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National Broadband Baseline Survey & Infrastructure Blueprint

Executive Summary, & Summary Report

MINISTRY OF ICT & NATIONAL GUIDANCE

A Knowledge and Productive Society driven by ICT & National Ideology

Table of Contents

Executive Summary

The main objectives of this study was to establish the national broadband baseline and to subsequently develop a 10-year National Broadband Infrastructure Blueprint (2022-2032). This study, commissioned by the Ministry of ICT and National Guidance (MoICT&NG), was funded through the World Bank's Regional Communications Infrastructure Program (RCIP).

Under the third National Development Plan (2020/21 – 2024/25) (NDPIII), Uganda has adopted a quasi-market approach in which "government needs to increase efficient and planned participation in the economy in order to direct development". The National Broadband Infrastructure Blueprint will provide MoICT&NG, its agencies, and private and public sector stakeholders with a consistent and known framework for policy, regulation, planning, deployment, and management of broadband infrastructure including spectrum. A clear and consistent framework will be a major step in actualizing the aspirations of the Digital Uganda Vision (2021) that include improved global competitiveness and attracting investments to enable universal access to broadband.

The study was framed in terms of the broadband value chain, enabling a more granular examination of what is at play at each stage of the value chain. This approach makes it easier to link gaps and weak links in the value chain to the broadband ecosystem so that better policy, institutional arrangements, laws and regulations can be designed. Using a consistent value chain approach also means that Uganda's current status can be benchmarked against other countries. Countries that employ best practice in parts of the value chain and ecosystem become points of reference as Uganda looks to refine its approach to broadband.

Uganda's economy has been negatively affected by the COVID-19 pandemic with lower production and consumption, and a reduction in remittances. The COVID-19 pandemic, however, highlighted the importance of the ICT sector and demonstrated the efficiency gains that digitalization of work processes can bring. What sets the ICT sector apart is its role as an economic enabler. ICT processes can bring efficiencies to all other sectors of the economy, ranging from mining to e-Government. Greater broadband penetration and use is linked to increased productivity, employment and economic growth.

Uganda urgently needs investment in order to drive digital transformation across all facets of the economy. Investment requirements in Uganda range from better access to broadband infrastructure to cheaper smartphones to data centres. Because of the need for an increase in locally stored content and service provisioning with less reliance on out-of-country core services and related third parties, infrastructure planning is a critical piece of the broadband superstructure to allow online services to remain available in the event of Internet blackouts.

The Baseline

The First Mile, international connectivity to neighbouring countries, is adequate. Used International bandwidth however lags leading countries in the region, pointing to significant opportunity for growth in Uganda. Bandwidth usage is driven by content providers and Internet backbone providers. Achieving parity with countries like Kenya will require releasing Uganda from the inhibiting factors identified in this study.

The Middle Mile, comprising the key elements of national backbones, internet exchange points (IXPs), content distribution network (CDN) caches, and data centres, still has a lot of limitations. While fibre routes are an important indicator, access to fibre nodes (where users can be connected) is limited, with only 29% of the population living within 10km of such nodes. Uganda has only one IXP and one carrier neutral data centre. Raxio Data Centre is Uganda's first Tier-III carrier-neutral data centre. Investment in national fibre

routes and increased fibre node density will improve Middle Mile connectivity and support wider and faster Last Mile connectivity.

The Last Mile faces multiple challenges. Mobile broadband is cheap in absolute terms but not affordable in relative terms. Uganda is the 12th cheapest country for 300 MB and 1GB monthly usage out of 54 countries in Africa. However, expressed in terms of GNI per capita, Uganda only ranks 27th and 28th. Broadband adoption is low despite good broadband coverage and relatively fast download speeds. Various factors point to affordability as one of the main obstacles to wider broadband adoption.

Smartphone penetration is low. Only 30% of phones in Uganda are smartphones (UCC, June 2021). Smartphone penetration is impacted by affordability, availability of fast mobile broadband and ability to charge phones at home. Demand for broadband is limited, pointing to a high growth potential. MTN's data for the financial year ending in December 2020 reveals that only a third of mobile subscribers are active data users. Mobile is still mostly a voice and SMS market and broadband services still have considerable growth potential.

The low rate of digitalization of the Uganda economy and government administration point to environmental considerations not being a top priority. Globally, there is increased advocacy for institutions to carry out environmentally friendly operations which has led to the increased use of digital transactions, such as paperless invoices leading ultimately towards a cashless economy. Other examples include a focus on energy efficient and environmentally conscious construction.

The challenge of cost

It is important for the government to see the ICT sector as an engine for growth and not as a mechanism to extract taxes. Companies in the ICT sector in Uganda pay more taxes than companies from other sectors. Excise duties on airtime, value added services and mobile money all place a higher tax burden on the ICT sector relative to the rest of the economy. This distorts investment and slows down the digital transformation of the economy. A 10% increase in broadband adoption would mean higher GDP and more tax revenues for the state. A 10% higher broadband penetration could add up to USD 916 million in GDP and USD 108 million in taxes through productivity gains across all sectors. Dropping excise duties altogether combined with a 10% increase in broadband penetration would raise more revenues for the state and this does not even account for additional multiplier effects throughout the economy.

The ecosystem

The number of policy documents that relate to the broadband value chain in Uganda is overwhelming, and not necessarily always consistent, making rationalization and consolidation urgent so that all stakeholders can refer to a single clear source that articulates policy. Where derived documents from the main one are generated, the linkage and the reason for such expansion should be clear. The Digital Uganda Vision is now the core reference document under Vision 2040, and most of the earlier policies, outside the need to evaluate and learn lessons from them, should be retired. Revisions should ensure that the National Strategy on 4IR and other key sectoral strategies and operational policies are parented by the Digital Uganda Vision. Competition, critical infrastructure, and rights-of-way for public utilities (including dig-once requirements) are major national level policies that need to be developed/concluded and implemented urgently.

Alignment of policy objectives across government ministries is still a challenge that needs to be addressed. The most visible example raised by stakeholders relates to the efforts within MoICT&NG to reduce access

costs to ICT goods and services for users; and running counter to this, action from the Ministry of Finance and Economic Planning to raise more revenue by imposing more or higher taxes on ICT goods and services.

There is need for better coordination and collaborative approaches among the institutions that set direction and provide policy and operational oversight in the sector, and to ensure that the perennial underfunding compounded by high taxation across the ICT sector is addressed. To create a unity of purpose, the MoICT&NG may need an internal review to eliminate mission drift and 'turf wars 'among its departments and agencies. The private sector is a key stakeholder and should be more routinely included in policy and strategy discussions. The MoICT&NG should also provide the lead in the periodic assessment of the broadband value chain, and its contribution to Uganda's socioeconomic transformation.

One of the challenges MoICT&NG and all other arms and levels of government face is the shortage of competent human resources due to competition for such people from the private sector. Measures, such as remuneration outside the standard civil service pay structure, should be implemented in order to retain the professional competences required to capacitate and service MDAs 'transition to a fully-integrated e-government system that is citizen-centric. The absence of adequate competent human resource in the ICT arena is especially acute across other Ministries and District Local Governments (DLGs), the key points of delivery of e-services. The demands of the Parish-centric Socio-economic Development Model underscore the urgency of addressing this cross-cutting challenge.

While Uganda has gone a long way in establishing the legal and regulatory environment to support broadband penetration and adoption, a lot still needs to be done to address various disabling gaps and barriers. It is important to create a more flexible and easy licensing regime that allows for more innovation and competition especially in the services markets and in areas that are underserved. The establishment of an efficient and fair regulatory regime for obtaining rights-of-way in collaboration with all interested parties is also key. Sharing of facilities to reduce capex and opex and resultant end-user prices needs to be more effectively enforced. Intellectual property rights laws need to be reviewed keeping in mind the changes brought about by the broadband value chain, and matters such as artificial intelligence, and the importance of data, among others. Similarly, the legal and regulatory regimes that impact on the delicate balance of protecting rights of free speech and the surveillance mechanisms available, should be reviewed. Finally, cross-cutting laws that extend beyond the ICT sector to ensure a more holistic approach to establishing a good ecosystem should be promulgated as a matter of urgency. These include laws addressing competition; consumer protection; and critical infrastructure.

Spectrum

Uganda, through the Uganda Communications Commission, has developed a new Frequency Allocation Table that is generally consistent with current international best practice. Moving ahead, it is important to provide an online version that is constantly kept up to date, and contains all key notes, references, and information to guide users. Allocating a healthy spectrum mix for different applications creates opportunity for alternative approaches and technologies to ensure universal broadband access in different environments and different population densities. As an example, TVWS in the 470 to 694 MHz UHF band will also support the needs for coverage in low density rural areas for alternative access models such as wireless ISPs and community networks. In addition, spectrum for WiFi in the 6 GHz band will provide valuable capacity for already congested WiFi networks and allow offloading from congested mobile networks to WiFi networks. Guiding principles for spectrum allocation need to be established so that any approach used at any particular time ensures a balance among the desired outcomes of increasing broadband access at prices affordable to

consumers; ensuring fair competition; eliminating hoarding; and ensuring efficient utilisation. It should be particularly noted that auctions designed to maximise state revenues risk serious harm to consumers

The Broadband Blueprint

The purpose of the Broadband Blueprint is to lay out a plan using a set of action points that need to be implemented to extend broadband access and use to all Ugandans. The Table below summarises the key activities required to progress Uganda to the desired state of access and connectivity over the next ten years. A cross-reference is made to the main report where the full background and rationale leading to each action item is provided.

Intervention	Action item	Chapter	Horizon
Broadband Policies	Rationalisation of broadband policies and establish a single, clear policy source.	5.4	Short term: 1- 2 years
	Support initiatives to show consistency in policy outcomes, e.g., that broadband policies are not contradicted by tax policies	5.4	Medium term: 3-5 years
	Develop a right-of-way policy	7.1.4	Immediate
	Adopt the Radio Spectrum Management Policy of 2019	7.1.5	Immediate
	Develop a revised open data policy	5.3	Immediate
Legal and regulatory	Review licensing guidelines to encourage more innovation in the sector.	7.1.1	Short term: 1- 2 years
	Begin consultations on a feasible rights-of-way regulations	7.1.4	Short term: 1- 2 years
	Develop facilities sharing regulations	7.1.3	Immediate
	Update the frequency table	8.1	Immediate
	Develop open data regulations, targeting UCC and MNOs.	5.4	Immediate
	Enforce existing fair competition regulations	7.1.2	Immediate
	Enforce consumer protection regulations	7.1.7	Immediate
	Repeal of sector-specific taxation	3.1 & 3.2	Medium term: 3-5 years
	Develop Critical infrastructure Act to facilitate the protection of critical infrastructure	7.1	Short term: 1- 2 years
Institutional arrangements	If development of the digital economy is a goal, line ministries need to receive adequate funding to fulfill their tasks.	6.1	Medium term: 3-5 years
	Clear targets for government departments to minimize inter-governmental conflict and stone-walling (e.g. getting data from UCC)	6.1	Short term: 1- 2 years
	Develop internal skills within ministries and government departments	6.2	10 years
	Consultation with the private sector	6.3	Immediate

Intervention	Action item	Chapter	Horizon
Spectrum	Design alternative spectrum models to encourage innovation (see, for e.g., the New Zealand case study)	8.6	Short term: 1- 2 years
	Support community networks through tools such as license-exempt spectrum, especially in the 17 GHz, 24 Ghz and 60 GHz	8.9	Immediate
	Create a social purpose IMT spectrum license to support community-operated cellular networks in the 800 MHz, 2600 Hz or 3500 MHz bands	8.11	Short term: 1- 2 years
	License LEO technology to provide backhaul for small wireless operators	8.10	Short term: 1- 2 years
	Pilot HAPS technology to see if it is a feasible option to provide IMT services in remote regions	8.6 & 8.10	Short term: 1- 2 years
RAN sites	10 year investment plan to rollout fibre and RAN sites	9.4	10 years
Fibre			

The Uganda Broadband Portal (UBP) provides users with a single window to assess the current status of broadband access and plan interventions to expand broadband coverage. This portal enables the generation of an evolving picture as data is updated periodically, and enables the planning of new fibre routes or RAN locations to ensure broadband access in identified locations. In addition to generating coverage maps, the portal also provides cost calculations.

A total of investment USD 70million over the next ten years is required to ensure that at least 90% of the population has access to either fixed or mobile broadband. There is a two part strategy behind the ten year investment plan to expand broadband coverage and quality.

The first part of the strategy is to invest USD 29 million in fibre first. New technologies such as 5G (and soon 6G) demand significant bandwidth that alternatives cannot supply. This is the estimated amount required to connect all district capitals to fibre. This investment will increase the backhaul capacity for RAN sites and incentivize 4G upgrades. The interventions add an additional 3,242 kilometres of fibre, representing an increase of over 16% to the total amount of fibre available in Uganda. People living within a 10 km radius to a fibre node would be increased from 29% to 56%, and those living within 25km from 67% to 94%.

The second part of the strategy is to subsidize the expansion of the Radio Access Network (RAN) site rollout after the connection of all district capitals to fibre. Many potential locations for new RAN sites are commercially viable. By funding RAN sites only in year 6 of the investment plan, many (and hopefully most) commercially viable RAN sites would already be covered. The estimated subsidy required to increase the 4G population coverage from the current 72% to 92% is about USD 41 million. Uganda's universal access and service fund, administered by the RCDF will be responsible for this intervention. In total 503 new RAN sites would be subsidised, bringing 4G coverage to 9 million more Ugandans.

It is evident that Uganda has all the underpinning requirements for an inclusive fully digitalised economy, provided there is consistent and coordinated political will and leadership to deal with the remaining barriers and gaps highlighted in this Report. None of the gaps or challenges identified is insurmountable.

SUMMARY REPORT

(The full Report can be accessed at……..)

1. Introduction

The main objective of this assignment was to undertake a national broadband baseline study and subsequently develop a 10-year National Broadband Infrastructure Blueprint (2022-2032), which shall guide the planning, development, deployment, and management of broadband infrastructure including, spectrum resources. This study is funded through the World Bank's Regional Communications Infrastructure Program (RCIP).

Under the third National Development Plan (2020/21 – 2024/25)[1] (NDPIII), Uganda has adopted a quasi-market approach in which "government needs to increase efficient and planned participation in the economy in order to direct development". Uganda's Vision 2040 seeks "A Transformed Ugandan Society from a Peasant to a Modern and Prosperous Country", and connectivity is recognized as one of the key enablers, with the specific statement that "*Uganda shall continuously build robust ultra-high speed, pervasive, intelligent and trusted high speed ICT infrastructure all over the country in line with the changing technologies"*. It was observed as part of the development process of NDPIII that while Uganda has for long relied on a purely private sector led approach to development, the expected national outcomes were not being achieved, noting as one of the examples that "*Access to the Internet (specifically broadband) remains low due to limited coverage and the cost of accessing it remains high"*. The National Broadband Infrastructure Blueprint will provide the Ministry of ICT and National Guidance (MoICT&NG), its agencies, and private and public sector players with a consistent and known framework for policy guidance, regulation, planning, deployment, and exploitation within the broadband market. A clear and consistent framework will be a major step in actualizing the aspirations of the Digital Uganda Vision (2021) that include attracting investments and improved global competitiveness.

The study was framed in terms of the broadband value chain, enabling a more granular examination of what is at play at each stage of the value chain and within the ecosystem, how this compares both to other countries and what is desirable, and what actions need to be taken. This approach makes it easier to identify gaps and weak links in the value chain.

The analysis, recommendations, and development of an online GIS-based portal to guide planning, implementation and monitoring the development of broadband infrastructure was informed by:

- Extensive desk studies;
- Data provided by the Uganda Communications Commission (UCC) based on annual reporting from licensed service providers;
- Data provided by some of the licensed service providers;
- Internal documents from MoICT&NG and its agencies (UCC and the National Information Technology Agency-Uganda, NITA-U, including some policies and guidelines in development); and
- Stakeholder interviews (public and private sector).

2. The MoICT&NG GIS Portal

The tool used to develop the blueprint for broadband access and use in Uganda is a GIS portal developed for the Government of Uganda by the consulting team. The Uganda Broadband Portal (UBP) combines the following data sets into an easy-to-use interface that supports intervention planning, subsidy estimation and monitoring and evaluation of these Universal Access and Service (UAS) interventions:

[1] http://www.npa.go.ug/wp-content/uploads/2020/08/NDPIII-Finale_Compressed.pdf

- **Radio propagation model:** Generated using CloudRF, using -94dBm signal at a 12km radius, based on tower locations obtained from the combined 4G coverage map received from UCC.
- **Spatial population data:** The population data is sourced from the Center for International Earth Science Information Network - CIESIN - Columbia University. To create the high-resolution maps, machine learning techniques are used to identify buildings from commercially available satellite images. Then general population estimates are overlaid based on publicly available census data and other population statistics. The resulting maps are the most detailed and actionable tools available for Aid and research Organizations[2]
- **GIS admin boundaries:** Uganda Bureau of Statistics (UBOS)
- **Survey data**: Uganda National Household Survey (UNHS, 2019/2020)

All broadband coverage and fibre statistics used in this report are generated by this portal unless otherwise indicated. Statistics generated include geographic 4G coverage, 4G population coverage, estimate of people not covered by 4G, length of fibre routes and the number of people living within 10km, 25km and 50km of a fibre node. The statistics are available for each sub-county, district, sub-region, region and Uganda as a whole.

3. PESTLE & SWOT Analysis

Strength: Uganda's strength lies in its connectivity to its neighbours and a well-established set of laws, rules, regulations and institutions. While not perfect, it means that the sector governance is in place and can be improved.	**Weakness:** Uganda's weaknesses include high prices for broadband, low broadband penetration, high taxation, low fibre rollout, multiple conflicting policy documents, poor coordination amongst government departments, a rigid licensing regime, lack of a rights-of-way regime, lack of an infrastructure sharing regime, lack of a flexible spectrum regime.
Opportunity: Broadband adoption and the digitalization of the economy is still low in comparison to other African countries. This is an opportunity for the rapid expansion of broadband and thus increased economic growth and job creation. Specific opportunities include: • Uganda could become a regional ICT hub for its landlocked neighbours, providing connectivity and data centre services. • Once the African Continental Free Trade Agreement (ACFTA) is implemented, Uganda could export its digital services to other countries on the continent • By transforming its digital sector, Uganda could take advantage of Information technology-enabled services (ITES) and business process outsourcing (BPO) opportunities around the world.	**Threat:** There is a time sensitive opportunity to be an ICT hub for East Africa. Other countries, such as Kenya and Rwanda, are rapidly improving their ICT infrastructure and investment climate. If these countries become more attractive, they will siphon investment away from Uganda and the gap between Uganda and these countries will grow greater. Other threats include: • Global digital companies (Facebook, Google, Amazon, etc.) extract revenues from Uganda and do not pay taxes, reducing the funds available to support infrastructure rollout • Increased cyber threats stimulated by a broadband environment. Addressing these threats requires a coordinated legal, policy and technical response.

A key problem is that the ICT sector is treated as a cash cow and carries a higher burden of taxes compared to other sectors. The conflict between tax and ICT policies is derived from a fragmented approach

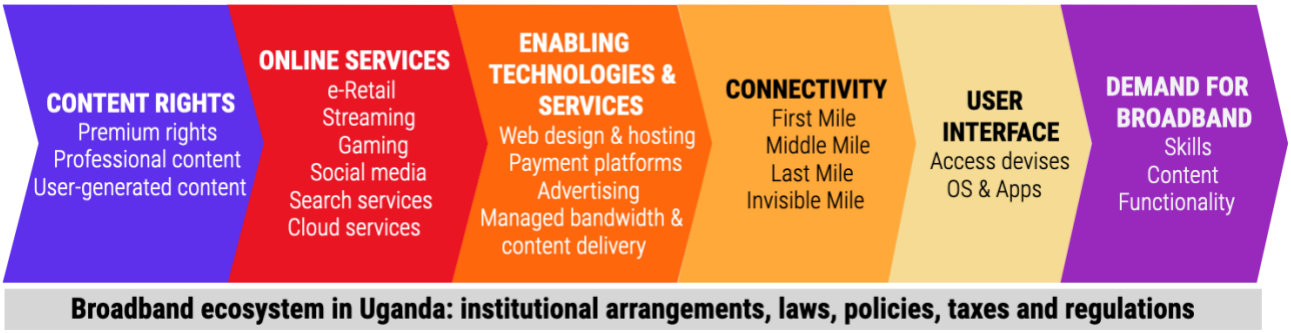
[2] Centre for Humanitarian Data Humanitarian, Data Exchange v1.57.16, 2021. Webpage for Uganda: https://data.humdata.org/group/uga

to the ICT sector. Uganda may miss the opportunity to become the East African Internet hub unless it addresses these challenges. The remedy is to coordinate ICT sector strategies between different government institutions under a single digital transformation vision and ensure a consistent approach to the sector, especially in collaboration with the Ministry of Finance.

4. Benchmarking Uganda's Broadband Value Chain

ATKearney[3] compiled an Internet value chain analysis in 2010 and the study was updated in 2016 for the GSMA.[4] The study distinguishes between five segments of the Internet value chain (GSMA, 2016b). The methodology for this study uses an expanded value chain concept by adding the broadband demand segment (Figure 8):

- **Content rights:** Includes premium rights with content that is produced professionally and that is distributed via the Internet or other channels (e.g., TV) and is paid for by subscription fees or advertising-funded broadcasters. Content rights also include user-generated content which is made available via social media platforms such as YouTube, Twitter, Instagram, Vimeo and Facebook, amongst others.
- **Online services:** Covers a wide range of services provided over the Internet including e-commerce; entertainment (gaming, gambling, video, music, publishing); search and reference services (Wikipedia, Google, Yahoo); social media and cloud services (Dropbox, online bookkeeping services, etc.).
- **Enabling technologies:** Consists of essential services for the smooth running of the Internet such as the design and hosting of websites; payment platforms (credit cards, PayPal, MPESA), platforms enabling machine-to-machine (M2M) based services; advertisement platforms (ad exchanges and brokers); and managed bandwidth and content delivery (wholesale interconnect).
- **Connectivity:** End-users access to the Internet via mobile, fixed-wireless or wired broadband connections or satellite (VSAT). The connectivity segment of the Internet value chain is the most common segment that falls under the jurisdiction of the National Regulatory Authorities (NRA).
- **User interface:** Devices used by the end-user to access the Internet include smart and feature phones; PC, laptops and tablets; as well as digital TVs or digital set-top boxes. Operating software (OS) for these devices also falls into this segment as well as applications that run on top of the OS. NRAs in Africa typically accept type approvals from other larger jurisdictions and access devices such as iPhones get an automatic approval. This segment is mostly regulated based on the principle of forbearance.
- **Demand for Broadband:** The demand for broadband depends on many factors including disposable income, the price of usage, skills, and content. Content in particular is a main driver for broadband adoption and usage, driven by user generated content through social media applications.



[3] https://www.atkearney.com/communications-media-technology/article?/a/Internet-value-chain-economics
[4] https://www.gsma.com/publicpolicy/wp-content/uploads/2016/05/GSMA_The-Internet-Value-Chain_WEB.pdf

Each segment of the Internet value chain is subject to own laws, rules and regulations, implemented by different bodies. The table below summarizes the findings from the benchmarking of the broadband value chain.

	Problem	Recommendations
Broadband ecosystem	Lack of collaboration between sector regulators	Memorandums of Understanding between the telecom, energy and transportation sectors
Content rights	Enforcement mechanisms are weak	Ensure funding for institutions enforcing intellectual property
Online services Enabling technologies and services	• Only 1.7% of Ugandans purchased online in 2017 • High excise duties, such as those on mobile money and Internet data, result in declines in transaction value and volume and disproportionately affect the poor.	• Lower or remove excise duties • Improve affordability of broadband • Facilitate the adoption of electronic payment systems.
Connectivity	Used international bandwidth is low	Reduce obstacles to data usage, such as prices
	Access to fibre: 29% of the population are within 10 km of a fibre node compared to 41% in Kenya	Remove obstacles to fibre roll-out
	High data prices: As a % of GNI per capita per month, Uganda is ranked 27th in Africa for 300MB	Lower the cost of operating a network in Uganda by removing obstacles to spectrum, lowering excise duties and other factors such as rights-of-way.
User interface	High cost of smartphones	Lower import duties, VAT and excise duties on smartphones
Demand for broadband	Only a third of mobile subscribers are active data users	Lower the cost of data and smartphones

5. Broadband Policies & Strategies

The number of policy documents that relate to the broadband value chain in Uganda is overwhelming, and not necessarily always consistent. There is an urgent need to rationalize these so that all stakeholders (including MDAs) can refer to a single clear source that establishes policy (and the related strategy – which needs to be revised from time to time). Where derived documents from the main one are generated, the linkage and the reason for such expansion should be clear. If the Digital Uganda Vision is now the core reference document under Vision 2040, most of the earlier policies, outside the need to evaluate and learn lessons from them, should be retired. Revisions should ensure that the National Strategy on 4IR is parented by the Digital Uganda Vision.

The Table below summarises the challenges and gaps within policy along with action recommendations for addressing them.

Challenge/gap	Action required
The number of policy documents that relate to the broadband value chain in Uganda is overwhelming, and not necessarily always consistent	• Rationalize all policies under MoICT&NG these so that all stakeholders can refer to a single clear source that establishes policy. The Digital Uganda Vision is now the core reference document under Vision 2040, most of the earlier policies, outside the need to evaluate and learn lessons from them, should be retired. Revisions should ensure that the National Strategy on 4IR is parented by the Digital Uganda Vision • Where derived documents from DUV are generated, the linkage and the reason for such expansion should be clear.
Policy gaps relating to key elements that impact on the broadband value chain	Address the following major gaps at the policy level so that appropriate laws can be developed and implemented: • National Policy on Critical Infrastructure (of which critical ICT infrastructure is a sub-set). • Rights-of-way for public utilities (of which ICT infrastructure is now a recognised subset). • It is not immediately apparent what the main cause is, but there are key policies that for a long time have not progressed to full implementation and this needs to be examined. These include the policies addressing the national top-level domain (MoICT&NG), and the national competition policy (MTIC).
Policies to support NDPs are always out of synch with the NDP, starting several years into the NDP, and extending into the next one	NDPs are essentially five-year strategic tools and should not be the basis for policy. Key policies of this nature should link directly to the National Vision 2040, with provision for continuing iterations that still keep focus on the long term (minimum 10 years). Such policies should guide the NDPs, not the other way round.
Misaligned policy objectives across MDAs leading to contradicting outcomes, especially increased access to ICT goods and services vis a vis taxation	MoICT&G and Ministry of Finance and Economic Planning, through the agency of the Prime Minister's Office to address the contradictions.
Gaps (in various policy documents) that impede or likely to impede rollout and exploitation of broadband	Modify the following policies as indicated: • NDPIII: Set a more aggressive cost of access target for. • Digital Uganda Vision: Define broadband either quantitatively or qualitatively. A qualitative definition that enables the ministry to set targets adaptively should be used. If quantitative targets are used, these should be made aspirational in recognition of the rapid evolution of the capability of data network technologies. • National Intellectual Property Policy: The policy recommends a process for applying for patents that is laborious and needs to be amended, especially taking into account the rapid evolution of technology. • Draft National Postcode and Addressing System Policy: The policy should be reviewed to provide addressing of properties, street naming and numbering. There is especially need to take into consideration how to address last mile (e.g., rural areas), geospatial mapping and data management, maintenance of the national addressing database, and compliance and enforcement issues in cases where stakeholders do not adhere to the national policy. • Draft Open Data Policy: The policy needs to be clear on how data can be designated, whether it is open or not – for example, there is a need to introduce an Open Data Criteria Assessment Checklist. The policy also needs to be clear on ownership and responsibilities of the government in respect of open data (i.e., who is accountable for what).

Alignment of policy objectives across government ministries is still a challenge that needs to be addressed. The Programme Working Groups as set up under NDPIII was supposed to address this alongside its other objectives. The most visible example raised by stakeholders relates to the efforts within MoICT&NG and its associated agencies to reduce access costs to ICT goods and services for users; and running counter to this, action from the Ministry of Finance and Economic Planning to raise more revenue by imposing taxes on ICT goods and services. The most recent example is the 12% excise duty on data.

The situation of the National ICT Policy (2014) and the National Broadband Policy (2018) points to the pitfall in linking major policies to the national development plans. NDPs are essentially five-year strategic tools and should not be the basis for policy. Key policies of this nature should link directly to the National Vision 2040, with provision for continuing iterations that still keep focus on the long term (minimum 10 years). Such policies should guide the NDPs, not the other way round.

Other recommendations include:

- NDPIII: A more aggressive cost of access target to consumers is needed – reducing the unit cost of 1Mbps /month of Internet on the retail market from USD 237 to USD 70 by 2025 is not sufficiently aggressive to break the cost barrier to usage of broadband, which will then disable the usage targets under NDPIII, and therefore the Uganda Digital Transformation Programme.
- Digital Uganda Vision: While the document sets targets for broadband coverage and cost as a percentage of income, broadband is not defined either quantitatively or qualitatively. As a minimum, a qualitative definition that enables the ministry to set targets adaptively should be used. Where quantitative targets are used, these should be made aspirational in recognition of the rapid evolution of the capability of data network technologies.
- National Intellectual Property Policy: The policy recommends a process for applying for patents that is laborious and needs to be amended, especially taking into account the rapid evolution of technology.
- Draft National Postcode and Addressing System Policy: The policy should be reviewed to provide addressing of properties, street naming and numbering. There is especially need to take into consideration how to address last mile (e.g., rural areas), geospatial mapping and data management, maintenance of the national addressing database, and compliance and enforcement issues in cases where stakeholders do not adhere to the national policy.
- Draft Open Data Policy: The policy needs to be clear on how data can be designated, whether it is open or not – for example, there is a need to introduce an Open Data Criteria Assessment Checklist. The policy also needs to be clear on ownership and responsibilities of the government in respect of open data (i.e., who is accountable for what).

6. Institutional Arrangements

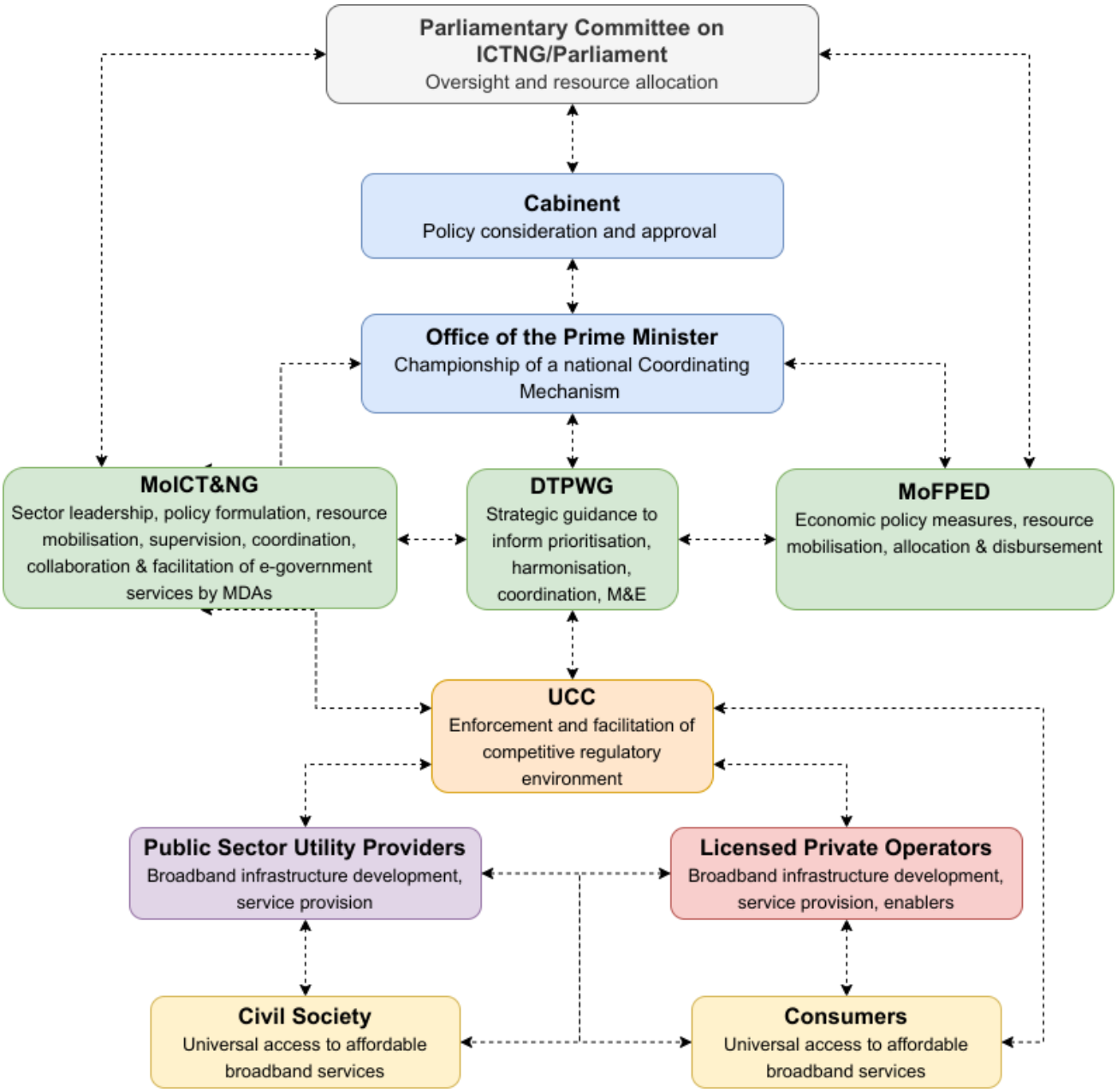
The guiding principles for establishment of good, mutually reinforcing institutional arrangements include the following:[5]

- **Mandate specification:** ensuring clear definition and delineation of the different roles, responsibilities and terms of reference of each player in the ICT industry, paying attention to avoid ambiguity, overlaps, lacunas and misinterpretation.

[5] Adopted from UN's National Institutional Arrangements: Instruments, Principles and Guidelines, UN Committee of Experts on Global Geospatial Information Management, 2017

- **Effective coordination:** enhancing the voluntary or forced alignment of tasks and efforts of relevant stakeholders within a national setting to avoid mission drift, duplication of infrastructure, roles and responsibilities while fostering efficiencies across the sector.
- **Collaboration:** encouraging productive, mutually beneficial linkages among key stakeholders to facilitate improvements in the development, regulation, servicing, management and use of the broadband ecosystem.
- **Agility and Adaptiveness:** the ability to move quickly, address, and take advantage of institutional, technological and other advancements in support of the development and delivery of industry products and services.
- **Participation, Inclusion and Partnership:** empowering, through representation in government and other mechanisms; facilitating free, active and meaningful participation in decision-making processes. Meaningful and free participation of stakeholders, including citizens, in decision-making processes could contribute to the overall adaptability and stability of institutions and promote innovative policy dialogues.
- **Economy (Performance):** improving the overall efficiency of the national Broadband Ecosystem to avoid expensive and unnecessary operations.
- **Transparency and Accountability:** identifying and sharing relevant information to create a clear understanding of the national broadband ecosystem and facilitating trust amongst different stakeholders as well as timely accountability for the resources employed.

The figure below shows the key actors in Uganda's broadband ecosystem.



The overall aim of the recommendations below is to provide Government with a framework for enhancing the functionality of the institutional arrangements to support a rationalized, coordinated and collaborative broadband ecosystem that will help propel the country into a competitive digital economy.

Problem to be addressed	Recommendation
Weak institutional oversight	The Parliamentary Commission, in liaison with MoICT&NG, UCC and Directorate of ICT Support (former NITA-U), should organise orientation and periodic sensitization programmes for all Members of Parliament to sensitise legislators to the imperatives of the digital economy, including emerging opportunities and challenges, to enable the country to grow and develop competitively while providing employment to the millions of its youthful population.

Problem to be addressed	Recommendation
Inadequate financial resource allocation	MoICT&NG, Ministry of Finance, Planning & Economic Development and Parliament need to work closely together to i) increase budget allocation to ICT infrastructure development, and to MDAs mandated to champion the country's transition into a digital economy and ii) reduce the cost of ICT devices, Internet access and usage. Increased usage(volume) should be the anchor for expanding the tax base in the ICT industry.
Mission drift	MoICT&NG should remain focused on policy formulation, providing innovative policy guidance for project coordination and oversight to the Regulator as well as mobilizing resources to grow the digital economy. The Ministry would also provide the lead in the periodic assessment of the IT value chain, and its contribution to Uganda's socioeconomic transformation. To this end, the departmental structure of the Ministry may need review to eliminate mission drift and 'tuff wars' between departments.
Rationalization of NITA-U's role	The restructured Directorate of ICT Support in MoICT&NG would concentrate on ensuring availability of quality ICT resources and services across Ministries and District Local Governments (DLGs) through planning, development, resource standardization and acquisition, capacity building, control and maintenance processes that are customer-oriented.
	In moving NITA-U back as a Directorate in MoICT&NG, measures should be taken to retain and energise the professional competences required to capacitate and service MDAs' transition to a fully-integrated e-government system that is citizen-centric. Government will need to offer 'personal-to-holder' terms and conditions of employment designed to attract and retain specialized IT personnel.
	The Directorate would also collaborate with the private sector to train businesses and business owners on how to adopt digital transformation (a welcome development reported recently in the Press was the call by Kampala City Traders Association (KACITA) upon the government to provide the business community with the necessary support that will enable them to embrace e-commerce and, in particular, the e-government procurement that has been introduced by the Public Procurement and Disposal of Public Assets Authority. More specifically, KACITA asked the Government to make the infrastructure to support e-procurement available for the local business community to effectively embrace it).
Weak internal capacity of MDAs to support e-Government services	The internal e-Service capacity of Ministries and District Local Governments (DLGs) should be strengthened preferably by establishment of a senior position of Chief ICT Officer in each Ministry and at DLG level to work closely with the Directorate of ICT Support in MoICT&NG. This collaboration is imperative in the light of the recent adoption of the Parish-centric Socio-economic Development Model.
Poor coordination and collaboration in BB infrastructure development and service provision	Government, through joint collaboration between MoWT and MoICT&NG, should lead the roll-out of broadband infrastructure across the country with a view to reducing cost, improving competition among service providers, and expanding access to broadband services across the country.
	UCC should expedite approval and operationalisation of the draft Guidelines on Infrastructure Deployment and Sharing so as to rationalize, harmonise and introduce efficiencies in the BB Value Chain.
	OPM, in liaison with NPA, needs to put in place a functional National Coordination Mechanism (NCM) and capacitate it, to support execution of OPM's crucial constitutional mandate of coordinating all government policies and programmes both at national and local government levels. The NCM must have competent leadership, experience and the authority to act.

Problem to be addressed	Recommendation
	The Digital Transformation Programme Working Group (DTPWG) should play an important role in promoting harmonisation, coordination and collaboration in digital infrastructure development to ensure efficiencies and affordable Internet access. OPM should establish clear rules of engagement to ensure that all MDAs participate in WG meetings at the right level of responsibility and authority to realise the objectives of the WGs. The Agenda for the DTPWG must reinforce strategic leadership of the ICT sector and go beyond merely listening to project reports.
	MoICT&NG, in liaison with UCC, should establish and manage a Joint Infrastructure Coordination Mechanism (JICM) to promote harmonisation, coordination and collaboration in ICT infrastructure planning and development by all sector players.
	MoICT&NG, in liaison with MoWT, should expedite the establishment of the planned Spatial Data Infrastructure for the ICT Sector (SDI4ICT), to provide a reliable and transparent information platform for long-term planning and development in the digital economy.
	MoICT&NG, in collaboration with UCC needs to strengthen its information, education and communication (IEC) capability to be able to publicise and link stakeholders in Uganda's digital economy, with special attention being given to energizing the country's predominantly young population through appropriate interventions including vigorous promotion of Business Process Outsourcing (BPO) e-Services.
	MoICT&NG and UCC might wish to institute a more regular Stakeholders' Consultative Forum (SCF) that brings together BB developers/investors, Internet operators and users to share on operational matters that impact the effectiveness, efficiency and sustainability of the ICT sector in Uganda.

7. Laws, Regulations and other Regulatory Instruments

There are many laws and regulations that impact on the rollout of broadband infrastructure in Uganda. There are a number of recommendations made to the legal and regulatory frameworks currently in place in Uganda, that will either remove some roadblocks to or facilitate a more robust broadband ecosystem. The most urgent include the following that can be affected by the UCC.

- Create a more flexible licensing regime that allows for more innovation and competition, especially in the services markets and in areas that are underserved;
- Create an efficient and fair regulatory regime for obtaining rights of way in collaboration with all interested parties;
- Effectively enforce a robust facilities sharing regulatory regime; and
- Make changes to the spectrum plan and licensing regimes, as discussed in section 8 below.

In addition, the intellectual property rights laws need to be reviewed keeping in mind the changes brought about the broadband value chain, and matters such as artificial intelligence, the importance of data, among others. Similarly, the legal and regulatory regimes that impact on the delicate balance of protecting rights of free speech, amongst others and the surveillance mechanisms available, should be reviews. Finally, the following laws should be promulgated as a matter of urgency: competition; consumer protection; and critical infrastructure.

Problem to be addressed	Recommendation
Inflexible licensing regime	It is recommended that the UCC review its licensing guidelines to encourage innovation and allow more flexibility in the licensing of services and in the imposition of fees. An example in this regard may be a request by the Research and Education Network for Uganda for a special licence for its broadband network in support of education in Uganda. Another example might include a more flexible regulatory regime in respect of community networks. The regulatory framework should also include a listing of categories of licence exempt activities along with standards. Employing this regulatory flexibility will facilitate innovation in the industry and allow the UCC to respond to such innovations in real time. This, in turn, will help drive the supply and demand side of broadband ecosystem.
Shut down of services by UCC	As stated in a Report to the World Bank Group, "[t]he partial or total shutdown of selected services and quite often the Internet severely disrupts operations and, where it occurs periodically, is a disincentive for investment: it leads to loss in revenue that cannot necessarily be recovered without taking governments to court." Therefore, It is recommended that licence conditions be amended to make such shut downs unavailable alternatively very difficult to impose.
Unfair competition	It seems that that fair competition regulations have not resulted in an alteration of the concentration of two dominant players in the telecommunications market in Uganda. This failure has resulted in players exiting the market as well as perpetuation of an anti-competitive environment that does not allow smaller competitors to thrive. The first recommendation is that the UCC aggressively enforce the fair competition regulations. The second recommendation is to consider the fast tracking of competition law policy and the enactment of a comprehensive Competition Law. This will be followed by the creation of an effective and efficient competition law enforcing organisation as a matter of urgency.
Regulatory framework for interconnection and facilities sharing	There is a lack of an effective and efficient regulatory framework for interconnection and especially, facilities sharing. It is also clear that there is little effective enforcement of the regulations and guidelines in place. Therefore, It is recommended that the finalisation and implementation of the Guidelines on infrastructure sharing be made a priority. The following should be included. • Clear and strict regulation of the pricing of infrastructure sharing, interconnection and roaming to ensure the facilitation of more competition; • Effective dig-once rule, forcing network licensees to cooperate; • Establishment of a database of infrastructure ensuring efficient and transparent processes. It is also recommended that regulations and/or guidelines for the sharing of infrastructure with other sectors be promulgated. The infrastructure includes towers, ducts, poles, and buildings owned by persons in other sectors, such as broadcasting, roads, and other public works. The regulations and/or guidelines should be made in consultation with the Ministries of Lands, Housing and Urban Development, Works and Transport, Water and Environment, Local Government, Finance, Planning and Economic Development, and Government agencies such as the Civil Aviation Authority, Electricity Regulatory Authority, Uganda National Roads Authority, National Planning Authority, and local governments, amongst others. The passage of a critical infrastructure law along with a critical information infrastructure law, discussed more fully below, should also be considered.

Problem to be addressed	Recommendation
Regulatory framework for rights of way	There is a lack of a coordinated regulatory framework for rights of way. Licensees, of course, want a guaranteed (and cheap or free) right of way. On the other hand, there are valid competing concerns from local governments, other government agencies, land and building owners and communities. Therefore, it is recommended that in carrying out these recommendations that all parties be consulted. These include Ministries of Lands, Housing and Urban Development, Works and Transport, Water and Environment, Local Government, Finance, Planning and Economic Development, and government agencies such as the Civil Aviation Authority, Electricity Regulatory Authority, Uganda National Roads Authority, National Planning Authority, local governments, land owners, local communities, and any other interested party. The first recommendation is that The Uganda Communications Act should be amended to include a variation of the provisions that were set out in Part VIII of the 1997 Uganda Communications Act. The Act should also provide for prompt payment of fair and adequate compensation and a right of access to a court of law by any person who has an interest or right over the property. This is required by the Constitution. The second is that The Land Act should be amended to include telecommunications network facilities are included in the definition of public works. The third recommendation is that the Minister, in consulting with the UCC, make regulations and/or guidelines setting out a comprehensive regulatory framework for the negotiation of rights of way. The regulations should make the process streamlined, quick and easy. They should also include protections and obligations for operators on the one hand and other affected parties, such as local governments, land owners and communities, on the other hand. The regulations or guidelines should provide for the following: • Require all public works, including networks operators and other public works providers, to share rights of way, subject to the regulations and guidelines: • Clear and strict regulation of the pricing of new rights of way and use of existing rights of way • Ban the granting of exclusive rights of way by private or public land owners • Effective dig once rule, forcing network licensees and other public works providers to cooperate • Establishment of a database of all public works infrastructure and existing rights of way ensuring efficient and transparent processes • Establish simple, easy and consistent procedures that will be used by local authorities in respect of building permits • Rules for the acquisition of rights of way where land is private, including rules for reasonable compensation • Rules for the acquisition of rights of way where land is public, including rules for reasonable compensation • Rules for acquiring use rights to public rights of way, such as public roads, railways and other public works.
Spectrum planning and licensing	One of the most important regulatory issues for the rollout of mobile broadband in 2021 is the efficient and effective management and use of spectrum. It is recommended that the Proposed Radio Spectrum Management Policy public for comment in 2019 be adopted and implemented (as Guidelines). Specific recommendations regarding spectrum policy and regulation are set out in Chapter 8 below.
Universal service and access	It is recommended that the Uganda Communications Universal Service Access Fund Strategic Plan be developed urgently. The Plan should include projects and programmes that will impact the most positively on the broadband ecosystem. This might include supply side measures such as providing broadband infrastructure in key access points such as schools and hospitals. It may also include programmes and projects on the demand side, such as providing support for local innovations to ensure local and relevant content and service and training and education required to support the use of broadband services.

Problem to be addressed	Recommendation
Protection of consumers	There has been little enforcement of the UCC's consumer protection regulations. It is recommended that the regulations that are in place be implemented efficiently and effectively. It is also recommended that the Government consider enacting a general consumer protection law.
Number portability	The issue of number portability should be addressed by the UCC to enhance competition in the industry.
Update to the electronic transactions and signatures legislation	It may be time to review the Electronic Transactions Act and the Electronic Signatures Act in line with international best practices. Benchmarking instruments might include the UNCITRAL Model Law on Electronic Transferable Records (2017), the East Africa Community Electronic Transactions Act, and the COMESA Model Law on Electronic Transactions.
Update to cybercrime to legislation	While most of the provisions of the Computer Misuse Act are sufficient, it may be timely to review the provisions taking recent international best practices into consideration. The Budapest Convention on Cybercrime and related Additional Protocol to the Convention on Cybercrime could inform such a review.
Review of laws impacting content production and protection	It may be time for Uganda to conduct a holistic review of legislation regulating content to ensure greater protection of fundamental rights.
Review of laws impacting interception and monitoring	It may be time for Uganda to conduct a holistic review of legislation allowing monitoring and interception to ensure greater protection of fundamental rights.
Protection of critical infrastructure	The Ministry has made the regulations creating a computer emergency response team, The Uganda Communications (Computer Emergency Response Team) Regulations, 2019. However, there is no comprehensive law in Uganda that will facilitate the protection of critical infrastructure and critical information infrastructure. It is recommended therefore that such as law be developed in line with best practices.

8. Spectrum Management

Spectrum is not a scarce resource such as minerals or metals and there is no economic benefit from not using it. Problems only arise if several parties try to use the same spectrum at the same time and location.

The overall aim of the recommendations below is to ensure the Uganda's spectrum is used both provide affordable access for its citizens and enable a competitive marketplace in the telecommunications sector.

Problem	Recommendation
Improving the Frequency Allocation Table	Provide an online version of the Frequency Allocation Table that is constantly kept up to date. Add a typical application section that lists technologies and frequency ranges as well as a notes section that lists paired frequencies and any other important notes. Provide links to published documents related to spectrum band where appropriate. See Section 8.2 for comments on Frequency Allocation Table and Section 14.5 for detailed comments on Frequency Allocation Table

Problem	Recommendation
Allocating a healthy spectrum mix	Over the near term, new mid-band spectrum in the 3.3 GHz to 4.2 GHz will be valuable for 4G and 5G networks that balance the need for coverage and capacity and sub 1GHz spectrum in new bands, such as 700 MHz, will provide excellent value for uncovered rural areas. TVWS in the 470 to 694 MHz UHF band will also support the needs for coverage in low density rural areas for alternative access models such as wireless ISPs and community networks. Providing additional spectrum for WiFi in the 6 GHz band will provide valuable capacity for already congested WiFi networks and allow offloading from congested mobile networks to WiFi networks. Over the long term, new 5G spectrum in the bands above 7 GHz such as the 28 GHz band will provide the high capacity required in high density urban areas. The 60 GHz license-exempt bands can also serve as fibre replacement to create high-capacity links in areas with high population density.
Guiding principles for licensing spectrum	Based on lessons learned from auctions in African countries and around the world and Uganda's "Framework for spectrum assignment to telecommunications services in Uganda". The following guiding principles are made: • First check the industry purpose / use of the spectrum and the requirement for exclusive or shared access. Check the amount of spectrum required vs demand and the market structure envisaged; • In the case where demand for the spectrum is high and there is clear need for exclusive access to the spectrum then follow the spectrum auction principles outlined below, otherwise explore other models such as shared spectrum, license-exempt spectrum, or a beauty contest. a. The top priority for spectrum auctions should be to support affordable, high-quality mobile services; b. Auctions designed to maximise state revenues risk serious harm to consumers; c. Spectrum caps and set-asides can distort the level playing field or could ensure more competition in the market – they need to be designed well; d. Licence obligations and conditions should be carefully designed to incentivize expansion in poorly serviced areas while at the same time minimizing the cost of covering poorly-serviced areas; e. Poorly chosen lot sizes or inflexible packages of spectrum lots risk inefficient outcomes;
Adding additional alternative access options in Uganda to improve choices for consumer's	Release additional license-exempt spectrum in the 6 GHz, 17 GHz, 24 GHz and 60 GHz bands will provide opportunities to build high-capacity fixed wireless links in poorly connected regions for traditional operators and community network operators. This should be coupled subsidies from Universal Service Funds for infrastructure such as backhaul and towers and affordable license fees for community network operators (use Kenya's community network licensing model as a reference) or license waivers.
	Create a social purpose IMT spectrum license to support community-operated cellular networks, for example, allocate only 5 MHz in any of the 800 MHz, 2600 Hz or 3500 MHz bands could allow a community-based operator to deploy low-cost small cell technologies in poorly connected rural villages.
	License LEO technology to provide backhaul for small wireless operators and community networks in poorly serviced regions.
	Explore HAPS technology to provide IMT services in remote regions.

9. Broadband Blueprint

The Broadband Blueprint is a set of action points that need to be implemented to extend broadband access and use to all Ugandans. It briefly outlines the methodology, the tools for the project and the recommendations of the study.

The purpose of the Broadband Blueprint is to lay out a plan to extend broadband connectivity to all Ugandans. The first step is to identify the scope of the problem. There are three parts to this step:

I. Collecting data in order to analyze the current status of broadband access;
II. To methodically investigate what obstacles exist - in this instance, the PESTLE model was used; and
III. To benchmark the current status against peer and best practice countries.

Intervention	Action item	Horizon
RAN sites	10 year investment plan to rollout fibre and RAN sites	10 years
Fibre		
Spectrum	Design alternative spectrum models to encourage innovation (see, for e.g., the New Zealand case study)	Short term: 1- 2 years
	Support community networks through tools such as license-exempt spectrum, especially in the 17 GHz, 24 Ghz and 60 GHz	Immediate
	Create a social purpose IMT spectrum license to support community-operated cellular networks in the 800 MHz, 2600 Hz or 3500 MHz bands	Short term: 1- 2 years
	License LEO technology to provide backhaul for small wireless operators	Short term: 1- 2 years
	Pilot HAPS technology to see if it is a feasible option to provide IMT services in remote regions	Short term: 1- 2 years

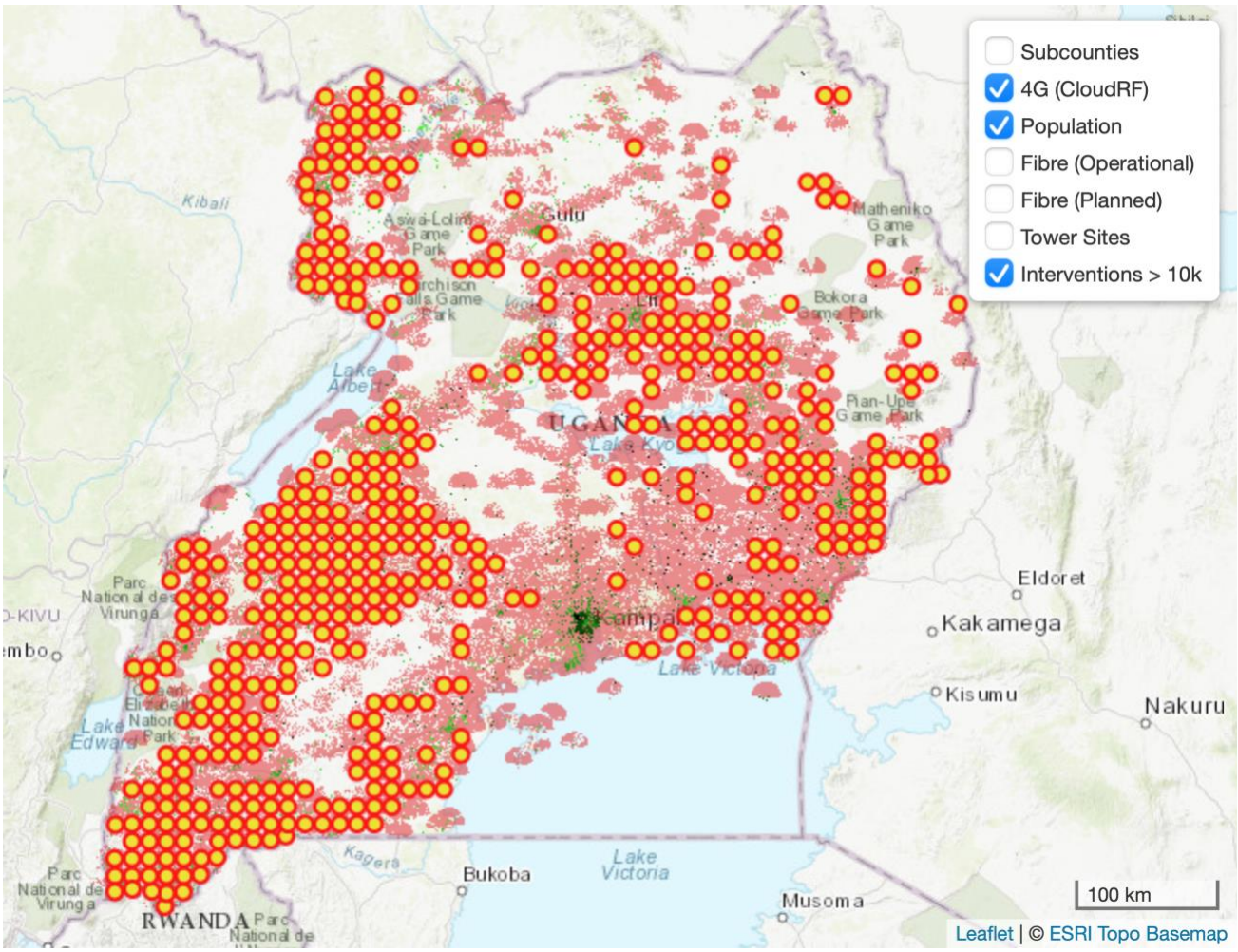
The two components where the Government of Uganda can have the most impact are connectivity and the broadband ecosystem.

Intervention	Action item	Horizon
Broadband Policies	Rationalisation of broadband policies and establish a single, clear policy source.	Short term: 1- 2 years
	Support initiatives to show consistency in policy outcomes, e.g., that broadband policies are not contradicted by tax policies	Medium term: 3-5 years
	Develop a right-of-way policy	Immediate
	Adopt the Radio Spectrum Management Policy of 2019	Immediate
	Develop a revised open data policy	Immediate
Legal and regulatory	Review licensing guidelines to encourage more innovation in the sector.	Short term: 1- 2 years
	Begin consultations on a feasible rights-of-way regulations	Short term: 1- 2 years
	Develop facilities sharing regulations	Immediate

Intervention	Action item	Horizon
	Update the frequency table	Immediate
	Develop open data regulations, targeting UCC and MNOs.	Immediate
	Enforce existing fair competition regulations	Immediate
	Enforce consumer protection regulations	Immediate
	Repeal of sector-specific taxation	Medium term: 3-5 years
	Develop Critical infrastructure Act to facilitate the protection of critical infrastructure	Short term: 1- 2 years
Institutional arrangements	If development of the digital economy is a goal, line ministries need to receive adequate funding to fulfill their tasks.	Medium term: 3-5 years
	Clear targets for government departments to minimize inter-governmental conflict and stone-walling (e.g. getting data from UCC)	Short term: 1- 2 years
	Develop internal skills within ministries and government departments	10 years
	Consultation with the private sector	Immediate

Expanding Mobile Broadband Coverage

A grid approach was used to identify positions for new RAN sites systematically. The best location of an RAN site can be discussed with MNOs and MNOs can propose those during tender processes. The yellow circles outlined in red show the locations of each proposed RAN site.

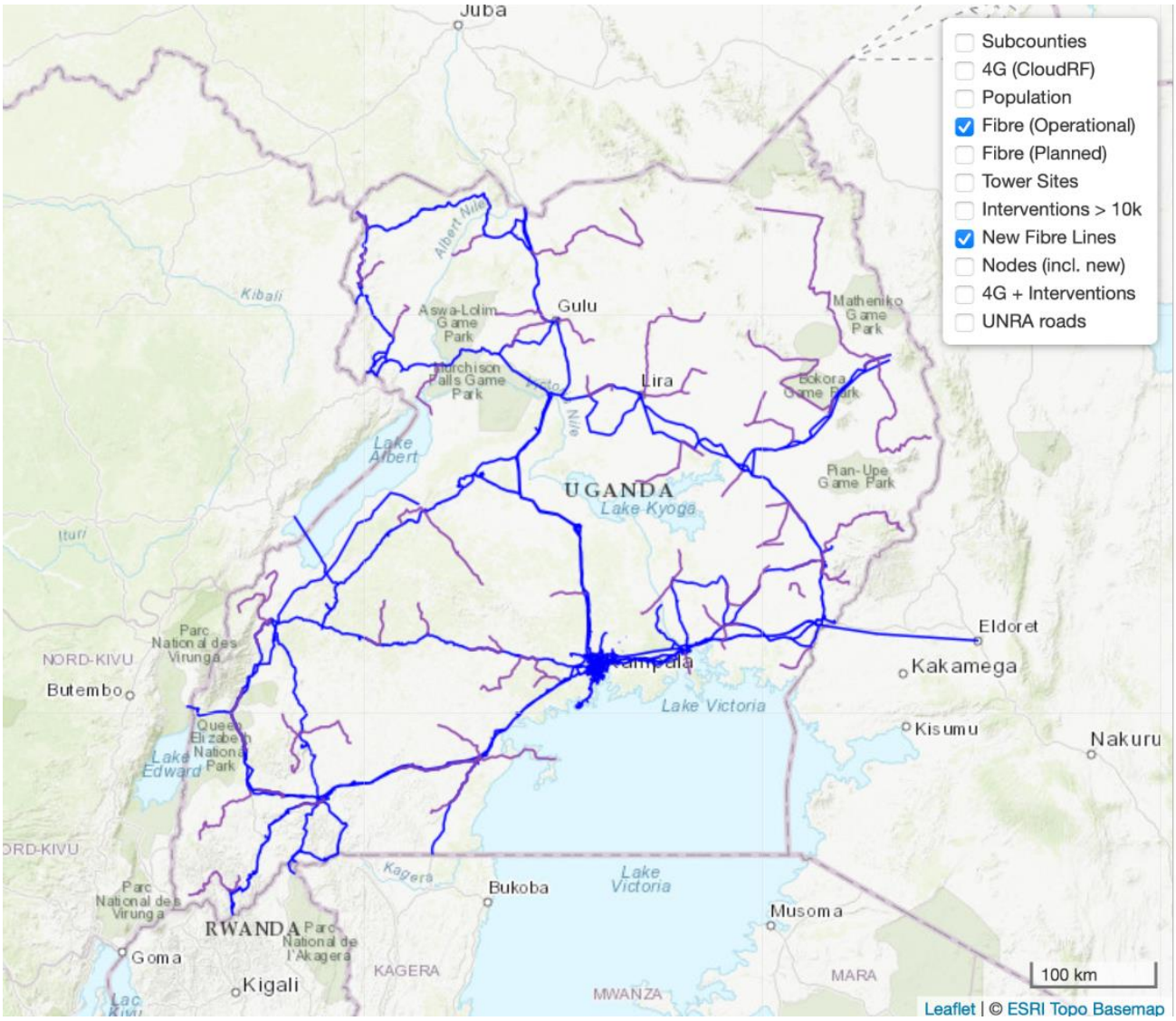

Subcounties
4G (CloudRF)
Population
Fibre (Operational)
Fibre (Planned)
Tower Sites
Interventions > 10k
Gulu
Matheniko Game Park
Bokora Game Park
Pian-Upe Game Park
Lake Albert
UGANDA
Lake Kyoga
Kampala
Lake Victoria
Eldoret
Kakamega
Kisumu
Nakuru
Parc National de Virunga
Lake Edward
Kagera
Bukoba
Musoma
RWANDA
100 km
Leaflet | © ESRI Topo Basemap

Cost estimates for a new RAN site are based on the tower rental business model. The assumption is that the active equipment costs USD 50,000 with an economic life of five years. The estimates further assumes a tower rent, including electricity, of USD 2,500 per month and operating expenditure (OPEX) of USD 500 per month.

		Current		Intervention		
		4G Population coverage	People not covered by 4G	New RAN Sites	People covered by Intervention	4G population coverage
Uganda		**72%**	**12,861,440**	**503**	**8,996,013**	**92%**
Regions	Central	84%	2,046,079	73	1,085,940	92%
	Eastern	80%	2,346,703	95	1,728,472	95%
	Northern	58%	3,931,702	138	2,390,849	84%
	Western	61%	4,536,957	197	3,790,752	94%
Sub-Regions	Buganda North	76%	1,175,882	41	4,431,095	92%
	Buganda South	86%	870,143	32	5,805,345	96%
	Acholi	61%	774,064	16	1,528,023	77%
	Ankole	61%	1,412,949	63	3,557,107	97%
	Bukedi	87%	334,243	14	2,479,221	99%
	Bunyoro	60%	1,156,321	48	2,766,737	96%
	Busoga	85%	702,903	24	4,528,563	97%
	Elgon	81%	446,511	18	2,325,312	100%
	Kampala	100%	53		1,849,606	100%
	Karamoja	40%	762,891	19	1,063,061	83%
	Kigezi	59%	677,592	29	1,641,845	99%
	Lango	59%	1,111,976	50	2,622,200	97%
	Teso	65%	863,045	39	2,356,938	97%
	Tooro	63%	1,290,095	57	3,432,256	99%
	West Nile	63%	1,282,770	53	3,339,123	96%

Expanding Fibre Routes to connect all district capitals

A NITA-U target is to connect all district capitals to fibre. The figure below shows operational fibre in blue and the proposed new fibre lines in purple. Extending fibre access is necessary because high bandwidth applications, especially video, require fibre backhaul to operate effectively.



The interventions add an additional 3,104 kilometres of fibre, representing an increase of over 16% to the total amount of fibre available in Uganda. The Table below compares the current situation in terms of access to fibre to the situation after the interventions. In the Western region, for example, the population within 10 kilometres of a fibre node goes from 19% to 45%. All Ugandans would be within 50km of a fibre node.

		Current				After intervention			
		Fibre km	Population within distance to a fibre node			New Fibre km	Population within distance to a fibre node		
			10km	25km	50km		10km	25km	50km
Uganda		**19,707**	**29%**	**67%**	**93%**	**3,242**	**56%**	**94%**	**100%**
Regions	Central	7,527	47%	74%	94%	511	63%	96%	100%
	Eastern	2,979	23%	67%	97%	769	65%	97%	100%
	Northern	3,984	24%	59%	81%	1,367	51%	93%	100%
	Western	5,217	19%	64%	98%	596	45%	90%	100%
Sub-Regions	Buganda North	2,155	25%	70%	97%	238	42%	93%	100%
	Buganda South	2,942	48%	70%	91%	273	69%	97%	100%
	Acholi	1,215	19%	34%	58%	350	47%	84%	100%
	Ankole	1,998	23%	80%	99%	263	48%	95%	100%
	Bukedi	573	28%	67%	100%	92	77%	100%	100%
	Bunyoro	1,560	21%	62%	100%	77	32%	84%	100%
	Busoga	1,284	25%	71%	98%	160	50%	95%	100%
	Elgon	238	19%	60%	89%	293	90%	100%	100%
	Kampala	2,430	100%	100%	100%		100%	100%	100%
	Karamoja	148	15%	22%	37%	624	67%	94%	100%
	Kigezi	334	10%	38%	92%	121	60%	98%	100%
	Lango	811	22%	66%	96%	261	50%	98%	100%
	Teso	884	17%	67%	98%	224	56%	97%	100%
	Tooro	1,326	18%	62%	100%	135	44%	87%	100%
	West Nile	1,810	32%	81%	100%	133	50%	94%	100%

Ten Year Investment Plan

There is a two-part strategy behind the ten year investment plan to expand broadband coverage and quality. The first part of the strategy is to invest in fibre first.

	RAN Sites	National Fibre	Total USD
Year 1		5,277,123	5,277,123
Year 2		5,277,123	5,277,123
Year 3		5,277,123	5,277,123
Year 4		5,277,123	5,277,123
Year 5		5,277,123	5,277,123
Year 6	8,103,943		8,103,943
Year 7	8,103,943		8,103,943
Year 8	8,103,943		8,103,943
Year 9	8,103,943		8,103,943
Year 10	8,103,943		8,103,943
Total USD	**40,519,714**	**26,385,615**	**66,905,329**

Economic Impact of the 10-Year investment plan

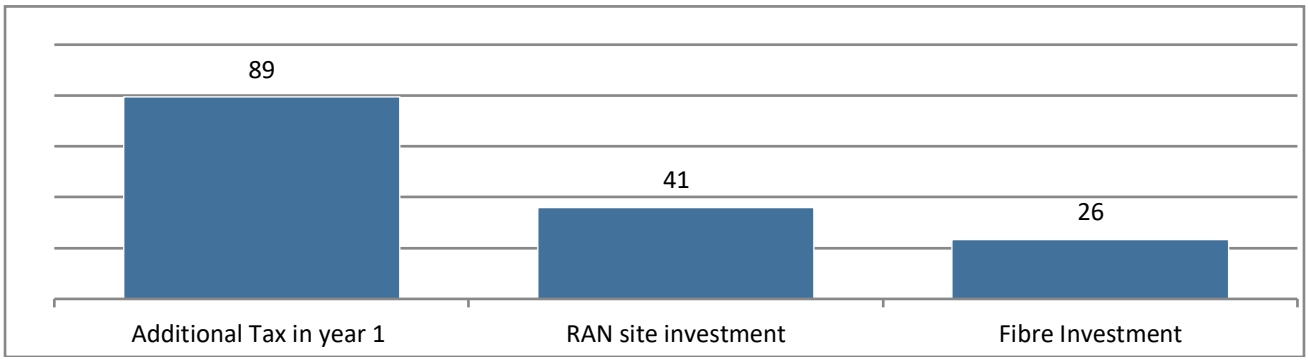
The impact of the fibre investment is difficult to assess since there are no affect sizes for GDP growth and job creation available for better quality of services available. However, for broadband penetration the economic growth can be projected.

	4G Population coverage	Mobile broadband SIM per 100 inhabitants
Current	72%	32.4%
Through Intervention	92%	41.5%
Difference	20%	9.0%
Increase	28%	28%
Sources	GIS	ITU Dec 2020

Increasing 4G population coverage from 72% to 92% is a percentage increase of 28%. Applying this increase to the current mobile broadband penetration of 32.4%, leads to a 9% higher penetration, of 41.5%.

	GDP 2019 USD million	Additional GDP USD million	Tax to GDP Ratio %	Additional Tax USD million
Mobile Coverage intervention	34,387	761	11.7%	89.4
Sources	WDI 2020	calculation based on ITU 2020	Most recent available WDI 2021	Calculation

The additional tax revenues from a single year pays for both RAN site and fibre intervention. Applying the effect size of the ITU (2020) study for a 9% higher broadband penetration to the 2019 GDP and Tax-to-GDP ratio, yields an additional GDP of USD 761 million and additional tax revenue of USD 89.4 million. This is considerably higher than the USD 70 million needed for the investment.



10. Conclusion

Based on the analysis and recommendations provided in the different chapters in this Report, it is evident that transitioning from the current state of broadband access in Uganda to what is desirable to achieve the DUV aspirations will require coordinated and collaborative action across government. This includes the policy environment where focus and consistency is needed especially in reducing cost of rollout and access; the institutional arrangements to ensure clear roles in a collaborative rather than combative setting; the legal and regulatory environment to ensure a regionally competitive investment climate, ease of infrastructure rollout, collaboration, fair competition as well as consumer protection; and approaches to spectrum management that create opportunities for large, small, and community players to enable access. With direct international connections to five countries, Uganda is positioned to become an Internet hub for its landlocked neighbours, providing connectivity and data centre services. This opportunity is however time sensitive as Kenya and Rwanda, are rapidly improving their ICT infrastructure and investment climate.

It is evident that Uganda has all the underpinning requirements for an inclusive fully digitalised economy, provided there is consistent and coordinated political will and leadership to deal with the remaining barriers and gaps highlighted in this Report. None of the gaps or challenges identified is insurmountable.