal Service
USAC	Universal Service Advisory Council
USF	Universal Service Fund

1 Introduction

1.1 Background

1.1.1 Communications Authority of Kenya

The Communications Authority of Kenya (CA) is the regulatory authority for the communications sector in Kenya. Established in 1999 by the Kenya Information and Communications Act, 1998, the Authority is responsible for facilitating the development of the information and communications technology sector including broadcasting, cybersecurity, multimedia, telecommunications, electronic commerce, postal and courier services. During the COVID-19 pandemic era, CA can offer flexible regulatory measures and frameworks to facilitate access to ICTs by all. CA can support connectivity initiatives under Universal Access initiatives targeting the un-served and underserved communities and support the expansion of communication services to organizations serving public needs.

1.1.2 Universal Service Fund (USF)

The Kenya Information Communications Amendment Act, 1998 and the Kenya Information and Communications (Universal Access and Services) Regulations, 2010, established the Universal Service Fund (USF). This fund is desired to enable the government to realise its commitment to ensuring that all people of Kenya have access to modern, high-quality communication services. While the private sector has an important role to play in meeting universal access targets through increased investments, there is a need for the government to promote investments in rural and other un-served areas through provision of incentives. The Fund is governed by the Communications Authority of Kenya with oversight of the Universal Service Advisory Council (USAC), appointed competitively by the Government.

The objectives of the fund are among others: to promote communications infrastructure and services rollout in rural, remote and under-served areas; to ensure availability of communication services to persons with disabilities, women and other vulnerable groups; to support the development of capacity building in ICTs and technological innovation; to support the expansion of communication services to schools, health facilities and other organizations serving public needs; and to facilitate the development of and access to a wide range of local and relevant content.

1.1.3 Digital Access Programme

The Digital Access Programme is a UK Government Prosperity Fund flagship initiative led by the UK Foreign Commonwealth and Development Office (FCDO) and delivered in partnership with the Department for Digital, Culture, Media & Sport (DCMS) through the UK Global Tech Hub Network. The programme operates in five countries: Kenya, Nigeria, South Africa, Brazil and Indonesia.

The objective of the Programme is to catalyse affordable, inclusive, safe, and secure digital access for underserved or excluded populations; and to use this as a basis for a more thriving digital ecosystem that generates digital solutions to local development challenges, as well as skilled jobs in the local digital economy. The Programme is grounded in the recognition that digital technology is a key enabler of development and inclusive growth. However, almost 50% of people globally cannot access the Internet and, while digital technologies bring great potential to tackle poverty and accelerate progress towards the Sustainable Development Goals, this will only happen if the benefits of digital technologies are accessible to all.

The Programme aims to work in partnership with governments, private sector, civil society, and academia to support innovative interventions to enable excluded or underserved communities and local organisations to obtain basic but meaningful digital access in an inclusive, secure and sustainable manner. The Programme focuses on providing technical assistance, building local capacity, and facilitating stakeholder dialogue and learning, to catalyse a sustainable process of digital inclusion. The programme does not fund infrastructure or technology.

The end beneficiaries of the Programme are those who are excluded and underserved, and so, for example, they may be female, live in more rural and/or remote or lower-income areas, be less literate and have limited access to information and opportunities.

1.2 Consultancy Project

1.2.1 Justification

In 2016, the Communications Authority of Kenya undertook a detailed ICT Access Gaps study to map out the availability of communication services in the country with a view of identifying areas that require deliberate government intervention. The study aimed at developing a framework that ensures the provision of affordable ICT services to all parts of the country.

Owing to sector dynamism experienced over the past few years, the Authority recognized that a combination of experiences issues including the recent global pandemic must have transformed both the communication needs and the landscape. This situation, therefore, called for an urgent need to assess and update the existing nation-wide ICT access gaps report, specifically with regards to voice and data services.

This called for a consultancy to review and update the existing voice and data access gaps and develop models and strategies that will enhance access across the country. The recommendations are aligned to emerging issues including response to COVID-19 pandemic.

1.2.2 Scope of the consultancy

With the guidance and facilitation of the Digital Access Programme Manager and Adviser, the consultancy team provided the Communications Authority of Kenya with capacity building on the determination of a road map for the update of voice and data services access gaps that will increase affordable, inclusive, safe, secure digital access for excluded communities in Kenya, to enable a more rapid and granular COVID response and mitigation of secondary impacts including cyber threats and harms.

1.1.1 Intervention Areas

The consultancy recommendations feed into the new USF strategic plan and aided USF programs under the following areas:

1. **Capacity Building:** The USF supports expanded capacity and awareness building, particularly in connection with other Fund projects. The Fund administration established on-going relationships with qualified ICT training organizations, including the private sector and university-based groups, to deliver customized public capacity-building projects in communities where broadband networks and services are introduced. Projects include hands-on training classes, public awareness-raising events, assistance to local entrepreneurs, and both user and management training at public institutions. The goal will always be to ensure that new users in these communities have the best opportunity to benefit from the technologies as they become available.
2. **Voice & Data Services Expansion:** Projects under this program to target coverage gaps in voice and data services in the un-served and

underserved areas and other places where operators are unable or unwilling to extend service on their own. The Fund to work with operators to identify the boundaries of these gaps, and to determine the scope of infrastructure investment and other related costs that may require support from the USF to ensure full coverage. Priority projects to be those that reach the largest un-served populations in remote areas of the country.

3. **Community Broadband Networks:** The focus of this program is to bring broadband connectivity into towns and villages where broadband is currently unavailable. The main requirements are to establish broadband connections at major public institutions within each designated location. These include Schools, Health facilities, Government offices, Post offices, Libraries and Other community service locations. Projects may also include a requirement to establish a public access ICT facility (community ICT centre) in each designated location, potentially linked to a local post office or school.

1.2.3 Project Consultant: Viscar Industrial Capacity Limited

The Communications Authority of Kenya (CA) and the UK Digital Access program (DAP) selected Viscar Industrial Capacity Limited (Viscar) to undertake the study entitled "Capacity building, review and update of the voice and data services access gaps in Kenya".

Viscar provided a core team of five senior consultants to undertake the assignment. The project involved supporting the Universal Service Fund (USF), which is hosted and governed by CA, to evaluate and update the status of the existing network service gaps (from the 2016 version) and review the strategy to extend and increase its investments into the un-served and underserved rural areas and communities that are still excluded, being unreached by USF programs to date.

The project covers two inter-related and progressive components, namely:

Part 1 - Capacity Building: Augmenting the internal skills and administrative capacity of the CA and USF itself by training 12 personnel to identify service gaps, design, execute, manage and monitor the overall task of implementing universal access projects.

Part 2 - Access Gap analysis, Voice & Data service expansions: Working with the CA technical team trained in the capacity-building exercise, collaborated with Network Facilities Providers and key stakeholders to undertake a comprehensive analysis, with GIS mapping, of the voice and data gaps in Kenya. The team developed models and strategies that will design projects to provide access to the services, thus increasing population inclusion in the gap areas.

1.3 The role of the Universal Service Fund

The universal access and service programme administered by the Communications Authority of Kenya (CA) is a key financial mechanism for bridging all barriers – physical and human – to bring all citizens within the boundaries of modern economic transformation and digital literacy. Bringing universal and affordable access to voice and data (Internet) services to all Kenyan individuals, businesses and public departments, agencies and institutions is the USF's mission.

USF also has a mandate which includes support of capacity building in ICTs, technological innovation, expansion of communication services to schools, health facilities, and other organizations serving public needs, and development of, and access to, relevant local content. USF's mandate also extends to ensuring availability of communication services to persons with disabilities, women, and other vulnerable groups. Whereas infrastructure and service rollout serve to widen the voice and data services, these areas *deepen* the use and impact of voice and data services and help to develop the ICT market thus enhancing

sustainability of services in the most rural and remote reaches of the country as well as to socially marginalized and excluded groups.

The USF thus can facilitate, through its financial resources, additional initiatives involving other stakeholders, aimed at supporting socio-economic development through supplementary local access, digital literacy and skills programmes that help to create and develop demand and beneficial usage of the network services amongst all. These initiatives must generally be supported by other public and private stakeholders. Their role has increased in importance with the onset of COVID-19, which has accentuated the understanding of the impact of some of some the barriers. Both aspects of the USF's mandate are covered in this report.

1.4 Report Contents

Following this Introduction, the remainder of this report is structured as follows:

Section 2 presents the context for updating the Access Gaps, including the traditional understanding of market and universal access gaps, an assessment of various trends in telecom infrastructure ownership and operation, security issues and sustainability concerns.

Section 3 describes the essential methodology employed for data collection, mapping and modelling of the gaps.

Section 4 lays out the findings of the gap analysis, with description maps, discussion of issues and the solutions envisaged for addressing the range of gaps identified, both macro and micro scale.

Section 5 introduces the model input assumptions and describes the sensitivity analysis that was undertaken to arrive at the results in Section 4, as well as the risks identified and addressed. A review of the Phase 2 tender methodology is provided in the light of the risk analysis and recommendations for future USF projects provided.

Section 6 introduces the collaborative engagement CA is committed to, in order to ensure that USF projects extend beyond the purely physical filling of gaps to include a holistic range of activities in the education sector and in the areas of digital literacy and inclusion, including people with disabilities, women's development, capacity building and local content and innovation.

Section 8 provides conclusions from the analysis related to demand stimulation and capacity building and provides clear recommendations on how to establish a USF programme which promotes community-oriented local broadband network and capacity building.

Section 7 concludes with an epilogue considering the range of emerging issues dealt with in the report as well as regulatory concerns on which CA wishes to consult and enable evolution of the universal service framework, to encourage, enable and license all interested parties to participate in creating solutions to the challenges of universal access and service.

2 Context for Updating the Access Gaps

2.1 Overview

As noted in The Part I report entitled *"Digital Barriers Opportunities, Barriers and Gaps for Voice and Data Services"* the provision of digital access through voice and data services in the ICT gap areas of the country provides a huge opportunity for the USF to drive the Government of Kenya's vision for economic transformation and digital literacy down into the most remote rural areas and excluded populations, thus helping to achieve the vision for all citizens. This overall vision was captured in progressively specific formulations, described in the Phase I report, namely:

1) The Kenya 2030 Vision
2) The current National Broadband Strategy 2018 – 2023
3) The "Big Four" Agenda
4) The Digital Economy Blueprint, and
5) The ICT Infrastructure Master Plan 2019 - 2029

A theme developed in these documents is the critical role of the USF as the financial facilitator supporting roll-out of ICT infrastructure and connectivity to the un-served and underserved areas.

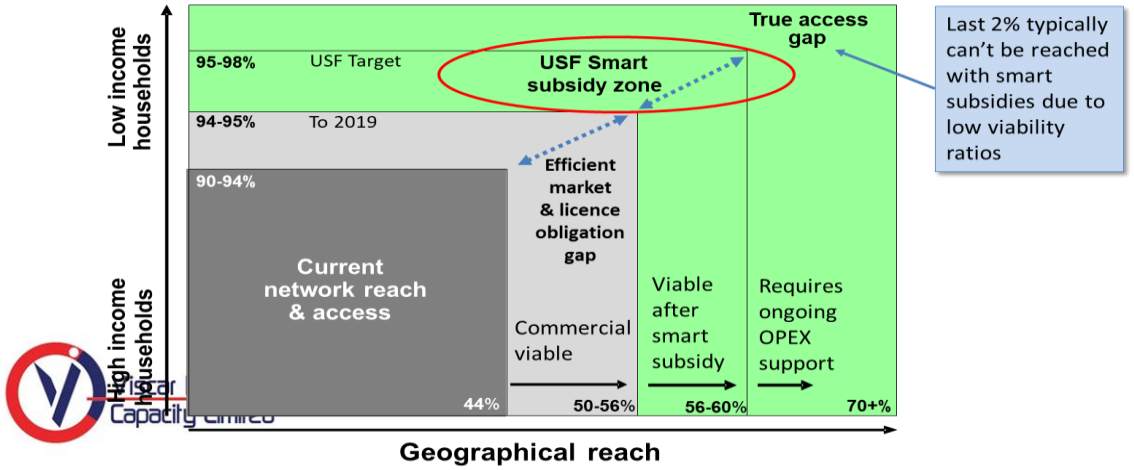
2.2 The physical barriers: Access Gaps and Security issues

This report addresses the physical barriers which remain for populations not covered by the country's fixed and mobile services. As indicated in the Part I report and previous discussion, there are customer related barriers of accessibility, affordability, gender, literacy, and digital skills which hinder participation in the digital economy, even when network infrastructure services are present. The response of the Gap Study to these is provided in Section 6.

2.3 Two types of physical network barrier

Reference to the traditional Market Gap Model, shown in Figure 2-1, provides a reminder that even the comprehensive funding of conventional USF projects in **"smart subsidy zone"** gap areas will still leave up to 2 percent (1 million) of the population outside of conventional coverage.

Figure 2-1: Market Gap Model



The areas falling in the **"True Access Gap"** zone principally are so remote or their community populations so low and dispersed, and supply costs are high, and revenues are even below operating costs. These areas may never provide any return unless they receive operating subsidies indefinitely, or for as long as the operating surplus remains negative.

As a result, the barriers highlighted by the conventional gap model - primarily identifying "macro gaps" – which potentially have straightforward smart subsidy driven investments are one category. Other models must be considered for addressing small gaps which may still be financially viable with subsidy, or remote areas in the "True access gap" areas and extremely low population centres, are introduced in sub-section 4.6.

2.4 The Changing Landscape in Telecom Infrastructure Ownership

The last 5 years have seen the emergence of tower leasing companies, "Towercos", as operators move to focus more on their core businesses and acquire tower space for their equipment on an OPEX (lease) basis. This reduces their CAPEX investment and instead enables investing more capital in new services. The USF has already leveraged on the towerco model by splitting the phase 2 tender into active and passive components. While the towerco model has come with some benefits, it also presents some challenges that must be addressed moving forward.

In particular, CA needs to ensure that if Towercos are subsidised by the USF programme, they become part of the solution in the most challenging and unviable sublocations that remain unconnected. That is, the USF subsidy will enable them to reduce their lease rates markedly below commercial benchmark, in proportion with subsidies they receive which lower their CAPEX investment in sites and infrastructure. This in turn reduces the service providers' OPEX costs and helps to bring otherwise loss-making services into marginal viability and sustainability. If this synergistic situation is not created, then the split into passive and active components will not have achieved the smart subsidy objectives required by the USF.

The above assumption of mutual benefit between Tier 1 and Tier 2 operators' participation in the USF programme is the essence of the Towerco model that has been considered appropriate, at least for macro sized solutions to the country's remaining ICT gaps.

2.5 Inclusion of additional players from the Public, Non-profit and private sector

All CA licensed operators have an obligation to contribute to the USF, however so far projects have been executed by no more than 6 players. The inclusion of Tier 2 Towercos in phase 2 improved the participation and has the potential to create more sustainable solutions, as described above.

The breadth of participation has a lot to do with the way USF projects are designed and executed but is largely informed by the existing legal and regulatory framework. The USF framework states that for a company to be eligible for Fund Application**,** it has to be **a** duly licensed operator and up to date with its remittances. This has thus locked out players from non-profit organizations and the wider private sector. As a result, some operators or community-based groups who could have very innovative proposals that lead to low-cost and sustainable solutions

are not eligible for USF support. The implication is that locking players out of USF's framework limits the potential for innovative solutions.

While this study focuses largely, as required, on updating the Gap Study performed in 2016, the team also hereby presents to CA a proposal to consider opening a measured level of USF awards to other sector players as special projects. The rationale behind this argument is that some gap area responses might not be driven by commercial motivations as much as by socio-economic and community drivers, including livelihood or security, in line with this, the following approaches are recommended to ensure inclusivity of more players, both licenced and non-licenced:

i. Establish the legal and regulatory basis of a framework for grants managed by USF and special licensing (see Section 8.2) for any innovative solutions meeting USF objectives in the underserved or unserved areas, including community-based networks. This could lead to an open call for proposals/solutions to address specific ICT service needs in focus areas.

ii. Allow for and encourage Joint Ventures (JV's) and partnerships between license holders and any player from the wider public with innovative solutions, which could yield similar benefits; and

iii. Institute a mechanism for periodic updates and engagement of all stakeholders and potential stakeholders on USF projects.

2.6 Security of sites in High Insecurity Areas

Through stakeholder consultation, high insecurity in some areas – notably in Garissa, Tana River, Wajir, Mandera, Kwale, Lamu and Kilifi - has emerged as an area that requires special solutions for sustainability of USF projects. Some remaining and unviable gaps are thus subject to high security risk, similar to the many cases of sites being blown up by terrorists. The argument from operators then is that they should not bear the cost of replacing such sites, and their OPEX is high due to the insecurity. Having had consultative meetings with some stakeholders on insecurity, we propose the following as approaches to addressing the challenges imposed by insecurity

i. Site location must be done in consultation with the National County and/or local administration and, subjected to a formal risk assessment investigation.

ii. Use of a multi-agency approach to ensure security of some sites in insecure areas. All relevant security agencies must be involved, in consultation with CA but with a central command center, under the county commissioners. The local community must be part and parcel of security considerations and solutions.

iii. Collaboration among all relevant operators through the leadership of CA in openly discussing risks and adoption of solutions that enhance security (MNOs, Towercos, Ketraco, Kenya Power);

iv. Government to consider setting up and owning some sites purely for the advantages that might be gained for local uplift and security, as well as for collaborating with CA/ USF on ensuring affordable open access to the service providers in highly marginal or otherwise unviable sub-counties.

v. Integrated rural development: Whereas priority and timely execution must be maintained, CA should consider the advantage of casting USF projects in the context of integrated rural development initiatives, were realistic. Collaborating with other state and non-state actors who have key development projects in the concerned areas, to seek synergy

could make the USF component more impactful as well as secure, more easily received by the communities, and sustainable.

Those considerations that impact project choice, risk assessment and the cost of mitigating the risk have been included in the gap solution analysis described in subsequent sections.

2.7 Sustainability

Some stakeholder input regarding the burden of OPEX costs in marginal USF projects, combined with examination of the weaknesses reported in the Phase 1 (2016) secondary schools broadband project, as well as best international practice, lead to some clear-cut considerations that must be included in future USF projects. These should be adopted into the project development framework going forward:

i. Enable projects to have manageable CAPEX/OPEX profiles through the subsidy modelling.

ii. Consider a positive USF response and creative CA licensing position to address innovative small-scale and community led projects wherever arising, for their advantages in providing gap solutions and meeting community needs and skills development.

iii. Promote local content creation to deepen usage among the new solution areas.

iv. Incorporate a capacity building component – e.g., digital literacy, user and resource person training (e.g., key schoolteachers) and PwD and other excluded group component, in every USF project released;

v. Consider any possibility to participate, as USF, in integrated development approaches if they can be feasibly timed and executed.

The above principles are discussed in more specific application in Section 6.

3 Access Gap Study Methodology

This section provides a comprehensive overview of the methodology which has been used to update the 2016 Gap Study. A preview of the overall result on a national basis is first provided, followed by a step-by-step description of the methodology pursued, which uses a similar process to that used in the original study, though with important departures and developments.

3.1 Previewing development of the main Infrastructure

The access gaps at the time of the previous gap study comprised around 3 million people (5.6% of population) for voice service and around 13 million (over 22%) for broadband access. A positive development since the 2016 gap study is that broadband coverage (3G plus 4G) has expanded to the point where coverage is virtually equal to 2G. The total voice service gap, based on the combined coverage of all Tier 1 operators, has shrunk to around 3.4% today and the broadband service gap has also shrunk to 3.7% today, as illustrated in Figures 2-2 and 2-3.

Fig. 2-2: 2G Combined Coverage
96.6% population
56.5% area

Fig. 2-3: Broadband 3G/4G Coverage
96.3% population
56.3% area

As well, there are promising technological trends and developments which mitigate the scale of the problem even more. Most noteworthy is that broadband conversion from 3G to 4G by the Tier 1 operators is bringing further positive change. 4G now exceeds 3G by a wide margin and therefore dominates the coverage map. This change is aided by the application of 700/800 MHz frequency spectrum bringing longer reach to the coverage of broadband in rural areas, which is the prime interest of the USF.

There is thus strong forward-looking rationale for moving to the superior 4G technology which offers 10x bandwidth capacity and longer geographic reach. However, proposed 4G build-out under USF support will need to address the need for

retention and continuing deployment of 2G sites into the same gap areas. This is for reasons related to voice coverage and the relatively low penetration (36%) of smart phones.

3.2 The Gap model

The Access Gap analysis has followed a similar methodology as employed for the initial study in 2016, with some important variations, including extensions beyond the essential gap analysis to reflect various technical solutions to the range of gap features identified by the model.

The overall Gap Model process illustrated in Figure 3-1 comprises:

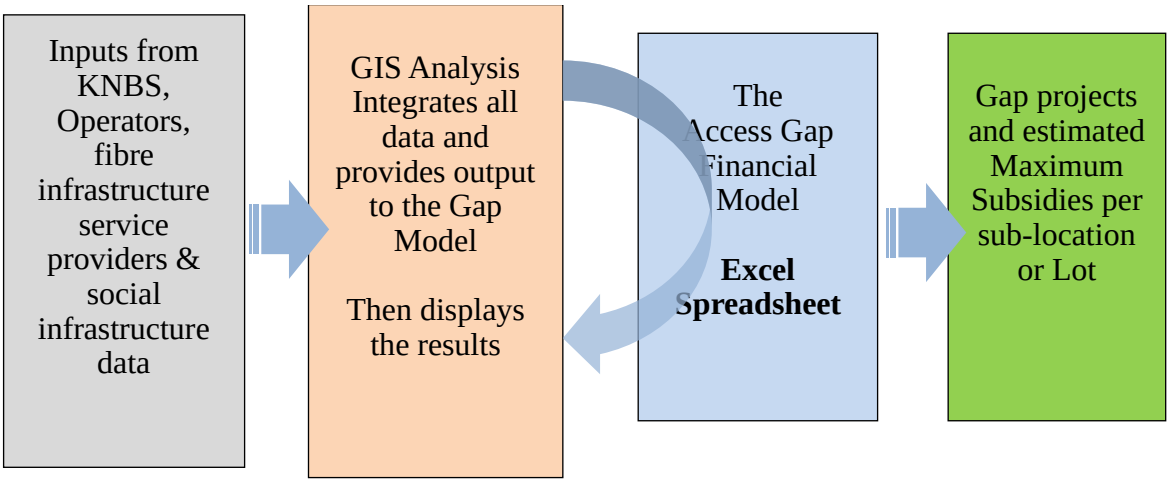
A suite of GIS software integrating GIS maps and geo-referenced data (i.e., data with GPS coordinates) from several different standards into a single model displaying the boundaries of counties, constituencies, wards and sub-locations, natural and infrastructure features, populations and population distribution, 2G and broadband (3G and 4G) mobile signal coverage maps, fibre routes and the locations of towns, villages, schools, health centres and post offices.

A complex Excel spread sheet, which is referenced to the GIS software, calculates the areas and populations covered and uncovered by 2G and broadband (3G and 4G) mobile signals. This allows calculations that enable estimation of the subsidies required to fill the mobile signal coverage gaps, including required transmission routes. This Excel model includes all demand and cost data relevant to the estimation of the commercial viability and subsidy requirements for providing telecommunications services to the gap areas.

The model has been considerably developed from the 2016 version. A main feature is the ability to switch between:

- "Towerco" model (Tier 2 passive and Tier 1 active RANs) for full, multi-operator macro-site applications, and
- Integrated Tier 1 or alternate operator model which is likely to be the most appropriate for small and "micro-site" applications including antenna optimisation and new micro-base-station deployments
- (see Section 4.6 for further explanation)

Figure 3-1: The Central Gap Analysis Methodology



3.3 Gap Analysis applied to National Mobile Coverage

The basic Excel model accepts population coverage data from the GIS software, as illustrated above, and performs a gap analysis, estimating:

- which areas of the country are fully or partially covered with usable mobile signal - conservatively set above the minimum licence requirements of the mobile operators at -95 dBm (indoor) for 2G basic services.
- broadband coverage is modelled at -90 or -95 dBm depending on data received from the operators and 4G at -110 and -115 dBm
- the extent to which areas are uncovered (% area and % population); and
- The feasibility of extending coverage into the gap areas with a one-time smart subsidy.

The areas are initially analysed at the sub-location level. Where practical, the feasibility analysis of USF subsidised expansion projects may be increased to a "lot" at the *ward* or *partial ward* level. For example, in some areas sub-locations may not be feasibly supported as individual areas (or too small to justify a new base station), but may be a viable project if combined with one or more other sub-locations in the same ward.

The critical drivers of the model are the:

- The uncovered populations per sub-location estimated from the GIS software (using Census figures per sub-location projected forward to 2021/22 and the HRSL layer for identifying population distribution within the sub-location borders);
- The demand side assumptions – predicted user penetration and average revenue per user (Rural ARPU) for the rural gap areas only;
- The number of mobile base stations estimated to be required to cover at least 80% of the population within the unserved geographical areas – based on assumed tower height and coverage radius and considering terrain;
- The cost side assumptions, obtained from consultation with the Tier 1 and Tier 2 operators and the consultant's general knowledge on costs in Africa, namely:
  - Per site passive infrastructure CAPEX costs, including towers, access road, enclosure, power supply and security;
  - Active CAPEX costs including 2G and 4G radio access networks (RANs – electronics and antennas), backbone transmission extension (14 MHz or 28 MHz digital microwave);
  - Per site OPEX costs, which in the "Towerco" model are the monthly site lease payments by the Tier 1 operator to the Tier 2 operator. These comprise:
    - *Fixed monthly OPEX expense* – for fuel, site maintenance and security
    - *CAPEX recovery payment* - monthly amount calculated to provide a 10-15 year investment recovery and is reduced below normal commercial rate depending on the amount of USF subsidy received for the sites by the Tier 2 operator.
  - Per base station OPEX costs of the active RAN equipment, including equipment operation & maintenance (O&M), and CA spectrum fees; and
  - Direct cost of sales, usually estimated as a percentage of revenues (e.g., 30%), covering the costs of customer acquisition, agents' fees, and incremental sales and marketing and commercial fees for service roll-out in the new areas.

The commercial performance analysis (return on investment) from the technical solution derived by the model for each sub-location. This identifies the financial gap (subsidy requirement to achieve a marginally acceptable return) where commercial viability or sustainability is not possible. The essential outputs based on an internationally proven set of assumptions and target criteria, are:

- Can the needed investment yield a 5 year payback of CAPEX from net revenues, after all site and operational OPEX costs are considered?
- For all cases where the viability has a financial gap, what level of one-time smart subsidy would make it marginally feasible and sustainable in the long run?
- If a sub-location's gap cannot be filled sustainably, what level of minimum ongoing OPEX support is required to create and maintain sustainability?

The outputs of this analysis are provided in Section 4. Annex B provides a copy of the Model's Input Table showing the whole range of assumptions driving the calculations.
A Sensitivity and Risk evaluation is provided in Section 5, which provides explanations and discussion of some of the model's critical assumptions.

3.4 Administrative boundaries for the GIS Analysis

GIS maps which included all administrative boundaries at county, constituency, ward and sub-location level (7,149 sub-locations) were obtained from KNBS for the 2016 study. However these could not be updated to the situation pertaining at the time of the 2019 Census, which delineated populations in 8,932 sub-locations.

On account of a well-publicised problem of unresolved boundary disputes, the study had to proceed on the basis of the original boundaries, while the receipt of a GIS "Centroid" file enabled the consultant to link the expanded number of sub-locations to the original list.

As a result of this, whereas 5,049 of the original sub-locations are exactly the same as in 2016, a total of 2,100 today include a number of newly created sub-locations (between 2 and 8) within their boundaries. The boundaries within these 2,100 areas which separate one sub-location from another are not known as the time of updating the gaps study. The harmonised list is provided to CA separately (registered as Annex A to this report) for the purpose of being able to keep track of the changes that have taken place. However, the gap study has proceeded on the basis of the original 7,149 boundary sets and is reported on this basis.

3.5 The Census Population and Distribution

Securing of up-to-date and officially sanctioned population data was crucial for:

- accurate gap population coverage analysis, and
- revenue projections from unserved populations and thus for project sustainability and subsidy calculations

The populations used for this latest study are from the 2019 Kenya Population and Housing Census at sub-location level, with equivalence to the 2016 sublocation boundaries. The census data were scaled up at the latest national population growth rate (average 2.2% per annum) to 2021, in order to project total populations to the anticipated date of potential USF project roll-out.

KNBS was not able to provide population distribution below sub-location level. The KNBS data was thus used for the basic population numbers within the administrative boundaries, while an accurate satellite image-based dataset named the "High Resolution Settlement Layer (HRSL)" was used to identify population distribution accurately within each of the 7,149 sub-location boundaries.

This combination of datasets enabled accurate estimates of human distribution from which to calculate percentage population coverage of the

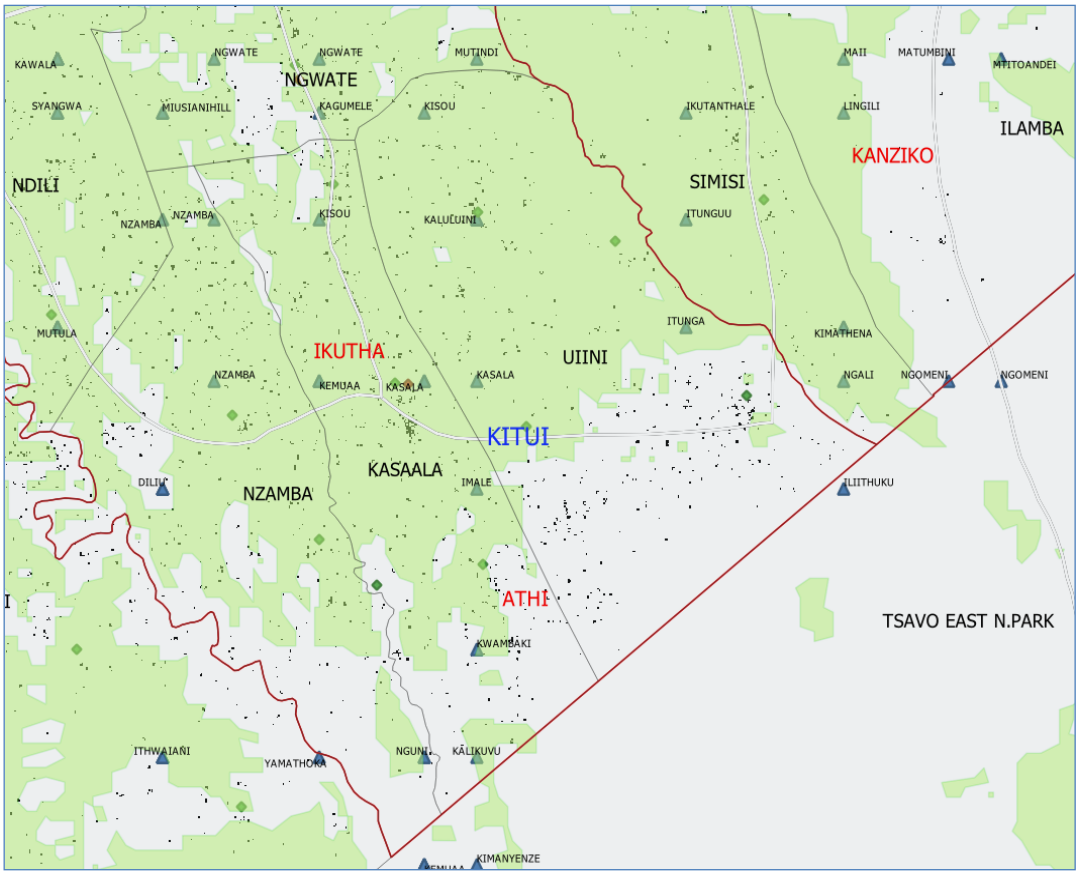
mobile operators within the administrative boundaries. The percentage coverage ratios were then applied to the Census-based figures at the sub-location level, in order to estimate the unserved populations living in the gap areas

The HRSL dataset methodology is described below.

The High Resolution Settlement Layer (HRSL) obtained from the Centre for Earth Science Information Network (CIESIN), Earth Institute, Columbia University, provides estimates of human population distribution at a resolution of 1 arc-second (approximately 30m). The population estimates are based on recent census data and high-resolution (0.5m) satellite imagery from DigitalGlobe. The population grids provide detailed delineation of settlements in both urban and rural areas, which is useful for many applications—from disaster response and humanitarian planning to the development of communications infrastructure. The settlement extent data were developed by the Connectivity Lab at Facebook using computer vision techniques to classify blocks of optical satellite data as settled (containing buildings) or not. The Kenya dataset was last updated in 2019, though it has yet to be integrated with the 2019 Census data.

Figure 2.4 illustrates how the HRSL dataset is used to enable the GIS software to calculate the population coverage within the boundaries of Nzamba, Kasaala and Uiini sub-locations in southeastern Kitui

Fig. 3-2: 2G coverage and population concentrations in SE Kitui



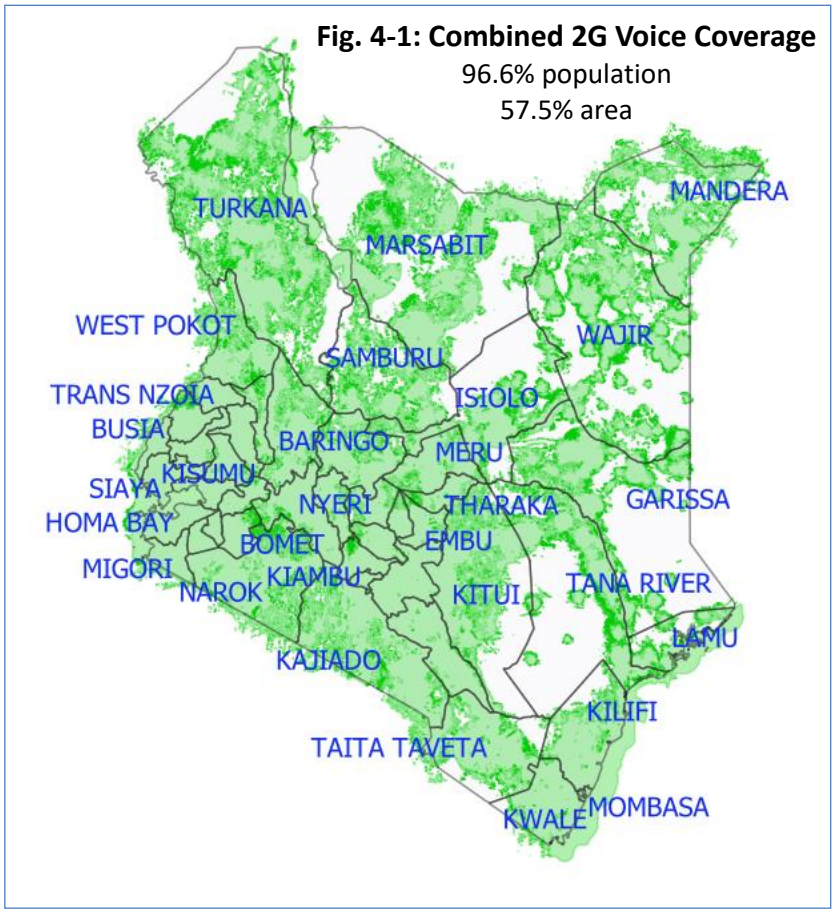
3.6 Field Validation Survey

A field verification visit was undertaken in line with the methodology in two counties, namely: Kitui and Garissa, which enabled specific issues – coverage anomalies in Kitui and security concerns in Garissa – to be discussed with local county administrators. As well, in both areas visited, the team carried out indicative user surveys to gain an appreciation for the impact of service gaps on economic and social life and the demand for service in terms of calls, use of data and expected monetary expenditure.

4 Findings of the Gap Analysis

4.1 Voice service coverage

As shown initially in Section 3.1 the gap analysis projected that only 3.4 % of Kenya's population is calculated to have no access to mobile voice communications services. The GIS software incorporated the latest coverage maps supplied by all three Tier 1 mobile operators and created a combined signal coverage map at -95dBm signal level. The combined 2G coverage map is shown in Figure 4-1.



4.1.1 The uncovered sub-locations

Based on the gap analysis model, only 79 out of a total of 7,149 sub-locations from the 2016 boundaries remain totally uncovered (at Zero %), which is more than half reduction from 164 in 2016. A further 196 sub-locations have less than 50% population coverage, which is also greater than half reduction from 2016. Table 4-1 summarises the coverage analysis.

Table 4-1: Sub-location 2G population coverage					
Coverage	**100%**	**>90%**	**50% - 90%**	**below 50%**	**0%**
Sub-locations	**5,409**	**988**	**477**	**196**	**79**
USF Targets	**6,397**		**752**		

As can be seen from the Figure 4-1 map, virtually all the major unserved areas are in the Northern Rift, and relatively insecure areas of the North and Eastern regions of the country. Tana River and Garissa are the most sparsely covered counties beyond towns and sub-locations along major routes, largely due to their sparse population densities. Small areas also remain uncovered in the far Southeast areas of Taita Taveta, Kwale, Kilifi and Kitui.

4.1.2 Comparison with 2016

It is important to note that the analysis has identified a few more small-gap areas in relatively well covered counties than in 2016. A total of approximately 248 sub-locations previously indicated as 100% covered are now calculated to be in the "nineties". This can be attributed to greater accuracy of the HRSL dataset, although the two figures are within less than 5%. In a few cases this may also reflect on-the-ground experience where officials and politicians in some counties have been reporting gaps not previously recognised by the previous Gap Study.

The total number of sub-locations in the two highest categories above 90%, totalling 6,397 today, is 255 more than the total in 2016, which is shown in Table 4-2. An overall increase in the high coverage areas is to be expected from commercial expansion and improvement over the last five years.

Table 4-2: Sub-location population 2G coverage in 2016					
Coverage	**100%**	**>90%**	**50% - 90%**	**Below 50%**	**0%**
Sub-locations	**5,657**	**485**	**425**	**418**	**164**
Totals	**6,142**		**1,007**		

4.1.3 Reduction of least covered sub-locations by the USF Phase 2 Projects

At least 15 of the 79 sub-locations which remain with zero percent coverage will be covered by the projects included under the Phase 2 tenders. It is also important to understand that if the least covered category is expanded from zero to "Near zero", e.g., less than 5%, or less than 10%, the number increases and the coverage achieved by Phase 2 likewise increases, as illustrated in Table 4-3.

Table 4-3: Least covered sub-locations addressed by Phase 2 projects					
Coverage	**10-50%**	**5 to 10%**	**2 to 5%**	**0 to 2%**	**0%**
Least covered Sub-locations	**145**	**14**	**14**	**15**	**79**
Addressed by Phase 2	**25**	**1**	**3**	**4**	**15**
Uncovered balance remaining	**120**	**13**	**11**	**11**	**64**

Many of the sub-locations in the "Uncovered balance remaining" row of these categories will be addressed by the proposed Phase 3 projects that are listed and summarised in Section 4.5.

4.2 The Mobile Broadband Gap

As noted in Section 3.1, the broadband (3G and/or 4G) coverage is virtually identical to, or exceeds, that of 2G. Broadband is now dominated by 4G and covers 56.3% of Kenya's

geographical area, while 96.3% of the population is covered. Thus, the access gap for mobile broadband service is approximately 3.7% of the population, as illustrated in Figure 4-2.

Fig. 4-2: Broadband 3G/4G coverage

96.3% population

56.3% area

Every County now enjoys major mobile broadband coverage, with Tana River and Garissa being the most sparsely served, as is the case for 2G coverage also. A comparison of Table 4-4 with the 2G equivalent in Table 4-1 shows that 2G coverage is only very slightly stronger than broadband in the categories above 90%, but slightly higher in the 50%-90% category.

In summary then, since broadband is in a very similar position nationwide, the USF gap targets will be largely driven by the need to fill 2G coverage gaps for basic voice coverage, while every USF project will specify 4G coverage enhancements – whether new sites or antenna optimisation - to ensure that all gap closure projects include both 2G and 4G broadband components.

Table 4-4: Sub-location population Broadband coverage					
Coverage	**100%**	**>90%**	**50% - 90%**	**Below 50%**	**0%**
Sub-locations	**5,166**	**1,210**	**485**	**195**	**93**
USF Targets	**6,376**		**773**		

4.2.1 Comparing 3G and 4G coverage

As noted in Section 3.1, the development of broadband mobile technology is such that 3G is being eclipsed and gradually replaced by the much more bandwidth-powerful 4G. The advantage of 4G is further enhanced with the use of the pro-rural 700 and 800 MHz frequency bands where needed for range. Figures 4-3 and 4-4 illustrate the presence of the two technologies across the country. It should be noted that the Mobile Broadband map illustrated in Figures 4-2 and 4.5 is dominated by the 4G coverage. The remaining 3G coverage will be phased out as soon as operators are convinced that the

range of user devices (handsets) being used for Internet access are adequately serviced by the combination of 2G and 4G signals.

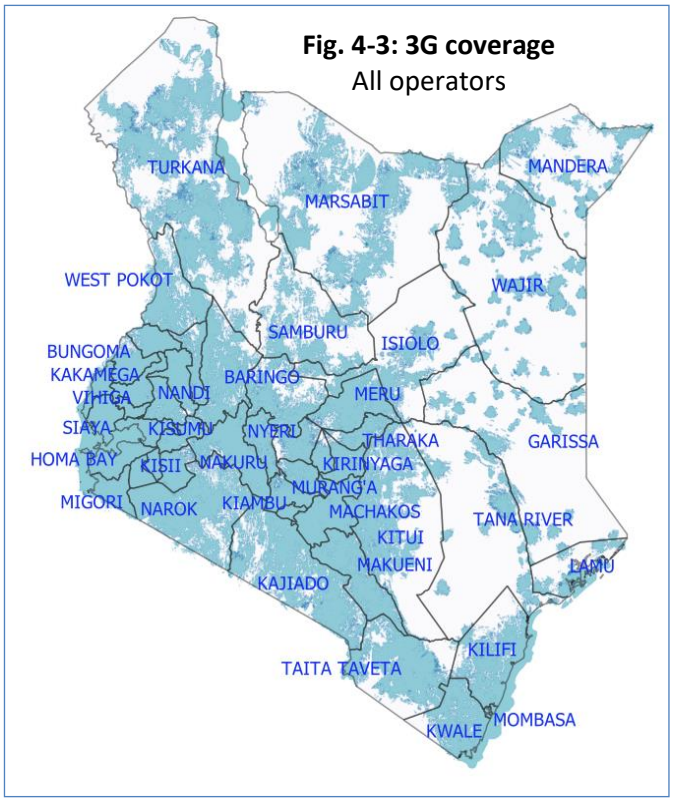


Fig. 4-3: 3G coverage
All operators

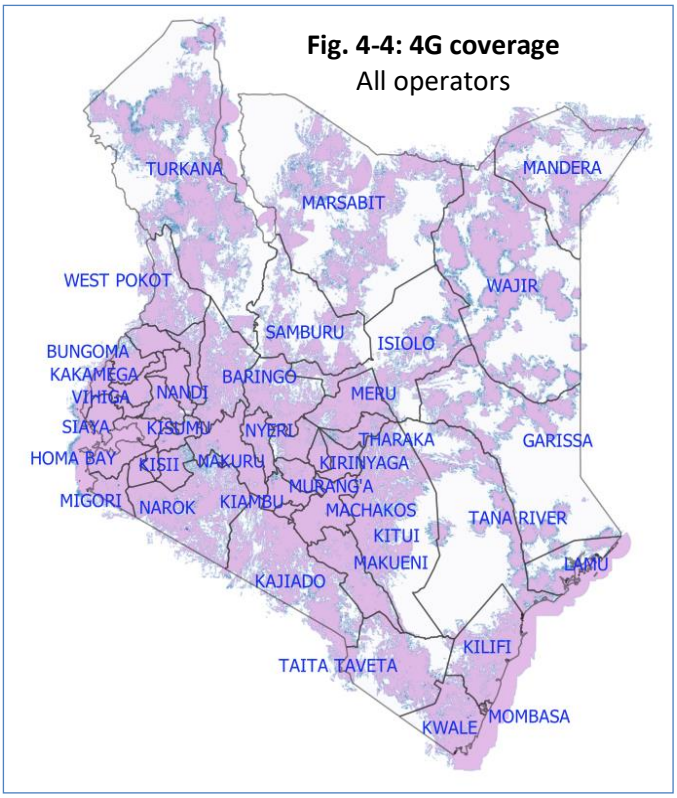


Fig. 4-4: 4G coverage
All operators

4.3 The Fibre Backbone and Broadband Development

Figure 4-5 illustrates the 30,000 km fibre backbone constructed and operated for NOFBI and other fibre routes built by Tier 1 operators and Tier 2 licensees, primarily Liquid Telecom, Kenya Electricity Transmission Company (KETRACO) and Kenya Power. These together provide a fibre presence in every county and enable expanding broadband capacity in the broadband mobile networks and well as increased potential for fixed broadband penetration and networks.

Figure 4-5: Broadband and Fibre Routes
80% population within 25% of fibre node

Data provided by http://www.africabandwidthmaps.com indicates that over 95% of the population is within 50 km of a fibre backbone node and 81% within 25 km. These data indicate that most broadband base stations providing 4G connectivity will be within 2-3 hops of a node. Beyond this, there is also high potential for point-to-point or point-to-multipoint broadband connectivity solutions to link into urban fixed network development and institutional networks in administration, health, and education directly into the power

of the fibre backbone.

4.3.1 School proximity analysis

Our analysis of 37,930+ primary and secondary schools in our GIS dataset indicates that 2,703 schools are located within 2 Km of a fibre node, while 15,722 (41.5%) are within 10 Km of a fibre node and 75% within 20 km. These data are discussed further in Section 6, which presents the options for enabling education to realise a greater level of digital transformation.

4.4 Issues identified about map accuracy and small gaps

The field verification visits to Kitui and Garissa brought to light significant discrepancies which exist between the coverage mapping (reliant on GIS signal prediction maps supplied by the operators) and on-the-ground realities. This concern both the 2G and broadband coverage, although shortcomings in the 2G coverage tend to cause the most discussion and complaint amongst populations who still have no coverage at all and can't even make a phone call.

The Kitui County Commissioner provided a list of twelve (12) constituencies that have a large number of underserved communities, markets and schools in many sub-locations. In addition, the consultant visited two of the sub-locations (Katalwa and Enziu, in Mwingi Central Constituency) where a large discrepancy appears to exist between mapped coverage (92 and 93% of population, and well less than 500 persons uncovered) and the actual presence of useable signal, leaving communities, markets and schools uncovered.

A similar discrepancy was observed in Dertu and Alango Arba sub-locations in Garissa, which was fixed by adjustment of the 2G signal level band used in the Gap coverage model. However, the problem in Kitui was not so easily fixed and is believed to be related to "coverage shadows" created by the many hills in the Kitui terrain.

This type of situation is believed to be widespread across the country, especially in areas with difficult terrain. Further examples of local discrepancies are in Narok County, where officials have reported weak or poor signal quality in approximately 118 sub-locations where coverage is indicated to exist. Narok is also a county like Kitui which includes some challenging terrain.

The consultants have partly addressed these situations by careful adjustment of the signal strength bands in the GIS files supplied by the operators, in order to reduce weak-signal presence recorded as coverage[1]. However, since issues remain and are ongoing, it is advised that CA must coordinate with county officials in counties where discrepancies are reported to exist and especially in areas with hilly terrain. CA should also employ signal testing devices to map out areas of interest.

The consultant strongly recommends that CA should treat gap analysis, as a continually ongoing process rather as a once-only exercise every few years.

The Authority must establish a process for receiving coverage information from the operators, and for verifying whether coverage reflects the license QoS standards in areas that are indicated to be covered. CA should be requesting updated signal coverage prediction maps *on an annual basis*. Where discrepancy is reported to exist, dialogue should take place and operators should

[1] Related to this, the consultant collaborated with the CA licensing department to adjust the coverage mapping of Telkom in 10 areas where the 2G coverage mapping received from Telkom appeared to show much more extensive coverage than is the case in reality.

be requested to jointly investigate and report how they can improve their coverage if discrepancies are shown to exist.

4.5 Current Gap status and Phase 3 Subsidy Costs

4.5.1 Overview

A careful sensitivity analysis and iteration with the geo-referenced Excel model (see Section 5) has identified 274 sub-locations in 25 different counties as *potential* candidates for including in the next phase of USF subsidy projects. This compares with only 179 sub-locations that were addressed in the first two phases in 2016 and 2020. Overall, the required subsidies will not increase in the same proportion because of the many low-cost "micro-scale" projects in this analysis.

The large number of gaps will not be smoothly accommodated in a single competition and must be tendered in stages. They represent a "screenshot" of the current gap situation and also highlight issues around scale and technical models.

The county list for sub-counties to be included in Phase 3 is summarised in Table 4.5.

Table 4-5: Potentially sustainable Phase 3 Gap Sub-locations

No.	County	Sub-locations	Addressable Unserved population	Gap sizes (No. of cells)			Total Max. subsidy (USD)
				"Micro" <0.25	"Small" 0.25-0.5	"Macro" > 0.5	
1	Baringo	24	21,799	24	-	-	653,642
2	Bomet	2	1,419	2	-	-	57,459
3	Elgeyo Marakwet	5	3,722	5	-	-	168,537
4	Garissa	21	159,252	3	5	3	3,253,927
5	Homa Bay	1	618	1	-	-	31,953
6	Isiolo	2	9,462	1	-	1	209,944
7	Kajiado	10	12,640	9	1	-	292,874
8	Kiambu	1	1,506	1	-	-	20,660
9	Kilifi	2	2,632	1	1	-	82,766
10	Kitui	55	52,255	54	-	1	1,784,223
11	Laikipia	5	5,356	5	-	-	154,156
12	Lamu	1	1,241	1	-	-	16,168
13	Makweni	1	1,889	1	-	-	5,164
14	Mandera	13	72,861	3	1	9	2,098,057
15	Marsabit	8	17,407	5	-	3	826,048
16	Meru	6	5,097	6	-	-	146,777
17	Nakuru	3	3,679	3	-	-	60,078
18	Nandi	2	2,076	2	-	-	46,052
19	Narok	20	24,267	17	2	1	785,291
20	Samburu	18	35,081	10	3	5	1,739,238
21	Tana River	8	11,483	6	2	-	236,231
22	Tharaka Nithi	2	1,227	2	-	-	66,179
23	Turkana	25	89,999	12	2	11	2,843,061
24	Wajir	16	74,216	11	4	1	2,765,793
25	W. Pokot	23	23,930	21	2	-	668,622
	Totals	**274**	**635,111**	**195**	**24**	**55**	**19,006,432**

4.5.2 Overall assumption

The subsidy levels in Table 4-5 are calculated assuming the 2G and 3G/4G gaps are approximately the same, which is the case in the vast majority of cases. Therefore, base station RANs for both 2G and 4G expansions are automatically included in the site and RAN costs. In a few cases where there might be a significant difference between 2G and 4G coverage, some adjustment to the final tender price may be required.

4.5.3 Final number of USF tender projects:

The list of 274 sub-locations can be compressed into fewer unique projects (Lots) since many "micro-scale" projects which are contiguous with one another, as illustrated in the map, may be combined into feasible Ward level projects. Potential Ward-level aggregations are illustrated in the Annex B list of all Phase 3 sub-locations.

It is also possible that some projects can be expanded to include adjacent sublocations which would be unsustainable on their own but would add increased value. It is therefore important that CA's USF team also study the list carefully and make the USF's own determination of how to maximize benefit from the information provided.

4.5.4 Model parameters defining the 274 Phase 3 sub-locations

The full list of sublocations[2] is attached at Annex A and shown graphically in Figure 4-6 (next page). The list is not totally exhaustive of all remaining gaps but includes all sub-locations meeting the following feasibility criteria:

a) Gap is more than 10% of population or at least 500 persons (greater of).

b) In the case of macro sites where the number of new cells is indicated to be greater than 0.5 cell for which the "towerco model" is relevant:
   - The Tier 2 site operating cost component of total OPEX is fixed at Ksh 105,000 (see Section 5.1 for details)
   - It is assumed that the Tier 2 operators will be subsidised to the 90% level and thus reduce the *CAPEX recovery portion* of their site lease rate to 10% of their normal charge-out rate, to create viability for the Tier 1 operators.

c) The acceptable "viability factor[3]" is assumed at 0.1% (i.e., barely cash flow positive above OPEX) in order to cast the net for potential subsidy projects as broadly as possible

d) In macro site analysis, no upper limit for viability factor is assumed. This means that some Active networks will be commercially viable if they receive the lower OPEX rate assumed (see Section 5: Sensitivity and Risk Analysis). It is assumed that they will agree to occupy the site without subsidy or will receive a subsidy by mutual agreement depending on Tier 1/Tier 2 pre-bid agreement including the site lease rate. The viability factor for 25 of the Macro cases indicates commercial viability at the Tier 2 lease rate assumed in Section 5.1, which indicates that the final rate could be adjusted for mutual satisfaction.

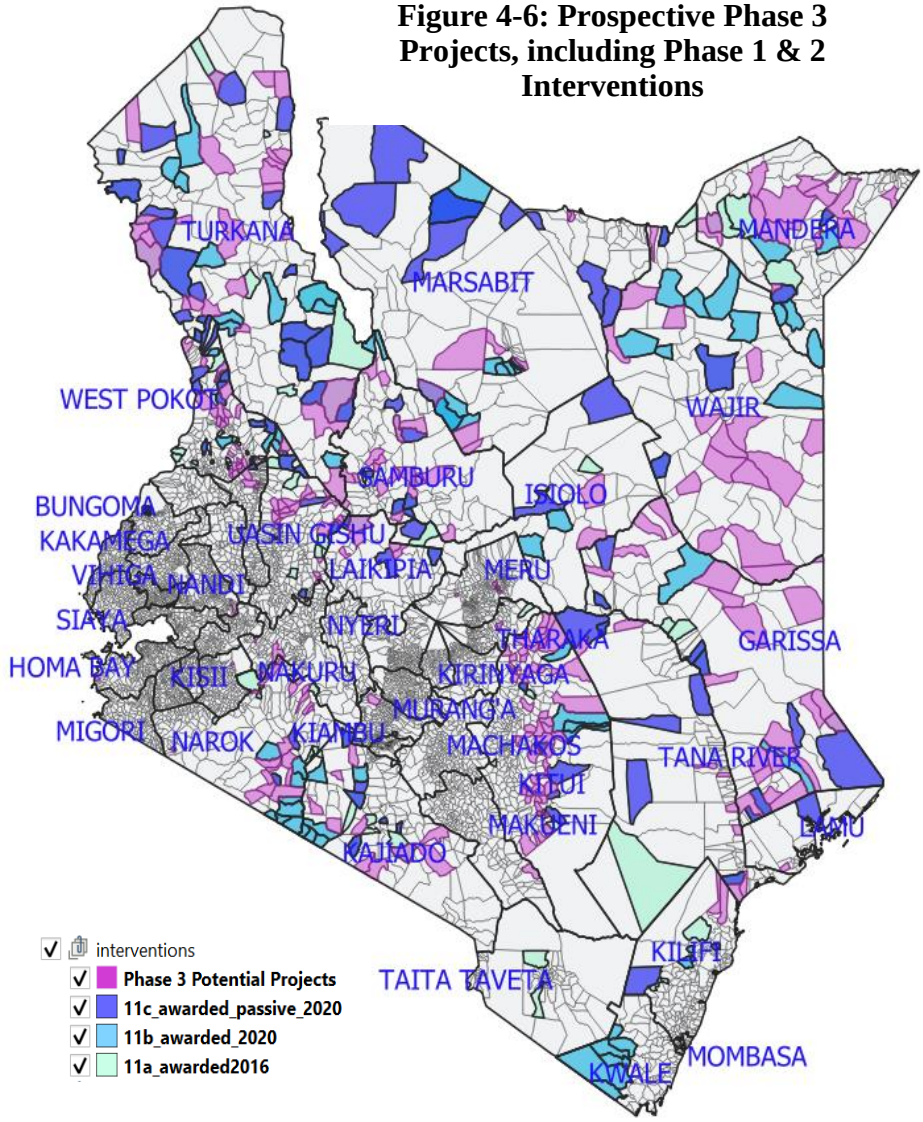
e) *Microwave hop connection:* Because of the critical issue of site OPEX in the viability of the most marginal macro base station sites, it is assumed that some sites will be connected to the next cell and into the backbone via 14 MHz microwave, with annual spectrum licence fees that are half that of 28 MHz spectrum. Hence their bandwidth

[2] 2016 boundaries

[3] The Viability Factor is the proportion of net revenues that a project can generate over five years to repay the CAPEX investment. Zero means that the project is not generating any net revenue over OPEX and will therefore have no sustainability even if the smart subsidy covers all CAPEX. 100% viability factor indicates that the net revenues are sufficient to repay CAPEX in five years without subsidy.

capacity will be lower unless CA decides to forego the increased charge in the case of marginal USF cases.

Figure 4-6: Prospective Phase 3 Projects, including Phase 1 & 2 Interventions



It will be noted that most of the geographically largest and most sparsely populated sub-locations in Phase 2 are those for which only Tier 2 tower awards were made. This was because the Tier 1 operators judged the subsidies offered to be inadequate for sustainability. Further discussion on this point is made in Section 5.3. These sublocations will need to be re-bid or negotiated with the Tier 1 operators at more acceptable (higher) subsidy levels.

4.5.5 Coverage characteristics of Phase 3 sublocations

The 274 Phase 3 projects will address the coverage categories as shown in Table 4.6:

Table 4-6: Summary of Phase 3 coverage characteristics

Coverage	75-90%	50-75%	30-50%	10-30%	0-10%	0%
Sub-locations	89	96	32	27	13	17

Balance remaining after Phase 3	**47**	**20**	**16**	**10**	**12**	**18**

None of the Phase 3 projects have coverage above 90%, in accordance with the model selection parameters.

4.6 Technical models and Implementation priorities for Phase 3

The overall Phase 3 project list encompasses at least three separate technical approaches which can be implemented. The technical options are summarised in Table 4-6 and should be implemented in three separate phases, which are the order of priority, namely:

- **Priority 1. Macro sites (55)**
- **Priority 2. Small scale sites (24)**
- **Priority 3. Micro solutions (195)**

The LEO satellite option previously mentioned as potentially having relevance has been discounted until further deployment information of Starlink for Kenya is available.

A. Macro site	Requires at least one min. half-scale conventional tower with Tier 1/ MNO active RAN to service the gap. Radial service ranges from 6 km up to 12 km+ (Most cases require at least one full-sized passive site)	Assumes Tier 2 "Towerco" and Tier 1 active RANs Tier 2 subsidies will reduce Tier 1 Site OPEX payments to increase viability Maintain multiple operators hosting requirement on towers, possibly reducing as market size reduces In security risk areas and cases where service would be unviable for smart subsidy, consider the option of County Government site and passive infrastructure ownership with low site rental rates
B. Small scale	Tower radial service range less than 6 km and ideal for low cost BTS solution Expect small scale tower Some solutions may require 2 or 3 more micro-scale solutions	Expect Tier 1 operators to innovate through proposing small-scale sites, as well as booster sites combined with antenna optimisation in contiguous cell area Potential opportunity for Tier 2 and Tier 3 wireless providers focused on rural gaps and larger community networks Licensing issues to be clarified, i.e., for spectrum access and allowable traffic (i.e., voice and data). Forbearance is recommended and a special rural community licensing framework is recommended (See Section 8.2). Limited requirement for multi-operator co-location

C. Micro-scale	Tower radial service range less than 3 km Expect very small-scale tower May need 2 or 3 micro-sites	Tier 1 innovation also expected. Many micro-gaps can be solved with booster and /or antenna optimisation from contiguous cell area Tier 2 and Tier 3 opportunities and small-scale community networks can be in collaboration with Tier 1 also. Same licensing issues to be clarified – spectrum and allowable traffic. Forbearance is recommended and a special rural community licensing framework is recommended (See Sect. 8.2). No requirement for multi-operator co-location

4.7 Final coverage status including all USF Interventions

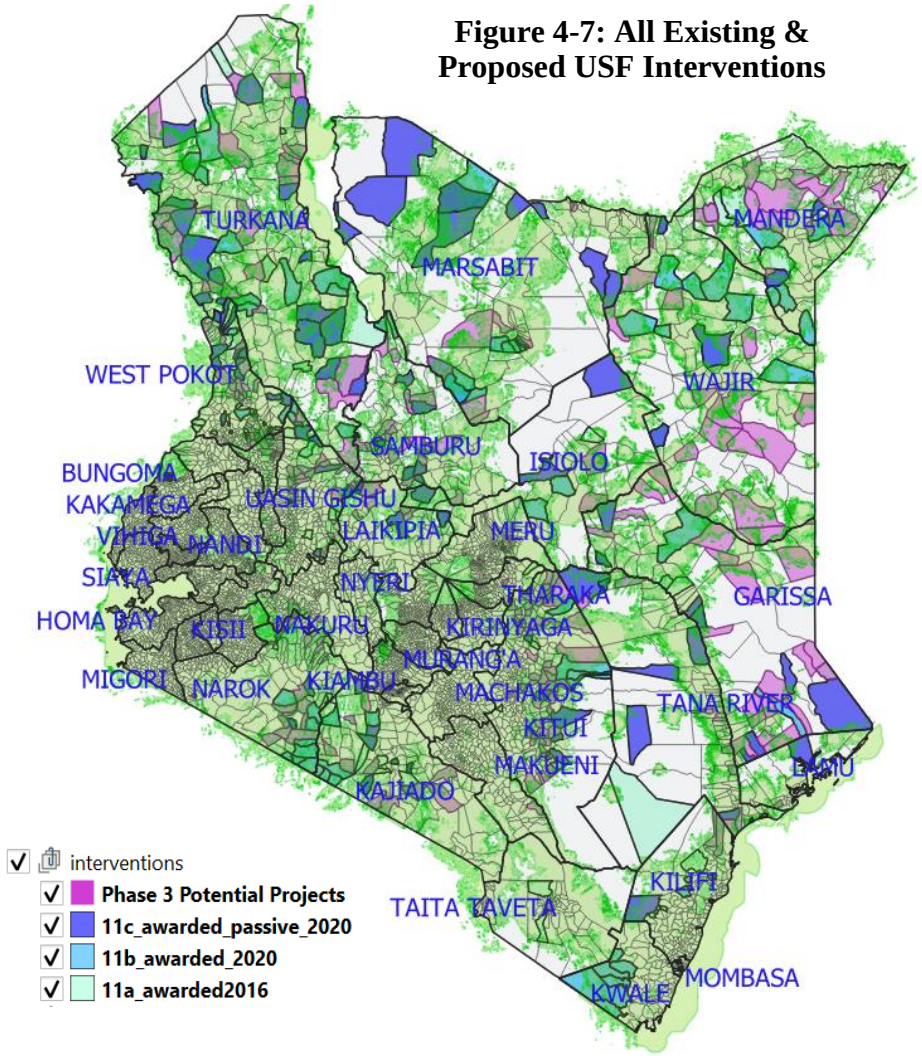
Table 4-8 summarises the overall gap status including the populations remaining unserved following the Phase 1 (2016) investments and the populations currently unserved and waiting to be covered by the Phase 2 investments (2020).

Table 4-8: Full Gap analysis in context

Description	Population	Percentage
Total population uncovered based on the 2019 Census projected forward to 2021	1,673,966	3.27%
Population remaining uncovered in 78 Phase 1 sub-locations, incl. 4 projects still to be operationalised	72,234	0.14%
Uncovered population in 101 sub-locations to be served by Phase 2	214,791	0.42%
Uncovered population in 274 identified Phase 3 projects	635,113	1.24%
Balance of uncovered population in all other micro or unsustainable gap areas	751,738	1.47%

Figure 4-7 repeats the spatial information of the previous map, super-imposed on the current 2G coverage in order to enable visualisation of the remaining gaps in coverage, essentially in the North and East of the country.

Figure 4-7: All Existing & Proposed USF Interventions



4.8 Remaining sub-locations

The 1.47% of population which will remain uncovered following Phase 3 are made up approximately as shown in Table 4-9 below.

A	987 sub-locations below the 10% uncovered model trigger criterion	141,742	0.28%	143
B	123 sub-locations which are so unsustainable that ongoing OPEX subsidies will be required, incl. 88 macro cases and 30 sublocations with zero or less than 10% population coverage (shown in Figure 4-7 as uncovered)	187,976	0.37%	1,528
C	61 sub-locations calculated to be commercially viable	282,945	0.55%	4,638

As noted in Section 4.5.3, it is possible that, in the final Phase 3 tender preparations, some projects in the Phase 3 list can be expanded to include adjacent sublocations which would be unsustainable on their own but would add increased value to a Phase 3 project.

4.8.1 Industry dialogue required regarding the remaining gaps

Beyond this, the above list are a matter for CA to consider in detail and to dialogue with the Tier 1 operators and other proponents, to promote resolutions and to understand the conditions under which these sublocations could justifiably be added to the USF programme in future. In particular, discussion needs to focus on the following:

- **In Category A,** some of these cases reflect the re-calculations that have taken place in the 2021 Gap Study (as described in Section 4.1.2). These will mostly require CA to request Tier 1 operators to optimise their coverage. Where significant investment is required to boost signal strength in certain areas and that may not be commercially viable, CA should be prepared to negotiate USF contributions commensurate with the scale of the problem. As discussed elsewhere (e.g., Section 6.6), some of these areas may be addressed by currently unlicensed entities
- **In Category B,** the solution will be to hold an industry consultation, followed by a competition or negotiation with operators on a case-by-case basis to conclude 5-year subsidy contracts including explicit OPEX support from Day 1, since none of these cases can generate sufficient cash-flow to repay CAPEX over any period of time. Subsequent to the 5-year contract, a renewal should be allowed to cover ongoing OPEX support to the level that is demonstrated from the latest project financials at the time. The complete list is provided in Annex D.
- **In Category C,** the geographical spread and scale of these cases is provided in Annex E. They fall into 15 counties, largely overlapping with the Phase 3 counties. All are small or micro-cases, because macro cases have been absorbed into the Phase 3 projects, as described in Section These are estimated to be commercially viable because their underserved populations are sufficient to provide the minimum required return on investment. It is recommended that CA should investigate the opportunities for linking some of these with contiguous sub-locations in the Phase 3 list.

4.8.2 Contribution of Community Networks to Phase 3 Gaps

While the consultant is not expecting the emergence of community networks to be rapid or to be sufficiently numerous to become a majority factor in the closing of these gaps, they are, in-principle, important developments to consider. Anytime a community network proposal to USF emerges to solve a coverage problem, CA should consider it seriously as recommended in Sections 2.5 and 4.6 and should exercise forbearance in the licensing arena in order to enable innovation and creative solutions to solve gap challenges. A high-level proposed license framework that would include these opportunities is appended at Annex F.

As noted above and in the Phase 1 report, the consultant is not necessarily expecting many ambitious community networks, since these would not rapidly gain traction, especially in gap areas. Alternatively, relatively small-scale USF interventions are envisaged. CA would offer modest “special project” financial grant incentives for community groups to establish public access vehicles. Sponsors could be institutions, NGOs or other private sector applicants; any relevant institutional bodies locally – schools, clinics, local Government offices – and international and Kenyan stakeholders to step in as sponsors to partner with the USF in such ventures. These could be beneficially tied to important capacity building initiatives as noted in the Phase 1 Report and are discussed further in Section 7.4.

5 Sensitivity and Risk

5.1 Sensitivities

The building of internal consensus on addressing the scale of gap areas that can be closed by USF intervention in the next investment phase requires experimentation with several key parameters. The Excel model input table provides a summary of all parameter assumptions that could be varied. The full set of assumptions from Sheet 2 of the Model is provided in Table 5-1.

Table 5-1. Model Assumptions and Inputs

Demand & Revenues	Penetration	**40%**	
	Household size & penetration in rural areas	4.7	96%
	Penetration due to unique household mobiles only	20%	
	ARPU (KES)	**200**	
	Cost of sales (on/off)	**30%**	
	Cost of sales (on/off)	On/Off	**on**
Infrastructure & RAN unit costs	Site CAPEX per BTS (KES)	**25,400,000**	77%
	Electronics/RAN CAPEX	**7,700,000**	23%
	Towerco model / RAN only	**yes**	
	Regional CAPEX surcharges - Mandera, Wajir, Garissa, TanaR, Lamu Turkana, W.Pokot, Marsabit	**1.2**	**1.1**
	Coverage radius	**12**	
	Default terrain coefficient	1.00	
	Empty spaces factor - default	0.80	
	Use lower space factor above cells	2.0	
	Lower space factor	0.5	
	Calculate above % cell	0	
	Minimum cost @ % cell	0.25	50,000
	Full cost above @ % cell	0.50	
	Macro site fuel, maintenance & security/month (fixed)	**105,000**	75%
	Towerco CAPEX recovery lease charge per BTS site/mo (KES)	**170,000**	
	Subsidised Towerco Lease charge factor	**10%**	
	Equipment O&M OPEX (based on 5%of RAN CAPEX/mo. KES)	**32,083**	12%
	Annual Spectrum Fees (Zone B) 28 MHz MW	**696,346**	22%
	Spectrum Fees reduced to 14 MHz (yes/no) - See sheet 3 Col AY	**412,673**	**yes**
Payback and viability ratio	No of years recovery	**5**	
	Minimum Viability ratio	**0.1%**	
	Maximum viability ratio	**101%**	
Gap threshold control	Uncovered population trigger	**10.0%**	
	Minimum population	**500**	
General	Exchange rate: USD/KES	**110**	

The final scenario developed to arrive at 274 *potential* sub-locations for Phase 3 subsidy tendering has been revised substantially from the Draft

Report and was described in Section 4.5. This scenario is the one for which the assumptions are shown in the table. The most critical assumptions which have the most volatile range of possible values affecting the operating viability of the Tier 1 service providers (who must guarantee quality of service) were the following:

1) **Expected revenue (Rural ARPU) is assumed at Ksh 200**, near the top-end of the 100-230 range provided by operators. This was justified from the consultant's experience of tender responses in previous USF projects, as well as indications of consumer demand from the field verification visit. As well, the local ARPU grows once an area has coverage with establishment of micro and small businesses. Reduction of this parameter to Ksh 100, would increase the viability risk of larger sublocations requiring full macro cells (above 0.5). The number of potential sublocations in this category would reduce from 54 to 19.
2) **Towerco (Tier 2) lease charges to Tier 1 operators have two components:**
   a) ***Normal site OPEX expense*** is the fixed cost of fuel, site maintenance and security and is a monthly expense that is passed on to the Tier 1 tenant. The consensus opinion received by the consultant during interviews with Tier 2 operators for this component is Ksh 105,000, comprises approximately of fuel (60,000), maintenance (15,000) and normal security (20,000). Heightened security in counties subject to terrorist threat could increase this OPEX charge but will also be taken into account by the amount charged for CAPEX recovery (see below), which is finalised only after full security planning has taken place as recommended in Sections 2.6 and 5.2.
   b) ***CAPEX recovery payment*** is a monthly amount calculated to provide a 10-15 year investment recovery to the Tier 2 operator and can be varied depending on the amount of subsidy received. Based on site CAPEX estimated at Ksh 25.4 million for the complete passive infrastructure site (building, access road, secure enclosure, hybrid power supply, generator, solar and deep discharge batteries and 50-60 meter towers for rural areas), the commercial rate is assumed at Ksh 170,000 per month for 12.5 years capital recovery. This component is assumed to be reduced at least to 25 % of normal commercial rate to achieve USF objectives. – *Since the subsidies are envisaged to be divided between Tier 2 (Passive) and Tier 1 (Active) bidders, the benefit to service viability must be reflected in a reduction in rental charge well below commercial benchmark. This is required to enable the Tier 1 operators to provide service in challenging, sparsely populated macro areas.* This reduction is set aggressively to 10% (Ksh 17,000), under a condition that the Passive Infrastructure subsidy could be at 90% of the site CAPEX. This ensures that the total number of macro sublocations in Phase 3 is as high as possible (55), whereas if the Towercos were charging even as much as 25% of their normal lease rate, the number of feasible macro solutions would decrease to 45.
3) **Minimum viability ratio is set at 0.1%** to include all sublocations that would provide any positive annual cash flow above OPEX to repay their CAPEX investment. Obviously, this is radical compared to previous practice. This marginal level of cash flow would be very insufficient and will be reflected in the size of subsidy. However, increasing this parameter to 0.2 (20% viability) which is the normal minimum in USF competitions, would reduce the total number of sub-locations to 233 and the number of macro scale sublocations from 55 to 47.

Impact of relaxing all three assumptions to more conservative levels - Changing all of the above assumptions as discussed would have the combined effect of reducing the total Phase 3 programme from 274 to 105 sublocations – almost all micro-scale projects.

The number of potential sublocations with macro scale solutions in the Phase 3 programme would reduce to just 15, leaving an additional 40 large sized sublocations and "unviable" to consider for the next round of USF investments.

The consultant chose the more aggressive scenario to highlight the need for a) positive enforcement of the benefits of USF investments, which are usually evident in user expenditure levels; b) clarity on the conditions under which Tier 2 operators must engage with the programme, enabling viable service provision; and c) accepting that at this stage of Kenya's telecom development, the most challenging areas must receive subsidies that are calculated and explicitly distributed (in tranches) with the aim of covering OPEX costs and creating sustainability for the service providers.

5.2 Security and other Risks

Two risks that can hinder, delay or even destroy USF sponsored sites were identified as the following:

- Securing sites against terrorist attack in Garissa, Wajir, Mandera and Tana River; and
- Needing to provide additional community investments to counter resistance to the placement of communications towers in Turkana, West Pokot and Marsabit.

These are addressed by the inclusion of site CAPEX surcharges in the financial model, namely:

- Ksh 5 million (approx. 20% additional CAPEX) has been estimated as a minimal response to the risk of terrorism by securing sites on high ground within populated communities as proposed by local officials in Garissa; and
- Ksh 2.5 million (10% of CAPEX) to respond to the risk of community resistance by undertaking local-scale social uplift projects that might be demanded.

These surcharges are not necessarily exact but are considered necessary costs which do not impact the number of sublocations that can be included in the Phase 3 programme. Their main impact will be reflected in higher final subsidies allowed to the operators who build the sites.

It is strongly recommended that prior to the construction of sites in the areas of greatest concern, CA commission a site risk and cost assessment, to be carried out by a team that includes a certified risk evaluation professional.

5.3 Comparing the "Towerco" and Single Operator Models

As noted in Section 2.4 and implied in the above analysis, CA needs to ensure that the USF tender documents require that if Towercos are subsidised, they must become part of the solution to ensure that the overall USF subsidy guarantees sustainability for macro-sized sites in the least viable sub-locations. As explained in sub-section 5.1 above, the USF subsidy to the Towerco must result in reduced lease rates, markedly below commercial benchmark, in proportion with subsidies they receive that lower their CAPEX investment in the passive infrastructure.

This in turn reduces the service providers' OPEX costs and helps to bring otherwise loss-making services into marginal viability and sustainability. If this synergistic situation is not created, then the split into passive and active components will not achieve the smart subsidy objectives required by the USF but would accentuate the financial challenges.

The sensitivity analysis has shown that there is no financial benefit accruing from the presence of Tier 2 operators in USF competitions *unless the most aggressive assumptions on lease rates are enforced in practice.* Otherwise, there is a large risk to the USF and to the sustainability of services in the target areas.

The model analysis indicates that when the analysis is switched from "Towerco" (based on the above assumptions) to "Singular" (i.e., the integrated active/passive solution), the result in terms of Phase 3 selection and subsidy is only marginally different. In the "Singular" non-Towerco model, the Phase 3 program would increase to 298 sub-locations, including 78 macro cases, at a total cost of USD 24.3 million. The 28% increase in cost would simply reflect the increase in the number of macro cases included in the Phase 3 programme. Therefore, the two models are virtually equivalent. However, the Towerco model recognises that some MNOs prefer to outsource their towers and passive infrastructure to Towercos in any case.

As pointed out elsewhere, there is really no role for Towercos in small cell and micro-cases, since the only realistic solution in these cases is existing network optimisation or deployment of singular micro-base station solutions by Tier 1 or Community Network operators. The Towerco model runs out of benefits as the scale of the solution reduces and as the opportunity for multiple tenancy on towers reduces.

In these cases, the only possibility for consumer choice is via roaming or active RAN sharing, which is a regulatory issue that requires separate study.

5.3.1 Insights applied to the Phase 2 Competition

The above sensitivity analysis shows that implementing of the Towerco model (active/passive split) in the Phase 2 competition may have opened the programme to the following risks:

a) Competition between the active and passive network suppliers and making awards before Tier 1/Tier 2 agreements are in place, means that tower location /specification, signal coverage requirements and relative costs between the operators, were uncoordinated until after separate and independent financial and contractual parameters were set.

b) The simple passive/ active subsidy distribution formula (73% / 27%) is not appropriate as a general rule, because the most challenging and unviable, low-density sub-locations present a relatively much greater financial challenge for the Tier 1 operators. This resulted in their refusal to submit offers for the worst cases. To compound this, CA's requirement for the Tier 1 operators to share these very small markets and co-locate on towers at a "fraction" of the 27% subsidy, which they already declined to bid for, was not realistic.

c) Finally, there was no clear requirement for the Tier 2 operators to reduce their lease rates below commercial benchmark (as described above) in line with subsidies received. Therefore, the Tier 1 operators run the risk of not receiving sufficient site OPEX benefit commensurate with the USF subsidies. This could result in possible service sustainability issues.

In summary, the sensitivity and risk analysis show that if a Towerco model is pursued, the physical and financial-operational risks must be reduced with more specificity in the tendering procedures. International experience shows that Towercos should be engaged under a joint-venture or sub-contract relationship with the MNOs, who must guarantee signal coverage and quality of service and instruct the towercos on tower specifications.

5.3.2 Summary

It is recommended that the Phase 3 programme should be organised as follows:

1) It should be tendered in *at least* two separate components, namely macro and small/micro solutions, opening also the possibility of new licensees being allowed to offer solutions for the small and micro cases as described in 3) below;

2) The macro site cases should require Tier 1 and Tier 2 operators to form joint ventures or sub-contractual relationships to ensure that the subsidies are calculated, bid and applied in such a way as to ensure operational viability. In some cases, the Towerco model can even enable operators to serve some areas in a commercially viable way if the lease rates are suitable, while in others, their share of the subsidy must increase. Requiring pre-bid Tier 1/Tier 2 agreements ensures that these issues are resolved ahead of the bids;

3) Small and micro solution cases present a different problem. The tenders should request and facilitate Tier 1 operators and other service provider entities, including Community Networks and other specially licensed operators, to compete and/or to collaborate for solutions. Additional commentary on this is provided in Section 8.2 and includes a draft framework license in Annex F.

6 USF projects and involvements beyond basic coverage expansion

6.1 Schools, Health Centres and other Organisations

The benefits of supplying schools, health centres and other organizations with broadband do not require further emphasis. The Covid-19 pandemic has re-casted and re-emphasised the need for broadband in these public institutions. Besides, availability of broadband in these institutions is also aligned with the government's Big-4 agenda, and Kenya's blueprint for Digital economy.

While it is recommended that CA should have an interest in supporting other key sectors of the economy including education, health, agriculture among others, this should be on the basis of collaborating with an initiative from the specific sector, requesting participation from the USF on specific ICT components, e.g. broadband connectivity, capacity building on digital skills, development of local content, provision of devices among others. This however, ought to be premised on the understanding that the requested support will promote the achievement of the objectives as set-out by the Fund.

For the school's sector, since USF has already had vital involvement since 2016, it is recommended that a strong supportive interest should be maintained. It is also noteworthy that while USF's involvement was solely with the secondary schools, UNICEF is desirous to connect 1,160 primary schools under a pilot focus project connected with its Giga initiative https://gigaconnect.org/ which is eventually targeting Internet connectivity for all schools in the developing world. There should be no reason for the USF not to consider participating, if an approach is made that ensures sustainability through sound commitment by the host ministry and other lead players. Therefore, it is recommended that ongoing school's involvement by USF should consider both primary and secondary institutions. In addition, where existing school connectivity projects exist (e.g., access to schools via KENET points of presence), these should be envisioned as potential take-off positions for additional school connectivity, or replication via additional tertiary education nodes considered.

6.2 Secondary Schools Project – Lessons learned and way forward

The 2016 study resulted in implementation of special broadband project in which 896 secondary schools were identified for connection with dedicated 5mb/s. Both the CAPEX and OPEX for 5 years was funded by USF. This project has provided USF with valuable lessons upon which the success of future institutional projects will be built for better performance and impact. Based on the feedback collected from both schools and operators, the 2016 schools broadband project recorded both success and challenges that curtailed its optimal value to schools. The most direct success was that schools were able to access broadband which has been a great enabler to learning services and efficiency in administrative functions. Among the challenges experienced, and out of which we would derive most of our recommendations for future institutional projects include:

1. Power instability in schools
2. Inadequate support from service providers
3. Most schools do not have ICT managers who are focused on ICT management.
4. Lack of local support

5. Weak remote equipment support
6. Frequent relocation of classrooms
7. Resistance and low ICT awareness from principals
8. Frequent transfer away of teachers trained on ICTs to support the project
9. Ever increasing bandwidth demand from the schools using the facility successfully
10. Computer theft and vandalism
11. Sustainability of the project (commitment to take over payment)

Analysis of these challenges, together with the critical matter of sustainability has resulted in identification of the following factors as critical to the success of future school connectivity projects, as well as other related institutional projects

i. **Ownership:** The beneficiary institutions should own the projects right from the beginning. Institutions should be allowed to dictate their demands plus the type of configurations suitable for them. This will enable schools to take interest in the project right from the beginning which also increases knowledge and contributes to sustainability. The relevant sponsoring ministry should also be involved from the beginning to ensure budgetary integration for sustainability.

ii. **Capacity building:** A more intentional and elaborate capacity program, with repeat and ongoing support features, should be laid out in partnership with the parent ministry. The program must consider the impact of movement of public servants in ensuring continuity.

iii. **Expansion of participation of service providers:** To spur innovation and drive sustainability, USF should open provision of such services to a wider group. This will ensure that licensed operators come in with a host of technologies, as well as solutions that tap into their strength. Such expansion can accommodate innovative solutions like use of anchor institutions to enhance broadband connectivity in the community and neighbouring institutions.

iv. **Re-modeling the approach to school's broadband connectivity:** The USF should consider focusing on financing the extension of the last mile connectivity infrastructure, e.g. the fibre network, to schools or to nearest points, e.g., to an institution which could share the access – see sub-section 6.3 below.

6.3 Expanded Community Connection Vision for Schools

It is recommended that the "anchor" model be considered for whole communities of interest in the vicinity of schools, whereby the school could become the entry point from where the health and other public institutions nearby could be connected. This could be especially attractive where the school is located within economic connection distance from the NOFBI or other fibre routes.

Consensus is that the most favourable (sustainable) CAPEX/OPEX profile for school and related institutional connectivity would be where the school or closest institution is within 2 Km of an accessible fibre node, while 3-5 Km would also prove to be economic where demand is high, including large-sized secondary schools, the other neighbouring institutions, or community network with public access. Our GIS database of 32,000+ schools indicate the potential for graduated cost connectivity as shown in Table 6-1:

Table 6-1: Schools' proximity to NOBFI and other Fibre Route Nodes						
Schools	**Distances**					
	2 km	**3 km**	**5km**	**10km**	**20km**	**Remaining**
Primary	2,020	3,163	5,504	11,869	21,613	7,484
Secondary	683	1,064	1,813	3,853	6,942	1,891
Total	**2,703**	**4,227**	**7,317**	**15,722**	**28,555**	**9,375**

In summary, it is recommended that CA should do the following in addition to following the principles for successful project development outlined in Sub-section 6.1:

a) Seek an update of secondary schools' "internet readiness", adapted and updated from the criteria used for the schools' project in 2016; or

b) Develop other criteria to assess school demand and justification for connection in collaboration with the parent Ministry.

c) Coordinate with the UNESCO Giga initiative where primary schools are pilot focal points, in the event that participation by USF would help to create needed synergies.

d) Ask partners selected under general enquiry (See Sub-section 6.3.1 below) to select and develop connectivity cost models based on the data in Table 6-1 and GPS knowledge of the location of other key institutions such as hospitals;

e) Set out options for USF support of school network development based on the criteria outlined in sub-section 6.2 and the above supporting data, with priorities established consultatively with stakeholder ministries and organisations.

f) Consider increasing bandwidth capacity for schools to a minimum of 20Mbps. Many schools are willing to sustain the project on their own so long as their speeds are adequate / meet the objectives of e-learning and administrative functions in schools.

6.3.1 Next Steps

It is recommended that the following approach be used by CA in providing solutions to schools and other institutional beneficiaries:

i. **Open discussions with the parent ministry and establish a partnership framework** (like the proposed but never-signed MOU in 2016) as the first step.

ii. **Issue a call for expression of interest to interested and qualified institutions and operators (Tier 1, Tier 2 and Tier 3) to participate.** Proper guidance on participation should be clearly stipulated in the terms of reference.

iii. **Evaluate** the EOIs further, consider all scenarios presented, and identify qualified and deserving institutions to participate.

iv. **Call for proposals** from all licensed operators. The proposals will be evaluated based on established criteria, and awards made.

It is recommended that USF should seriously consider a range of scenarios and *terrestrial* connectivity modes, from fibre to broadband point-to-point and 4G options depending on proximity to the fibre network and physical considerations. It is recommended that a range of most economic connectivity modes should be contracted.

The USF should only fund the CAPEX and seed finance OPEX ***for a maximum of 1 year*** with no possibility for uncertainty in sustainability. The institutions, or their parent ministry, must fund the OPEX beyond any brief onboarding period. This will eliminate the culture of dependency and contribute to sustainability

6.4 Addressing people with disabilities, women, and other vulnerable groups

6.4.1 People with Disabilities

Digital divide caused by persons with disabilities (PWDs), women and other vulnerable groups still stands to be addressed under USF. ICT technologies must be designed, developed, and fabricated at the outset for accessibility and usability for people with disabilities. Without this design and development approach, people with disabilities are left behind and are forced to play catch-up. A key point in advancing non-discrimination policy in technology is that people with disabilities must not be relegated to obsolete technologies.

If the many provisions involving technology in the UN Convention on the Rights of Persons with Disabilities (UNCRPD) are to be realized regarding inclusive communication technologies, policy and implementation should include people with disabilities alongside everyone else. The goal must be that any technology used in everyday settings by people without disabilities must also work for people with disabilities. This, then, is the road to reducing the "digital divide" in information and communication technologies.

Among the challenges that this special group faces include inappropriate content to meet their special needs, lack of skills in use of some devices, high cost of suitable devices, poor design of access service areas, like shops. All these challenges are compounded with poverty levels when one considers remote and rural areas. The following recommendations are made to address the challenge of PWDs and other special groups

i. Lobby the government to have tax exemptions or lower tax rate for devices to be used by PWDs
ii. Make it a requirement for operators, and the government to involve PWDS during design stages of services
iii. Customization of existing business and public e-platforms to carter for PWDs
iv. Development of special content that can be consumed by PWDs
v. Champion for subsiding and/or provision of ICT devices for PwDs more-so in learning institutions
vi. Consider supporting special educational content development for PwDs
vii. Carry out special capacity building programs for PWDS and special groups
viii. Carry out awareness campaigns to the wider public on challenges facing PWDS in accessing ICT services

The following sub-section extends the opportunity for integrating PwD and other special focus components into the USF programme. Section 7.4 (Towards a Universal Community-oriented Capacity Promotion) also includes a potential component of USF gap projects that include serving the interests of PwDs, through the promotion of community networking and public access at the local level.

6.4.2 Role of local facilities in outreach and Women's Development

The Phase 1 Report heightened the important role of public access which could be strongly related to community sponsorship. There is common knowledge that the emergence of community networks, especially those with an interest in community development, information dissemination, digital skills development and with forms of public access, can play a crucial and complementary role for access to the broadband market, including especially for women and PWDs. Studies on best practice across several cases and reported in various publications on Internet and broadband development have given at least the following insights[4], that public access, with the guidance provided alongside:

- Helps to onboard new users for the first time.
- Creates additional points of connectivity which can stimulate demand for services amongst users.
- Expands participation at the margins, especially where access is promoted and personally moderated to create a more inclusive digital outreach and reduce the digital gender gap.
- In addition, community and public access can provide social dividends across education, healthcare, agriculture, e-Government, etc. when motivated and supported by individuals or agencies whose interest is in providing increased access to service in these sectors. This is a particular interest in view of COVID-19 concerns.

Public access options when accompanied by socio-developmental vision and expertise offer an essential complement to the mobile networks. In Kenya[5], they have been shown to create an opportunity to bring people from the margins in towards the digital economy targeted by the Government. The benefits can range from greater economic and digital inclusion to a range of wider social benefits. Access points such as Wi-Fi hotspots in public buildings and internet cafes create a web of connectivity that can sustain affordable entry and participation in online activities for rural people, as much as they have proved to do for many urban dwellers in the same marginal situation.

Public access options can be especially important for women, who may face barriers to accessing devices and data at home for various reasons. This has been cited as especially so in Kenya[6]. Public access facilities can provide an alternative route to internet access to women, particularly when established in locations such as marketplaces or near schools, which are convenient for women with care responsibilities to visit. These centres could also be staffed and managed by women, who can provide outreach and assistance that is welcoming and supportive.

People with disabilities: Community networks and public access policies and centres can also be vital in understanding and responding to the issues faced by people with disabilities and promoting internet access for people in wheelchairs, those with hearing or vision disabilities, and people unable to manipulate standard devices, among others. Commercial providers often do not prioritise serving customers with specialised hardware and software accommodations. Community networks and public access facilities can help them access digital technologies and provide technical and financial support for specialised access options.

6.5 Local Content and Innovation

Content remains the biggest driver of increased broadband consumption. Both institutional and individual use of broadband emanates from the need to access useful content that either may be

[4] Reference adapted from Affordability Report 2019, Alliance for Affordable Internet (A4AI)
[5] E.g., TanapandaNET in Kibera and AHERI in Kisumu
[6] Ibid

educational, entertainment, informational, business, and administrative. Thus, creation of local content, and or customization of existing content to appeal to consumers remains one of the solutions towards deepening of voice and data usage. In fact, appropriate and valuable content indirectly acts as a solution to sustainability. CA/USF must therefore deliberately move to spur local content creation and especially in marginalized areas, after introduction of services. Creation of local content will also be a boon to the government's developmental initiatives such as Big-4 agenda and the Digital economic blueprint. It will also marry into the sustainable development goals. Such content should address areas including Agriculture, Health, Manufacturing, Culture, and Education. The following approaches are recommended for adoption when driving local content:

1) **Competitions among the registered content service providers** (CSP): Within the licensing framework of CA, there are content service providers (CSP) who also make contribution to the USF fund. These providers currently develop content and distribute through the NSP licensed providers, mainly MNOs. CA/USF should consider making use of the experience and competence within these CSPs to spur development and provision of appropriate local content as per their mandate

2) **Collaboration with relevant government organizations in the innovation space**: There are several government organizations in the innovation space, who would relish partnering with CA/USF in local content and innovation activities. These include KICD, which is at the forefront of developing appropriate content for the country's education programs, KOTDA, which is setting up Konza technopolies, the first ever smart city in the country and the region. Through its knowledge economy and innovation blueprint, Konza aspires to spur innovations in life sciences, agriculture, and ICT. Kenya agricultural & livestock research organization (KALRO) is another government agency that CA/USF can partner with in local content development and innovation. KALRO is at the forefront of promoting research and innovation in Agriculture and Livestock.

3) **Incorporation of appropriate content creation as a deliverable for operators while rolling out USF projects for voice and data.** CA/USF should make a requirement for licensed operators to develop appropriate content for the unserved and underserved areas, as part of their obligations. This will help instigate usage of the voice and data services and create more impact in the beneficiary communities.

4) **Issue Grants**: The USF framework provides for issuance of grants to any organisation it sees fit. CA/USF should capitalize on this clause to open the market for innovative local content by issuing grants to deserving organizations, including especially those focusing on PwD, youth employment and women's access issues. Once guidelines for grant issuance are established, it will open the market for more players to participate.

7 Conclusion: Overall Demand Stimulation and Capacity Building

As the voice and data gaps shrink, universal access to Broadband service is in sight. However, considering the complexity of achieving full inclusion with coverage, every USF project must contain a demand stimulation and specialised literacy/ capacity building, including Disability & Gender issues element as discussed previously

7.1 Contracting framework

The actual partnership on a county-by-county or local level will vary, but the USF implementation framework must include a community ICT development and/or literacy, capacity building and accessibility component with every project.

The capacity building components should be offered alongside gap projects as separate contract opportunities, but proposals may be included in prime licensee bids, through partnerships with non-licensed entities, as previously discussed.

7.2 Building partnerships

The focus now shifts towards deepening usage. Digital literacy remains one of the barriers of ICT access in the country. Equipping consumers with skills and knowledge to enable usage and benefit from these services is thus paramount. To this end, since CA is not wholly competent in these areas, the Authority needs to build partnerships with organisations (e.g., education institutions, civil society agencies, private organizations, community network alliances, relevant government agencies) committed to training, community ICT development, community networking, infrastructure roll-out and specialised accessibility concerns.

All offers for rural community network buildouts anywhere should have the status of being considered for grant support under a general special project request for proposals.

7.3 Approach to ongoing commitment in capacity building

We recommend the following approach to adding capacity building as a culture to the USF programme and especially in gap areas where services are rolled out

i. A comprehensive research could be carried out in targeted areas to profile the literacy, skills, and special needs gap in voice and data service usage.

ii. From this, with professional support develop an appropriate “curriculum” that would ensure a meaningful program of skills acquisition and utilization.

iii. Develop an appropriate M&E framework in this area to enable tracking of the impact of skills transferred in deepening voice and data services usage.

7.4 Towards a Universal Community-oriented Capacity Promotion

The following scenario for Gap area complementary community oriented small-scale networks and capacity promotion was presented in the Phase 1 Report. All or some of the possibilities to bridge barriers in targeted communities could be realized if the USF works with the selected universal access operators as well as with the broader stakeholder community to offer grant incentives to any entity wishing to establish two or more of the following type of local facilities in a gap area:

a) Free or low-cost public Wi-fi (e.g., through a government, health, community agency or private business platform) in local gathering spots. The cost can be specifically included in the operator subsidy or external incentives offered to interest agencies.

b) Simple Internet cafés (e.g., one or two position) with an outreach mission sponsored by individual entrepreneur, local business, or institution, covered under small-scale USF "Special Project" awards.

c) Periodic digital literacy and skills training/coaching spot based in a public building/location such as local Government office, post office, clinic, school, or community organisation. This could include demonstration and guidance of internet access for private, e-Government, education, telehealth, agricultural or other service.

d) Facilitation programme for access to special feature handset/devices to special groups such as persons with disabilities - visually impaired, deaf etc., through organized groups such as Institutions of Special Learning.

e) Support of Local Content Development for special groups such as Special Needs Learners and marginalized rural communities, e.g., womens' groups and PwDs.

Whereas some inspiration can be gained from any one of the four existing community networks in Kenya already cited[7] and other initiatives underway, a number of international cases can also be drawn on to illustrate the kind of focus and impact that even much smaller, very limited community networks could have, especially if replicated in many places.

In principle, the objective should be to encourage and incentivise at least one or two community service points to emerge in each gap area community and encourage them to include provision of special feature handsets to special groups such as persons with disabilities. Support of these possibilities should also be enshrined in the operator's USF service contract, requiring the operator to offer attractive 4G wholesale flat rate data deals with prospective service point sponsor(s). Treating them as partners can effectively multiply the beneficial effect and contribute to the operator's commercial interests.

[7] Ibid

8 Epilogue: Emerging Issues and Regulatory Development

8.1 Overview

During the study, meetings with key stakeholders brought out several key issues that need addressing to ensure that USF fulfils its full mandate successfully and maintains good will with all the key stakeholders. The key issues that have emerged and summarised in Table 8-1 have all been addressed in previous sections of the report. Some of the insights from these key issues have already been applied in the solutions proposed.

The changing landscape in Telecom infrastructure ownership	Addressed in Section 2.4
Inclusivity of all licensed operators in UDF projects	Addressed in Section 2.5
Security of sites in high insecurity areas	Addressed in Section 2.6
Sustainability of USF projects	Addressed in Section 2.7
USF Mandate to consider and develop partnerships with other institutions for addressing digital literacy, capacity building and response to special needs groups	Addressed in Sections 6 and 7

8.2 Towards accommodating Change: Review of USF legal and Regulatory Framework

As the macro-environment within which USF operates changes, there is more pressure for USF to transform its operations to conform to the change. Changes are being witnessed in technology, consumer expectations, and political landscape. Access gaps in voice and data service coverage also continue to shrink but vary in style and challenge considerably, thus requiring different approaches to addressing them and fulfilling the USF mandate. These issues call for review of the USF legal and regulatory framework, including consideration by CA of special licenses for rural and gap areas, to accommodate new ways of accomplishing its mandate.

There is a growing need to accommodate the issuance of grants, accommodate currently non-licensed and community network organizations in providing USF solutions, and streamlining administration of the fund and its projects. This study has captured a few amendments which are proposed for consideration to be incorporated in the USF management and processes. Just like any other organizational policies, the legal, regulatory, and environmental changes affect internal management and operational documents, which would need to be updated to accommodate any shift in direction. A high-level summary of the analysis of the identified issues is provided in Table 8-2.

USF Framework	The Framework articulates many guiding principles and therefore impinges on some of the above-mentioned proposals. This study highlights areas of ICT Capacity Building and Awareness (to update ICT products and solutions), Special USF Projects (to accommodate non-contributors), Monitoring and Evaluation (impact study) which have covered the new approaches	• The Authority to develop the scope, location, and details of specific projects to be implemented under the Fund programmes, in consultation with industry and local stakeholders. • The Authority to consider the issuance of a special license covering the deployment of technical / operational solutions for rural and USF gap areas. A Draft Special Rural Community License & USF Contracting Framework is provided at Annex F. • The Authority may consider engaging external consultants to handle some of activities considering the scope of projects and M&E functions
USF Operational Manual	The Operational manual covers all the desired areas to help the organisation handle the projects. To accommodate this Study's proposed approaches, recommendations are made.	The following sections should be revised: • Program Development, • Project Design and Prioritisation Criteria, • Procurement, Tendering Procedures; and • Selection and Subsidy Disbursement, Monitoring & Evaluation to accommodate: • Non contributors' participation • Community lead/based projects that could have a profound impact at the local level • Incorporate site visit undertakings and project risk assessment before awarding and commissioning

Legal and regulatory policies	The Universal Service Regulation of 2010 guides the Fund in its operations and limitations. It might need to guide more on how financing can take place if Government becomes a site owner in insecure areas	The regulation will need to describe how a Government entity can receive a grant for site funding by the USF The Universal Service Regulation of 2010 already states that the USF may fund universal services programmes and projects through: (a) Subsidies. (b) Loans; and (c) Grants.

Electronic File supplied separately

Model Assumptions and Inputs (Model Sheet 2)			
Demand & Revenues	Penetration	**40%**	
	Household size & penetration in rural areas	4.7	96%
	Penetration due to unique household mobiles only	20%	
	ARPU (KES)	**200**	
	Cost of sales (on/off)	**30%**	
	Cost of sales (on/off)	On/Off	**on**
Infrastructure & RAN unit costs	Site CAPEX per BTS (KES)	**25,400,000**	77%
	Electronics/RAN CAPEX	**7,700,000**	23%
	Towerco model / RAN only	**yes**	
	Regional CAPEX surcharges - Mandera, Wajir, Garissa, TanaR, Lamu Turkana, W.Pokot, Marsabit	**1.2**	**1.1**
	Coverage radius	**12**	
	Default terrain coefficient	1.00	
	Empty spaces factor - default	0.80	
	Use lower space factor above cells	2.0	
	Lower space factor	0.5	
	Calculate above % cell	0	
	Minimum cost @ % cell	0.25	50,000
	Full cost above @ % cell	0.50	
	Macro site fuel, maintenance & security/month (fixed)	**105,000**	75%
	Towerco CAPEX recovery lease charge per BTS site/mo (KES)	**170,000**	
	Subsidised Towerco Lease charge factor	**25%**	
	Equipment O&M OPEX (based on 5%of RAN CAPEX/mo. KES)	**32,083**	12%
	Annual Spectrum Fees (Zone B) 28 MHz MW	**696,346**	22%
	Spectrum Fees reduced to 14 MHz (yes/no) - See sheet 3 Col AY	**412,673**	**yes**
Payback and viability ratio	No of years recovery	**5**	
	Minimum Viability ratio	**0.1%**	
	Maximum viability ratio	**101%**	
Gap threshold control	Uncovered population trigger	**10.0%**	
	Minimum population	**500**	
General	Exchange rate: USD/KES	**110**	

ANNEX C: LIST OF PHASE 3 POTENTIAL SUB-LOCATIONS

Note that Ward groupings are indicate in colour code as a possible starting point for aggregation of small and micro cases to ward level Lots.

No. Per County	COUNTY	WARD	SUBLOCATION	% POP'N COVERED	UNSERVED POP'N	NO. of CELLS	VIABILITY RATIO	MAX SUBSIDY (USD)
1	BARINGO	MOCHONGOI	KASIELA	64	541	0.02	0.28	35,954
2	BARINGO	BARTABWA	KALABATA	66	576	0.05	0.25	37,337
3	BARINGO	BARTABWA	BARTABWA	30	1,111	0.03	0.62	18,852
4	BARINGO	BARTABWA	KESUMET	36	1,023	0.04	0.55	22,510
5	BARINGO	BARTABWA	TULUK	48	718	0.04	0.36	31,796
6	BARINGO	BARTABWA	KAPTURO	26	792	0.10	0.27	36,477
7	BARINGO	BARTABWA	TERIK	75	1,065	0.01	0.63	18,714
8	BARINGO	BARTABWA	ATIAR	75	562	0.04	0.26	36,847
9	BARINGO	SAIMO/KIPSARAM	KAPKOIWO	81	1,146	0.02	0.67	16,595
10	BARINGO	SAIMO/KIPSARAM	ISSAS	71	609	0.01	0.36	32,145
11	BARINGO	TIRIOKO	ANGORITIANG	75	696	0.10	0.21	39,401
12	BARINGO	RIBKWO	KOSITEI	33	1,805	0.11	0.87	6,309
13	BARINGO	RIBKWO	SERETION	45	1,223	0.10	0.54	22,889
14	BARINGO	SILALE	NAKOKO	84	1,132	0.03	0.64	18,028
15	BARINGO	SILALE	LOSIKIRIAMOI	85	845	0.07	0.38	31,112
16	BARINGO	SILALE	NASOROT	67	521	0.01	0.30	34,912
17	BARINGO	TANGULBEI/ KOROSSI	CHEMOIGUT	89	518	0.10	0.12	44,247
18	BARINGO	TANGULBEI/ KOROSSI	ORUS	37	1,336	0.08	0.64	17,863
19	BARINGO	CHURO/AMAYA	CHURO	63	1,229	0.05	0.65	17,364
20	BARINGO	CHURO/AMAYA	CHEPELOW	54	842	0.03	0.45	27,713
21	BARINGO	CHURO/AMAYA	TEBELEKWO	59	1,656	0.05	0.90	4,769
22	BARINGO	KISANANA	WASEGES	28	741	0.05	0.36	32,043
23	BARINGO	KISANANA	KABUSWO	61	500	0.02	0.26	36,806
24	BARINGO	KISANANA	KIRIBOT	33	613	0.02	0.34	32,960
1	BOMET	EMBOMOS	EMBOMOS	89	547	0.00	0.33	33,690
2	BOMET	CHEMANER	LELKATET	84	872	0.00	0.52	23,762
1	ELGEYO-MARAKWET	SAMBIRIR	CHESOI	77	610	0.00	0.36	31,885
2	ELGEYO-MARAKWET	SAMBIRIR	CHEMWOROR	79	726	0.00	0.43	28,293
3	ELGEYO-MARAKWET	SAMBIRIR	CHESIYO	72	556	0.00	0.34	33,245
4	ELGEYO-MARAKWET	KAPYEGO	KARARIA	82	1,071	0.16	0.33	33,342
5	ELGEYO-MARAKWET	KAPYEGO	KESSOM	71	760	0.15	0.16	41,771
1	GARISSA	DANYERE	DAGOOB	31	2,234	0.29	0.54	27,567
2	GARISSA	MAALAMIN	DIHILEY	0	8,443	0.60	1.00	207,818
3	GARISSA	SABENA	ILAN	35	2,590	0.58	0.11	269,821
4	GARISSA	SABENA	GARUFA	79	1,542	0.19	0.48	25,833

ANNEX C: LIST OF PHASE 3 POTENTIAL SUB-LOCATIONS

No. Per County	COUNTY	WARD	SUBLOCATION	% POP'N COVERED	UNSERVED POP'N	NO. of CELLS	VIABILITY RATIO	MAX SUBSIDY (USD)
5	GARISSA	ABAKAILE	KUMAHUMATO	85	4,768	1.06	0.21	263,270
6	GARISSA	ABAKAILE	ABAKAILE	66	2,733	0.39	0.56	28,075
7	GARISSA	LIBOI	HAREHARE	80	785	0.01	0.45	27,498
8	GARISSA	DAMAJALE	DAMAJALE	49	5,216	1.21	0.14	268,241
9	GARISSA	NANIGHI	KAMUTHE	20	4,261	0.63	0.75	225,158
10	GARISSA	DEKAHARIA	BULLA GOLOL	0	5,085	0.78	0.84	218,871
11	GARISSA	FAFI	YUMBIS	4	62,715	0.67	1.00	207,818
12	GARISSA	HULUGHO	ELKAMBERE	0	11,456	0.83	1.00	207,818
13	GARISSA	HULUGHO	GARABEY	0	10,411	0.55	1.00	207,818
14	GARISSA	IJARA	BODHAI	29	6,421	0.84	1.00	207,818
15	GARISSA	IJARA	JALISH	26	3,454	0.39	0.90	6,053
16	GARISSA	SANGAILU	WAKABHAREY	36	13,507	1.11	1.00	207,818
17	GARISSA	SANGAILU	GEDILUN	2	3,557	0.74	0.24	260,779
18	GARISSA	MASALANI	HARA	74	1,978	0.45	0.07	61,566
19	GARISSA	IJARA	SANGOLE	51	1,655	0.41	0.00	64,228
20	GARISSA	IJARA	WARSAME	0	5,225	0.82	0.83	219,496
21	GARISSA	IJARA	RUQA	77	1,216	0.22	0.19	40,561
1	HOMA BAY	GWASSI NORTH	KITAWA	87	618	0.01	0.36	31,983
1	ISIOLO	SERICHO	ERESA BORU	18	7,213	0.71	1.00	207,818
2	ISIOLO	SERICHO	ELDERA	32	2,249	0.20	0.96	2,126
1	KAJIADO	OLOODOKILAN	TOROKA	82	656	0.10	0.20	40,216
2	KAJIADO	MATAPATO NORTH	EMOTOROKI	77	944	0.21	0.15	42,447
3	KAJIADO	KENYEWA-POKA	SULTAN HAMUD	90	1,303	0.13	0.52	24,022
4	KAJIADO	MATAPATO SOUTH	METO	59	2,710	0.26	0.94	3,329
5	KAJIADO	MATAPATO SOUTH	OLDONYOROK	79	1,753	0.22	0.62	18,872
6	KAJIADO	IMBIRIKANI/ ESSELENGEI	ESSELENGEI	70	1,859	0.23	0.67	16,601
7	KAJIADO	EWUASO KEDONG	SAIKERI	81	577	0.11	0.12	43,834
8	KAJIADO	KEEKONYOKIE	ESONORUA WEST	26	1,103	0.12	0.43	28,309
9	KAJIADO	MAGADI	OLKERI-MAGADI	53	1,062	0.23	0.19	40,739
10	KAJIADO	MAGADI	OLKIRAMATIAN	70	674	0.05	0.31	34,504
1	KIAMBU	GITHOBOKONI	KIENI	54	1,506	0.16	0.59	20,660
1	KILIFI	ADU	KAMALE	58	1,026	0.22	0.17	41,406
2	KILIFI	ADU	RAMADA	69	1,606	0.29	0.31	41,360
1	KITUI	MIAMBANI	NZAAYA	67	1,101	0.04	0.60	19,987
2	KITUI	MIAMBANI	USIANI	87	677	0.01	0.39	30,577
3	KITUI	VOO/KYAMATU	KYAMATU	81	784	0.05	0.38	31,063
4	KITUI	ZOMBE/MWITIKA	KAVINGO	73	799	0.04	0.40	29,767
5	KITUI	ENDAU/MALALANI	SYOU	32	1,108	0.15	0.37	31,586
6	KITUI	MUTITU/KALIKU	MUSUKINI	83	694	0.02	0.38	30,889
7	KITUI	ZOMBE/MWITIKA	MALATANI	84	882	0.05	0.44	28,169

ANNEX C: LIST OF PHASE 3 POTENTIAL SUB-LOCATIONS

No. Per County	COUNTY	WARD	SUBLOCATION	% POP'N COVERED	UNSERVED POP'N	NO. of CELLS	VIABILITY RATIO	MAX SUBSIDY (USD)
8	KITUI	MUTITU/KALIKU	KAWALA	79	622	0.05	0.29	35,666
9	KITUI	MUTITU/KALIKU	KYAIMU	54	771	0.08	0.31	34,452
10	KITUI	MUTITU/KALIKU	MANYOENI	60	1,314	0.15	0.49	25,556
11	KITUI	MUTOMO	KIBWEA	58	1,475	0.06	0.78	10,880
12	KITUI	MUTOMO	UAE	84	534	0.02	0.28	35,791
13	KITUI	IKANGA/KYATUNE	NGWANI	80	825	0.02	0.45	27,316
14	KITUI	IKANGA/KYATUNE	YONGELA	68	988	0.03	0.53	23,287
15	KITUI	VOO/KYAMATU	KYANGINI	73	610	0.02	0.32	33,904
16	KITUI	VOO/KYAMATU	NZUNGUNI	75	1,231	0.09	0.58	21,231
17	KITUI	VOO/KYAMATU	IMALE	66	713	0.03	0.36	31,785
18	KITUI	VOO/KYAMATU	KASASI	83	637	0.05	0.28	36,154
19	KITUI	MUTHA	KENGO	77	564	0.04	0.26	37,052
20	KITUI	MUTHA	KIIMANI	64	811	0.04	0.41	29,534
21	KITUI	MUTHA	KIATU	75	578	0.02	0.31	34,385
22	KITUI	KANZIKO	NDILILI	66	533	0.01	0.31	34,731
23	KITUI	KANZIKO	MWANIANGA	67	634	0.02	0.34	32,900
24	KITUI	KANZIKO	ILAMBA	58	668	0.11	0.19	40,533
25	KITUI	IKUTHA	KASAALA	83	600	0.03	0.31	34,284
26	KITUI	IKUTHA	UIINI	56	1,631	0.06	0.87	6,644
27	KITUI	ATHI	KITUTI	80	1,900	0.17	0.81	9,442
28	KITUI	KIVOU	ENZIU	89	882	0.00	0.53	23,546
29	KITUI	NGUNI	MWALALI	85	671	0.12	0.17	41,683
30	KITUI	NUU	NGIENI	84	523	0.03	0.26	37,163
31	KITUI	NUU	NYAANI	69	1,089	0.07	0.53	23,688
32	KITUI	NUU	MWAMBIU	69	930	0.06	0.44	28,010
33	KITUI	NUU	NGAANI	79	1,055	0.04	0.57	21,450
34	KITUI	MUI	NGILUNI	83	776	0.04	0.38	30,834
35	KITUI	KYUSO	GAI	90	773	0.05	0.36	31,927
36	KITUI	KYUSO	ITIVA-NZOU	76	1,592	0.04	0.88	5,756
37	KITUI	KYUSO	KATUKA	74	693	0.06	0.31	34,624
38	KITUI	KYUSO	KISEUNI	60	891	0.06	0.42	29,117
39	KITUI	KYUSO	MASEKI	72	729	0.04	0.37	31,565
40	KITUI	NGOMENI	KAMUSILIU	69	539	0.05	0.23	38,664
41	KITUI	NGOMENI	KAVAANI	85	724	0.15	0.13	43,256
42	KITUI	TSEIKURU	KAIVIRYA	78	577	0.05	0.26	37,044
43	KITUI	TSEIKURU	NGONGONI	52	791	0.05	0.38	31,047
44	KITUI	TSEIKURU	KITOVOTO	68	3,391	0.82	0.28	258,388
45	KITUI	TSEIKURU	KATHIANI	20	1,389	0.14	0.56	21,759
46	KITUI	TSEIKURU	KYANDANI	60	1,865	0.19	0.74	13,013
47	KITUI	TSEIKURU	KANINGO	70	1,106	0.07	0.54	23,070
48	KITUI	TSEIKURU	NGERENI	53	1,306	0.06	0.68	15,777

ANNEX C: LIST OF PHASE 3 POTENTIAL SUB-LOCATIONS

No. Per County	COUNTY	WARD	SUBLOCATION	% POP'N COVERED	UNSERVED POP'N	NO. of CELLS	VIABILITY RATIO	MAX SUBSIDY (USD)
49	KITUI	THARAKA	KAMAINDI	69	1,032	0.04	0.54	22,984
50	KITUI	MUMONI	KONYU	70	668	0.03	0.35	32,287
51	KITUI	MUMONI	KYANDALI	71	778	0.05	0.37	31,385
52	KITUI	THARAKA	GACIGONGO	72	917	0.07	0.42	29,148
53	KITUI	MUMONI	KALIWA	44	1,107	0.03	0.61	19,557
54	KITUI	MUMONI	MUSOSYA	78	508	0.01	0.28	35,953
55	KITUI	MUMONI	KATIA	56	1,266	0.03	0.72	13,964
1	LAIKIPIA	MUGOGODO WEST	ILMOTIOK	50	1,511	0.17	0.58	21,038
2	LAIKIPIA	MUGOGODO WEST	EWASO	81	676	0.10	0.21	39,535
3	LAIKIPIA	SOSIAN	MAGADI	48	1,252	0.20	0.35	32,539
4	LAIKIPIA	SOSIAN	LUONIEK	74	1,370	0.17	0.49	25,571
5	LAIKIPIA	SOSIAN	NDONYO LOIP	84	547	0.02	0.29	35,493
1	LAMU	HONGWE	BOMANI	84	1,241	0.03	0.68	16,168
1	MAKUENI	MASONGALENI	ULILINZI	75	1,889	0.13	0.90	5,164
1	MANDERA	GUTICHA	GUTICHA	42	6,151	1.07	0.80	222,083
2	MANDERA	MAROTHILE	KAJAJA	0	5,993	0.96	0.92	213,398
3	MANDERA	GUTICHA	OLLA	0	8,829	0.58	1.00	207,818
4	MANDERA	GUTICHA	SHIR SHIR	4	10,236	0.78	1.00	207,818
5	MANDERA	RHAMU DIMTU	MADO	84	787	0.02	0.43	28,354
6	MANDERA	SHAMBIR FATUMA	FINCHARO	72	529	0.04	0.22	39,165
7	MANDERA	WARANKARA	GARI	70	1,768	0.11	0.81	9,270
8	MANDERA	FINO	FINO	63	4,202	1.01	0.05	274,282
9	MANDERA	ARABIA	OMAR-JILLOW	7	1,752	0.34	0.19	50,024
10	MANDERA	LIBEHIA	JABI EAST	0	6,424	0.95	1.00	207,818
11	MANDERA	BANISSA	BANISA	87	3,964	0.53	0.79	222,391
12	MANDERA	DANDU	DANDU	79	7,699	0.52	1.00	207,818
13	MANDERA	DANDU	KUBIHALO	0	14,526	0.68	1.00	207,818
1	MARSABIT	KARARE	HULA_HULA	30	1,693	0.06	0.91	4,748
2	MARSABIT	SAGANTE/JALDESA	JALDESA	74	755	0.03	0.40	29,841
3	MARSABIT	LAISAMIS	IRIR	65	545	0.08	0.14	42,950
4	MARSABIT	LAISAMIS	LONTOLIO	14	4,865	0.72	0.96	210,938
5	MARSABIT	KORR/NGURUNIT	ILLAUT	7	3,299	0.67	0.36	252,435
6	MARSABIT	KARGI/SOUTH HORR	KAMBINYE	0	4,284	0.83	0.53	240,573
7	MARSABIT	URAN	GOLOLE	81	530	0.02	0.28	36,189
8	MARSABIT	URAN	KARBURURI	24	1,436	0.02	0.83	8,373
1	MERU	KIBIRICHIA	KIMBO	83	690	0.01	0.41	29,522
2	MERU	THANGATHA	NKWILA	62	965	0.00	0.58	20,851
3	MERU	THANGATHA	CHURIU	88	592	0.00	0.35	32,278
4	MERU	THANGATHA	AMUGAA	84	601	0.00	0.36	31,911
5	MERU	THANGATHA	GIITHU	74	1,532	0.00	0.93	3,636

ANNEX C: LIST OF PHASE 3 POTENTIAL SUB-LOCATIONS

No. Per County	COUNTY	WARD	SUBLOCATION	% POP'N COVERED	UNSERVED POP'N	NO. of CELLS	VIABILITY RATIO	MAX SUBSIDY (USD)
6	MERU	KIGUCHWA	MUCIIMUKURU	90	717	0.00	0.43	28,579
1	NAKURU	MARIASHONI	KIPTUNGA	86	1,465	0.20	0.49	25,553
2	NAKURU	NYOTA	MAWINGO	87	721	0.01	0.42	28,922
3	NAKURU	AMALO	KAPLAMAI	80	1,492	0.01	0.89	5,603
1	NANDI	TINDERET	CHEBANGANG	46	759	0.03	0.41	29,647
2	NANDI	KAPCHORUA	KAPKOROS	45	1,318	0.01	0.79	10,405
1	NAROK	ILDAMAT	ENOOSEYIA	81	653	0.04	0.32	34,159
2	NAROK	ILDAMAT	ILDAMAT	77	1,045	0.07	0.49	25,266
3	NAROK	MELILI	PARKARARA	83	918	0.07	0.42	28,851
4	NAROK	MELILI	OLKINYEI	82	846	0.10	0.31	34,641
5	NAROK	OLORROPIL	OLORROPIL	89	885	0.08	0.37	31,295
6	NAROK	OLORROPIL	EMPATIPAT	89	653	0.03	0.34	33,066
7	NAROK	OLPOSIMORU	OLMARIKO	73	971	0.04	0.51	24,485
8	NAROK	OLPOSIMORU	KAMURAR	66	1,829	0.22	0.66	16,941
9	NAROK	OLPOSIMORU	ILIKIAI	73	786	0.04	0.39	30,292
10	NAROK	MAJI MOTO/ NAROOSURA	ENKIU	66	2,428	0.30	0.72	16,820
11	NAROK	MAJI MOTO/ NAROOSURA	NTUKA	80	1,131	0.15	0.38	30,816
12	NAROK	MAJI MOTO/ NAROOSURA	NKIMPA	18	859	0.12	0.28	36,119
13	NAROK	MAJI MOTO/ NAROOSURA	OLOIROWUA	84	967	0.13	0.32	33,831
14	NAROK	MAJI MOTO/ NAROOSURA	OLENKULUO	71	916	0.19	0.16	41,833
15	NAROK	NAIKARRA	LESHUTA	87	708	0.14	0.15	42,361
16	NAROK	NAIKARRA	OSARARA	61	975	0.13	0.32	34,035
17	NAROK	NAIKARRA	OLDERKESI	58	2,811	0.27	0.99	824
18	NAROK	LOITA	MORIJO LOITA	80	2,530	0.57	0.26	259,505
19	NAROK	SAGAMIAN	SAGAMIAN	89	1,417	0.01	0.84	8,096
20	NAROK	ANGATA BARIKOI	OLDONYO-OROK	88	941	0.01	0.56	22,057
1	SAMBURU	LOOSUK	MALASO	78	618	0.11	0.15	42,423
2	SAMBURU	LOOSUK	PURRA	8	3,443	0.46	0.87	8,767
3	SAMBURU	BAAWA	MABATI	25	1,393	0.36	0.09	56,577
4	SAMBURU	ANGATA NANYUKIE	LULU	49	830	0.11	0.29	35,685
5	SAMBURU	ANGATA NANYUKIE	SOIT NAIBOR	71	567	0.16	0.02	49,111
6	SAMBURU	ANGATA NANYUKIE	ANGATA NANYUKIE	51	1,463	0.42	0.03	63,036
7	SAMBURU	LODOKEJEK	MUGUR	72	743	0.17	0.10	44,980
8	SAMBURU	BAAWA	BAAWA	82	1,973	0.20	0.79	10,396
9	SAMBURU	SUGUTA MARMAR	NASUR	13	1,676	0.20	0.62	19,110
10	SAMBURU	WAMBA WEST	RESIM	28	1,266	0.20	0.37	31,406
11	SAMBURU	WAMBA NORTH	SWARI	22	3,774	0.80	0.47	245,016
12	SAMBURU	WAMBA NORTH	LMARIMAROI	23	1,269	0.25	0.26	36,833

ANNEX C: LIST OF PHASE 3 POTENTIAL SUB-LOCATIONS

No. Per County	COUNTY	WARD	SUBLOCATION	% POP'N COVERED	UNSERVED POP'N	NO. of CELLS	VIABILITY RATIO	MAX SUBSIDY (USD)
13	SAMBURU	WAMBA NORTH	NGILAI	12	4,483	0.94	0.57	237,883
14	SAMBURU	WAMBA WEST	OLPUS LELUAI	64	1,190	0.24	0.23	38,289
15	SAMBURU	EL BARTA	MASIKITA	21	1,966	0.54	0.06	273,347
16	SAMBURU	NDOTO	LOIKUMKUM	23	2,691	0.76	0.05	274,093
17	SAMBURU	NYIRO	SIMALE	0	2,832	0.38	0.74	16,517
18	SAMBURU	NYIRO	PARKATI	9	2,903	0.65	0.32	255,768
1	TANA RIVER	MADOGO	BUWA	1	3,328	0.42	0.78	14,367
2	TANA RIVER	BANGALE	BOKA	4	2,777	0.34	0.69	19,307
3	TANA RIVER	WAYU	DAYATE	30	728	0.06	0.31	34,684
4	TANA RIVER	MIKINDUNI	LENDA	79	607	0.02	0.31	34,390
5	TANA RIVER	KINAKOMBA	HARA	35	1,130	0.08	0.50	25,123
6	TANA RIVER	GARSEN NORTH	MIKAMENI	39	819	0.15	0.13	43,390
7	TANA RIVER	KIPINI WEST	HANDARAKU	78	1,220	0.14	0.41	29,568
8	TANA RIVER	KIPINI WEST	KURAWA	86	873	0.10	0.29	35,492
1	THARAKA-NITHI	MARIMANTI	RUKENYA	71	715	0.02	0.39	30,687
2	THARAKA-NITHI	CHIAKARIGA	MWERERA	67	512	0.01	0.29	35,492
1	TURKANA	LOIMA	LOCHOR- EDOME	44	1,157	0.20	0.25	37,547
2	TURKANA	LOKIRIAMA/ LORENGIPPI	ATALA KAMUSIO	90	532	0.06	0.19	40,675
3	TURKANA	KANGATOTHA	LOCHER EKENY	78	1,353	0.02	0.78	10,976
4	TURKANA	TURKWEL	TURKWEL	79	2,051	0.16	0.89	5,309
5	TURKANA	KOTARUK/LOBEI	LOBEI	21	4,476	0.50	1.00	207,818
6	TURKANA	TURKWEL	LOMEYAN	50	9,927	1.04	1.00	207,818
7	TURKANA	LAKEZONE	KATIKO	57	1,239	0.24	0.21	39,589
8	TURKANA	LAKEZONE	LOMEKWI	57	1,762	0.47	0.01	65,823
9	TURKANA	LAKEZONE	RIAKOMOR	83	1,312	0.13	0.52	24,116
10	TURKANA	LAKEZONE	KOKISELEI	65	1,505	0.15	0.57	21,262
11	TURKANA	LAKEZONE	NACHUKUI	72	1,621	0.15	0.66	17,060
12	TURKANA	LAPUR	LEWAN	0	4,083	1.05	0.09	271,806
13	TURKANA	LAPUR	NAPEIKAR	44	1,461	0.28	0.22	46,778
14	TURKANA	KIBISH	KAITEDE	0	6,841	0.55	1.00	207,818
15	TURKANA	KAERIS	NADUNGA	0	5,669	0.83	1.00	207,818
16	TURKANA	LETEA	KATELEMOT	82	966	0.19	0.17	41,451
17	TURKANA	LETEA	LOKIPOTO	9	6,732	1.09	1.00	207,818
18	TURKANA	LETEA	LOITO	13	6,254	0.51	1.00	207,818
19	TURKANA	LETEA	NAMOR-KIRIONOK	76	692	0.14	0.11	44,453
20	TURKANA	KAKUMA	TARACH	74	518	0.10	0.09	45,354
21	TURKANA	NANAAM	MOGILA	8	5,802	1.01	0.90	214,955
22	TURKANA	LOKORI/KOCHODIN	LOTUBAE	0	10,332	0.84	1.00	207,818
23	TURKANA	KAPEDO/	EKIPOR	36	5,520	1.08	0.67	230,772

No. Per County	COUNTY	WARD	SUBLOCATION	% POP'N COVERED	UNSERVED POP'N	NO. of CELLS	VIABILITY RATIO	MAX SUBSIDY (USD)
		NAPEITOM						
24	TURKANA	KAPEDO/ NAPEITOM	KAMUGE	0	6,770	0.68	1.00	207,818
25	TURKANA	KATILU	KANAODON	83	1,424	0.14	0.55	22,589
1	WAJIR	DIFF	GERILLE	6	3,844	0.69	0.45	246,047
2	WAJIR	BUR-DER	BUR-DER	71	6,937	1.10	1.00	207,818
3	WAJIR	BUR-DER	KURSIN	14	10,557	1.09	1.00	207,818
4	WAJIR	BENANE	SHIMBIR	52	5,051	0.72	0.94	211,992
5	WAJIR	BENANE	DAGAHALEY	0	6,973	0.99	1.00	207,818
6	WAJIR	HABASWEIN	MERI	64	2,739	0.47	0.38	41,461
7	WAJIR	HABASWEIN	KANJARA	50	2,064	0.47	0.08	60,768
8	WAJIR	LAGBOGHOL SOUTH	LEHELEY	41	8,075	0.95	1.00	207,818
9	WAJIR	LAGBOGHOL SOUTH	EYRIB	44	4,706	1.02	0.26	259,623
10	WAJIR	IBRAHIM URE	KULAALEY	24	4,440	0.98	0.21	263,041
11	WAJIR	GODOMA	DUGO	75	2,021	0.14	0.89	5,696
12	WAJIR	KORONDILE	LENSAYU	43	6,861	0.66	1.00	207,818
13	WAJIR	MALKAGUFU	MALKAGUFU	84	1,924	0.27	0.42	34,240
14	WAJIR	WARGADUD	WARGADUD	16	3,304	0.81	0.01	276,855
15	WAJIR	ELNUR/TULA TULA	BASIR	25	3,453	0.77	0.15	267,531
16	WAJIR	GANYURE	GANYURE	83	1,266	0.30	0.02	59,448
1	WEST POKOT	ENDUGH	CHEPTRAM	80	605	0.02	0.31	34,328
2	WEST POKOT	ENDUGH	CHEWARANY	26	1,922	0.20	0.73	13,549
3	WEST POKOT	ENDUGH	TAMRUKWO	35	500	0.08	0.13	43,427
4	WEST POKOT	ENDUGH	KESOT	65	1,309	0.15	0.47	26,652
5	WEST POKOT	ENDUGH	KETIAM	79	805	0.04	0.39	30,372
6	WEST POKOT	ENDUGH	PTOYO	74	678	0.06	0.28	35,971
7	WEST POKOT	KIWAWA	KAMUNAI	9	1,279	0.13	0.48	26,067
8	WEST POKOT	ALALE	LOKITONYALA	55	1,794	0.27	0.41	34,953
9	WEST POKOT	KAPCHOK	KAPYEN	75	1,535	0.30	0.20	48,238
10	WEST POKOT	KASEI	SIRWACH	73	1,144	0.24	0.15	42,356
11	WEST POKOT	KIWAWA	CHEPROPOGH	67	999	0.12	0.35	32,532
12	WEST POKOT	LELAN	KAPSANGAR	86	839	0.04	0.43	28,658
13	WEST POKOT	LELAN	KAPTABUK	89	558	0.02	0.30	35,068
14	WEST POKOT	WEI WEI	KOKWOTONDWO	73	1,537	0.01	0.91	4,477
15	WEST POKOT	WEI WEI	SOLION	86	858	0.05	0.40	29,802
16	WEST POKOT	SEKERR	PAREK	58	695	0.10	0.19	40,324
17	WEST POKOT	BATEI	SEBIT	78	1,004	0.01	0.58	20,910
18	WEST POKOT	TAPACH	TANGASIA	88	734	0.03	0.39	30,641
19	WEST POKOT	TAPACH	NYARKULIAN	75	1,297	0.02	0.75	12,289
20	WEST POKOT	TAPACH	KAMELEI	72	1,132	0.05	0.59	20,678

No. Per County	COUNTY	WARD	SUBLOCATION	% POP'N COVERED	UNSERVED POP'N	NO. of CELLS	VIABILITY RATIO	MAX SUBSIDY (USD)
21	WEST POKOT	TAPACH	KOKWOPSIS	60	681	0.02	0.37	31,539
22	WEST POKOT	TAPACH	TAPACH	69	1,206	0.06	0.60	19,765
23	WEST POKOT	LOMUT	SUKUK	71	819	0.00	0.49	25,427

COUNTY	WARD	SUBLOCATION	% COVERED POP'N	UNSERVED POP'N	CELLS REQ'D
BARINGO	MORON	MORON	68	933	0.3
BUNGOMA	FOREST	FOREST	33	2,544	0.8
GARISSA	KASHA	KASHA	90	553	0.2
GARISSA	MAALIMIN	MAALIMIN	51	2,561	0.9
GARISSA	MODOGASHE	MODOGASHE	84	1,990	1.0
GARISSA	ALANGO ARBA	ALANGO ARBA	33	2,613	1.5
GARISSA	MANSABUBU	MANSABUBU	0	2,996	1.0
GARISSA	GARASWEINO	GARASWEINO	84	649	1.0
GARISSA	GUBIS	GUBIS	0	2,350	1.3
GARISSA	MATTA ARBA	MATTA ARBA	75	1,036	1.3
GARISSA	GABABA	GABABA	88	609	0.3
ISIOLO	GOTU	GOTU	65	1,094	0.6
ISIOLO	OLDONYIRO	OLDONYIRO	87	1,098	0.3
ISIOLO	KIPSING	KIPSING	83	828	0.3
ISIOLO	LENGURUMA	LENGURUMA	77	805	0.3
ISIOLO	BURTO BONSA	BURTO BONSA	4	2,001	0.7
ISIOLO	URURA	URURA	92	112	0.0
ISIOLO	BADANA GARDIDA	BADANA GARDIDA	0	1,902	0.9
ISIOLO	QURI	QURI	47	507	0.6
KAJIADO	TOROSEI	TOROSEI	65	1,543	0.8
KAJIADO	OLGULULUI	OLGULULUI	62	1,877	0.8
KAJIADO	EREMIT	EREMIT	65	2,782	1.1
KAJIADO	OLDORKO	OLDORKO	77	648	0.2
KITUI	TWAMBUI	TWAMBUI	21	3,597	1.4
KITUI	KATUMBI	KATUMBI	30	1,293	2.0
KITUI	NGAANI	NGAANI	76	1,750	3.5
KITUI	MITAMISYI	MITAMISYI	85	680	0.2
LAIKIPIA	ILPOLEI	ILPOLEI	85	990	0.4
LAIKIPIA	KIRIMON	KIRIMON	90	938	0.4
LAIKIPIA	SOSIAN	SOSIAN	46	1,253	0.5
MANDERA	ARABIA	ARABIA	85	1,061	1.5
MANDERA	ELDANABA	ELDANABA	83	1,016	0.4
MANDERA	MALKAMARI	MALKAMARI	71	2,692	0.8
MANDERA	HULLOW	HULLOW	86	1,694	0.8
MANDERA	DIDKURO	DIDKURO	84	1,030	0.6
MANDERA	DUDUBLE	DUDUBLE	21	2,754	0.8
MANDERA	KUBDISHEN	KUBDISHEN	49	1,554	0.9
MARSABIT	DUKANA	DUKANA	83	2,833	2.8
MARSABIT	MEDATE KURO	MEDATE KURO	20	983	0.6
MARSABIT	CHARI GOLLO	CHARI GOLLO	0	2,058	3.2
MARSABIT	MALABOT	MALABOT	24	1,779	0.5

COUNTY	WARD	SUBLOCATION	% COVERED POP'N	UNSERVED POP'N	CELLS REQ'D
MARSABIT	NORTH HORR	NORTH HORR	98	258	0.0
MARSABIT	BUBISA	BUBISA	96	53	0.0
MARSABIT	KOYA	KOYA	8	2,621	3.8
MARSABIT	KAMBOE	KAMBOE	90	520	0.5
MARSABIT	HAFARE	HAFARE	86	1,602	1.0
MARSABIT	ARGE	ARGE	3	1,977	1.3
MARSABIT	GAS	GAS	0	1,385	1.5
MARSABIT	GARBA	GARBA	46	504	1.4
NAROK	OLOKURTO	OLOKURTO	82	1,571	0.7
NAROK	TENDWET	TENDWET	78	1,663	0.8
SAMBURU	OPIROI	OPIROI	87	600	0.2
SAMBURU	LBUKOI	LBUKOI	9	1,212	0.6
SAMBURU	MORU	MORU	33	1,537	0.7
SAMBURU	LOROK ONYOKIE	LOROK ONYOKIE	0	2,574	1.3
SAMBURU	ENKARE NAROK	ENKARE NAROK	7	3,189	3.5
SAMBURU	KOITING	KOITING	82	605	0.9
SAMBURU	DONYO WASIN	DONYO WASIN	90	758	1.0
SAMBURU	NAKUPARAT	NAKUPARAT	0	2,506	1.1
SAMBURU	NGILAI	NGILAI	80	1,847	0.6
SAMBURU	LOODUA	LOODUA	78	885	0.5
SAMBURU	MORU AKIRING	MORU AKIRING	50	705	2.4
SAMBURU	SUYAN	SUYAN	0	1,539	1.5
SAMBURU	SOUTH HORR	SOUTH HORR	68	1,581	0.5
SAMBURU	SEREN	SEREN	9	1,388	1.3
SAMBURU	LKOTIKAL	LKOTIKAL	0	890	0.8
SAMBURU	ARSIM	ARSIM	19	1,272	0.8
SAMBURU	LOSURKOI	LOSURKOI	3	1,190	0.6
TANA RIVER	HIRIMANI	HIRIMANI	18	3,987	3.1
TANA RIVER	CHIFIRI	CHIFIRI	3	2,688	3.4
TANA RIVER	HAKOKA	HAKOKA	0	2,534	3.0
TANA RIVER	HARORESA	HARORESA	18	2,089	1.4
TANA RIVER	SERA	SERA	59	2,406	0.7
TANA RIVER	BAOMO	BAOMO	88	614	0.9
TURKANA	LOCHOR- EKUYEN	LOCHOR- EKUYEN	58	1,865	0.6
TURKANA	KAPUA	KAPUA	70	1,556	0.5
TURKANA	ELIYE	ELIYE	67	1,788	0.5
TURKANA	LOMOPUS	LOMOPUS	80	649	0.3
TURKANA	LORUGUM	LORUGUM	86	1,458	0.4
TURKANA	TIYA	TIYA	78	832	0.4
TURKANA	KOKURO	KOKURO	73	1,380	1.0
TURKANA	KARACH 1	KARACH 1	0	1,683	1.1
TURKANA	LORUTH ESEKON	LORUTH ESEKON	34	608	0.9

COUNTY	WARD	SUBLOCATION	% COVERED POP'N	UNSERVED POP'N	CELLS REQ'D
TURKANA	KANAKURUDIO	KANAKURUDIO	76	2,447	2.1
TURKANA	KAERIS	KAERIS	40	2,494	1.0
TURKANA	KANGAKIPUR	KANGAKIPUR	85	571	0.4
TURKANA	TULABALANY	TULABALANY	46	2,990	1.4
TURKANA	SONGOT	SONGOT	70	2,119	2.1
TURKANA	NAMON	NAMON	32	1,512	1.3
TURKANA	NAKALALE	NAKALALE	57	557	1.1
TURKANA	LOSAJAIT	LOSAJAIT	0	2,775	0.9
TURKANA	LOMEYAN	LOMEYAN	0	2,533	3.4
TURKANA	LOTETELEIT	LOTETELEIT	33	833	0.6
TURKANA	LOCHAKULA	LOCHAKULA	26	1,545	0.5
TURKANA	KAKULIT	KAKULIT	1	3,787	1.5
TURKANA	KATIR	KATIR	0	909	0.6
TURKANA	NAPEITOM	NAPEITOM	56	1,325	2.1
TURKANA	SILALE	SILALE	67	1,168	0.4
TURKANA	KAPESE	KAPESE	89	1,373	0.5
TURKANA	NAKALALE	NAKALALE	83	870	0.4
TURKANA	LOCHWANGI KAMATAK	LOCHWANGI KAMATAK	85	1,981	0.9
WAJIR	ARAB LOW	ARAB LOW	0	2,837	1.3
WAJIR	BANANE	BANANE	84	2,891	0.9
WAJIR	SALA	SALA	4	2,155	1.2
WAJIR	SEBULE	SEBULE	81	681	0.5
WAJIR	LAGBOGOS	LAGBOGOS	84	618	0.4
WAJIR	TESORIE	TESORIE	42	2,888	2.9
WAJIR	LAKOLE NORTH	LAKOLE NORTH	50	1,843	1.0
WAJIR	INGIRI	INGIRI	2	2,758	0.9
WAJIR	GURAR	GURAR	82	1,541	0.6
WAJIR	DANABA	DANABA	85	756	0.3
WAJIR	EL KUTULO	EL KUTULO	0	1,738	0.6
WAJIR	AUSMUDULE	AUSMUDULE	23	515	1.1
WAJIR	JAGAHIR	JAGAHIR	31	919	1.0
WAJIR	BOJIHERI	BOJIHERI	59	2,146	0.8
WAJIR	ATHIBOHOL	ATHIBOHOL	83	1,480	2.5
WAJIR	LOLKUTA NORTH	LOLKUTA NORTH	0	648	0.4
WEST POKOT	KODII	KODII	0	595	0.4
WEST POKOT	KOPITO	KOPITO	0	743	0.3
WEST POKOT	LOPET	LOPET	32	941	0.3
WEST POKOT	MBARU	MBARU	67	937	0.3

The commercially viable sub-locations are distributed and with cell size characteristics as follows:

SUMMARY OF COMMERCIALLY VIABLE SUB-LOCATIONS				
COUNTY	MICRO CELLS (<0.25)	SMALL CELLS (0.25-0.5)	MACRO CELLS (>0.5)	POP'N
KILIFI	1			2,584
TANA RIVER	1	1		9,663
ISIOLO	1			2,850
MERU	3			9,629
KITUI	4			9,966
GARISSA	2	4		49,018
WAJIR	2	2		19,537
MANDERA	8	5		85,160
TURKANA	1			5,107
W. POKOT	3	1		14,743
SAMBURU	2	2		12,710
BARINGO	6			21,056
ELGEYO-MARAKWET	1			3,139
NAKURU	4			12,967
NAROK	5	1		22,344
61	45	16	0	282,945

Annex F: Framework for issuance of "Special Rural Community Licenses" (SRCLs) to USF recipients governing voice and broadband data services in small-scale and low population areas

Background

The Gap Study has identified a need for CA to consider facilitating entry of currently unlicensed entities, including Community Networks, into the rural market as a means for USF to recognize, encourage and facilitate innovative and community-oriented solutions that will benefit the local populations in small gap areas.

These special licenses are envisaged to address small and micro-scale gaps in the provision of voice and broadband data services under USF subsidy contract support. These areas may typically require small or micro-scale base station deployments which are not normal practice by Tier 1 operators.

Since the SRCLs are envisaged to be made available primarily to small-scale operators, community-owned and non-profit organisations, the fee shall be nominal and spectrum charges will be concessional based on limited geographical application,

In addition, CA may consider requesting the government to consider some tax exemptions for such licensees or establish special tax regimes.

Objective Targets of Special Rural Community Networks

The targeted user and community benefits from licensing small scale or community-owned operators are affordable, cost-effective, and sustainable solutions. They are also expected to emphasise inclusivity, accompanied by digital literacy training, capacity building, locally relevant content and outreach to special needs persons.

These licenses are not for general issuance or intended to facilitate widespread competitive or disruptive entry by single organisations on a national basis. They shall be issued primarily to locally based organisations in relation to USF competitions and normal subsidy contracts, addressing unserved and underserved areas and specific targeted areas and services of interest to the USF.

Their interconnection shall normally be with Tier 1 operators offering voice network interconnection as well as Internet, or through data alternatives such as KENET depending on proximity.

Each SRCL shall be limited to a specified geographic area. Licenses issued to organisation that wish to operate in several geographic areas will need them to indicate the operating areas upon issuance. Areas added due to subsequent applications shall need the license to specify the new areas through an Addendum.

Requirements

SRCLs shall contain obligations in terms of coverage, including targeted communities, as well as services, signal strength and quality of service to be provided:

- Both voice and data obligations shall be included.

- Licensees should also demonstrate how they will ensure broadband is made available to institutions in the specified area, such as schools, health centres and other public institutions.
- A minimum level of public access (e.g., small Internet cafés) should also be a feature of the licensed network as a means of increasing the affordable and accessible envelope to all members of the community and for training and coaching consumers.

The license will also allow for price control to eliminate any controversy related to SRCL licensees profiting from disruption of the Tier 1 mobile market.

Spectrum

The license will include the identification and locking of specific spectrum band(s) or enable access to a managed spectrum park which could make allocation of available spectrum efficiently. (See Section below entitled “Supportive Administrative Infrastructure” below.

Application Procedure

Applications for the Special Rural Community License will be from organisations whose essential business proposition is to provide service to underserved rural areas and to bring identified impacts to specified communities or areas. Applicants shall be small-scale operators, community-owned, local Non-Government Organisations (NGOs) or other non-profit organisations.

The application to secure a SRCL can be made as part of a proposal submission responding to a USF small or micro-gap area tender competition, or in response to a General Invitation issued by the USF. The issuance of the SRCL shall therefore usually be associated with an acceptable proposal / business plan and subsidy award contract.

USF Competitions may specify a set of targets small or micro-gap area Lots, to which the SRCL applicant may respond by offering one or more Lots, in competition with other Tier1, Tier 2 or Tier 3 licensed operators.

In the case of responding to a USF General Invitation, the applicant may freely specify its chosen target area within the constraints of the invitation but will need to be specific about the area and target communities, services and QoS to be offered. The proponent shall demonstrate how the USF’s objectives and interests shall be met. The proposal shall also provide a pro-forma business plan showing costs, revenues, work plan and 5 Year cash flow, including an estimation of the subsidy requested from the USF and the requested subsidy deployment schedule.

Monitoring and Evaluation

Due to the special conditions such as concessionary license and spectrum fees, and experimental nature of the SRCL programme, CA shall provide a framework for reporting, monitoring and evaluation (M&E) of each license issued. The reporting requirements set out in the USF request for proposal (RFP) shall be strictly adhered to by the applicant.

Supportive Administrative Infrastructure

In order to assist prospective special rural community license holders on preparing their plans and proposals to be workable, the following measures shall be facilitated by CA in support of the SRCL regime.

Towers

Detailed Tier 1 and Tier 2 Operator site data – showing GPS and tower height – shall be made available to prospective SRCL applicants to assist them to identify potential take-off, interconnection, and backbone entry points.

Spectrum Park

A managed spectrum park using frequency bands which could be suitable for limited areas, including 5G technology, could be implemented to improve efficient, one-stop frequency enquiry and allocation.

A managed spectrum park means that spectrum is used on a specific geographic basis and a proportionate license fee is paid. In New Zealand, where this model has been successfully implemented, licensees pay a moderate fee based on the amount of spectrum (in MHz), the population to be covered and the average price per MHz paid in the most recent spectrum auction or allocations, as appropriate. Because the range of the transmitter is geographically limited, the same frequency can be used in many different places and the impact on national licensees very minimal[8].

Spatial data

The ability to take advantage of technologies such as 5G especially, with pin-point geographical application, is dependent upon having accurate infrastructure and location data for institutions such as schools, health centres, etc. This shall be made available in gap area competitions and CA will assist applications to obtain such datasets additional to this if required.

Open data sets such as the High-Resolution Settlement Layers (HRSL) from Facebook enable targeted infrastructure provision to people that are unserved. HRSL maps designed by Facebook and Columbia University enable targeted interventions. However, even with the help of this data set, interventions need to make use of information provided at the appropriate administrative level, due to CA's experience of the difficulties associated with pinpointing served and unserved areas and communities accurately.

Fibre

CA shall also make its GIS mapping of existing NOFBI and other fibre routes and access nodes available to SRCL applicants. The cost of running additional fibre links can be prohibitive, with the vast majority of the cost of installing fibre (up to 85%) being in the civil works. Therefore, coordination between different government agencies, private sector stakeholders and utilities is necessary to reduce the cost per km and incentivise extension of the national backbone into more local areas shall be managed by CA to the extent possible.

If fibre is already present close to the target area(s), the deployment of "last-mile" by means of low-frequency spectrum point-to-point microwave links or cheap access via Wi-Fi is advised for SRCL applications is advised and shall be included, where appropriate, in the SRCL document.

[8] Government of New Zealand, Radio Spectrum Management, available here https://www.rsm.govt.nz/licensing/licences-you-must-pay-for/managed-spectrum-park-licences/