Ministry of Information, Communications and Technology

NATIONAL ICT INFRASTRUCTURE MASTER PLAN
2019 - 2029

August 2019

Transforming Lives Through Smart ICT Infrastructure
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FOREWORD

Vision 2030 aims to transform Kenya into an industrialized middle-income country with a high quality of life for its citizens. It is being implemented in five (5) year medium term plans and we are currently on the third Medium Term Plan (MTP III). This plan has put emphasis on the improvement of the ongoing ICT infrastructural development in order to support the government development agenda including the “Big Four” Agenda.

This policy document has identified ICT as being a key foundation and enabler in driving the development agenda of the Kenyan nation and plays a big role in the attainment of the economic development, social well-being and job creation. In particular, it will support the ongoing Ajira Digital Programme and the Digital Literacy Programme (DLP) that will play a major part in raising the level of digital transformation in our country.

Uses of ICTs have been proved to be a major contributor in lowering of transaction costs through improved efficiencies. As the fourth industrial revolution (4IR) takes place, it will largely depend on the quality of ICT infrastructure among other factors. Several ICT infrastructure initiatives are ongoing and this master plan is aimed at accelerating the deployment of the same to the underserved and unserved population in our society.

Under this plan and in line with vision 2030 and MTPIII, ICT infrastructure development will be guided by priorities and will be expanded to broaden the broadband coverage to all government and public institutions within our borders. At the heart of this expansion of broadband connectivity will be the integration of all the various ICT network deployments to one government network that will seamlessly be available for the provision of government services. New deployments will be undertaken and existing ones will be expanded, upgraded or redesigned.

This ICT infrastructure master plan is aligned to the other government infrastructural development documents and provides a framework for the ICT Authority to undertake the deployment of the same. This will however require the review of the existing policies, legal, regulatory and institutional frameworks. In the next ten years, the implementation of this plan is envisaged to bring a complete change in the economic and social landscape as it will accelerate economic growth and spur job creation. It will transform the delivery of services in areas such as health and security as well as supporting the fight against corruption through digitization and automation of government services to reduce the human interaction.
I therefore call upon all the stakeholders to work together as a team and support one another to ensure success in the implementation of this plan. Each one of us should play their rightful role for the betterment of the future of our country as it is our shared responsibility to do so. I pledge to offer my full support and the Government in implementing this plan and together we will work very closely with the county governments, the private sector and the development partners to create synergies to deliver on the set targets.

Joe Mucheru, EGH
Cabinet Secretary
Ministry of Information, Communications and Technology & Youth Affairs
PREFACE

Over the last five years, the Government of Kenya through the Ministry of ICT and the ICT Authority has made great strides in rolling out ICT infrastructure across many parts of the country. Today, there is broadband infrastructure presence in all the 47 county headquarters that is currently being used to access government services. This has been made possible by the contribution of stakeholders including the government, the private sector and the development partners. A lot of investment has already been put into the deployment of the existing ICT infrastructure and this plan is aimed at ensuring that the utilization of this investment is optimized and the coverage broadened to reach the underserved and unserved communities.

In this regard, this ICT infrastructure master plan will be the blueprint in the rollout of ICT infrastructure by the ICT Authority and will be referenced for new deployments, upgrades or expansion of existing deployments. This Plan has been aligned to the government policy document including the Vision 2030, Third Medium Term Plan (MTP III), and the “Big Four” initiatives, the National ICT Masterplan, Cyber Security Strategy, Constitution of Kenya 2010, Smart Africa 2063 Agenda, Digital GOK Transformation and the Ministry of ICT Strategic Plan among others.

The current ICT infrastructure comprises of the undersea cables, fibre optic cable backbone, Local Area Networks, wireless networks and data centers. The East African Marine System (TEAMS) undersea cable connects the country to the rest of the world with backup being provided by other similar cables including SEACOM, EASY and LION2 among others. The National Optic Fiber Backbone (NOFBI) cable currently at around 9,000km spans across the country to cover all the 47 counties with metro LANs at the county headquarters.

In order to implement and manage this infrastructure, the ICT authority has created county offices and deployed staff. The Authority has also partnered with the private sector players for maintenance and to provide redundant links for high availability of the infrastructure. However, there are some challenges that we have encountered in the course of deployment of this infrastructure and I hope that this Master Plan will go a long way in alleviating them as we endeavor to offer better services to the citizens. Some of these challenges range include the uncoordinated approach in deployment, missed priorities, fiber cuts during road construction, vandalism and fiber degradation among others.

This plan also takes cognizance of the new technologies and emerging issues and has addressed them within the strategies in order to leverage on the new capabilities in
technology and exploit the opportunities inherent in the emerging issues. The ultimate goal is to facilitate the provision of broadband to all corners of the country, to provide cross border connectivity to the neighboring countries and to provide secure storage for data for national and county governments.

I wish to thank all those who participated and provided their input and necessary support in the preparation of this plan. It is my hope that once implemented, this plan will go a long way in transforming the lives of the people in Kenya and beyond and I urge all of us to support this endeavor to the best of our abilities. I personally will offer my full support and I hope every one of you will do likewise.

**Jerome Ochieng**  
Principal Secretary  
State Department of ICT  
*Ministry of Information, Communications & Technology*
MESSAGE BY THE ICT AUTHORITY CHAIRMAN

This ICT Infrastructure Master Plan is aligned to the constitution of Kenya, Vision 2030, MTP III, the “Big Four” Agenda and Africa Agenda 2063 and other policies and policy documents. This strategy focuses on creating an ICT environment that will support the digital economy development, creation of employment and uplifting the well being of citizens. This will be achieved through a well planned ICT infrastructure development approach and a close engagement with the stakeholders.

In order to bridge the digital divide, it is imperative that the unserved and the underserved areas in terms of ICT infrastructure coverage are addressed. Through this masterplan, a deliberate effort will be made to lay fiber cables and last mile connectivity to reach those areas in order to facilitate deployment of services by the government and also by other service providers.

The consolidation of critical government systems, data and applications is also key in this masterplan and data centers and government cloud will be developed to their full capacity. This will provide the much needed secure hosting facilities not only for national government organizations but also for the county governments.

Security is a very important component in this ecosystem and emphasis has been made to ensure that the security of the infrastructure is not regarded as a second thought during the implementation. Proper functioning of ICT infrastructure is very much dependent on how secure the infrastructure is in terms of access.

This masterplan envisages a demand for adequate skills to roll out and sustain various ICT infrastructure implementations. In this regard, human capacity development has been identified as a key component. With the increasing sophistication of ICT Infrastructure and its applications, high-end skill sets are increasingly being required and this challenge needs to be addressed for the achievement of the vision of this ICT Infrastructure Master Plan.

The implementation of the masterplan is hinged on a governance structure that encompasses the stakeholders who are directly or indirectly benefiting from the proposed projects. A National ICT infrastructure Master Plan (NIIMP) Steering Committee will provide strategic oversight for the effective implementation of NIIMP 2019-2029 and will coordinate all the necessary inputs and resources as necessary.

Last but not least, in order to provide the necessary feedback and enable management to make evidence-based decisions, it will be critical to carry out monitoring, evaluation and reporting for the successful implementation of this master Plan. The links between the set priorities, corresponding budgetary provisions and the resultant outputs and outcomes over the plan period will be reviewed and analyzed for feedback. It is my
believe that this masterplan will play a big role in the achievement of the digital economy and our individual participation will be regarded as a significant contribution to its success.

**Nani Mungai**
Chairman, The ICT Authority
EXECUTIVE SUMMARY

a) Introduction

In order to address the Vision 2030, MTP III, the “Big Four” Agenda and creation of employment for the youth, significance investment in ICT infrastructure is paramount. Affordable connectivity enhances region completeness and open up opportunities for innovation, Foreign Direct Investment (FDI) and social development. During the ten (10) years of this Master plan, the ICT infrastructure will adhere to address the digital divide and inequity in the country in terms of ICT Infrastructure. Access to universal broadband will address the unemployment and enhance the culture of innovation and creativity in particular to the youth who form the majority of the Kenyan population. Available and affordable broadband will catalyze the growth of the SMEs.

This Master Plan is in line with the national aspirations as articulated in various government policy documents including the Kenya Vision 2030, Third Medium Term Plan (MTP III), and the “Big Four” initiatives, the National ICT Masterplan, Cyber Security Strategy, Constitution of Kenya 2010, Smart Africa 2063 Agenda, Digital GOK Transformation and the Ministry of ICT strategic plan among others. The Kenya Vision 2030 envisages Kenya to be a globally competitive economy with its citizens enjoying high quality of life. The Information and Communications Technology (ICT) sector has undoubtedly huge potential to propel the country to a middle-income economy by the year 2030 and ICT has been identified as an enabler towards realizing a knowledge-based economy.

ICT in Kenya has grown tremendously mainly due to government initiatives, liberalization and a robust regulatory environment. However, there still exists a wide “digital divide” in access to digital services in the country and several efforts have been put in place to bridge the gaps in the digital divide. These include Government initiatives such as the National Optical Fiber Backbone Infrastructure (NOFBI), TEAM S, Government Common Core Network, Data Centers, Government Private Cloud and County Connectivity Project (CCP) among others.

In order to meet the need of growing ICT Services demand at an affordable cost, it is imperative that deliberate efforts are made to make the provision for these demands to be met. All government offices (national and county), schools, academic institutions, hospitals and other public institutions need to be connected through last mile connectivity to access e-Government services including internet. In addition, the ICT infrastructure components such as submarine cable, optic fiber cables, transmission
towers, ducts and data centers need to be classified as critical infrastructure and will need to be protected and an inventory of all the assets documented.

(b) ICT as a key contributor to the achievement of the “Big Four” Agenda

ICT sector is a major contributor to economic growth and will be a key driving force in the realization of the Government’s Big 4 agenda. It will provide the Government, businesses, and citizens with fast access to better information to enable more efficient processes and to make more informed decisions as seen in this graph which depicts the digital wheels for the Big 4 Agenda below:

At the core of the government’s development plan is the ‘Big Four Agenda’ whose initiatives directly relate to Kenya’s Vision 2030. The four pillars of this agenda are food security, affordable housing, universal health care, manufacturing and Job creation. This blueprint is aimed at ensuring that an ordinary Kenyan is employed or has a reliable source of livelihood, owns a home, has enough food and is able to access universal health care. This will in turn result in a vibrant workforce to drive the country to more growth in economic development and improve the living standards of Kenyans as follows:
i. ICT in Manufacturing

Manufacturing has the potential to advance socio-economic development through increased and diversified exports and enhanced employment creation. As such, policy interventions towards promoting the competitiveness of the manufacturing sector should aim at enhancing product diversity and complexity, improving the business environment, developing relevant infrastructure, enhancing credit and market access, strengthening technology transfer and innovation, and building an industrial culture. With focus on promoting local assembly of phones, TV sets, laptops and other digital devices, it is envisaged that about 10,000 jobs will be created annually fuelled by the numerous business process outsourcing (BPO) services.

No one-size-fits all approach to nurturing the development gains of digital technologies but governments should start by being future-orientated. Equipping populations with the skills needed to innovate and leverage digital tools, promoting investment and market entry to attain greater coverage of networks and driving inter-operability across policy and regulatory landscapes.

ii. Affordable Housing

In line with Article 43 of chapter four of the constitution of Kenya that states every person has a right to accessible and adequate housing with reasonable standards of sanitation, this pillar entails the development of adequate, standardized and well-spaced houses with continuous supply of clean water and electricity. The houses are to be located in decent places and be readily available to both the lower, middle and upper class in the society. They should be affordable so as to enable the owners meet their other basic needs.

The Ministry of Lands has recently adopted blockchain in the digitization of lands records to drive efficiency and speed in processing of the documents. This will see increased transparency and visibility of land ownership through a single source of truth thus facilitating development and construction that could spur economic growth.

Lack of transparency in the process of buying, selling and renting of land parcels could increase the value of land and in some instances cause conflicts due to the sensitivity of land matters. An internet platform could be used to streamlines this process to inform the public on the details of the land and properties including value and also
standardizing this process and making rentals and ownership more accessible to the public.

To support the above initiatives, a robust, reliable, efficient and secure ICT infrastructure and connectivity is required.

iii. **ICT in Universal Health Care**

This focus area aspires to have Universal Health Care (UHC) by scaling up the National Health Insurance Fund (NHIF) and increasing insurance coverage to all Kenyans. Health Insurance Subsidy Programme and Linda Mama Programme (Free Maternity Service), partnership and collaboration between levels of government and working closely with the health service providers in the private sector are some of the initiatives that are being implemented to enhance universal healthcare coverage.

Other policy interventions will include development of adequate healthcare workforce, equitable distribution of healthcare human resources, reduction of reliance on external support, strengthening of county supply chain management systems, and enhancing coordination in disease prevention, detection and response.

The tracking of available medicines available to the public could be done through an online database that is securely accessible for the health facilities through an appropriate ICT infrastructure. Such a database could support supply-chain management system of pharmaceuticals that could then make medicine available to the public and ensure that it gets to their location in time and in the right quantities.

In addition, through identification, automation and records management of beneficiary details for the National Hospital Insurance Fund (NHIF), enhanced access and speed of service in health institutions, adoption of telemedicine and artificial intelligence capabilities for diagnosis could be realized.

iv. **Food & Nutrition Security**

The Food & Nutrition pillar is aimed at reducing the cost of food as a percentage of income, halving the number of food insecure Kenyans, creating direct and indirect jobs, as well as increasing average daily income of farmers, fishermen and pastoralists.
In order to make food readily available, the Government intends to reduce average post-harvest losses and increase irrigated land through construction of smallholders’ water pans and de-silting existing old dams to increase the quantitative volumes of available food and hence making it readily available and cheaper.

In order to support the above-mentioned initiatives, ICT is one of the key drivers that will facilitate the achievement of each of them through the provision of the requisite systems, datasets and applications.

Basic ICT is already helping farmers in developing countries keep pace with accelerating demand for milk products that have aided in improving quality of life and boosting rural economic growth. Developing ICT Control systems could provide the automation and maintenance solutions necessary to ensure a hygienic, efficient environment for processing and preserving the health benefits of perishable products such as milk.

b) Vision

The vision of this Master Plan is to provision an accessible, affordable, reliable, quality and secure ICT infrastructure in Kenya. This will be achieved through addressing the gaps that have been identified more so in the underserved and unserved regions of this country. Several initiatives as outlined under section 4 will be undertaken so as to meet the broad objective of building a robust, secure and reliable ICT network infrastructure for improved access to information and equitable allocation of resources which are fundamental to achieving good governance, transparency and accountability. Other areas that the ICT Infrastructure Master Plan will endeavor to address are the adherence to best practice in project management and resource utilization.

c) Objectives

The objectives of this ICT Infrastructure Master Plan are the following among others: -

i. Compressive ICT network connectivity to all government MDAs
ii. Achieve universal, affordable access to broadband connectivity to accelerate “Big Four” agenda across the country
iii. Delivery of essential cost-effective digital services through secure data transmission and storage
iv. Skilled human resource to manage and maintain ICT infrastructure as well as skilled users to exploit all the capacity provided by the net.
v. Well organized secure integrated networks that facilitate the deployment of Smart Cities across Kenya
vi. Reduce cost of implementation through consolidation of different fragmented networks and leveraging on economies of scale;

vii. Support the medium- and long-term goals of consolidation and delivery of online services through multiple channels supporting advanced computing, infrastructure, applications and disaster recovery facilities;

viii. Implement and standardize security across the GoK One network and related infrastructure

d) Pillars and Guiding Principles

For the delivery of the vision of this Master Plan four critical pillars have been identified namely Connectivity, Services, Skills as well as Values and Governance. The pillars are to ensure that the Master Plan facilitates the achievement of real socio-economic growth as envision in Vision 2030. It is the framework that will guide the development and management of ICT Infrastructure in a manner that targets to benefit citizens and investors, strengthen local industries using ICT and create ICT businesses that help to create a thriving ICT sector. The successful implementation of the Master Plan will also be guided by the principles of partnerships, equity and non-discrimination, technology neutrality, environmental protection and conservation and good governance:

i) Governance

Good governance is critical for the successful implementation of this Master Plan. Thus, to be able to accomplish this mandate, a National ICT infrastructure Master Plan (NIIMP) Steering Committee to be headed by the Cabinet Secretary in charge of MoICT will be formed with membership from relevant key institutions. This committee will provide strategic oversight for the effective implementation of NIIMP 2019-2029 and will coordinate all the necessary inputs and resources as necessary. Its membership will comprise key agencies that will be implementing various aspects of the Master Plan.

In addition, this Master Plan has identified several stakeholders whose cooperation is of utmost importance. They include Government of Kenya, private sector, development partners, general public and civil society each of which has defined roles. For effective management of this transformation, there needs to be a continuous engagement, support, cooperation, attitude and cultural change for all the stakeholders to facilitate data integration, business process re-engineering, and change management should be sought and managed.
With regard to policy and legal framework, the most crucial ones are the Critical Infrastructure Bill (CIB) and the ICT Authority Act. A draft version has already been developed that still needs revision to focus on key areas that were not included in the draft such as fostering creativity and artistic expression; infrastructure sharing policy; industry code of practice; e-waste management; expansion of infrastructure; serving disadvantaged groups; network integrity, trust, security and e-commerce.

There will be need to harmonize all related policies, legislations and regulations as appropriate with recognition of ICT infrastructure as a basic utility so that infrastructure assets can receive similar protection and rights as other utilities such as water, electricity etc. especially during road construction and maintenance.

Risk identification, analysis and mitigation is another key aspect of this Master Plan and have been identified and outline indicating the success factors which must be satisfied, while managing the risks in order to successfully implement this ICT Infrastructure Master Plan.

ii) E-Government Infrastructure

Economic and social development of any country is highly dependent on the ICT infrastructure and the implementation of this Master Plan will unlock the high potential inherent in the ICT sector in the country as an enabler of development. Strategic initiatives, programmes and projects of key infrastructure areas of connectivity infrastructure, data centers & cloud infrastructure, Infrastructure security and human capital development will be undertaken that will unlock growth potential and build the resilience of the economy.

iii) Implementation Framework

The realization of this Master Plan will require the mobilization of significant financial and human resources. Funding of the flagship projects in this Master Plan will come from the national and County Governments, commercialization of the infrastructure, development partners, capital markets and other public or private institutions through Private Public Partnerships (PPPs) and collaborations.

For the projects impact to continue to last for a longer period after they are implemented and commissioned, sustainability will be of paramount importance. This will be ensured through commercialization of ICT infrastructure, implementation of IT charge back for all ICT infrastructure services, partnering with other government
agencies on capital expenditure sharing cost to enhance last mile connectivity, annual maintenance and support as well as continuous human capacity development.

iv) Social and Environmental safeguards

Environmental and social issues can negatively be impacted by the implementation of some if not all the projects envisaged in this Master Plan. Safeguards and mitigation measures have been identified that will be implemented before, during or after the initiatives are completed and closed. Among the aspects that have been identified include terrestrial habitats, soil erosion, water/air/soil pollution, landscape degradation, noise and vibrations, services interruptions, solid waste, health and safety hazards and loss on income/assets among others.

The increasing level of electronic waste that is not biodegradable more often that not is hazardous to the environment and affects the health of people. There is need to address this problem and governments both national and county together with other organizations will need to institute mechanisms for recycling and/or safe disposal of e-waste. In addition, policies and regulations will require to be reviewed and enhanced to empower governments to prevent dumping of electronic materials into the country.

v) Monitoring and evaluation

Monitoring, evaluation and reporting is a critical component for the successful implementation of this Master Plan that will provide the necessary feedback and enable management to make evidence-based decisions. This framework is geared towards improving the achievement of desired results, optimization of available resources and at maximizing the impact of the initiatives.

The monitoring framework will be employed to track actual performance against the plans and will involve continuous collection and analysis of data as well as results and recommend corrective measures. On the other hand, evaluation will aid in understanding why and to what extent intended and unintended results are achieved and their impact on stakeholders which is an important source of evidence for performance and the achievement of the set objectives. Evaluation results feed into management decision making processes for planning, programming, budgeting, implementation and reporting cycle of Master Plan.
vi) Conclusion

It is the desire of the government to provide the right ICT infrastructure to support the digital economy transformation agenda by putting in place reliable, secure and cost-effective broadband infrastructure. This will not only address the problem of digital divide but will also facilitate the reduction of cost of doing business by lowering the cost of broadband access by the citizens.

In order for this to happen, there must be a deliberate effort by all the stakeholders to embrace a coordinated approach and a well-planned methodology to actualize this dream. This Masterplan is intended to provide the roadmap in the short, medium and long term to realize the set out aspirations. It will require the goodwill, effort, dedication and support from each and every stakeholder to make it happen and a lot of resources especially finances and human capital will be needed to facilitate the implementation of the earmarked programmes and projects.
CHAPTER 1.0

1.0 INTRODUCTION

This Master Plan regards Information and Communications Technology (ICT) as a range of technologies for gathering, storing, retrieving, processing, analyzing, and transmitting information. It recognizes that dynamic market and technology developments have led to convergence where boundaries between previously separate ICT services, networks, and business practices have eroded.

The Master Plan takes into account the local, regional and global changes that have an influence on the ICT sector. At the global level, Kenya is a participant and a signatory to a number of international conventions and standards relating to ICT. It is an active member of the International Telecommunications Union (ITU) and the World Summit on the information society (WSIS). It is also spearheading issues of Internet Governance in the region, which is the development and application by governments, the private sector and civil society, in their respective roles, of shared principles, norms, rules, decision-making procedures, and programmes that shape the evolution and use of the Internet (WGIG, 2005). Kenya is active at the Internet Corporation for assigned names and numbers (ICANN) headquartered in the United States which is responsible for the coordination of the global Internet's systems of unique identifiers and, in particular, ensuring it’s stable and secure operation.

In addition, Kenya’s Internet exchange Point (KIXP) has been used as a successful model of public private partnership and is being emulated by other countries developing their own Internet exchange Points. Kenya enhances its competitiveness through investor friendly arrangements such as export Processing Zones (EPZ) Programme which offers attractive incentives to export oriented investors, and the Investment Promotion Centre (IPC) which promotes all other investment in Kenya. These conditions have created a conducive environment for the growth of the ICT sector, changing the nature of doing business in many sectors including finance, education, tourism, agriculture and health.

At the regional level, Kenya aims at improving its trade of goods and services with fellow East Africa Community (EAC) members and Common Market for Eastern and Southern Africa (COMESA). ICT has a major role to play in regard to facilitating communication and engagement among the members. There are various planned integrations such as implementation of the customs union, common market, monetary union and political federation including the legal, regulatory, and policy reforms
required to accomplish the plans. Seamless ICT infrastructure within the community is crucial to address the digital divide, the emerging mobile and cyber security issues perpetuated through ICT and fueled by the borderless nature of the services delivered through the technologies.

In addition, the Kenyan Government has underscored universal access to ICTs as a major objective of Vision 2030, which is Kenya’s economic blueprint that is aimed at propelling Kenya from a developed to a middle-income country. There has been tremendous growth in the ICT sector particularly in the mobile sector, which by September 2018, had 20.9 million subscribers and a penetration of 44.9 percent. At the same time, there are estimated 30.8 million Internet users with 47.1 per 100 inhabitants having access to Internet services (CAK, 2018). This is an indication that Kenyans are ready to embrace information and communication technology as long as it enhances their perceived quality of life.

ICT infrastructure and services are prerequisites to development in each County Government. Kenya’s Commission on Revenue allocation (CRA) which advice on revenue division between the national Government and the County Governments has already indicated that 84.5 percent of the revenues will be allocated to the national Government while 15 percent will be allocated to County Governments. The remaining 0.5 percent is designated as an equalization fund. Following this emerging changes, it is imperative that the Master Plan considers the role of ICT infrastructure not only at the national level, but at the County level and how the infrastructure and services can be integrated to better serve all citizens.

Based on institutional and situational analysis, the Master Plan is in recognizance of the fact that Kenya’s ICT potential has not been leveraged to its maximum to drive social and economic development. Finally, it is expected that the implementation of this ICT Infrastructure Master Plan will unlock the high potential of the ICT sector in the country. This will create a digital society and economy that is able to exploit the global, regional, national and local opportunities presented by the dynamic sector of information and communication technologies to advance its socio-economic growth leading to an enhanced quality of life by all the people of Kenya.
1.1 Vision

Accessible, Affordable, Reliable, Quality and Secure ICT infrastructure in Kenya.
1.2 Background

The ICT Infrastructure Master Plan is in tandem with the national aspirations as articulated by the Kenya Vision 2030 and the MTP III. The Kenya Vision 2030 envisages Kenya to be a globally competitive economy with its citizens enjoying high quality of life. The vision identifies ICT as an enabler towards realizing a knowledge-based economy. The Information and Communications Technology (ICT) sector has undoubtedly huge potential to propel the country to a middle-income economy by the year 2030.

In 2017 the ICT sector contributed 7.1% of the GDP registering a surge of 12.9% in its value from KES. 345.6 Billion in 2017 to KES. 390.2 Billion in 2018, largely driven by growth in the digital economy (Kenya National Economic Survey Report, 2019). Kenya digital economy spans consumer information communication, e-government, enterprise technology, interactive digital media and telecommunications. This figure indicates a positive growth trajectory in the next ten (10) years. Information and Communication Technology will continue to offer the needed opportunity for the Country to realize its national goals and leapfrog into a transformed society where every citizen will have better access to basic needs, create opportunities and prosper, living fulfilled lives enabled by technology and harness the benefits of a digitized economy.

ICT infrastructure in Kenya has experienced tremendous growth largely due to government initiatives, liberalization and a robust regulatory environment. However, despite heavy investment in ICT infrastructure, there still exists a wide “digital divide” in access to digital services in the country. Several efforts have been put in place to bridge the gaps in the digital divide and these include Government initiatives such as the National Optical Fiber Backbone Infrastructure (NOFBI), TEAMS, Government Common Core Network, Data Center, Cloud and County Connectivity Project (CCP) among others.

In order to meet the need of growing ICT Services demand at an affordable cost, it is imperative that deliberate efforts are made to make the provision for these demands to be met. All government offices (national and county), schools, academic institutions, hospitals and other public institutions need to be connected through last mile connectivity to access e-Government services including internet.
1.3 Rationale

The ICT Infrastructure Master Plan was envisaged to provide a holistic and coordinated approach in order to:

- Align and Optimize ICT resources with changing needs of state entities and local governing Authorities.
- Enable the effective implementation of State business strategies.
- Highlight and promote the value of ICT to executive and policy makers
- To reduce implementation and operation cost through a consistence enterprise wide approach to ICT solutions
- Consolidate or integrate existing systems and technical infrastructure
- Provide the ICT foundation to support the business process of state agencies and local governing authorities
- Reduce the number of duplicate technologies solutions across the State
- Ensure interoperability by elimination technology Silos
- Share and reuse Viable ICT assets
- Reduce Security risks of the state ICT infrastructure and Data
- Increase support for funding a functional secure and reliable infrastructure
- Improve delivery efficiency and accessibility of government services to the government
- Support the statewide ICT vision
- Align with National compliance standards
- Increase the consistency accessibility and sharing of data application
- Leverage the advantage of new technologies while balancing investment in existing ICT systems
- Respond to MDAs changes in technology and business requirement
- Empower all citizens including children in primary schools and adults across the country through digital literacy and awareness;

1.4 Objectives

The objectives of this ICT Infrastructure Master Plan are the following among others:-

1) Compressive ICT network connectivity to all government MDAs
2) Achieve universal, affordable access to broadband connectivity to accelerate “Big Four” agenda across the country
3) Delivery of essential cost-effective digital services through secure data transmission and storage
4) Skilled human resource to manage and maintain ICT infrastructure as well as skilled users to exploit all the capacity provided by the net.
5) Well organized secure integrated networks that facilitate the deployment of Smart Cities across Kenya
6) Reduce cost of implementation through consolidation of different fragmented networks and leveraging on economies of scale;
7) Support the medium- and long-term goals of consolidation and delivery of online services through multiple channels supporting advanced computing, infrastructure, applications and disaster recovery facilities;
8) Implement and standardize security across the GoK One network and related infrastructure

1.5 Pillars

The below pillars are one of the ways of delivering the vision of the Master Plan. They are meant to facilitate the achievement of real socio-economic growth and Vision 2030 targets through e-Government services that benefit citizens, businesses and other stakeholders; strengthening local industry using ICT; and creating ICT businesses that help to create a thriving ICT sector. Four pillars were derived from the situational analysis as follows.

a) **Connectivity**: ICT connectivity to all the unserved and underserves corners of the country is a key prequisite for transformation towards the realization of the Vision 2030, MTP III and the Big Four Agenda.

b) **Service**: Government is by far the biggest player in all key sectors in provision of information and services to citizens, businesses, government employees and other stakeholders. The provision of e-Government information and services is key to improving productivity, efficiency, effectiveness and governance in all sectors.

c) **Governance**: Streamlining the development of infrastructure through policy formulation legal frameworks, stakeholder and risk management.

d) **Skills and Values**: This is the development of a digitally skilled workforce that is grounded on ethical practices and social culture values to implement and operationalizes this master plan.
1.6 Guiding Principles

The following key principles will guide the implementation of this national ICT Master Plan:

a. **Partnership** - Conscious/deliberate efforts to engage and collaborate with the private sector, academic institutions, County Governments and local and international partners in implementing the national ICT Master Plan e.g. entrepreneurship culture of research and development and value addition

b. **Equity and non-discrimination**: Equitable and non-discriminate availability of and access to ICTs across County Governments, urban and rural areas, gender, women, youth and disadvantaged communities.

c. **Technology neutrality**: Use of common, interoperable standards and protocols must be encouraged.

d. **Environmental protection and conservation**: all institutions involved in ICT Master Plan implementation to adhere to the green ICT concept by environmentally friendly equipment that are cheaper and easy to implement and ensuring there is no e-waste dumping.

e. **Good governance**: All institutions and persons involved in procurement of ICTs and the implementation of the ICT Master Plan to adhere to the highest standards of good governance and ethical behavior.
CHAPTER 2.0

2.0 Governance

Arising from the weaknesses observed in the implementation of the ICT flagship projects, a clear structure to govern and deliver this master plan is recommended. The ICT Infrastructure Master Plan coordination body shall ensure timely decision making and implementation of projects including operations, maintenance of the ICT systems and ensuring effective monitoring and evaluation. In this regard, and in line with best practice, a well-coordinated implementation framework is required to ensure the success of the ICT Infrastructure Master Plan 2019-2029.

Coordination mechanisms will be implemented for at least three fundamental reasons:

- (i) For the provision of critical services such as Optic fiber infrastructure, Data centers and cloud, Last mile, Metro, Power/Energy installation to MCDAs, etc. as well as the supply of ICT equipment to other facilities;
- (ii) To ensure that the deployment of Infrastructure ICT Master Plan is aligned with the implementation of e-government and other government priorities/initiatives.
- (iii) To mitigate risks that may hinder implementation of this Master Plan.

To be able to accomplish this mandate, a National ICT infrastructure Master Plan Steering Committee to be headed by the Cabinet Secretary in charge of MoICT will be formed with membership from relevant key institutions. The purpose of this intervention is to provide strategic oversight for the effective implementation of NIIMP 2019-2029. The NIIMP steering committee will achieve this objective by coordinating all necessary inputs and resources necessary for effective delivery of ICT infrastructure since its membership will comprise key agencies that will be implementing various aspects of the Master Plan.

2.1 Stakeholder Engagement

The Master Plan has identified several stakeholders whose cooperation is of utmost importance. The stakeholders include Government of Kenya, private sector, development partners, general public and civil society. The implementation of the Master Plan will transform the operational processes of key sectors, e-Government services, access to data and information, and the perspective of citizens to ICT. This calls for careful management of this transformation to ensure continuous engagement, support, cooperation, attitude and cultural change. To mitigate this, cooperation of
stakeholders is required for data integration, business process re-engineering, and change management should be sought and managed.

2.1.1 Roles Of Stakeholders

a) Government:
   - Formulation and enforcement of policies to support ICT infrastructure in the country for both national and county governments
   - Allocation of resources for development and operation of infrastructure
   - Consumption of ICT infrastructure services
   - Sensitization of Citizen
   - Implementation of ICT infrastructure

b) Development partners:
   - Financing ICT infrastructure development
   - Consultancy services
   - Capacity building

c) Private sector
   - Participate in policy formulation
   - Consumption of ICT infrastructure services
   - Provision of ICT services
   - Financing ICT infrastructure development through Public Private Partnership

d) Citizens
   - Consumption of ICT infrastructure services
   - Participation of policy formulation
   - Ownership of ICT infrastructure

e) Civil society
   - Consumption of ICT infrastructure services
   - Participation in policy formulation

2.2 Policy and Legal Framework

Several policies need to be considered to ensure that the ICT Infrastructure Master Plan is implemented. The most crucial one is the Critical Infrastructure Bill (CIB). The ICT State Department has developed the ICT policy to guide towards the realization of vision 2030 goals. This still needs revision to focus, among others, on key areas:
fostering creativity and artistic expression; infrastructure sharing policy; industry code of practice; e-waste management; expansion of infrastructure; serving disadvantaged groups; network integrity, trust, security and e-commerce.

In addition, there is a need to harmonize policies and legislations related to energy, roads and ICT, as appropriate with provisions for categorization of ICT services as high energy users benefiting from special tariffs, and recognition of ICT infrastructure as a basic utility so that infrastructure access can receive similar protection and rights as other utilities, especially during road construction and maintenance.

Some of the Key policies to be considered for implementation in this Master Plan are the following among others:

a. National broadband strategy 2018-2023 which aims at extending the broadband to ward level
b. Big Four Agenda blueprint (Move to Governance)
c. Vision 2030/MTP III Plan
d. Digital Economy Blueprint
e. ICT Authority Strategic Plan
f. Existing Government Standards
g. Cyber Security Strategy
h. Smart Africa 2063
i. Ministry of ICT Strategic Plan
j. National ICT Policy

2.2.1 Legal Documents

Several legislations dealing with various issues that affect ICT infrastructure have been enacted including the following:-

- Kenya Information and Communication Amendment act 2013
- ICT Authority Legal notice no 183
- Consumer Protection Act no 46 of 2012
- Access to Information Act no 31 OF 2016
- Computer Misuse and CyberCrime Act of 2018
- Science Technology and Innovation Act of 2013
2.2.2 Required Policies

A number of pending ICT infrastructure enabling regulations, legislations and policies are:

- Critical Infrastructure Bill
- Mandatory infrastructure registration and mapping policy
- ICT Authority Act

2.3 Risk Management

To successfully implement this ICT Infrastructure master plan risk identification, analysis and mitigation is key. There are critical success factors which must be satisfied, and various risks managed in order to successfully implement this ICT Infrastructure Master Plan. The following table shows an outline of the risks and mitigation measures:

Table 1: Overall Master Plan Risks

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Contributing Factors</th>
<th>Mitigating Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Risk</td>
<td>● Over reliance on Exchequer for budgetary support.</td>
<td>● Widen scope of revenue streams.</td>
</tr>
<tr>
<td></td>
<td>● High inflation rates may lead to increased cost.</td>
<td>● Utilize a wider range of lending/financing instruments from development partners.</td>
</tr>
<tr>
<td></td>
<td>● Low absorption of funds.</td>
<td>● Optimal use of resources through cost reduction and prioritization.</td>
</tr>
<tr>
<td></td>
<td>● Inadequate financial management controls.</td>
<td>● Enhance financial monitoring and adherence to International Public Sector Accounting Standards.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Proper planning for expenditure and implementation</td>
</tr>
<tr>
<td>Organization Capacity</td>
<td>● Inadequate organization capacity</td>
<td>● Continuous Capacity building and training on industry technological changes</td>
</tr>
<tr>
<td></td>
<td>● Staff turnover</td>
<td>● Succession planning</td>
</tr>
<tr>
<td></td>
<td>● Inadequate skilled personnel in some specialized areas.</td>
<td>● Enhance performance-contracting goals.</td>
</tr>
</tbody>
</table>
| Stakeholder Management | ● Information asymmetry  
● Inability to effectively influence policy.  
● Inadequate response to radical changes in policy and regulation.  
● Negative media publicity  
● Non-cooperation of relevant stakeholders. | ● Implement cooperation frameworks.  
● Closely monitor changes to policy and regulations and proactively identify advocacy measures.  
● Continuously assess stakeholders and come up with plans to engage them.  
● Develop and implement a comprehensive Outreach, Communications and Media Strategy to proactively engage targeted stakeholders. |
| --- | --- | --- |
| Operational Risk | ● Policy changes that result in emergence of unplanned activities.  
● Litigation  
● Implementation uncertainty | ● Review and create awareness of internal and external communication policy/Records policy  
● Ensure directives are in line with the law  
● Prioritize negotiations, mediation and make provision for litigation costs. |
| Technological Risks | ● Lack of investment in new technology.  
● Cybersecurity threats  
● Loss of useful data due to poor ICT equipment | ● Develop Updated investment policy on new technology  
● Develop and implement cyber security policy and systems.  
● Establish of ICT Research and Development center |
CHAPTER 3.0

3.0 E-government infrastructure

E-Government ICT infrastructure is a prerequisite to development in any country and the implementation of this Master Plan will unlock the high potential of the ICT sector in the country as an enabler of development. This will in turn create a digital society and economy that is able to exploit the global, regional, national and local opportunities presented by this dynamic sector.

Infrastructure Master Plan will focus on Strategic initiatives, programmes and projects and expected outcome of key infrastructure areas below as foundations for national transformation that will unlock growth potential and build the resilience of the economy.

- Connectivity Infrastructure
- Data Center and Cloud infrastructure
- Infrastructure Security
- Human Capital Development
3.1 CONNECTIVITY INFRASTRUCTURE

Kenya currently boasts of being one of the most connected countries on the eastern Coast of Africa. There are six submarine cables; TEAMS, EASSY, SEACOM, DARE, SEAS and LION that offers connectivity to the rest of the world via redundant routing. Inland, there is a backbone, metro and last mile connectivity that has cut across the country through government National Optic Fiber Infrastructure (NOFBI).

However, Kenya still faces a number of challenges in developing and providing connectivity infrastructure among them being the following:

a) Limited coverage of national fibre infrastructure and limited internet penetration, especially in the rural areas.

b) Lack of last mile infrastructure connectivity to all government institutions

c) Internet access in homes, schools, social centers and villages should be key drivers to ensuring a knowledge economy.

d) High cost of ICT for businesses, households and individuals.

e) Limited sharing of communication infrastructure by infrastructure operators

f) Inadequate and high cost power infrastructure

g) Limited uptake of connectivity by SMEs due to lack of proper ICT sensitization as per survey done by ICT Authority in Naivasha town in June 2019.

This ICT Infrastructure Master Plan will address some of these key connectivity challenges hindering the country from transitioning into a knowledge economy.

3.1.1 OBJECTIVES, STRATEGIES AND DESIRED OUTCOME

3.1.1.1 Objectives

1) Reduced cost of doing business:- Deploying internet services to counties and under-served remote parts of the country has facilitated business communities with the rest of the world without travelling for long distances to access some of the government services e.g. e-procurement, business licenses application as well as enhancing IT related business industry.
2) **To bridge the digital divide:** The digital divide between rural and urban populations will be bridged through provision of backbone connectivity to the rural area and underserved areas as envisaged in this master plan.

3) **To spur the use of ICT products and services:** Telcos are utilizing government infrastructure to deliver ICT services and products to the citizens in areas they have not invested in their own backbone infrastructure.

4) **To increase access to government Digital services:** Increased public value of e-Government services with 50% of adults accessing at least one e-service increasing digital presence and economic competitiveness using ICT as per ICT master plan 2017.

5) **To provide and promote cost effective delivery of ICT services:** This will be achieved through shared infrastructure and economies of scale of ICT operation because of consolidation, standardization and interoperability of ICT infrastructure.

### 3.1.1.2 Desired Outcomes By 2029

A robust connectivity is mandatory in facilitating the development of ICT enabled economy. Despite the progress made so far, there is a need to step up development a secure, trusted, well managed connectivity that promotes integration and sharing of ICT infrastructure. The outcomes envisaged in end of the planned connectivity period are:

- Increased coverage of the national E-government infrastructure especially in the rural areas to achieve:
- High quality E-government Infrastructure (99.99% availability, high reliability and secure);
- Affordable ICT Services for citizens
- Additional 3.9% contribution to GDP. This is possible given the huge increases in penetration of ICT services going by the World Bank’s estimate that very 10% increase in internet penetration results in a 1.3% increase in economic growth.

### 3.1.1.3 Strategies

Strategy 1: Develop and Implement financial support mechanism
Strategy 2: Develop and implement connectivity management framework, shared infrastructure and policies, standards and structures.

Strategy 3: Ensure that all critical e-Government services are delivered through Government infrastructure.

Strategy 4: Ensure that all Government facilities countrywide are connected to the E-government infrastructure.

Strategy 5: Consolidate and Register all ICT infrastructure.

Strategy 6: Develop and Implement annual implementation connectivity plans.

Strategy 7: Expand the universal access fund to facilitate internet connectivity to underserved areas.
3.1.2 SUBMARINE CABLES

3.1.2.1 Situation Analysis

Subsequently, the Government network is connected to the international broadband highway through TEAMS, undersea Fiber cable providing activated internet capacity of 10 Gbps. GoK has a 20% shareholding of 5.2 TB (current capacity of TEAMS). The current TEAMS cable has no redundancy and thus affects the service availability and compromises on the quality of the service.

There are other submarine Cables at the coast which are as follows:

   a) DARE 1 - Currently in deployment
   b) SEACOM
   c) LION
   d) EASSY

The Government intends to acquire a second cable to provide redundancy to the TEAMS cable. In addition, a smart hub at Mombasa will be set up to address the issues of cable landing and the highly availability of cloud services.

The following diagram shows the submarine cables landing around the Africa coast:
3.1.2.2 Programmes/Projects

- Building of smart hub at Mombasa Smart-Hub - All the submarine cables will land at the smart hub in Mombasa where the capacity will be distributed to the other Points of Presence (POPs). The smart hub will also be used as a Data Center for hosting critical applications.
- Acquire redundancy for TEAMS through a second submarine cable.
- Put in place mechanism for repair and maintenance of the submarine cable landing in Kenya.
3.1.3 BACKBONE

The government in the last ten (10) years has built about 8900km of terrestrial fiber that have reached to the sub-county level mainly connecting key government institutions and offices to offer service delivery. Due to connectivity challenges in the delivery of government services through ICT there is a great demand for the government to take connectivity to the ward level for effective service delivery. There is also a huge demand for the government to provide alternative failover routes that will give government network the much-needed redundancy to serve all citizens and address market demands as well as extending broadband connectivity across the country as per the Sustainable Development Goals (SDG), Digital economy blueprint, National Broadband Strategy 2018-2023 and Smart Africa 2063.

3.1.3.1 Situation Analysis

The government implemented the National Optic Fibre Backbone Infrastructure (NOFBI) in Phases. NOFBI phase I was implemented between 2005-2009 and covered 4300Km of terrestrial fiber. NOFBI Phase 1 was largely a linear network and needed to be improved to make it more reliable and available; hence in 2010 the Government embarked of NOFBI Phase 2 in order to provide a more reliable, stable and efficient basic backbone network and also offer protection/redundancy leveraging on the NOFBI Phase I implementation.

The NOFBI Phase 2 project work started from September 2014 and its scope included 2,100 KM fiber links and IP equipment to all the 47-county headquarters, building of metropolitan area networks in all 47-county headquarters, and create a redundancy to the national backbone.

In 2017, the government embarked on NOFBI 2E network with a scope of 2,500 KM fiber links and IP equipment majorly covering sub-counties and creating sub-rings to further increase redundancy as shown in figure 1. Kenya has since achieved a more reliable,
stable and efficient national backbone network that is being used by the Government at the National and County levels.

Figure 1: Current backbone Connectivity

However, Kenya still faces a number of challenges in developing and providing backbone connectivity infrastructure among them being the following:

1. Limited coverage of backbone infrastructure in the rural areas.
2. Over Utilization/capacity constraints. The capacity of the network is not able to serve all the government needs as well as the private sector. This master plan will
standardize all the backbone in Kenya to have a cable not less than 96 cores and will rename all the optic fiber cables.

3. Unusable sections. The government network has also faced challenges of some of its section destroyed and therefore not useable. This master plan addresses this issue by rehabilitation all the destroyed and unused sections.

### 3.1.3.2 Programmes /Projects

The government’s national broadband strategy articulates in greater detail strategies towards the realization of connectivity in the country. The flagship projects to be implemented within the planned period are:

- Providing quality and secure connectivity to key government offices
- Rehabilitation of all unusable backbone optic fiber cable segments
- Centralize NOFBI equipment to ICTA offices or to any other appropriate government office.
- Backbone to cover all Counties, sub-counties, wards
- Establishment of one National NOC mirrored in all the 47 counties.

### 3.1.3.3 Project Activities

Table 2 shows the flagship projects’ activities that will be implemented during the plan period. The flagship projects activities shown in the first column will take relatively long to implement. However, even as components of these long-term project’s activities are implemented, it will be possible to implement this activity in an annual project implementation matrix as indicated in Appendix 1.

<table>
<thead>
<tr>
<th>#</th>
<th>Backbone Project Activities</th>
<th>Output (Distance (KM))</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Upgrading of degraded Backbone Routes</td>
<td>2521</td>
</tr>
<tr>
<td>2</td>
<td>New build backbone connectivity to underserved Sub Counties</td>
<td>723</td>
</tr>
<tr>
<td>3</td>
<td>Build new OFC to complete existing backbone infrastructure</td>
<td>4,701</td>
</tr>
<tr>
<td>4</td>
<td>New build backbone connectivity to all wards</td>
<td>20,320</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>28,265</td>
</tr>
</tbody>
</table>

*Table 2a: Backbone project activities*
<table>
<thead>
<tr>
<th>#</th>
<th>Shelters Project Activities</th>
<th>Output (NO.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Construction of ICT shelters in all counties to house ICT infrastructure equipment and offices (NOC, SOC, training room and call centers)</td>
<td>47</td>
</tr>
<tr>
<td>2</td>
<td>Construction of ICT equipment shelters</td>
<td>580</td>
</tr>
<tr>
<td>3</td>
<td>Network Operation Centre</td>
<td>47</td>
</tr>
</tbody>
</table>

*Table 2b: Shelters project activities*

### 3.1.4 METRO

In the last 10 years the government has built a total of 534km of metro mostly in the Nairobi and County headquarters mainly connecting key public institutions and offices to offer service delivery. Due to metro connectivity challenges and need for interconnectivity in public institution there is a great demand for the government to expand metro connectivity for effective service delivery as per the Sustainable Development Goals (SDG), Digital economy blueprint, National Broadband Strategy 2018-2023 and Smart Africa 2063.

#### 3.1.4.1 Situation Analysis

The Government has developed a Government Common Core Network (GCCN) within Nairobi meant to serve as a shared and secure interoperable Government-wide ICT architecture and improve inter-ministerial sharing of databases and exchange of information to eliminate duplication and redundancies, improve public access to Government services and ensure responsiveness in reporting, monitoring and evaluation (Kenya e-Government Master Plan, 2013).

Within the Nairobi Central Business district, all major government buildings are connected to the Government Common Core Network (GCCN) to facilitate the Ministries and other agencies in providing services. This metro is 24 km long and it forms the infrastructure backbone for data services in the government within CBD that facilitate ICT business planning, shared infrastructure and leverage on technology opportunities.

The current GCCN network was commissioned in the year 2009 with the initial purpose of accessing a centralized financial system by MDAs within Nairobi. Over time, other services have introduced including internet, voice, video, huduma and MCDAs specific applications. Like any other technology, active equipment has reached end of life and therefore, the support of these equipment by the manufacturer is not fully guaranteed.
In addition, the network architecture is no longer appropriate for the current use of the network considering the level of reliability expected by the business it serves.

The government also during implementation of Nation Optic Fiber Backbone Infrastructure (NOFBI) implemented county metros in the county headquarters to interconnect government institutions. A total of 457 km was implemented under the NOFBI 2 Project and an additional 53km implemented under the NOFBI 2 Expansion Project.

However, the government faces a number of challenges in developing and providing metro connectivity infrastructure among them being the following:

- Limited coverage of Metro infrastructure
- GCC equipment reach end of support and cannot be monitored
- Over Utilization/capacity constraints. The metro capacity of the network is not able to serve all the government needs as well as the private sector.
- Overall network stability, response, availability and security is not optimal
- Lack of redundancies in the fiber ring or active equipment

3.1.4.2 Programmes/Projects

The flagship projects to be implemented before 2017/2029 are:
1) Re-engineering of metros Optic Fiber Cable network to integrate to urban development plan
2) Upgrading of end of support and obsolete equipment
3) Provision of Metro connectivity in all Counties, Sub counties and Ward headquarters to facilitate last mile connectivity
4) Implement shared service duct with the road agencies in all the metros

3.1.4.3 Project Activities

Table 3 shows the flagship projects’ activities that will be implemented during the 10-year plan period. The flagship projects activities shown in the first column will take relatively long to implement. However, even as components of these long-term project’s activities are implemented, it will be possible to implement this activity in an annual project implementation matrix as indicated in Appendix 2.

<table>
<thead>
<tr>
<th>#</th>
<th>Metro Project Activities</th>
<th>Output (Distance (KM))</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Build New Nairobi Metro Re-engineering</td>
<td>700</td>
</tr>
</tbody>
</table>
Table 3: Metro project activities

<table>
<thead>
<tr>
<th>#</th>
<th>Activity</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Build New County Metro</td>
<td>1,060</td>
</tr>
<tr>
<td>3</td>
<td>Build New Sub County Metro</td>
<td>1,000</td>
</tr>
<tr>
<td>4</td>
<td>Ward Metro</td>
<td>1,700</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>4,460</td>
</tr>
</tbody>
</table>

3.1.5 LAST MILE

The foundation of ICT infrastructure is the physical connectivity. That is a combination of First Mile, Middle Mile, and Last Mile. First Mile is the underwater cables, the Middle Mile is the backbone and metro networks along with transmission and core network, and the Last Mile is the final connection to users. In this Infrastructure Master Plan Last mile connectivity aims to ensure that national, county and other government institutions are connected to the backbone network for delivery of digital services across the country.

3.1.5.1 Situation Analysis

The government has implemented last mile connectivity through County Connectivity Project (CCP) with the objective of connecting all government Institutions across the country to the backbone infrastructure. CCP Phase I and II have been completed, while phase III is ongoing expected to be completed by early 2020. The aim of this project is to interconnect all counties with VoIP (county and inter-county communication; voice services), internet connection (promoting online services using telephones, emails and video conferencing) and access to critical government applications like the IFMIS.

Kenya faces a number of challenges in developing and providing infrastructure across the country. A key challenge is the provision of last mile infrastructure connectivity, which if appropriately addressed can leapfrog the country into a knowledge economy. Internet access in homes, schools, social centers and villages should be key drivers to ensuring a knowledge economy.

Among the challenges in developing and providing last mile connectivity infrastructure are:

- High demand for last mile connectivity
- Lack of proper standards for interoperability as some solutions deployed utilize only proprietary protocols.
- Lack of sustainability model for the last mile infrastructure
- Limited and nonfunctional Local Area Network (LAN) connectivity
3.1.5.2 Programmes/Projects

The flagship projects to be implemented before 2017/2029 are:

- Last mile connectivity to key government institutions in the County, Sub county and Ward including government offices, schools, hospitals, police stations, courts, training institutions among others;
- Connectivity to key common public places such as Libraries, Constituency Innovation Hubs (CIH), Markets, rest stops and Museums;
- Upgrade and installation of Local Area Network (LAN) in government institutions

3.1.5.3 Project Activities

Table 4 shows the flagship projects activities that will be implemented during the 10-year plan period. The flagship projects activities shown below will take relatively long to implement. However, even as components of these long-term project’s activities are implemented, it will be possible to implement this activity in an annual project implementation matrix as indicated in Appendix 3. These last miles connectivity can also be implemented using wireless solution where appropriate.

<table>
<thead>
<tr>
<th>#</th>
<th>Last Mile Project Activity</th>
<th>Distance (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Police Station Connectivity</td>
<td>400</td>
</tr>
<tr>
<td>2</td>
<td>Judicial Institution Connectivity</td>
<td>69</td>
</tr>
<tr>
<td>3</td>
<td>Health Facilities Connectivity</td>
<td>6,500</td>
</tr>
<tr>
<td>4</td>
<td>County Government Connectivity</td>
<td>597</td>
</tr>
<tr>
<td>5</td>
<td>Constituency Offices and Constituency Innovation Hub Connectivity</td>
<td>435</td>
</tr>
<tr>
<td>6</td>
<td>Education Institution Connectivity</td>
<td>12,000</td>
</tr>
<tr>
<td>7</td>
<td>Key Public Areas (Museum, Libraries)</td>
<td>77</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td><strong>20,078</strong></td>
</tr>
</tbody>
</table>

*Table 4: Last Mile project activities*

NB: Local Area Network upgrade and installation will also be completed for the 41,055-government institution under the last mile connectivity activities
3.2 DATA CENTER AND CLOUD INFRASTRUCTURE

Data Center and cloud are critical ICT infrastructure that ensures E-Government services continuity by protecting critical applications and data against loss that could arise from natural disasters, acts of terrorism, sabotage, and technical faults among others. The Government in 2008 developed a tier-2 Government Data Center (GDC) infrastructure to ensure the security of Government data, applications and hosting of government critical data.

The GDC houses the power, storage, and applications of the most critical and sensitive data and information necessary to support government services. Through this centralization, government data is easy to access and is protected from natural or man-made disasters that may occur at the primary service sites/Government offices. GDC is connected to the Government Common Core Network (GCCN) with a high-speed connection links for faster access.

The Government is also implementing a disaster recovery facility and Konza Data center (KDC) for data and systems as part of the business continuity plan. This will ensure that the Government services continue to be provided even in case of any disaster at the primary sites. These facilities will also offer an environment for cloud computing for all MCDAs.

However, Kenya still faces a number of challenges in developing and providing Data and Cloud infrastructure among them being the following:

1) Lack of smart data center to host Local and international Internet Exchange and Content Delivery Networks (CDN)
2) Lack of functional Recovery Data Center
3) GDC equipment are end of support and no backup power
4) Lack of integrated monitoring for Data center
5) Capacity constraints to host all government institution
6) Partially operationalized government private cloud
7) Lack of sustainability model for government cloud and data centers

In order to develop a modern ICT Infrastructure, there is a need for government to put in place an integration cloud computing environment, big data and the internet of things with modern technologies that promotes e-commerce, industrial networks, Internet banking and new systems supporting high-tech in agriculture, Housing, Health and manufacturing as per the ‘BIG FOUR AGENDA’

3.2.1 OBJECTIVES, STRATEGIES AND DESIRED OUTCOME

3.2.1.1 Objectives

1) To provide a cost effective, centralized, reliable and highly secure environment for hosting critical Government data and applications.
2) To provide business continuity and Disaster Recovery services.
3) To efficiently connect and share strategic Government data and private entities
4) To cost effectively enable public institutions to store and access their administrative data

3.2.1.2 Desired Outcomes By 2029

A modern and operational data centers and cloud infrastructure is essential in facilitating the development of ICT enabled economy. Despite the progress made so far, there is a need to step up development of a secure, trusted, well managed data storage that promotes integration and sharing of ICT infrastructure.

The outcomes envisaged in end of the planned period are:

   a) Efficient Cost-effective storage of data
   b) Minimization of data security incident
   c) Business Continuity Achieved
   d) Large accessible data sets
   e) Integrated cloud computing, big data and the internet of things
   f) Reliable government recovery services

3.2.1.3 Strategies

The government recognizes the important economic role of data centers across all sectors of the economy and in order to deliver value to stakeholders and to guide the
continuous growth of the same in both public and private sectors; it will adopt the following strategies:

Strategy 1: Ensure government Ministries, Departments and Agencies share and optimize data center ICT infrastructure in order to save costs by eliminating the need for infrastructure expenses incurred by individual agencies and also provide cost efficient, scalable and secure environment for Government data and information.  

Strategy 2: Ensure the security of the Government information is harmonized and managed centrally  

Strategy 3: Encourage businesses to partner and invest jointly in data center infrastructure deployment or share data center infrastructure to minimize network duplications

Strategy 4: Ensure the availability of basic infrastructure especially reliable cost-effective grid power and connectivity.

3.2.1.4 Programmes/Projects

- Reengineering of all Government Data Centers
- Develop and implement data center policy
- Integration of cloud computing, big data and the internet of things with modern technologies that promotes e-commerce, industrial networks, Internet banking and new systems supporting high-tech in agriculture, Housing, Health and Manufacturing as per the ‘Big 4 Agenda’

3.2.1.5 Project Activities

<table>
<thead>
<tr>
<th>#</th>
<th>Data Center and Cloud Project Activities</th>
<th>Output</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Upgrade the current Data center</td>
<td>An upgraded data center that is operational</td>
<td>Enable citizens enjoy government services by assuring availability 24/7</td>
</tr>
<tr>
<td>2</td>
<td>Complete and operationalize the DR</td>
<td>A working DR site</td>
<td>Business continuity. Citizens continue to enjoy e-government services even when the main site is down</td>
</tr>
<tr>
<td>3</td>
<td>Build a new smart hub/data center</td>
<td>A smart datacenter/hub</td>
<td>Reduced cost of content in that content producer will be hosting their content locally in a neutral carrier data center. With carriers, cloud and content providers physically connected/hosted at the smart hub/data center, whatever network services you require are readily available e.g. google, Netflix etc.</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>4</td>
<td>Develop data center ICT infrastructure policy</td>
<td>Policy document in place</td>
<td>Promotion of data sharing culture which leads to more quality research papers,</td>
</tr>
<tr>
<td>5</td>
<td>Implement cloud infrastructure</td>
<td>Fully operational cloud infrastructure</td>
<td>New Business Models: it will become easier to create and innovate new business model by taking advantages of existing cloud resources. The New business models will add a value for both citizens and government agencies. By creating new business models, new revenue models will take a place in the local economy. Cost-effective approach: one of the main challenges that face e-government is a shortage in budget. By implementing cloud paradigm, governmental agencies create a pool of shared and common resources as: software, hardware and network infrastructure even employee that leads to reduction in cloud-government budget. Agility: Cloud computing ensures the resources availability when they are needed by eliminating activities that consume time for resources allocation. So, citizens will have real time services.</td>
</tr>
</tbody>
</table>

*Table 5: GDC Project Activities*
3.3 INFRASTRUCTURE SECURITY

In the past decade there has been expansive ICT infrastructure roll out including countrywide network connectivity and data centers which are the backbone of the growing reliance on automation and provision of government services to the public. As more e-services are being delivered through the infrastructure, it is becoming increasingly important that information and cyber security controls keep pace with the advances of threats to information and assets. Ensuring data security, privacy, online safety and cyber security is fundamental to building public confidence and uptake in government’s digital initiatives.

3.3.1 SITUATION ANALYSIS

As government envisages delivering more services through ICT, more emphasis should be given to information security to ensure that current and emerging threats are being addressed. In addressing information security challenges the government has enacted the following critical legal frameworks:

   a) Computer and cybercrimes act 2018
   b) Data protection bill 2018

However government ICT infrastructure is still exposed to various challenges among them the following:

- Lack of national government policies for information security implementation.
- Lack of security integration in government projects at inception
- Lack of proper security controls across the infrastructure resulting in service disruptions and outages
- Successful cyber-attacks resulting from lack of security management systems to manage security vulnerabilities on critical infrastructure.
- Lack of real time monitoring to identify vulnerabilities and threats.
- Lack of clear critical systems User Identity Management.
- Low and/or lack of skilled personnel in Cybersecurity
- Software and systems designed and manufactured from a variety of sources giving rise to the possibility of compromised supply chains
- Larger attack surfaces in the government, stemming from the increased complexity of systems and digital connectivity use models.
- Social and technology trends, such as teleworking, mobile devices, leading to an increased number of insecure devices accessing government networks and blurring the perimeters of systems

3.3.2 OBJECTIVES, STRATEGIES AND DESIRED OUTCOME

3.3.2.1 Objectives

- To identify and classify government information assets to ensure proper administration of security across critical government installations
- To identify and create a formal list of Critical National Infrastructure (CNI) on a multi-sectoral stakeholder consultation and work with respective agencies on securing them.
- To enhance the information security level for the Government ICT infrastructure to support e-Government services.
- To continuously manage information security events and incidents across the ICT infrastructure
- To identify and assess internal and external information security risks that may threaten the Government infrastructure
- To ensure swift recovery from information security incidents and restoration of normal operations and services.
- To identify a center of excellence in cybersecurity research and education to locate strengths and provide focused investment to address skillset and gap areas.
- Promote greater levels of trust in on-line services, such as e-government and e-commerce services.

3.3.2.2 Desired Outcomes By 2029

A resilient and secure infrastructure to facilitate the achievement of an ICT enabled economy. Despite the progress made so far, there is need to continuously improve the security of the infrastructure to inspire public confidence in government e-services. The outcomes envisaged in end of the planned period are:
a) A government infrastructure that will enable secure e-services provisioning.
b) Informed government workforce on information security.
c) Capability to effectively deter, detect, investigate and counter the threat from the cyber activities targeted to government systems
d) Developed Cybersecurity Skills across the Public service.
e) Increased public and investor confidence in government delivering secure digital services.

3.3.2.3 Strategies

In a constantly changing environment, there is a need to have flexible and dynamic information security strategies to meet new, global threats. The following are the strategies to be implemented:

Strategy S1: Develop, implement and institutionalize an infrastructure security management framework. This will facilitate the establishment of appropriate policies, procedures and standards to safeguard ICT infrastructure.

Strategy S2: Develop an ICT security policy that will strengthen implementation of various existing national ICT statutes.

Strategy S3: Enhance the nation’s infrastructure security posture which will enable the country’s digital growth, safety, and prosperity.

3.3.2.4 Programmes/Projects

- Implementation of a national Government Security Operations Center to pro-actively monitor, coordinate, defend and prevent against infrastructure security threats.
- Develop a government cyber security strategy
- Implementation of the National Public Key Infrastructure to facilitate digital economy & information security for e-Government services
- Fibre Network (NOFBI) being a critical National Infrastructure, Security (both Physical and Logical early warning) shall be inbuilt and incorporated as a safeguard built which includes but not limited to sensors, alert systems and geofencing system.
- Installation and configuration of security controls to the country’s gateways cross borders and Metro.
• Integration of threat discovery & intelligence capability, Anti-Denial of Services systems and Indicators of possible compromise to secure all the internet gateways, data centers and cross border points.
• Implement network security and access control to localize security threats and encryption of traffic within the infrastructure.
• Implement continuous network scanning systems to identify vulnerabilities that arise for quick remediation.
• Implement systems to apply security fixes and updates across the identified Critical infrastructure & Systems.
• Implement Digital Authentication and Access Management (DAAM) & DAM.
• Implement remote security surveillance systems for network sites
• Develop ICT infrastructure security policy
• Development of data protection standards for government.

3.3.2.5 Project Activities

<table>
<thead>
<tr>
<th>#</th>
<th>Infrastructure Security Project Activities</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Build a national Government Security Operations Center</td>
<td>This will provide a clear visibility into our environment for potential threat sources. Provide agile response when addressing incidences &amp; outages. Monitoring, detect and enable analysis of intrusions.</td>
</tr>
<tr>
<td>2</td>
<td>Build Security Operations Centers at the regions</td>
<td>Provide a clear visibility into our environment for potential threat sources. Provide agile response when addressing incidences &amp; outages. Monitoring, detection and analysis of intrusions.</td>
</tr>
<tr>
<td>#</td>
<td>Infrastructure Security Project Activities</td>
<td>Output</td>
</tr>
<tr>
<td>----</td>
<td>-----------------------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>3</td>
<td>Installation and configuration of internet next-generation gateway and cross boarder firewalls</td>
<td>Prevention of overall security threats at the Gateway, before entry to network. Provide a secure, robust GCCN &amp; overall government network. Address continued issues of IP Blacklists, malware and Botnets</td>
</tr>
<tr>
<td>4</td>
<td>Installation and configuration of metro next generation firewalls</td>
<td>Enhanced security threat at the Gateway, Provide a secure, robust GCCN &amp; overall government network. Address continued issues of IP Blacklists and Botnets</td>
</tr>
<tr>
<td>5</td>
<td>Implement a National Public Key Infrastructure</td>
<td>Enable GOK adoption of e-commerce and digital economy. Provide locally available and cheaper digital certificates/signatures to the citizenry</td>
</tr>
<tr>
<td>6</td>
<td>Implement Network Access Control systems at the infrastructure access level for all Critical Infrastructure.</td>
<td>A defined and enforceable logical access, managed privileges to system and the information in accordance with the access control policy and Criticality of Infrastructure.</td>
</tr>
<tr>
<td>7</td>
<td>Installation of Anti-Denial of Service systems for all gateways and datacenters.</td>
<td>Provide layered Infrastructure security for the Gateway; core Infrastructure Installation (GDC) and hosted applications. Provide a secure, robust GCCN &amp; overall government network.</td>
</tr>
<tr>
<td>8</td>
<td>Implement vulnerability management systems</td>
<td>The result of this is an ICT Infrastructure that has an understood risk posture that is updated and documented.</td>
</tr>
<tr>
<td>#</td>
<td>Infrastructure Security Project Activities</td>
<td>Output</td>
</tr>
<tr>
<td>----</td>
<td>---------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>9</td>
<td>Implement patch management systems for infrastructure active devices</td>
<td>The result of this is an ICT Infrastructure that has an understood risk posture that is updated and documented.</td>
</tr>
<tr>
<td>10</td>
<td>Installation of surveillance systems and smart locks for network sites and GPS for fiber cables</td>
<td>Provide layered Infrastructure security for the Gateway; core Infrastructure Installation (GDC) and hosted applications.</td>
</tr>
<tr>
<td>10</td>
<td>Implement Digital Authentication and Access Management (DAAM) &amp; DAM.</td>
<td>Provide better, faster, more efficient access to government services</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Safeguard privacy by protecting access to personal data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improve mobility by using widely interoperable credentials across both physical and logical domains</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Establish trust between the governments issuing agencies</td>
</tr>
<tr>
<td>11</td>
<td>Security, sensors, alert systems and geo-fencing system for National Fiber Optical Transmission Network</td>
<td>To safeguard Fiber as a critical national Infrastructure to ensure immediate resolution of and remediation of issues including outages and possible Physical damages.</td>
</tr>
<tr>
<td>12</td>
<td>Development of data protection standards</td>
<td>An established ecosystem &amp; levels of information security for all related Infrastructure and critical Installations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Provides an alignment to International Data Standards (GDPR) which ensures international cooperation.</td>
</tr>
<tr>
<td>13</td>
<td>Continuous risk assessment of critical assets</td>
<td>The result is an ICT Infrastructure that has an understood risk posture that is updated, documented and acceptable.</td>
</tr>
</tbody>
</table>
### Table 6: Infrastructure Security Project Activities

<table>
<thead>
<tr>
<th>#</th>
<th>Infrastructure Security Project Activities</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>Develop ICT infrastructure security policy.</td>
<td>Defined Governance structure for Infrastructure security. The is an ICT Infrastructure that has an understood risk posture that is updated, documented and acceptable to risk owners.</td>
</tr>
<tr>
<td>15</td>
<td>Develop a cybersecurity strategy</td>
<td>A high-level Government’s commitment to cybersecurity, protection of Critical Information and leadership.</td>
</tr>
</tbody>
</table>
3.4 HUMAN CAPITAL

The development of quality ICT human resources is a prerequisite to the development of a viable ICT sector. It ensures that ICT development, implementation and exploitation are an integral and sustainable component of development. While the Government and the private sector have been investing heavily in the ICT infrastructure there has comparatively been little investment in the human resources required to design, develop and operate this infrastructure and the associated e-applications. With the increasing sophistication of ICT Infrastructure and its applications, high-end skill sets are increasingly required, and availability presents a challenge of achieving the vision of this ICT Infrastructure Master Plan.

The local universities and tertiary colleges continue to develop ICT human capital and workforce that is neither guided by a human resource development policy nor well aligned to the industry needs, especially at the high end. This Master Plan suggests mechanism for developing and sustaining high-end talent by removing the skills gap between industry requirements and the capabilities of the local workforce. This includes reducing the need for foreign expertise in ICT projects, retaining current high-end talent, and creating a mechanism for effective skills transfer and training. High-end skills set that are found in ICT professionals are ICT projects managers, network engineers, network administrators, system administrators, application developers, Security information system analysts and Data Center expert who manage complex system design, development, and integration.

Some of the challenges experienced in Human capital Development include the following:-

a) Lack of adequate funds especially for the highly specialized skills
b) Non-alignment to the industry needs by the universities/colleges ICT human development programmes

c) High training costs for highly specialized ICT skills
d) Dynamic nature of the ICT industry that requires continuous training

3.4.1 OBJECTIVES, STRATEGIES AND DESIRED OUTCOME

3.4.1.1 Objectives

1) Develop ICT Ready Workforce
2) Increase digital literacy of Citizens
3) Building capacity of ICT Authority
4) Develop a critical mass of local high-end ICT skills

3.4.1.2 Strategies

Strategy S1: Implement awareness programs on the role of information and ICT for quality life.

Strategy S2: Build technical and leadership capacity in ICT Authority. It will be necessary to develop and implement a staff development program for professional ICT staff and a leadership and management program for all ICT Authority senior managers

Strategy S3: Competitive and strategic recruitment against ICT Authority Organizational structure

Strategy S4: Institutionalize a performance evaluation system at all levels of ICT professional staff

Strategy S5: Institutionalize Constituency Innovation Hub for ICT high end skills development and scholarship program

Strategy S6: Collaborate with the Commission of University education (CUE) and Industry to strengthen ICT degree programs in all Kenyan Universities. A pre-requisite for high-end ICT professional development is good ICT degree programs. Although there is a large number of an ICT graduate, local industry has complained about the quality of entry-level ICT employees from the universities as earlier noted.

Strategy S7: Review the terms of service of ICT staff and make them competitive. These terms should be reviewed to make working at ICT Authority comparable to working in leading public parastatals.
Strategy S8: Establish and operationalize a section to be in-charge of planning, designing and costing of ICT infrastructure projects at the ICT Authority.

3.4.1.3 Desired Outcomes

The master plan seeks to improve the ICT human capacity in Kenya with the following outcomes by 2029:

a) Availability of sustainable local high-end ICT skills to meet the needs of the industry
b) Adequate workforce to transform and innovate business using ICT
c) ICT literate population capable of exploiting ICT products and services for improved quality of life.

3.4.1.4 Programmes/Projects

a) Increase digital literacy of citizens through Ajira programme and Innovation hubs
b) Competitive and strategic recruitment of ICT Authority staff
c) Develop and implement a staff development program for professional ICT staff and a leadership and management program for all ICT Authority senior managers.
d) Institutionalize a performance evaluation system at all levels of ICT professional staff

3.4.1.5 Project Activities

- Training programmes for staff at all levels (technical, Supervisory & managerial)
- Implement and Research & Development Center at the ICT Authority
- Partnerships and collaboration with training institutions on technical capacity development in ICT infrastructure
CHAPTER 4.0

4.0 IMPLEMENTATION FRAMEWORK

4.1 RESOURCE MOBILIZATION

Achieving the vision of the national ICT infrastructure Master Plan will require the mobilization of significant financial and human resources. Funding of the flagship projects in this Master Plan will come from the national and County Governments, development partners and other public or private institutions through Private Public Partnerships (PPPs) and collaborations.

1) **Government**: In 2018/2019, Government of Kenya allocated KSH 28.7 Billion which is 1% of overall government budget. This will need to increase and be reallocated based on planned priorities. Due to financial limitations in public it is essential to develop innovative funding mechanisms to mobilize additional resources from other sources as outlined below:

   - Increase Government allocation on ICT to 5% of overall government budget as recommended in the national broadband strategy.
   - Use of Universal Access Fund to fund broadband roll-out in under-served areas, as recommended in the national broadband strategy.
   - Use of the equalization fund to fund ICT projects in marginalized counties.

2) **Commercialization of the infrastructure**: The already existing infrastructure will have a sustainability business model that will generate revenue, which will be used by government to fund this master plan and debt servicing.

3) **Private sector**: Development of suitable incentives and tax breaks to private sector both within and outside the ICT sector to fund the Master Plan projects. The incentives may include; Development of special Purpose Vehicles/ Private sector Consortiums and Public Private Partnership.

4) **Development Partners**: Government will leverage on funding from development partners who prioritize ICT as an enabler of social economic development. The flagship project in this ICT Infrastructure Master Plan will form the basis of this engagement. The funds may be on the following engineering procure and construct (EPC) or Build Operate and Transfer (BOP)
5) **Capital markets:** This needs to be developed to support the issuance of relevant instruments (such as ICT infrastructure bonds), which are considered to have investment grade credit rating. The national broadband strategy recommends Kes 70 billion broadband infrastructure bond to fund broadband strategy implementation.

### 4.2 Sustainability

Sustainability is the ability of an organization to continue its mission or programmes/Projects far into the future. All projects have to end eventually, but the project impact should continue and last for a longer period.

A project can be sustainable in three main categories: organizational, financial, and community sustainability.

The Sustainability of ICT infrastructure will be ensured through the following among others:

- Commercialization of ICT infrastructure
- Implementation of IT Charge back for all ICT infrastructure services
- Partnering with other government agencies on Capital Expenditure sharing cost to enhance last mile connectivity
- Annual Maintenance Contracts, Support and qualified technical staff

### 4.3 Social and Environmental safeguards

Environmental issues may present themselves as temporary or permanent changes to the atmosphere, water, and land due to human activities, which can result in impacts that may be either reversible or irreversible. Social issues may emerge in the workplace of a client’s/investee’s operations and may also impact surrounding communities. A client’s/investee’s performance in the areas listed below can represent environmental and social risks to the operation

**Adverse/Negative Impacts and Mitigation**

<table>
<thead>
<tr>
<th>IMPACTS AND RISKS</th>
<th>MITIGATION MEASURES</th>
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<tbody>
<tr>
<td>Terrestrial Habitat Alteration</td>
<td>• Activities be limited to the existing transport corridor, whenever possible:</td>
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<tr>
<td>Terrestrial habitats may be altered</td>
<td>• No construction activities to be undertaken during the breeding</td>
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<td>primarily during the construction</td>
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<td>depending on the type of</td>
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Potential adverse impacts may result from a number of activities such as vegetation clearing, trending and increased human traffic along previously undeveloped land.  

| **Soil Erosion and Sedimentation** | • Early installation and regular maintenance of drainage and diversion structures, silt traps, etc, drainage into vegetated areas if possible, vegetation along watercourses and drainage lines to be retained if possible.  
• Retention of topsoil for restoration (including tilling and revegetation) as soon as practicable.  
• Removed soil from trenching operation shall be used for backfilling.  
• Careful planning of timing of works (overall duration and seasonality specially avoiding works during the rainy season if possible).  
• Clear demarcation on project drawings of vegetation to be affected.  
• Minimization of cleared areas and soil disturbance, with revegetation as soon as feasible with species adapted to local conditions when applicable.  
• If the surface to be intervened is small, protection of erodible areas with mulch, and planting with protective vegetation once works are finished: preferable, execution of works during the dry season.  
• If the surface to be intervened is large, presentation of an adequate erosion and sedimentation control plan, specifying type of device to be applied, installation sequence and location: preferably, execution of works during the dry season. |
| **Water and Soil Pollution, and Landscape Degradation** | • Train personnel on waste handling and segregation. |
Trenching and Vegetation clearing may create exposed sites. Sediment-laden runoff from cleared could impact water quality of downstream watercourses. Release of hazardous substances associated with construction and maintenance activities or with transport materials (e.g., accidental spills and leaks), may lead to soil, surface or groundwater contamination. Inefficient waste management during construction and maintenance activities may lead to inadequate disposal of solid (domestic and construction) and liquid wastes that may pollute soils and watercourses, and visually degrade natural and man-made landscapes.

| Segregated waste storage containers with appropriate signs (hazardous or non-hazardous) shall be provide at construction sites. |
| No garbage, refuse, oil waste, fuel waste oil or removed/excess materials (e.g., asphalt, sidewalks, metal scrap, etc.) shall be discharged into drains, onto site grounds, natural areas or watercourses. |
| If feasible, reuse of removed/demolished materials (e.g., banded area with impervious polyline or similar) for both new and waste fuel, oil and hazardous materials to prevent and contain any spillage and leaks. |
| Prompt removal and safe disposal of soil contaminated with hydrocarbons. |
| Hazardous and oil waste shall be collected and disposed by NEMA licensed waste handlers. |
| Implementation of hazardous materials handling and control procedures (e.g. identify chemical products and store in storage area with restricted access, keep track of movement of each chemical, etc.) |
| Maintenance and cleaning of vehicles, trucks and equipment should take place offsite and prohibition of vehicle washing in watercourses. |
| Toilet facilities shall be provided for construction workers to avoid indiscriminate defecation in nearby bush. See soil erosion above for control of water pollution due to released sediments from disturbed construction sites. |

**Air Pollutions**

Dust and exhaust emissions from construction activities, and movement of constructive vehicles and trucks may affect human health.

| Whenever dust generation at construction sites becomes a problem, water spraying to suppress dust shall be undertaken. |
### Noise and Vibration

Use of earth-moving equipment and heavy vehicles may generate noise and vibration. Excessive noise can be a nuisance to local communities and business. In addition, noise may affect wildlife when optical fiber cables is laid in close proximity to natural areas. Vibration from compacting trenches may crack walls of structures adjoining work sites.

- Contractors shall implement best driving practices when approaching and leaving construction sites to minimize noise generation created through activities such as unnecessary acceleration and breaking.
- Strict control of timing of activities within authorized working hours, including banning work at night.
- Minimize noise levels and vibrations (e.g. sound insulation, select equipment with lower sound power levels, install acoustic enclosures for equipment, install suitable mufflers on engine exhaust and compressors components).
- See also air pollution above.

### Traffic Congestion, Creation of Hazardous Driving Conditions and Obstruction of Access

Potential traffic congestion, creation of hazardous driving conditions and obstruction of access to homes, businesses and community services during trenching and cable operation.

- Trenching across roads, and construction vehicles and trucks movement shall be scheduled during general traffic off-peak hours to avoid traffic congestion and hazards/
- Employ safe traffic control measures, including temporary road signs and flag persons to ward of dangerous conditions, and traffic diversions.
- Only experienced and trained drivers/operators shall drive/operate construction vehicles, trucks and machinery.

### Interruption of Water, Telephone or Internet Services

Excavation and removal of materials (pavement, sidewalks, soil etc.)

- Undertake a joint survey together with telecommunications technical personnel, construction personnel, and all affected individuals to inform...
required for the laying of optical fiber cable may accidentally rapture pipes, lines and cables, which will result in the interruption of services until affected infrastructure is repaired.

on the selection of the appropriate installation method, most efficient route, property issues and rights-of-ways, identification of existing facilities and where applicable, identification of fiber splice points and land mark references,

- Define on the final route map the depth at which the cable is to be buried. Mark on the route path with identification stakes or labels printed with the infrastructure owner details to caution the public and demarcate and properly secure points where manholes are to be placed.

- Trench excavation within a market center or a township shall only be done after verifying that all utility lines (water pipes, electric cables and sewer lines) in the area are marked and known. All reasonable steps necessary must be taken and special consideration given to water, electricity and sewer systems within the area that cannot be located accurately.

- Where damage has occurred of existing infrastructure while undertaking underground cable works, the license shall immediately inform the affected owner and suspended the ongoing work until the matter is resolved.

- The work team must place barriers along the trench area, to warn people of “Dangerous Trench” as required by current laws, during excavation works. The work team must place large and visible WARNING signs to warn road users and pedestrians of “Excavation Works” along the cable route. All open concrete pole holes must be guarded with red/white barrier tape to warn local community of possible hazard. Trenches should be
backfilled as soon as possible and to the original state.

- If the excavation must remain open or the road will be otherwise obstructed during the night or under low-visibility conditions, reflective road signs shall be complemented by lighting devices of the colour, shape and size stipulated by the Kenyan traffic code, and

- The OFC cables shall be laid as stipulated in the plan but any deviation to this rule, due to technical or practical reasons must be documented and authority to do so given by ICT Authority. This is to avoid disputes or fights with the local community - to avoid injury or damage to the cable and equipment.

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<th>Solid Waste</th>
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<td>A significant amount of solid waste will be generated during the construction phase through clearing of vegetation and excess soil, excavations and wastes from the construction materials, some which may be electronic waste. Adequate measures to manage this solid waste onsite should be adopted and implemented including working with NEMA and county government licensed waste handlers.</td>
<td>Waste generated by the project from excavation shall be re-used for backfilling and landscaping. Solid wastes that cannot be recycled or reused shall be segregated to source into e-waste, hazardous and non-hazardous waste then disposal conducted through NEMA licensed solid waste handlers.</td>
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<th>Biosecurity</th>
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<td>The fiber optic cables will need to be imported as there are not locally manufactured in Kenya. Imported cables and equipment can harbour plant and animal species which may pose a threat to Kenya's biodiversity and ecosystem.</td>
<td>All materials and equipment must be fumigated and official certificates issued prior to arrival in Mombasa to ensure no plant or animal pests are accidentally introduced. On arrival at the Port of Mombasa, the materials and equipment must be inspected by Kenya Plant Health Inspectorate Service &quot;KEPHIS&quot; to protect from pests, weeds and invasive species.</td>
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<th>Occupation Health and Safety Hazards</th>
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<td>Occupational health and safety hazards are anticipated during&gt;</td>
<td>Conduct a risk assessment of site safety hazards, and design and implement measures specific to identified hazards.</td>
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Trenching operations for laying of optical fiber cable. Installation of equipment at existing ICT sites to expand capacity and improve efficiency. Installation of equipment on some overhead power transmission lines to create backup routes for fiber cables using existing Optical Ground Wires on transmission lines. Construction of telecommunications compounds and other physical structures. Optical fiber installation activities may also pose a risk due to the presence of flammable materials in high-powered laser installation areas.

- Train workers on safe work practices and conduct toolbox talks.
- Provide and enforce use of adequate Personal Protective Equipment (PPE) on site including, as applicable, hard hats, overalls, high-visibility vests, safety boots, gloves etc.
- Put a system in place to track respond to accidents, incidents, near misses and fatalities.
- Except for areas secured by fencing, all active construction areas shall be marked with high-visibility tape, in particular open trenches, to reduce the risk of accidents involving workers, pedestrians and vehicles.
- All open trenches and excavated areas shall be backfilled as soon as possible after cable laying and construction has been completed.
- Implement good construction site-housekeeping and control access to active construction sites.
- Clear signage shall be used at construction sites.
- For risk of permanent eye damage due to exposure to laser light during cable connection and inspection activities.
  - Train workers on specific hazards associated with laser lights.
  - Prepare and implement laser light safety management procedures.
- For risk of microscopic glass fiber shards penetrating human tissue through skin or eyes, or by ingestion or inhalation/or
  - Train workers on optical fiber management.
  - Prepare and implement optical fiber management procedures
  - Avoid exposure to optical fibers through use of protective clothing and separation of work and eating areas.
- Proper disposal of microscopic fiber glass as a result of splicing
  - For risk of fire due to the presence of flammable materials in high-powered laser installation areas/
    o Same as above
    o For risks associated with contact with live power lines
    o Allow only trained and certified workers to install electrical equipment.
    o Deactivate and properly ground live power distribution lines before work is performed on or in close proximity to the lines.
    o Ensure that live-wire work is performed by trained workers with strict adherence to specific safety and insulation standards.
    o Workers not directly associated with power transmission and distribution activities that are operating around power lines shall adhere to recognize standards and guidelines relating to minimum approach distances for excavations, tools, vehicles, pruning and other activities.
    o Measures to prevent, minimize and control injuries related to electric shock must also be developed and implemented.
- For physical hazards due to falling objects when performing elevated and overhead work /
  o The area around which elevated work takes place shall be barricaded to prevent unauthorized access. Working under other personnel shall be avoided.
  o Hoisting and lifting equipment shall be rated and maintained, and operators shall be trained in their use.
Equipment and fall protection measures shall be used and implemented by individuals.

Ladders shall be used according to pre-established safety procedures (proper placement, climbing, standing, use of extensions).

- For risk of fall when working at elevation/
  - Implementation of a fall protection programme that includes techniques and use of fall protection measures, inspection, maintenance and replacement of fall protection equipment and rescue of fall-arrested workers among others.
  - Establishment of criteria for use of 100 percent fall protection (typically when working over 2 meters (m) above the working surface). The fall protection system should be appropriate for the tower structure and necessary movement, including ascent, descent and moving from point to point.
  - Installation of fixtures on tower components to facilitate the use of fall protection systems.
  - Provision of adequate work-positioning device system for workers. Connectors on positioning systems should be compatible with the tower components to which they are attached.
  - Safety belts shall be of not less than 16 millimeters (mm).
  - Ropes should be 5/8 inch (1.6 cm) in diameter, tow-in-one nylon or material of equivalent strength. Rope safety belts should be replaced before signs of aging or fraying of fibers become evident.
When operating power tools at height, workers shall use a second (backup) safety strap.

- For risks associated with confined spaces when performing manual boring operations
  - Develop and implement confined space entry procedures, including:
    - Require work permits for all confined space entries, install appropriate access controls for non-permitting personnel, use ventilation and oxygen/explosive level detection and alarm equipment prior to access.

See also traffic congestion, creation of hazardous driving conditions and obstruction of access above.

<table>
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<tr>
<th>Partial Loss of Productive Assets, and Temporary Limitation of Access to Commercial and Institutional Establishments, and to Residential Properties, Excavation and backfilling operations required to install underground optical fiber cable may, Impact partially agricultural crops and fruit trees, as well as ornamental vegetation. Temporarily impede access to commercial and institutional establishments and to residual buildings.</th>
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<tr>
<td>• For the partial impact on agricultural fields and areas with ornamental vegetation and fruit trees, implementation for compensation measures for affected parties in accordance with the Resettlement Policy Framework enclosed as Annex XI.</td>
</tr>
<tr>
<td>• For the temporary limitation of access to commercial and institutional establishments, and to residential buildings, careful planning of construction activities to minimize duration of impact.</td>
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<tr>
<th>Community Health and Safety HIV/AIDS. The project may lead to migration of people (contractors and workers) from outside the local community in search of employment opportunities especially during construction. This influx of people in the project areas may lead to increase incidences of sexually transmitted disease which may exacerbate HIV/AIDS situation</th>
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<tbody>
<tr>
<td>• For HIV/AIDS mitigation</td>
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  - Conduct awareness campaigns on HIV/AIDS among the workers and the locals. This can be undertaken by the various NGOs and government agencies in the Counties. |
  - Erection of billboards to sensitize locals on the need to practice safe sex to help in the fight against HIV/AIDS. |
among the locals. A number of mitigation measures have been identified including awareness training (offered by the Ministry of Health, County Government and local NGOs) for foreign workers employing local laborers.

Gender-Based Violence (GBV). Men dominated the unskilled market in most project areas. Providing equal opportunities for women unskilled laborers may exacerbate existing households’ problems. Particularly, this is possible where the men have more limited resources and feel threatened by the additional income brought by the women. The fear of GBV, therefore, make women less free and comfortable to participate in development activities.

Conflicts with the local community. Projects of such magnitude usually attract public uproar especially from the local community if they are not involved in its implementation. Conflicts usually arise due to inadequate consultations with the local community, importation of unskilled labourers, livestock injuries due to uncovered trenches, destruction of grazing lands and non-provision of equal opportunities to women.

Internet User Safety< During stakeholders engagement and consultation, a concern was raised regarding the safety of users, It was noted that ICT Authority will have little or no influence over the safe use of the OFC by their clients. How will cases of fraud and cyber bullying, among others be handler?

<table>
<thead>
<tr>
<th>Mitigation Measures</th>
<th>Provision of free condoms</th>
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<tbody>
<tr>
<td>• For Gender-Based Violence Mitigation</td>
<td>• Establish multiples modes of communication and outreach for awareness raising to ensure outreach to women and girls,</td>
</tr>
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<td></td>
<td>• Creating and enabling environment for women participation by enlisting support of village elders and others respected and trusted by community,</td>
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<td>• Inclusive community meetings ensuring substantial presence of women or separate meetings for women required, and quotas for women beneficiaries of 50 percent in livelihoods support.</td>
</tr>
<tr>
<td>• For conflict with Local Community mitigation</td>
<td>• Consultation with the host community and relevant stakeholders on the mitigation measures proposed for the negative impacts.</td>
</tr>
<tr>
<td></td>
<td>• Offer women equal employment opportunities as men.</td>
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<td></td>
<td>• Utilize Area Chiefs and Ward Administration in the recruitment of local unskilled labour.</td>
</tr>
<tr>
<td>• Internet Security Assurance</td>
<td>• To assure internet security, to the extent feasible, ICT Authority should partner with Ministry of Information and Communication Technology (MoICT) to promote the safe use of internet through such methods as customer information campaigns which may include distribution of information at the time of...</td>
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</table>
customer service sign-up or by mail with billing information, or through public advertising campaigns.

4.3.1 E-WASTE

There’s an increasing level of cyber waste (or e-waste) which not only cannot biodegrade but is generally hazardous to the environment. Governments from the national to local levels, as well as international organizations, need to provide guidance and resources that require and encourage proper recycling and safe disposal of ICT waste. Many used items such as mobile phones and computers cannot always be easily recycled directly for reuse or refurbishing.

Government and industry cooperation can help manage e-waste costs and ensure sector-wide compliance with recycling mandates. The regulations would empower the government to investigate and prevent illegal waste dumping, including inspecting imported equipment to determine if it may be actually for sale and use, or is merely intended to be disposed of illegally within Kenya.

All e-waste emanating from ICT infrastructure shall be managed in accordance with the existing ICT Authority Standards, NEMA e-waste Guidelines, and EMCA act of 1999.
CHAPTER 5.0

5.0 MONITORING AND EVALUATION

Monitoring, evaluation and reporting will form a critical component for the successful implementation of this master Plan. It is meant to examine the link between the set priorities, corresponding budgetary provisions and the resultant outputs and outcomes over the plan period. It will provide the necessary feedback and enable management to make evidence-based decisions.

5.1 MONITORING AND EVALUATION FRAMEWORK

The framework provides details of roles and responsibilities which different departments and directorates will undertake in order for it to be operational. The framework also provides a standardized template for M&E reporting. The framework will assist in ensuring timely and successful delivering of services, projects and Programmes in line with the ICT master plan. The process will be continuous management process to factor in emerging issues during the period and for improved results. To this end, regular feedback to the stakeholders will be maintained. His will ensure early indications of progress or lack thereof in the achievement of the intended results at activity, output, outcome and impact level.

The monitoring framework will track actual performance against what was planned in the ICT master plan and will involve continuous collection and analysis of data as well as results and recommend corrective measures. The monitoring function will be:

- Results oriented to report on progress, output, outcome and strategic objective.
- Lesson learning oriented.
- Building the ability to predict about projects
- Building lessons and mitigations for the programme/project.

- Evaluation will include aiding the understanding of why and to what extent intended and unintended results are achieved and their impact on stakeholders. It will be important source of evidence for the achievement of the objectives as well as performance. It is also intended to feed into management decision making processes and make an essential contribution to planning, programming, budgeting, implementation and reporting cycle of master plan.
Finally, the M&E framework aims at improving the ICT Authority institutional relevance, achievement of desired results, optimization of available resources and at maximizing the impact of ICT Authority.

5.2 RESEARCH AND DEVELOPMENT

As Kenya seeks to transform into a digital economy with universally accessible and affordable broadband research and development will play a crucial part in the development of innovations to spur the digital growth. Science and technology keep changing and improving, therefore staying ahead means transforming these advancements into products or services that will contribute to improved quality of life and enhanced economic competitiveness. In light of this, the masterplan seeks to create an enabling framework for the advancement of R&D.

5.2.1 OBJECTIVES

- To stimulate a human workforce with advanced capabilities
- To develop a world class research with active local and international collaboration
- Create a strong Kenyan ICT brand, focusing on innovative solutions which address the needs of the developing world
- A shift from the traditional ICT economy to give greater emphasis to development, production and export
- A market-driven approach that addresses needs through innovative products, services and solutions
- Create effective mechanisms for technology transfer, from idea generation through to productive implementation (including export)
- Creation of state-of-the-art research infrastructure including sufficient and affordable bandwidth.
- Development of organizational and regulatory policy and other support infrastructure to govern the R&D process from generation to implementation

5.2.2 STRATEGIES

- Identifying and supporting key application and technology domains which contribute to improved quality of life and enhanced economic competitiveness.
- Implementing a supportive environment and funding mechanisms which allow young people to work under the leadership of experienced ICT professionals.
- Establishing research centers and partnership with academic institutions and other industry players
● Establishing networks of researchers and other role-players to collaborate in joint research locally and internationally.
● Supporting R&D initiatives that address identified socio-economic needs.
● Conducting regular road mapping to updates continuously update focus domains that are being supported.
● Setting national challenges to stimulate integrative R&D and inspire researchers and research groups.
● Developing and refining indicators and processes to assess the state of ICT R&D and innovation.
● Marketing and market development of R&D outputs and outcomes.
● Setting up an implementation framework for industry to use the outputs of R&D and innovation.
● Partner with other government institutions to develop Intellectual Property framework.

5.2.4 PROJECTS

● Establishment of a national ICT Research and Development center.
### Annex 1: BACKBONE (NOFBI EXPANSION) IMPLEMENTATION MATRIX

|     | 1  | 5  | 0  | 0  | 30 | 0  | 0  | 45 | 0  | 0  | 60 | 0  | 75 | 0  | 0  | 90 | 0  | 0  | 10 | 50 | 0  | 0  | 12 | 00 | 0  | 13 | 50 | 0  | 15 | 00 | 0  | 16 | 50 | 0  | 18 | 00 | 0  | 19 | 50 | 0  | 21 | 00 | 0  | 22 | 50 | 0  | 24 | 00 | 0  |
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Annex 2: LAST MILE IMPLEMENTATION MATRIX

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<tr>
<td>No</td>
<td>Projects /Programs</td>
<td>Objectives /Program</td>
<td>Expected outcomes/ Outputs</td>
<td>Performance Indicators</td>
<td>Time Frame</td>
<td>Total Budget (KShs Billions)</td>
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<tr>
<td>1</td>
<td>NOFBI Expansion to 30,000km</td>
<td>To improve access to ICT services</td>
<td>30,000 Km of fiber cable laid</td>
<td>No. of km laid</td>
<td>2018-2029</td>
<td>118</td>
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<td></td>
<td></td>
<td>Relevant and stable interconnected in MDA’s, Hospital, Police, Schools availed</td>
<td>No. of MDA’s, Hospital, Schools, Police etc with stable reliable connectivity</td>
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<tr>
<td>2</td>
<td>Last Mile Connectivity to 20,000Km and establishment of point of presence (No. 8)</td>
<td>To improve access to ICT services</td>
<td>20,000 Km of fiber cable laid</td>
<td>No. of km laid</td>
<td>2018-2029</td>
<td>60</td>
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<tr>
<td>4</td>
<td>Nairobi Metro to 4500 km and implementation of the active devices</td>
<td>Provide all the Government building with reliable connectivity</td>
<td>Reliable and stable interconnected in MDA’s,</td>
<td>No. of MDA’s,</td>
<td>2019-2029</td>
<td>17</td>
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<tr>
<td>7</td>
<td>Data center (Main, DR, Smart hub)</td>
<td>To Ensure continuity in Government operations</td>
<td>Data center and DR established</td>
<td>Percentage of establishment of a functional DRC</td>
<td>2019-2029</td>
<td>10</td>
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<td>8</td>
<td>Cyber Security Infrastructure</td>
<td>To reduce cyber-attack incidence</td>
<td>Secure Government Infrastructure</td>
<td>Percentage of cyber security initiatives implemented</td>
<td>2019-2029</td>
<td>10</td>
<td></td>
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<tr>
<td>9</td>
<td>Security Operation Centre</td>
<td>To reduce cyber-attack incidence</td>
<td>Security Operational Center</td>
<td></td>
<td>2019-2029</td>
<td>3</td>
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<td>10</td>
<td>Critical Infrastructure Bill</td>
<td>Provide and safe guide all the critical Infrastructure</td>
<td>Bill Creation</td>
<td>Pass the critical Bill</td>
<td>2019-2021</td>
<td>0.01</td>
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<td></td>
<td>Standards</td>
<td>To protect the customer from inferior goods</td>
<td>Standards review and dissemination</td>
<td>Revised Standards</td>
<td>2019-2020</td>
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<td>12</td>
<td>Data Protection Bill</td>
<td>Protect of Data and information</td>
<td>Passed Data Protection Bill</td>
<td>Pass the Data Protection Bill</td>
<td>2019-2021</td>
<td>0.01</td>
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<td>13</td>
<td>Cyber Security Bill</td>
<td>Protect the system, Data, Information for attacks</td>
<td>Restructured institutions</td>
<td>Cyber security Bill</td>
<td>2019-2021</td>
<td>0.01</td>
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<td>14</td>
<td>Second Gateway for sub marine cable</td>
<td>Redundancy of the Internet connectivity</td>
<td>Second cable at Mombasa</td>
<td>Second cable and 3T of capacity</td>
<td>2019-2022</td>
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<td>15</td>
<td>Activation of TEAMS to 100G</td>
<td>Improve on service</td>
<td>Activation to 100TEAMS</td>
<td>100G activated</td>
<td>2019-2022</td>
<td>0.5</td>
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<td>16</td>
<td>Maintenance</td>
<td>Improve on service</td>
<td>Comprehensiv e Repair and Maintenance plan</td>
<td>One broadband Connectivity Corrective and Preventative Maintenance</td>
<td>2019-2029</td>
<td>30</td>
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<td>17</td>
<td>Capacity Development</td>
<td>Improve on service</td>
<td>Capacity building plans</td>
<td>Train of 200 Staffs on security, Network, Fibre, Datacentre, Sub Marine cable</td>
<td>2019-2019</td>
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<td>18</td>
<td>M &amp; E</td>
<td>To monitor and evaluate implementation of projects</td>
<td>M &amp; E reports</td>
<td>No. of M &amp; E reports</td>
<td>2019-2029</td>
<td>0.3</td>
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TOTAL BUDGET (KSH BILLIONS) 250.84