REPUBLIC OF RWANDA

MINISTRY OF INFORMATION TECHNOLOGY AND COMMUNICATIONS

ICT SECTOR STRATEGIC PLAN

(2018-2024)

"Towards digital enabled economy"

NOVEMBER 2017

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ACRONYMS

DHS	Demographic and Health Survey
ECIV	Integrated Household Living Conditions Survey
EAC-BIN	East African Broadband Infrastructure Network
EDPRS	Economic Development & Poverty Reduction Strategy (I, &II)
FDI	Foreign Direct Investment
GCC	Government Command Center
GDP	Gross Domestic Product
GIS	Geographic Information System
GNI	Gross National Income
ICT	Information Communication Technologies
ICT4D	ICT for Development
ID	Identification
IoT	Internet of Things (IoT)
ITU	International Telecommunication Union
JICA	Japan International Cooperation Agency
KIC	Kigali Innovation City
KOICA	Korea International Cooperation Agency
LTE	Long-Term Evolution
MITEC	Ministry of Information Technology and Communication
MYICT	Ministry of Youth and ICT
NCIP	Northern Corridor Integration Projects
NCSA	National Cyber Security Authority
NCST	National Commission for Science and Technology
NIA	National Information Society Agency
NICI	National Information and Communication Infrastructure plan
NISR	National Institute of Statistics Rwanda
NST-1	National Strategy for Transformation (2017-2024)
OLPC	One Laptop Per Child
PKI	Public Key Infrastructure
RIF	Rwanda Innovation Fund
RISA	Rwanda Information Society Authority
SMAA	Social Media Awards Africa
SMEs	Small Medium Enterprises
SRMP	Smart Rwanda Master Plan (SRMP)
UR	University of Rwanda
WEF	World Economic Forum
3D	Three-dimensional
7YGP	7 Years Government Program
MIS	Management Information System

EXECUTIVE SUMMARY

The ICT sector is increasingly occupying an important position in the country's endeavor to achieve the targets associated with the National Strategy for Transformation & Prosperity, the Vision 2035 and 2050 goals. The Vision 2020 and the Smart Rwanda Master Plan laid out clear paths for the development of the Rwanda's economy by defining the goal of transforming the nation from agrarian into a knowledge driven economy. They set out policies and social initiatives to achieve that goal.

This ICT SSP leverage on principles set under the SRMP: Establishing a Service-oriented, Modern, Accountable, and Real-Time (SMART) Government that drives Rwanda's global competitiveness and job creation; Becoming a highly competitive, agile, open and innovative smart economy with the most favorable business climate that attracts large-scale investments, rewards entrepreneurship and enables fast growth and exports; and leveraging powerful ICT innovations such as Digital solutions, Internet of Things, Big Data and Analytics, Creative Industries and Multimedia, Mobility & Digital Lifestyle, Robotics, Block Chain, Artificial Intelligence and e-commerce.

ICT Sector shall continue to be a catalyst for rapid and sustained economic growth, equitable social development and employment creation. The ICT SSP has defined the following seven pillars: Smart Cities, Fintech, Smart-Agriculture, Trade& Industry, Health, Education, Government, Women and Youth Empowerment in ICT. Along with three redefined enablers: ICT Capability and Capacity Development, Smart Governance and Intelligent, and secured & shared infrastructures. Rwanda has been making significant investments in ICT infrastructure to improve productivity of the entire economy, reduce transaction costs and inefficiencies in the use of capital and labor. In order to achieve the maximum and optimal adoption of ICT across different sectors of the economy, the ICT Sector should achieve the universal access and wider usage of broadband in Rwanda through encouraging access to appropriate and affordable finance, hardware, services.

CHAPTER I. INTRODUCTION

1.1 Context and Purpose of the ICT Sector Strategic Plan

In 2000, the Government of Rwanda adopted the Vision 2020 with a primary objective of transforming Rwanda into a middle-income country by year 2020. In order to accelerate realize the Vision 2020; the Government formulated 7 Years Government Program in 2010. As the 1st 7YGP is coming to fruition, a new 7 Year Government Plan currently known as National Strategy for Transformation (NST-1) was adopted to ensure attainment of Vision 2020 and excel beyond the original Vision 2020 goals. The NST-1 will cover the period from 2017 to 2024.

In order to support the Vision 2020 and 7YGP, the ICT sector has been developing and implementing its own strategies and plans from the year 2000 that has been renewed and expanded with 5 years' cycle. The first National ICT Strategy, the National Information and Communication Infrastructure plan (NICI-I) focused on the vision setting and creating a conducive legal and regulatory framework. The NICI-II (2005-2010) focused on Infrastructure development and the third NICI (NICI 2010-2015) focused on utilization of ICT infrastructure which included service and private sector development. The fourth and the last 5 years NICI plan was evolved into Smart Rwanda Master plan (SRMP). The SRMP is the strategy currently being pursued with an overarching goal of transforming Rwanda into a knowledge based economy. This goal of SRMP is also aligned with the all 3 pillars of the NST-1 which is aiming at Economic, Social and governance transformation.

Smart Rwanda 2020 Master Plan drew its inspiration from the Smart Africa Manifesto that was launched during the Transform Africa Summit in October 2013 where prominent African Heads of State signed the SMART Africa Manifesto which aims to accelerate African development through ICT. The SRMP was adopted in 2015 and planned to complete its implementation by 20201.

This ICT SSP is based on the timeframe and initiatives of NST-1 which will be completed in 2024. This plan will complement and expand the SRMP and other national development plans and it contains 3 foundations: Economics transformation, Social transformation and Governance transformation. The SSP aims to achieve set of targets which will culminate Rwanda to fast track its path of continued socio-economic transformation.

The ICT SSP derives its initiatives from analysis and assessment of three key perspectives: 1) aligning national development vision and strategies for becoming upper middle and high income country respectively by 2035 and 2050, 2) reflecting the achievements of NST-1 initiatives and assessment of Rwanda's current internal and external environment challenges, and 3) current execution and management performance of the ICT sector.

1.2 Process and methodology of ICT SSP elaboration

The development of ICT Sector Strategic Plan has involved all efforts and commitments from all key ICT stakeholders with the guidelines of MINECOFIN.

The key elements of the methodology included the following.

Preliminary meetings with management of MYICT: This was aimed at agreeing upon the methodology, road map of activities and their respective time frame.

National consultation processes: MYICT (MITEC) organized different meetings to ensure that all stakeholders in the ICT sector had good participation in the formulation processes. These included key ministries and affiliated agencies of MYICT, Ministry of Finance and Economic Planning (MINECOIFN), Rwanda Development Board, JICA, the Rwanda Private Sector Federation ICT Chamber and its member companies, and others.

Through MINALOC, the local districts were also consulted to ensure that the districts' inputs were duly incorporated in the plan.

The draft plan was circulated among the stakeholders to seek further inputs into the draft document

Desk review: this method was used to review different pertinent government policy documents which include: VISION 2020, 7YGP NST-1, EDPRS (I&II), SRMP, ICT Joint Sector Review reports, ICT EDPRS Self-assessment report (2012), ICT Sector Progress Reports, Thematic studies/papers, various ICT programs and support documents, relevant statistical data such as EICV and DHS, etc.

A few EAC documents were also reviewed. These include EAC-BIN project documents and the EAC legal framework on cyber laws. Documents and studies from other development partners relevant to the ICT sector were also reviewed and inputs were made into the plan.

Situational Analysis: The situational analysis was conducted within the framework of monitoring and evaluation of different ICT programs and projects implemented. Furthermore, field visits were conducted which resulted in reports highlighting the situation of ICT integration from the local government to central government.

Quality assurance and review meetings: Quality assurance and review meetings were held to ensure alignment and integration of technical comments into the ICT SSP for finalization.

CHAPTER 2: OVERVIEW OF THE ICT SECTOR

2.1. Policy Context

ICT is both cross-sectoral tools as well as a sector in its own right. This cross-cutting characteristic is one of the main reasons why a coherent, harmonized and over-arching National ICT Strategic Plan is needed.

Signature initiatives such as SMART housing, SMART cities (optimal space utilization, connected cities, broadband, internet of things), Smart Village, are some of the key initiatives that will be implanted under the strategical plan. Moreover, the strategic Plan seeks to strengthen innovation ecosystem and wider ICT adoption to increase productivity and competitiveness throughout the society and to create "full and productive employment and decent work" for Rwandans both at the high value ICT and tech services/ industry and various different ICT enhanced/enabled sectors.

In order to attain long term developmental goals of Rwanda and Africa, such as the Sustainable Development Goals (SDG), Rwanda's Vision 2050 and African Union's common goals under the Agenda 2063, it is essential to maximize the power of ICT as a true enabler of socio-economic development.

2.1.1. Sector Analysis

Since the year 2000, Rwanda has gradually propelled the growth of its ICT sector through various national policies, plans and initiatives. As a result, Rwanda has made impressive progress in establishing telecommunications infrastructure and provision of telecom which resulted in a huge revenue generation since the businesses are well established. For example, the telecom sector in Rwanda has generated a total investment of 590.4 Billion RWF over the period 2001-2015. In the same period, the Government of Rwanda has aggressively implemented many ICT projects and initiatives to fuel the growth and development of its society and its priority economic sectors.

The ICT Gross Value Addition (GVA) for Rwanda's economy grew at an average of 21.1% annually over the period 2000-2015. A higher value of ICT-driven GVA implies an increasing share of the ICT sector in the national economy. The GVA of ICT sector has grown at a rate much faster than the other major sectors of the economy in Rwanda. For example, other sectors like agriculture, services and industry grew at an average of only 5.5 to 8 per cent annually over the same period. Within the ICT sector, Telecommunications remains the largest contributor to the ICT sector (~75 per cent). However, since 2006, the GVA of the ICT services industry has been growing at an average rate that is faster than the growth of the telecommunications industry.

During the period 2010-2015, ICT sector grew at an average rate of 15.3 per cent. Government was the major source of ICT budget allocation (83%) to public sector during the period 2011-16. External Grants & Loans constituted only around 15% of the total funding related to ICT during the same period.

2.1.3. Alignment between ICT sector outcomes and NSTP-1 priority areas

NST-1 Pillar	NST-1 Priority Area[1]	ICT SSP Outcome
Economic Transformation	Create 1.5m (over 214,000 annually) decent and productive jobs for economic development	Vibrant, competitive, and innovative ICT private sector established
	Establish Rwanda as a Globally Competitive Knowledge-based Economy	Kigali innovation city and national ecosystem operationalized
	Promote Industrialization and attain a Structural Shift in the export base to High-value goods and services with the aim of growing exports by 17% annually	Enabling ICT platforms developed for productivity
	Increase Domestic Savings and position Rwanda as a hub for financial services to promote investments	Long-term savings and innovative financing mechanisms created and operationalized
	Accelerate Sustainable Urbanization from 17.3% (2013/14) to 35% by 2024	Vibrant Smart Cities created and sustained
Social Transformation	Moving towards a Modern Rwandan Household	Empowered and transformative digital communities fostered through improved access to information and services using ICT
Transformational Governance	Strengthen Capacity, Service delivery and Accountability of public institutions	Government operational efficiency and citizens satisfaction improved
		High quality ICT skills leveraging Knowledge based Economy Developed
		Rwanda's cyber space, critical national infrastructure, and information assets made secure

Table 2.1: ICT sector outcomes and NSTP-1 priority areas

2.3. ICT Sector Status, Achievements and Challenges

2.3.1 Key sector status and achievements (2010-2017)

Since the inception of the 7-year Government Program in 2010, several achievements have been registered by the sector in areas related to ICT infrastructure, service development, business and investments, cyber security, global partnerships, among others. Some of the ICT sector achievements over the period 2010 -2017 were as following:

Internet Penetration in Rwanda is increasing steadily. For instance, internet penetration increased from 7% in 2011 to 39.76% mid 2017.

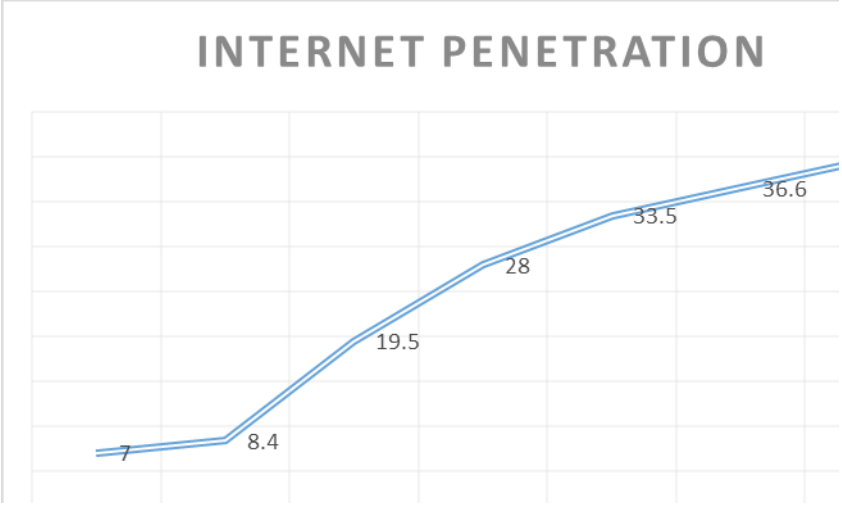


Figure 2.1: Internet penetration

While mobile increased from 639,673 to 9.7 million over the period 2010 -2017.

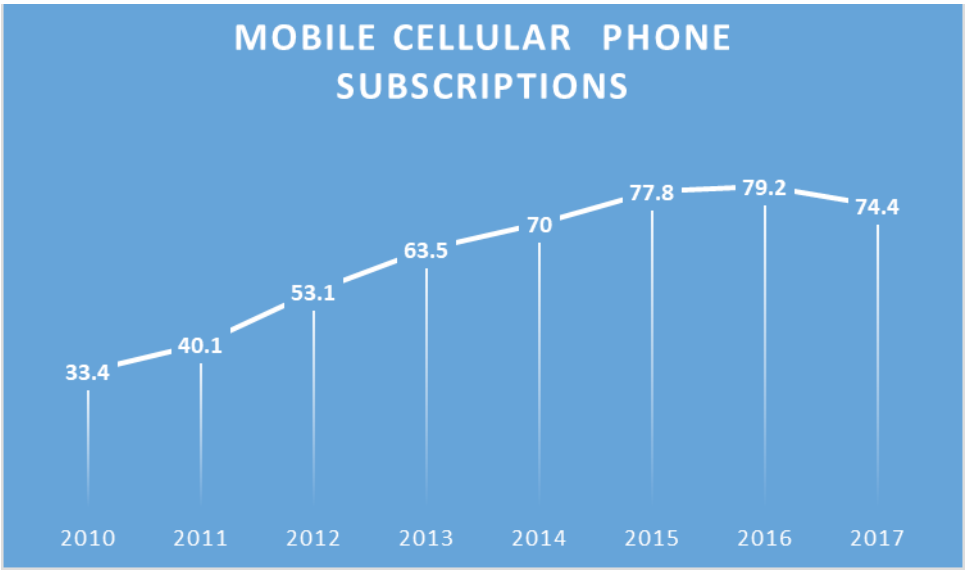


Figure 2.2: Mobile cellular phone subscriptions

Over the last decade and half, the Gross Domestic Product of the ICT sector in Rwanda has been growing at a median rate of 15.3% (NISR,2016). Mobile Money subscribers across all mobile network operators have reached 9,735,694 (2016) from 639,673 (2011) with the total mobile payments value of transactions equivalent to 1,040 billion Rwandan francs from 51 billion Rwandan francs for the same period.

For ICT infrastructure, there had been substantial public investments in infrastructure development such as national and metropolitan fiber networks which has been open to the private enterprises to facilitate creation of enhanced services and private sector investment in the field of ICT. Under the scheme, many of the signature critical national infrastructures were built. Fiber optic backbone of 4000kms has been laid across Kigali, districts and border posts. National Data Centre that provide facility for centralized and secure data warehousing and spurring new generations of on-demand ICT enabled services while reducing IT related costs especially in equipment, human resources and related infrastructure. E-Government portal which provide over 69 (as of 2017) Government services online which is providing better services to the citizens while improving Government efficiency,

Rwanda's strong push for ICT usage and corresponding investments are evident in the Global surveys and researches. According to the Global ICT Development Index (2016) compiled by ITU, Rwanda was ranked 150th out of 175 countries. The WEF Network Readiness Index (2016) ranked Rwanda at the 80th place out of 139 countries. The UNDESA e-Government Index (2014) placed Rwanda at the 138th out of 193 countries.
Although some key statistical data used for ranking Rwanda were not up to date to reflect current situation, these data confirm the Rwanda's strong commitment in the ICT led development and its resolve to position itself as the African ICT and innovation hub in order to truly establish an information society and to create capacities and services necessary to achieve the Rwanda's economic objectives, however, these ICT gains need to be sustained and expanded further. Moreover, concerted strategies, plans and policies are needed in the area of to accelerate broadband access and uptake of ICT usage by all citizens.

2.3.2 Challenges

Rwanda has made impressive strides over the years towards ICT development and developing ICT as a crosscutting enabler for the development of other sectors. However, many challenges remain and more efforts are need, especially in the following areas.

1. **Low digital literacy rate:** currently**,** the computer literacy is at 8.4% and citizens' lack of skills to use smart devices to access digital services without depending on agents as intermediaries should be addressed.

Over time. Massive investment should be made to furnish digital skills and empower citizens in digital literacy to allow consumption of ICT enabled services.

2. **Limited budget allocated to ICT:** many ICT projects require considerable upfront investment which would be difficult to acquire from the Government.. An approach has been taken to encourage private sector investment to fulfill the gaps.
3. **Limited local contents and local hosting:** there is limited production of local content that translates into limited services for citizens. The content available is not translated into local language that can be understood by wider citizen. The cost for hosting in Rwanda is still high and companies are hosting their contents abroad. As a remedy, a focus has been undertaken to encourage more investment to increase local contents creation and hosting by providing various incentives.

4. **Low Broadband Internet penetration (Usage):** Internet penetration rate in Rwanda stands at 39.76% (May 2017) and there is high geographical divide. The weak penetration rate is attributed to, high cost of Internet, lack of awareness by the citizen, lack of local content and services in local language, weak telecommunication infrastructure in rural areas, and small numbers of digital literate citizens to utilize the Internet.

5. **High attrition rate of SMEs start up:** Small and Medium Enterprises (SMEs) constitute 97.8% of the private sector in Rwanda. They are an important vehicle to address the challenges of job creation, sustainable economic growth, equitable distribution of income and the overall stimulation of economic development. However, new SMEs startups suffer from a high failure rate in Rwanda. Their failure are due to both internal and external factors. Internal factors include lack of management experience, lack of functional skills and poor marketing research development and poor attitudes towards customers. External factors include non-availability of friendly financing mechanisms, high cost of distribution, competition, and rising costs of doing business.

   Once the Rwanda Innovation Fund is operationalized, it will occupy a critical part of the financing value-chain, starting at the early stage of growth and nurturing companies through growth stage till initial public offering (IPO). Growth of the ecosystem will be measured in terms of the number of new technology companies and how successfully they become. It will be achieved through strengthening start-up friendly innovation ecosystem with variety of key success components which include locally domiciled innovation-friendly financial capital that support technology companies through all stages of growth.

6. **Low device penetration (smart phones, tablets and PCs):** Smart devices such as computers and smart phones are relatively expensive compared to rural citizens' disposal income. As a solution, several financing schemes are being explored with partnership of private sector device vendors. In addition, operationalization of the POSITIVO PC production in Rwanda is boosting the device penetration

7. **Low electricity penetration:** with only 27% of electricity penetration, ICT service provision in the rural areas continues to be a major challenge. A partnership with Rwanda Energy Group is being explored to prioritize electrifying public sites to facilitate ICT services delivery but promotion of more off-grid electricity solutions are needed to expand ICT penetration in the rural areas.

8. **Maintenance of Information and data assets:** As Rwanda is moving forward with its digital transformation, data and information are generated. However, these data and information are not harnessed efficiently. As Open Data policy is implemented, adequate resources should be allocated to encourage effective data maintenance and utilization.

2.4. Institutional overview of the sector

2.4.1. ICT Sector Stakeholder analysis

An important precondition in the implementation of the National ICT Strategic Plan is that there should be constant and meaningful dialogue and strong partnership between Government and stakeholders. This strategic plan is the result of country's effort to harmonize, co-ordinate, and integrate all ICT initiatives towards achieving overall objectives of National Strategy for Transformation and Prosperity (NST-1).

For the successful attainment of the strategic objectives, it is imperative that all partners and stakeholders of the ICT sector integrates as a community and move forward in the same direction. Following table indicates key stakeholders active in the ICT sector and their roles:

#	Stakeholder	Responsibilities
1	MITEC	Address national priorities for economic growth and poverty reduction through the development and coordination of national policies related to Information & Communication Technology policies.
2	RISA	Implement national Information and Communication Technologies (ICT) policies and programs in order to fast-track socio-economic growth.

3	RURA	Grant licenses, monitor and enforce license obligations, manage scarce resources, advise policy makers on ICT related issues and represent Rwanda in international organizations on issues pertaining to ICT.
4	NCST	Provides strategic advices and recommendations to the Government on all matters relating to policies, legislation and regulation in the fields of science, technology, research and innovation and monitor the implementation of such policies and legislation.
5	RDB	Addresses the needs of ICT companies of all sizes and both local and foreign investors
6	IPOSITA	Provides postal services, which will contribute to the social and economic development of Rwanda as well as to ensure continued universal service
7	TELECOM OPERATORS	Provide voice and data, and various value added (including financial) services
8	PSF ICT CHAMBER	Creating career paths through skills development, especially among the youth, Stimulating entrepreneurship and competitiveness, Driving and protecting investments and innovation, Promoting export of ICT products and services, Becoming the arbitrator of the ICT sector
11	DEVELOPMENT PARTNERS	Work with the GoR to achieve Socio-economic development of Rwanda, particularly using ICT and developing the ICT sector
11	MINISTRIES	Formulate appropriate policies, strategies and provide the necessary legal framework for the development of ICT and its optimal use across all sectors
12	DISTRICTS	Implement and provide enhanced services to the citizens through ICT
13	PROFFESIONAL CERTIFICATION INSTITUTIONS	Provide professional education to ensure high level of qualification amongst ICT professionals.
14	ACADEMIC INSTITUTIONS	Provide education at various different levels to create new generations of skilled personnel (ICT education provided from primary to Post Graduate level)
	CIVIL SOCIETIES	Implement various different ICT capacity building and advocacy initiatives to strengthen Rwandan human resources in the area of ICT

Table 2.2: ICT Sector Stakeholder analysis

CHAPTER 3: THE STRATEGIC FRAMEWORK

3.1 Mission of ICT Sector

The mission of ICT Sector is to address national priorities for Rwandan society and modernizing the economy using ICT as an engine for accelerated development and economic growth, national prosperity and global competitiveness

3.2 Vision

The vision of ICT Sector in Rwanda is to help Rwanda's Economic transformation, Social transformation, and transformational Governance while becoming the "Leading ICT Hub in Africa."

3.3 Objectives

3.3.1 Overall objective and specific objectives

The overall objectives of the sector stems from Smart Rwanda Master Plan which aims at fast tracking Rwanda's transformation to a knowledge-based society. Its key objectives include the following:

- **Broadband for all by 2024:** Broadband is considered "basic need" for all Rwandans. This shall be realized promoting "Broadband as utility"

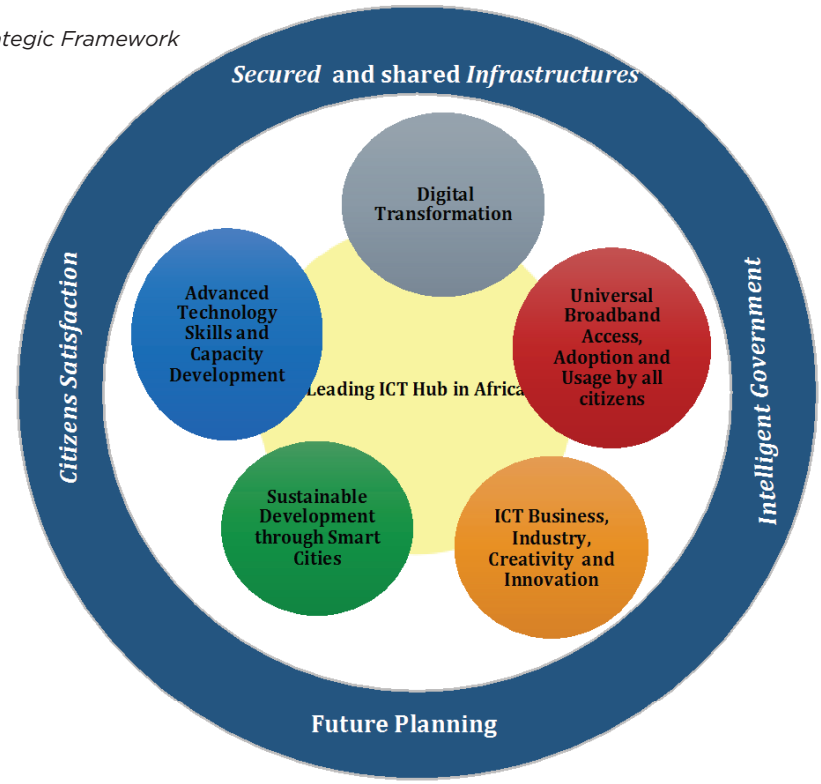
- **Government Digital Transformation by 2024:** Government should be able to serve people 24 hours a day. With a plan to conduct all essential Government transactions online, it will be possible to provide ubiquitous Government services and achieve effective and efficient Government to Business, Government to Citizens, and Government to Government interactions.

- **Digital Literacy for all :** Rwanda is determined to become a knowledge based economy. Everyone in Rwanda, regardless of their socio-economic-political stature, needs to be digitally literate to transform their lives and contribute to the society.

3.3.2 Contribution to NST-1 and Strategic Orientations

The following figure summarizes key strategic orientations and the overall environment needed to achieve the vision and NST-1 targets:

Figure 2.3: ICT Strategic Framework



- Apply innovative approaches for implementation
- Leads to job creation
- Focus on digitizing economy and position ICT enabled services and products as one of the key exports of the country
- Contributes to the operationalization of the Smart Africa initiative that Rwanda spearheads.
- Retain flexibility to take advantages of technological advances
- Create strong ecosystem for increased private sector growth and participation

3.3.3 ICT Priority areas

3.3.3.1 Key areas and foundations

The ICT strategic plan will strive to achieve the following key areas and foundations defined under SRMP:

Rwanda, the Leading ICT Hub in Africa: Position Rwanda as Africa's leading ICT hub by 2024 through leveraging leadership in such areas as Smart Cities, Smart Africa Alliance, Funding mechanism for Innovation and ICT businesses, and a strong ICT Innovation ecosystem

- **Universal broadband usage by all:** All Rwandans shall have access to broadband connectivity as a basic utility and right. Citizens shall fully adopt and use the Internet in their daily life.

This shall be realized through increased access to high speed Internet to through aggressive expansion of last mile and household connectivity and smart device penetration. Efforts shall also be made to transform Rwanda into a digitally literate nation, targeting all citizens to utilize expanded broadband access.

- **Creative and innovative ICT sector:** nurturing a vibrant and innovative ICT sector is essential to spearheads the economic growth Harnessing opportunities for Foreign Direct Investment in the ICT sector with such projects as Kigali Innovation City must be prioritized. In the same token, nurturing homegrown ICT businesses with innovative solutions and products to promote "Zero kg export" will be strengthened through creating conducive innovation ecosystem.

- **Sustainable Development through Smart Cities:** The country will strive to create sustainable and SMART cities and villages through three main pillars: 1) smart governance and planning, 2) smart and efficient service and utility delivery, and 3) localized innovations to achieve social and economic development. .

- **National Digital Transformation:** Rwanda's digital transformation will continue to base itself on seven (7) pillars and three (3) enablers set by SMRP. The seven SMRP pillars are: Agriculture, Finance, Trade and Industry, Health, Education, Government, and Women & Youth Empowerment in Technology (WOY-Tech). The three SMART enablers are: ICT Capability & Capacity, Secure & Shared Infrastructure as well as Governance & Management.

  The country shall achieve end to end digitization which provides seamless and integrated services for all (G2G, G2B, G2C). Citizens shall fully enjoy "zero trip - zero paper," cashless, and convenient services.

- **Advanced Technology skills and capacity development:** Market oriented and industry requires ICT skills that are needed to transform Rwanda into a knowledge-based economy. Creating skilled ICT professionals, however, require concerted efforts and partnerships between private sector, academic institutions, and various different international partners/supporters...

  Tangible incentives on needed digital skill-sets and creating circular linkages between our national FDI effort and human capital development will be enhanced. More efforts are needed to increase human capacity through a combination of improved domestic education as well as attracting Rwandan diaspora and foreign talent.

3.3.2 Foundations, Driving Factors and assumptions

Foundations	Driving factors and assumptions
• Digital Literacy • Affordable Smart Devices Penetration • Electricity and Energy • Affordable and accessible Broadband Connectivity & Infrastructure (Broadband as utility) • IT Security • Advanced Technology Skills and Capacity • Entrepreneurship, Creativity & Innovation • Strong investment incentives for the ICT related Sector • Conducive ICT Strategies and Policies: • Financial Mechanisms and partnerships (Public, Private, PPP) • Enabling Business Environment • Increased incentives for attracting investment in ICT • Localized contents, services, and products • Meaningful and sustained Data and Information collection, analysis, and utilization • Strengthened innovation ecosystem	• Digital literacy for all • Universal access to broadband • 98% mobile penetration by 2024 • 80% internet penetration by 2024 • Thriving local content which are hosted locally • Innovative solutions • Knowledge exports • Online services for citizens, B2B, B2C, G2B, G2C: Paper less/Light • Smart Cities, Smart Education, Smart Agriculture, Smart Health, Smart Finance, Smart Commerce • Integrated Government and data centric decision making • Cashless economy • Tax rebates/incentives • One Digital ID • ICT Sector value chain: 10KCompanies valued at 100K -1M USD; 30 Companies valued at 1M-5M USD; 10 companies valued at 5M-25M USD • Startup innovation ecosystem • Variety of Financial Mechanisms (Angel Funding, Venture capitals, etc.)
Economic growth Job creation and increase productivity Digital Society and Digital transformation Sustainable development and inclusive Citizens satisfaction Cashless Economy Government Intelligent Transparency, Trust and accountability	

Table 3.1: Foundations and driving factors

3.3.3.3. Results Chain

The Result chain of The ICT Sector Strategic Plan is summarized in the following Logical framework and a priority policy actions matrix:
* Fiscal period and duration of each activity will be determined as necessary

Table 3.1: Results chain

Goal/ Impacts	Rwanda transformed into a Knowledge Based Economy
	Middle upper income and high income Country status
	ICT Hub in Africa
Outcome 1	**Vibrant, competitive, and innovative ICT private sector established**
Output 1	created 100,000 jobs
Activities	**Act 1.1:** Foster young people in ICT careers (ICT Centric Ecosystem)
	Act 1.2: Accelerate and complete public service transformation (ICT Centric Ecosystem)
	Act 1.3: Foster last mile innovation and infrastructure capacity (ICT Centric Ecosystem)
	Act 1.4: Create Rwandan hub network (ICT Centric Ecosystem)
	Act 1.5: Foster a single regional digital market (ICT Centric Ecosystem)
	Act 1.6: Advance implementation of Elite digital corpHs initiatives
	Act 1.7: Promote digital exports in potential markets (Digital exports strategy)
	Act1. 8: Support entrepreneurship & creation of Rwandan tech solutions to African problems (Digital exports strategy)
	Act 1.9: Build spikes in products / services / technologies where Rwanda has a potential advantage (Digital exports strategy)
	Act 1.10: Support improved quality and quantity of skills in the ICT workforce (current and future), and better linkages between education providers and industry (Digital exports strategy)
	Act 1.11: Establish digital trade promoters / ambassadors and work through existing commercial attaches
	Act 1.12: Attract capital investment to fund the creation and scaling of new ICT companies with the potential to export (Digital exports strategy)
	Act 1.13: Implement BPO strategy
	Act 1.14: Promote broadband services to SMEs (BB)
	Act 1.15: Roll out BB network (BB)
	Act 1.16: Establish a program to provide affordable end user equipment to low income citizens and relevant Content and Applications (BB)
	Act 1.17: Implement **Kigali Innovation City**
Outcome 2	**Kigali innovation city and national ecosystem operationalized**

Activities	**Act 2.1:** Establishing Research and Development facility,
	Act 2.2: Establish ICT training centers, software build and testing labs,
	Act 2.3: Establish specialized institutions of higher learning and a business incubation Centre
	Act 2.4: Establish and operat ionalize the innovation fund to support firms in the innovation and technology industry
	Act 2.5: Foster local and appropriate agriculture innovation system/
	Tools (ICT4AG)
	Act 2.6: Create home grown agricultural solutions/tools through, FABLAB
	Act 2.7: Provide Pricing and weather information system (ICT4AG)
	Act 2.8: Support the development of applications (apps) to help buyers manage transactions with the thousands of small-scale farmers who supply to them. (ICT4AG)
	Act 2.9: Establish collaborative urban innovation labs with academy, community and industry (Smart City RMP)
	Act 2.10: Promote Innovation in Education, form primary school to higher education (Smart City RMP)
Outcome 3	**Emerging technologies for productivity capitalized**
Output 3a	Established research and development industries
Activities	**Act 3.1:** Capitalize emerging ICT solutions (e.g.; block-chains, drone, IOT, virtual reality, Artificial Intelligence/Deep Learning, Robotics, Digital Manufacturing, Aerospace technologies etc.)
Output 3b	Developed Fintech solutions
	Act 3.8: Promote cashless payment
	Act 3.9: Introduce a one stop e-payment platform for all life-time services
	Act 3.10: Enable electronic due-diligence and business loan systems for SMEs
	Act 3.11: Strengthen and integrate ICT Sector value chains
	Act 3.12: Promote local market recapturing, Intellectual property standardization and protection “Made in Rwanda”
Outcome 4	**Vibrant smart cities sustained**
Output 4	Developed smart cities and villages

Activities	**Act 4.1:** Establish GIS-based urban management platform (Smart City RMP)
	Act 4.2: Establish multi stakeholder safer cities program me (Smart City RMP)
	Act 4.3: Enable environment for urban technology testing (Smart City RMP)
	Act 4.4: Establish data strategies including open data, privacy and cyber security (Smart City RMP)
	Act 4.5: Create free internet zones in strategic and residential areas
	Act 4.6: Establish digital citizen engagement tools and ensure they are accessible to all
	Act 4.7: Monitor and manage digitally utility infrastructure
	Act 4.8: Explore Smart micro grids based on the prosumer model
	Act 4.9: Promote smart data- led, door to door mobility solutions
	Act 4.10: Promote usage of sensor networks to collect environmental data
	Act 4.11: Enable healthcare workers to use ICT to increase their ability to diagnose and treat diseases (Smart City BP)
	Act 4.12: Equip healthcare facilities with electronic medical records that allows patients to be managed using their smart health insurance cards (Smart City BP)
	Act 4.13: Combine structured, traditional health information systems data with unstructured community data to improve planning, surveillance and response to disease outbreaks and epidemics (Smart City BP)
	Act 4.14: Establish CCTV networks (Smart City BP)
	Act 4.15: Develop mobile solutions used to disseminate traffic updates (Smart City BP)
	Act 4.16: Establish living roads framework to map and identify hotspots by analyzing driver behavior (uses road sensors mounted on mass transit vehicles and government fleets) (Smart City BP)
	Act 4.17: Establish Smart air quality management systems (Smart City BP)
Outcome 5	**Digital communities empowered and transformed through improved access to information and services using ICT**
Output 5	empowered citizens digitally
Activities	**Act 5.1:** Implement Smart Villages initiative.
	Act 5.2: Create collaborative community co-working spaces and digital excellence centers (Smart City RMP)
	Act 5.3: Operationalize the Digital ambassadors program
	Act 5.4: Promote Smart device penetration
Outcome 6	**Government operational efficiency and citizens satisfaction improved**
Output 6	Satisfied citizens with service delivery

Activities	**Act 6.1:** Promote the last mile Internet coverage for a 24/7 self-serving Government.
	Act 6.2: Implement "Digital Government Platform Program" by implementing back end systems, Enterprise Service Bus and CVRS projects
	Act 6.3: Promote efficiency through end to end digitization of G2C, G2B, G2G services by modernizing laws and business processes
	Act 6.4: Improve accessibility to digital education information and content
	Act 6.5: Operationalize Intranet for local information exchanges
	Act 6.6: Implement One Digital ID Program for enabling shared services across all critical sectors like health, insurance, education and civil status.
	Act 6.7: Fast-track mainstreaming ICT solutions in all domains of the society, especially key sectors like transport, Agriculture, Health, Education, Business & Commerce among others.
	Act 6.8: Improve accessibility to broadcasting contents through government led development of promoting the broadcasting industry
Outcome 7	**Rwanda's cyber space and information assets secured.**
Output 7	Secured ICT infrastructures and information
Activities	**Act 7.1:** Maximize the security and stability of networks by separating function based network from the just backbone establishments
	Act 7.2: Establish a cyber-security program to get high level skilled people
	Act 7.3: Ensure Planning, coordination and implementation of national cyber security policy/strategy and other related information security initiatives;
	Act 7.4: Promote National, Regional and International Cooperation, Research and Development in the field of cyber security.
	Act 7.5: Put in place strategies to build a sustainable cyber-security industry to position Rwanda as a regional hub.
	Act 7.6: Put in place a population awareness program me on Cyber security (senior managers, technicians, general population)
	Act 7.7: Protect National Critical Information Infrastructure (CII) and Information Systems as well as the non-critical.
	Act 7.8: Carry out Information security assessment of public and private networks, systems and applications to ensure compliance with best practices.
	Act 7.9: Ensure appropriate legal and regulatory frameworks are in compliance with national and international cyber security standards and best practices.
	Act 7.10: Promote Cyber Security Awareness in all sectors and at levels in order to build a cyber-security culture and cyber aware society;
Outcome 8	**High quality skills in ICT leveraging knowledge based economy developed**
Output 8	Produced high quality of ICT skills

Activities	**Activity 8.1 Implement Digital Talent Policy**
	Act 8.1.1: Promote Smart Classrooms (Digital talent Policy)
	Act 8.1.2: Promote Digital Ambassador's Programme which aim to provide digital literacy training for Rwanda's general population with emphasis on women, youth, members of cooperatives, people with disabilities and other People with special needs through organized groups
	Act 8.1.3: Train and Certify Secondary and HLI students
	Act 8.1.4: Certify all Government employees in Digital Literacy
	Act 8.1.5: Carry out a national digital skills supply and demand matching study and implement digital skills supply and demand matching strategy
	Act 8.1.6: Formulate and implement policy to allow accelerated capacity building paths for gifted students
	Act 8.1.7: Promote acquisition of real "Certifications" for all ICT professionals of the Government, private sector and civil society
	Act 8.1.9: Formulate a special programme to create a pool of highly talented ICT professionals with future ready/proof qualifications
	Act 8.1.10: Attract internationally recognized training and certification providers
	Act 8.1.11: Strengthen Industrial attachment programme for ICT students
	Act 8.1.12: Introduce strong ICT components at non PICT graduate program
	Act 8.1.13: Promote education and professional training to ensure the development of skilled workforce in the area of cyber security
	Act 8.1.14: Establish Globally recognized ICT Skills Licensing body
	Act 8.1.15: Promote Innovation in Education, form primary school to higher education in partnership with relevant institutions
	Act 8.1.16: Create e-itorero program for wider rollout
Inputs	The costing model developed by Ministry of Finance and economic planning estimated that the resources of implementing the ICT Sector Strategy over the period 2018-2024 are about RWF 164 billion.
Inputs	The costing model developed by Ministry of Finance and economic planning estimated that the resources of implementing the ICT Sector Strategy over the period 2018-2024 are about RWF 164 billion.

3.3.3.4. Logical framework

Goal: "Rwanda transformed into a Knowledge Based Economy "									
	Targets								
Outcome Indicators	BL 2016/17	18/19	19/20	20/21	21/22	22/23	23/24	MOV	Assumptions
Digital transformation								GITR	digitization of G2C,G2B,B2C, B2B services
ICT Development Index	150th /175	140th	130th	120th	115th	110th	100th		
E-Government Index	138th/193	120th	110th	100th	90th	80th	70th		
ICT Hub in Africa									
Network Readiness Index	80th /130	78th	74th	70th	68th	66th	65th		
Middle upper income Country									
Global Competitiveness Development Index	48th /140	48th	48th	47th	46th	45th	45th		
Outcome 1: Vibrant, competitive, and innovative ICT private sector Established								EICV, Survey	Direct measurement only. ICT contribution to other sectors may be calculated when suitable methodology has been Innovative solutions, digital exports and universal access to broadband
% of ICT Contribution to GDP	2%	3%	3%	5%	5%	5%	5%		
Number of new Technology Companies valued between 100K- One Million USD in Rwanda	15	17	18	20	24	26	30		
Number of new Technology Companies valued between one Million – Twenty Million USD in Rwanda	25	27	28	30	32	34	35		
Number of new Technology Companies valued at over $20 Million in Rwanda (including FDIs)	11	11	12	13	14	16	18		
% of business/companies participating in e-commerce	TBD	5%	8%	10%	15%	20%	30%		
ICT Export as % to total export	0%	0.00%	2%	5%	5%	6%	7%		
ICT Capital Investment (Amount in Million_ USD)	715.9	770	830	912	980	1012	1,112		
ICT jobs as % of formal total employment	2%	2%	2.5%	3%	3%	4%	5%		
Number of jobs created through BPO	10,988	11,200	13,000	15,000	15,500	16,000	17,000		

Outcome 2: High ICT quality skills leveraging knowledge based Economy developed								Administrative reports	Digital literacy for all
Number of Elite IT professional	2,377	3,000	5,000	7,000	9,000	10,500	12,000		
% graduates with ICT professional certificates by gender	NA	20%	25%	30%	35%	40%	50%		
% Elite IT professional owning commercialized Innovation, IT operational Business company, jobs	NA	20%	50%	60%	65%	70%	75%		
ICT labor productivity (FRW/hour; Av or Med)- 11,969Frw:OECD Av (2015)	4,458Frw: RDA (2014)	4,600	4,800	5,000	5,100	5,300	5,500		
School with smart classroom as % of total schools (internet, computer and digital content)	8%	16%	30%	40%	50%	60%	70%		
Outcome 3: Government operational efficiency and citizens satisfaction Improved								Administrative reports	Full digitization of G2C,G2B, B2C ,B2B services
Fully digitized services as % of total online services	155 (online services)	5%	10%	20%	30%	40%	50%		
% of Public Institutions connected to 4G or faster Internet (Education, Health, Justice, Local Government)	10%	30%	40%	50%	60%	70%	80%		
% of digitized services out of total services	TBD	5%	10%	20%	30%	40%	50%		
% of government Integration and interoperability	TBD	10%	15%	20%	40%%	50%	60%		
% of websites that use the .RW domain hosted in Rwanda	14.9%	16%	17%	18%	20%	25%	30%		
% of MIS integrated with GCC	12%	20%	30%	40%	42%	44%	45%		
% of ICT projected managed and updated into Smart Dashboard/Automation	0%	20%	30%	45%	60%	70%	80%		
% of public institutions using electronic signature (PKI)	72.45%	75%	78%	80%	82%	85%	85%		

Outcome 4: Empowered and transformed digital community Created								Administrative reports	Devices penetration
% of digital literacy for citizens by gender (aged above15 years)	40%	45%	50%	60%	80%	90%	95%		
Internet penetration	39.76%	41%	43%	45%	48%	50%	55%		
Mobile Phone Penetration	72.45%	75%	80%	85%	87%	92%	95%		
Proportion of smart phone as % of mobile subscribers	13.2%	15%	25%	30%	35%	40%	50%		
Mobile-broadband internet subscriptions /100 pop.	28%	30%	35%	40%	42%	45%	47%		
Cost of broadband access as a percentage of average monthly GNI per capita (average monthly income)	14%	12%	10%	8%	6%	5%	5%		
% of Households with access to high speed internet	8%	15%	20%	30%	32%	35%	40%		
% of citizens with digital single ID	0%	5%	10%	15%	50%	60%	80%		
Outcome 5: Sustainable and vibrant Smart Cities created								Administrative reports	Infrastructure Sharing
% of Smart buses	0%	0.00%	3%	5%	7%	8%	10%		
Number of innovation Centers established	2	2	3	4	4	4	5		
Number of innovations (intellectual property/patent) commercialized	TBD	10	30	60	120	180	240		
Value of electronic payment as % of GDP	21%	26%	34%	40%	42%	45%	50%		
Smart households as % of total households in cities (	9% (Proxy)	25%	30%	45%	45%	50%	55%		
Amount earned from digital exports ('000s' USD)	TBD	50	300	500	3,000	4,000	5,000		
Total sales from ICT local manufacturing-Million in USD	43,5	44	50	55	60	70	80		
Outcome 6: Secured Rwanda's cyber space and information assets								Administrative reports	Government integrated and data centric
Number of highly skilled people in cyber-security	30	60	90	120	160	200	300		

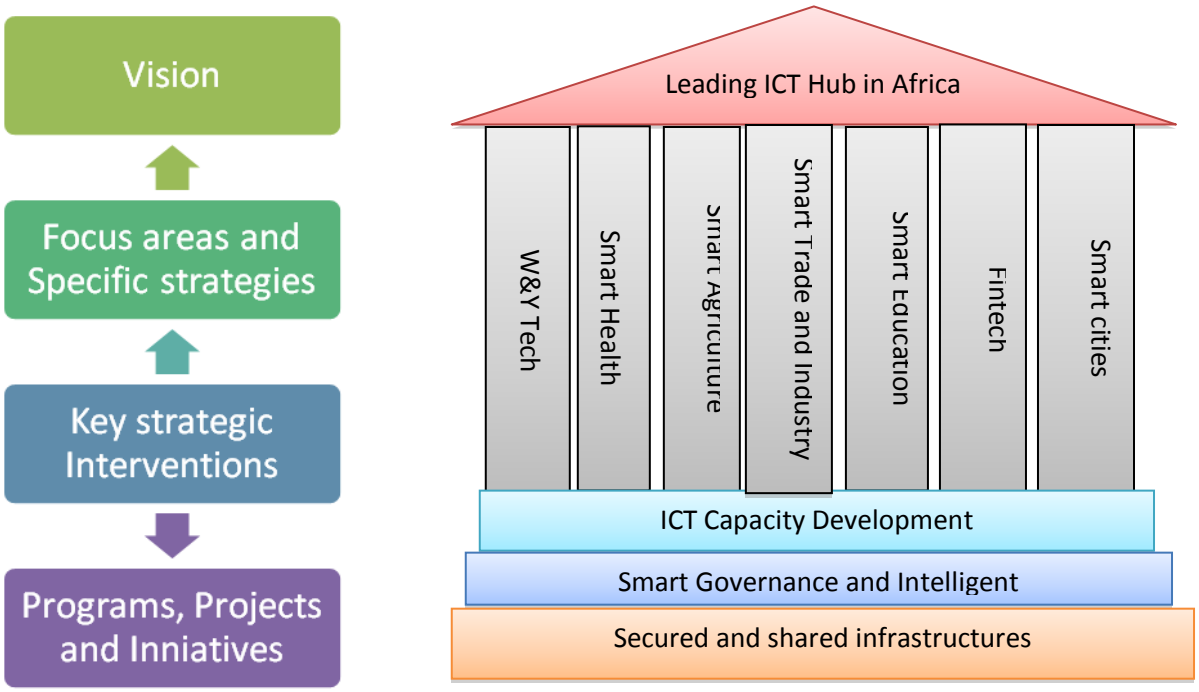
Table 3.2: Logical framework

CHAPTER 4: IMPLEMENTATION OF THE ICT STRATEGIC PLAN

4.1 Implementation Framework

The ICT SSP initiatives are derived from sector specific strategies and policies. These include NST-1, SRMP, Digital exports strategy, e-Commerce strategy, ICT Centric Innovation Ecosystem, SDGs, SMART Africa Manifesto, different specific sector strategies and other ongoing Government initiatives and program.

Figure 4.1: Implementation Framework



4.2. ICT Sector Implementation Plan

Outcomes	Outcome Indicators	Responsible Stakeholder	2018/19	2019/20	2020/21	2021/22	2022/23
Vibrant, competitive, and innovative ICT private sector established		PSF RDB, ,RISA	Support entrepreneurship & creation of Rwandan tech solutions to African problems Promote digital exports in potential markets Implement BPO strategy	Establish incentives mechanisms for SMESs (broadband services, content/ service creation, data Centre, devices) Establish digital trade promoters / ambassadors and work through existing commercial attaches	Foster young people in ICT careers Foster last mile innovation and infrastructure capacity	Create Rwandan hub network Foster a single regional digital market	Advance implementation of Elite digital corps initiatives Promote digital exports in potential markets

Kigali innovation city and national ecosystem operationalized		RDB, PSF, RISA, NCST, MINEDUC, MINAGRI	FastTrack and operationalize Rwanda innovation fund Implement Kigali Innovation City.	Foster local and appropriate agriculture innovation system/Tools	Create home grown agricultural solutions/ tools through FABLAB (e.g. micro sensors, IOT, etc. (ICT4AG) Provide Pricing and weather information system	Support the development of applications (apps) to help buyers manage transactions with the thousands of small-scale farmers who supply to them.	Promote Innovation in Education, form primary school to higher education Establish collaborative urban innovation labs with academy, community and industry
Enabling platforms developed for productivity gains		RDB,PSF, RISA	Capitalize emerging ICT solutions (e.g.; block-chains, drone, IOT, virtual reality, Artificial Intelligence/ Deep Learning, Robotics, Digital Manufacturing, Aerospace technologies etc.)	Continue capitalize emerging ICT solutions (e.g.; block-chains, drone, IOT, virtual reality, Artificial Intelligence/ Deep Learning, Robotics, Digital Manufacturing, Aerospace technologies etc.)	Continue capitalize emerging ICT solutions (e.g.; block-chains, drone, IOT, virtual reality, Artificial Intelligence/ Deep Learning, Robotics, Digital Manufacturing, Aerospace technologies etc.)	Continue capitalize emerging ICT solutions (e.g.; block-chains, drone, IOT, virtual reality, Artificial Intelligence/ Deep Learning, Robotics, Digital Manufacturing, Aerospace technologies etc.)	Continue capitalize emerging ICT solutions (e.g.; block-chains, drone, IOT, virtual reality, Artificial Intelligence/ Deep Learning, Robotics, Digital Manufacturing, Aerospace technologies etc.)

Long-term savings and innovative financing mechanism enhanced		MINECOFIN, BNR RDB,PSF, RISA	Promote cashless payment Develop Fintech solutions	Introduce a one stop e-payment platform for all life-time services Enable electronic due-diligence and business loan systems for SMEs	Strengthen and integrate ICT Sector value chains	Promote local market recapturing, Intellectual property standardization and protection "Made in Rwanda"	Promote local market recapturing, Intellectual property standardization and protection "Made in Rwanda"
Vibrant smart cities sustained		RDB,PSF, RISA	Establish GIS-based urban management platform Promote usage of sensor networks to collect environmental data Establish multi stakeholder safer cities program Establish CCTV networks Develop mobile solutions used to disseminate traffic updates	Enable environment for urban technology testing Establish data strategies including open data, privacy and cyber security Enable healthcare workers to use ICT to increase their ability to diagnose and treat diseases	Create free internet zones in strategic and residential areas Establish digital citizen engagement tools and ensure they are accessible to all Monitor and manage digitally utility infrastructure Establish living roads framework to map and identify hotspots by analyzing driver behavior	Explore Smart micro grids based on the prosumer model Promote smart data- led, door to door mobility solutions Equip healthcare facilities with electronic medical records that allows patients to be managed using their smart health insurance cards	Combine structured, traditional health information systems data with unstructured community data to improve planning, surveillance and response to disease outbreaks and epidemics Establish Smart air quality management systems

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Digital communities empowered and transformed through improved access to information and services using ICT		MITEC, RISA DISTRICTS, COK	Operationalize the Digital ambassadors program Promote Smart device penetration	Operationalize the Digital ambassadors program Promote Smart device penetration	Enhance Smart Villages initiative by providing access to sustainable energy services, enabling the provision of good education and healthcare, access to clean water, sanitation and nutrition, the growth of productive enterprises to boost incomes, and enhanced security, gender equality and democratic engagement	Operationalize the Digital ambassadors program	Create collaborative community co-working spaces and digital excellence centers

High quality skills in ICT leveraging knowledge based economy developed		MITEC, RISA, ICDL, DISTRICTS; FBO	Promote Smart Classrooms Undertake digital literacy training for Rwanda's general Identify and develop Rwanda's niche globally and regionally Attract internationally recognized training and certification providers	Implement e-Torero Program Initiate a special program to create a pool of highly talented ICT professionals with future ready qualifications Customize specialized ICT programs matching Rwanda and regional ICT industry/ market need	Provide upward mobility of technically endowed students Train and certify all ICT professionals of the Government, private sector and civil society Strengthen Industrial attachment for ICT students Introduce strong ICT components at non PICT graduate program	Certify all Government employees in Digital Literacy Carry out a National ICT Skills supply and demand matching study Establish ICT Engineers' Licensing body	Train and Certify Secondary and HLI students Develop and Implement a National Digital Skills and Literacy supply and Demand matching strategy Promote education and professional training to ensure the development of skilled workforce in the area of cyber security

Table 4.1: ICT Sector Implementation Plan

4.3. Risk Analysis and mitigation strategies

The SWOT Analysis was used to identify key strengths, weaknesses, opportunities, and threats associated within the ICT Sector. Specifically, it assisted the ICT sector to understand potential risks and opportunities affecting the sector and to formulate mitigating strategies for these risks. This process highlighted strategic issues that must be addressed in order to achieve the vision, mission and goals of the sector as well as NST1.

Strengths	Weaknesses
❖ Strong political will to utilize ICT as pillar of development ❖ Strong and consistent National ICT Policies, ❖ ICT sector budget is on par with OECD countries at 1.6 percent, far above the African average ❖ Premier national ICT Network infrastructure ❖ Strong ICT related institutions RISA, MITEC, RURA, etc. ❖ Strong commitment from ICT Sector/community ❖ Focus on E-Government and E-Governance, ❖ Harmonizing ICT legislations across the region	❖ Limited skilled human resources ❖ Insufficient electricity (a prerequisite to the ICT accessibility) ❖ Inadequate financial resources/mechanisms ❖ High cost of access/usage in comparison with neighboring countries (both communication cost and availability of affordable devices) ❖ Lack of awareness about ICT and the benefits of e-government in both urban and rural areas ❖ Weak private sector ❖ High rate of illiteracy (traditional and digital) ❖ Limited innovations
Opportunities	**Threats**
❖ Broadband networks ❖ Vibrant ICT entrepreneurship and innovation emerging ❖ Political will to develop ICT sector ❖ The country's infrastructure in place	❖ Competition among African countries for ICT Hub ❖ Global economic slow down ❖ Slow growth of skilled ICT professionals ❖ Slow growth of innovations ❖ Change of donors' and investors' priorities, ❖ Potential ICT Cyber Crime and attach against critical national infrastructures ❖ Potential loss of job due to ICT replacement

Table 4.2: Risk Analysis and mitigation strategies

CHAPTER 5: MONITORING AND EVALUATION FRAMEWORK

5.1 ICT Outcome indicators and targets

In order to develop key outcome indicators, the following criteria have been used: data availability, international benchmarking and comparison, time series and existing or ongoing targets especially those used by EDPRS2. Some other indicators were modified to be aligned with the newly approved and ongoing strategies and policies.

Since the SSP is not entirely a new strategy but a progression of the SRMP, many indicators used in the SRMP were retained. MITEC as a leader and the sector Chair will continue to conduct reviews, highlighting progress, challenges and short- to medium-term priorities for achieving the ICT sector's outcomes and meeting NST-1 targets.
The ICT-SSP, however, shifts its focus slightly and makes special emphasis on the last mile connectivity, improving service usage experience, and jobs creation through innovation promotion. Such shift has some implications for the indicators used to measure success. Ensuring the monitoring framework to correctly reflect the shifting priority is important. The ICT SSP will, therefore, monitor the following key performance indicators:

5.2.2. Key Performance Indicators for ICT Sector 2018-2024

KPI	Policy action selected	TARGET 2023/24
Number of Elite IT professional	Initiate a special program to create a pool of elite ICT professionals	12,000
School with smart classroom as % of total schools	Develop Smart Classroom framework Develop and implement roll out plan	70%
Outcome 3: Government operational efficiency and citizens satisfaction Improved		
Fully digitized services as % of total online services	Integrate systems to Enterprise Service Bus. Develop back end systems, and CVRS projects	50%
% of Public Institutions connected to Broadband Internet	Implement OGN	90%
Outcome 4: "Empowered and Transformed Digital Community" created		
% of Households with access to Broadband Internet	Promote the last mile Internet coverage for a 24/7 self-serving Government.	50%
Number of Smart villages established	Implement Smart Villages initiative	40
Fully digitized services as % of total online services	Integrate systems to Enterprise Service Bus. Develop back end systems, and CVRS projects	50%
% of Public Institutions connected to Broadband Internet	Implement OGN	90%
Outcome 4: "Empowered and Transformed Digital Community" created		
% of Households with access to Broadband Internet	Promote the last mile Internet coverage for a 24/7 self-serving Government.	50%
Number of Smart villages established	Implement Smart Villages initiative	40

Internet penetration	Engage private internet operators to improve internet coverage in remote areas	90%
Mobile Phone Penetration	Re-engineer VIZIYO Program Promote acquisition of affordable data-enabled smart devices to consumers	97%
Outcome 5: Sustained vibrant Smart Cities established		
Smart households as % of total urban households	Implement Rwanda smart city master plan	55%
Outcome 6: Emerging technologies developed		
Number of emerging technologies operationalized	Capitalize emerging ICT solutions (e.g.; block-chains, drone, IOT, virtual reality, Artificial Intelligence/Deep Learning, Robotics, Digital Manufacturing, Aerospace technologies etc.)	7

Table 4.4: Key Performance Indicators

CHAPTER 6: COST AND FINANCING

1. **The estimated cost of implementing the ICT Sector Strategy over the period 2018-2024 is RWF 164 billion.** This is spread across the 4 pillars and covers both capital and recurrent expenditures. The tables below summarize the expenditures by categories and pillar. All costs are estimated in Rwandan francs.

2. Detailed cost breakdown for the ICT-Sector

		Values						
Pillar	Outcome	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	TOTAL
Pillar 1: Economic Transfor-mation	Vibrant, competitive, and innovative ICT private sector	937,000,000	1,112,655,000	1,598,655,000	2,009,310,000	2,076,965,000	2,811,965,000	10,546,550,000
	Kigali innovation city and national ecosystem operationalized	3,265,580,064	3,265,580,064	6,531,160,127	6,531,160,127	6,531,160,127	6,531,160,127	32,655,800,636
	Enabling platforms developed for productivity	266,000,000	266,000,000	532,000,000	532,000,000	532,000,000	532,000,000	2,660,000,000
	Enhanced long-term savings and innovative financing mechanisms	89,000,000	89,000,000	178,000,000	178,000,000	178,000,000	178,000,000	890,000,000
	Developed and integrated urban and rural settlements	737,000,000	737,000,000	1,474,000,000	1,474,000,000	1,474,000,000	1,474,000,000	7,370,000,000

Pillar 1: Economic Transformation **Total**		5,294,580,064	5,470,235,064	10,313,815,127	10,724,470,127	10,792,125,127	11,527,125,127	54,122,350,636
Pillar 2: Social Transformation	Empowered and transformed digital communities through improved access to information and services using ICT.	330,000,000	330,000,000	660,000,000	660,000,000	660,000,000	660,000,000	3,300,000,000
Pillar 2: Social Transformation **Total**		330,000,000	330,000,000	660,000,000	660,000,000	660,000,000	660,000,000	3,300,000,000
Pillar 3: Transformational Governance	Improved Government operational efficiency and citizens satisfaction	279,000,000	279,000,000	558,000,000	558,000,000	558,000,000	558,000,000	2,790,000,000
	Secured Rwanda's cyber space and information assets.	49,000,000	49,000,000	98,000,000	98,000,000	98,000,000	98,000,000	490,000,000
	Developed High quality skills in ICT Leveraging knowledge based Economy	10,354,000,000	10,354,000,000	20,698,000,000	20,698,000,000	20,698,000,000	20,698,000,000	103,500,000,000

Pillar 3: Transformational Governance Total		10,682,000,000	10,682,000,000	21,354,000,000	21,354,000,000	21,354,000,000	21,354,000,000	106,780,000,000
Grand Total		**16,306,580,064**	**16,482,235,064**	**32,327,815,127**	**32,738,470,127**	**32,806,125,127**	**33,541,125,127**	**164,202,350,636**

Table.6.1: Detailed cost breakdown for the ICT-Sector

This document is accompanied by a detailed costing plan in excel format. This costing plan sets out clearly who are responsible for each activity required to fully implement all interventions here, as well the sequencing and budgeting. These activities need to be mainstreamed into the annual action plans of the respective public institutions, civil society and private partners sourced for projects that require PPP.

7. ANNEXES

ANNEX1: ICT SECTOR STATUS, ACHIEVEMENTS AND CHALLENGES

#	Achievement	Status
1	Increased phone penetration	In 2010, the phone penetration was at 33%. It has greatly increased to 79.2% in 2016.
2	Internet Penetration	In 2011, the internet penetration was at 7%. It has increased to 39.76% by 2017.
3	4G LTE Coverage	Since Rwanda signed an agreement with Korea Telecom in 2013, 4G LTE was introduced and now has been rolled out by 64.3% population coverage across the country.
4	Mobile Financial services	The Mobile Financial Service subscribers in 2011 were 639,000. This increased to 9,700,000 by the year 2016.
5	Positivo Plant	In 2014, the GoR signed an agreement with the Latin American multinational POSITIVO and established a local computer assembly plant. Since July 2015, POSITIVO BGH plant has assembled 95,580 laptops to date including 24,180 XO (OLPC) and 71,400 mini-laptops.
6	Smart Kigali Program	In 2013, the GoR initiated a smart city program that modernizes the lifestyle of Kigali City dwellers and visitors through use of ICT for better service delivery. This program has already registered success where free Wi-Fi is now provided in public places including commercial buildings, Bus Stations, public transport, hotels etc. For instance, until now, over 485 buses are connected to WI-FI and several other public places.
7	SIM Card Registration	In 2013, GoR completed registering all SIM cards and linked them to national IDs of users in a bid to promote security and efficiency.
8	Digital Migration	In 2014, Rwanda successfully completed digital migration from analog to digital terrestrial television.
9	Increased Radio & TV Station Penetration	The number of Radio and TV stations increased from 1 radio and TV stations to 34 and 12 respectively.
10	Internet Service Providers and Telecom Operators	By Q3 2017, there are 16 registered Internet service providers and 4Telecom operators.

7. ANNEXES

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5	Positivo Plant	In 2014, the GoR signed an agreement with the Latin American multinational POSITIVO and established a local computer assembly plant. Since July 2015, POSITIVO BGH plant has assembled 95,580 laptops to date including 24,180 XO (OLPC) and 71,400 mini-laptops.
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10	Internet Service Providers and Telecom Operators	By Q3 2017, there are 16 registered Internet service providers and 4Telecom operators.

#	Achievement	Status
11	ICT Awareness Campaigns Program.	A local based ICT awareness program dubbed "Korana ubuhanga" was initiated which rotates across the 30 districts. It is an avenue where citizens are informed about existing ICT solutions by vendors. On average, over 100000 citizens participate in a single campaign and it's conducted each quarter.
12	National Cyber Security Authority	With increasing global threats, the GoR is in the process of establishing an institution in charge of cyber security. NCSA has been established and operationalization is currently underway.
13	Cyber Security Incidence Response Team	In 2010, the Government operationalized a CSIRT team which works 24/7 hour and responsible for surveillance of all cyber threats to respond and prevent/curb incidences.
14	National Cyber Investigation Center	In 2015, the Government took an initiative to establish a national cyber investigation center within Rwanda National Police. The center has 2 major components including: Cyber Fusion Center -Used to monitor cyber threats and report on crimes and Digital Forensic laboratory- Used for digital investigations, Disc Data Recovery, Mobile forensic and Malware analysis
15	CCTV	This project has established security cameras across the major sites in Kigali to help monitor incidences and crimes. The CCTV services from different sites are connected to a live-feed central command center.
16	Public Key Infrastructure	In 2015, GOR established a PKI infrastructure used for authentic access of information on online platforms. Once al the relevant institutions are on board for e-signature, it is expected to cut off most manual processes and promote efficient paperless processes.
17	Rwanda Online (ROL) Project	In 2014, the Government, through a PPP model, established a dedicated company and digitized all G2C and G2B services. The corresponding online e-Government site, "Irembo," to date, has 56 e-services and runs a monthly transaction of 1,445,186. However, there are over 150 other online services that are not integrated into Irembo platform. The service access points/agents to help citizens with easy access have also grown to 168,000 Online.
18	Street Naming integrated with GIS	In 2013, the Kigali streets and houses were given new numbers and migrated to standardized address scheme. The names were also integrated into GIS based maps that are found on Internet.

19	Automobile Technical control & Speed Governors	The Automobile Technical Control helps to inspect cars automatically and recommends the faults. Also speed control devices were installed in all public vehicles to limit the speed to 60kh. Both projects have been instrumental in reducing and preventing accidents.
20	Rwanda Information Society Authority (RISA)	In 2017, the GoR established an agency in charge of implementing Cross-Governmental ICT initiatives based on SRMP and other policies.
21	Video Conferences	Video conference devices were deployed at both central and local government authorities to help conduct online meetings and communications between institutions
22	E-Gates	In 2012, Rwanda introduced the e-Gates, which are deployed at the Kigali airport and boarder-ports to facilitate immigration process.
23	Drone Industry	In 2015, Rwanda was the first country globally to launch use of Unmanned Autonomous Vehicles (Drones) that go beyond the visual line of sight at a commercial scale. Zipline drones operate in health sector delivering blood to patients across all district hospitals. Coordination should be made to expand the use of Drones for other industries to position Rwanda as a leading technology hub.
24	ID Integration	The National ID has opened APIs to different institutions and now interfaces with more than 18 institutions, which authenticate their services against ID database for smooth and secure processes.
25	Government Command Center	Established in 2014, the GCC helps track in real-time, the key performance indicators of both central and local government.
26	Smart Classroom Program	In 2016, Rwanda initiated a smart classroom program that digitizes education-learning process. It provides students' access to computers and basic education software platforms as well as internet access.
27	Digital Ambassador Program	In 2016, the GoR initiated the digital ambassadors program with partners which aims to train 5 million citizens in the next 5 years (2022) using 500 Digital Ambassadors delivering digital literacy skills to community members, and creating social enterprises, self-employment in the digital economy.

28	Establishment of centers of excellence	1. Carnegie Mellon University- Africa, a world-class university was officially launched in 2012. 2. African Institute of Mathematical sciences –Pan African Center of Excellence was established in 2016. 3. Africa center of excellence for Data Sciences was established at the University of Rwanda in 2016. 4. Center of Excellence in Internet of Things (IoT) was established at the University of Rwanda in 2016. 5. An Information Access Center was launched in 2017 with the support of KOICA- NIA 6. Establishment of a Center of excellence for Biomedical sciences and e-Health in University of Rwanda is underway. 7. Establishment of an ITU Cyber security center of excellence is currently underway.
29	Girls in ICT Initiative & He for She campaign	The GoR has a dedicated focus in promoting girls and women through ICT. Several programs have been set forth including Ms. Geek Competition, Tech-Kobwa camps, Tech innovation challenges, and digital financial inclusion through Rugori fund among others.
30	Kigali Innovation City (KIC)	The KIC provides space for an eco-system of ICT industry and services including academia, operators, incubation centers, companies, innovation centers, financing venture capitalists etc. The project is currently underway with prospects of attracting top talent and FDI.
31	Rwanda Innovation Fund	The RIF has set a target of $100 million for the African young ICT entrepreneurs through venture capital support.
32	KT-Rwanda partnerships	In 2013, Rwanda signed an agreement with KT to introduce 2 subsidiaries Olleh African Services and Africa Olleh Networks, which focused on Services and 4G roll-out respectively.
33	ICT companies introduced	Over 68 ICT companies each valued at 350,000 USD were introduced into the market over the years and these have generated Approx. 4997 jobs.

34	kLab & FabLab	With JICA and RDB support, ICT Chamber established kLab in 2011 as an innovation center for people to turn idea into ICT based solutions and products. It's a venue that connects, nurtures, and introduces potential entrepreneurs to ICT opportunities. FabLab is an open digital manufacturing/maker space which enable prototyping/modeling using digital tools. It was established in 2016 with partnership between GoR, JICA, MIT, SolidWorks, and ICT Chamber. The Lab caters for people with aspiration to create products and prototypes and turn them into viable businesses.
35	Northern Corridor Integration Projects	The NCIP framework brings together partner states Uganda, Kenya, Rwanda and South Sudan. An ICT cluster collaboration has enabled realization of transformative projects including One Area Network, Cyber Security, E-Services among others.
36	The Smart Africa Alliance	In 2015, The Smart Africa Alliance established its headquarter in Kigali. It provides a forum for African countries, collaborating in making smart investments for accelerated socio-economic development. Smart Africa launched in 2017 the Smart city blueprint for Africa that is expected to guide African cities to plan accordingly.
37	Guiding policies	• **Smart Rwanda Master Plan** – The principal ICT sector strategy and plan that guides the overall National ICT for development initiatives. It is the last of the NICI Plans and will come to fruition in FY2020. • **Broadband Policy** –Puts in place a policy and implementation framework for universal broadband access in Rwanda. • **Cyber Security Policy** – Establishes a policy and operational framework to ensure Rwanda's cyber resilience. • **Data Revolution Policy** – Sets an agenda to open data and conduct big data analytics. • **Digital talent Policy** – Sets a mechanism to train all Rwandans to be a digitally literate population by focusing on 3 layers; the top experts (elite), professional skills for workers and basic literacy for citizens. • **E-Waste Policy** – E-waste puts up a business framework to manage and recycle all electronic materials for better conversation of environment but also for creating more jobs.

37		• **ICT4AG Strategy** – The agriculture sector elaborated an ICT strategic plan aimed at position ICT to accelerate production and reducing the cost of doing business. • **ICT4ED Strategy** – The ICT in Education Master Plan was elaborated to set a framework for mainstreaming ICT in the entire learning process of students at all levels. • A number of other policies mainly Women empowerment strategy, e-commerce are currently underway.
38	Global rankings	• Rwanda ranked 1st globally in ICT promotion (World Economic Report 2015). • Rwanda ranked 1st for Continental Social Media Award (Social Media Awards Africa-SMAA Report 2015). • Rwanda ranked 2nd in Africa for ease of doing business (World bank Report 2015). • Rwanda ranked Number 3 among Competitive Economies (World Economic Report 2015). • Rwanda ranked number One in Open Data in Africa (Open Data Institute Report 2016). • Rwanda ranked 2nd in Africa in Cyber Security (ITU Report Global Cyber security Index 2017).

Table. Annex.7.1: ICT sector status and achievements

ANNEX2: ASSUMPTIONS AND METHODOLOGY USE TO SET TARGETS AND PROJECTIONS[1]

✓ ICT Contribution to GDP

During the period 2010-2015, the ICT sector in Rwanda has grown at a median rate of 15.3 per cent. This rate of growth over the last five years has been used as a guideline to project probable growth rates of ICT sector in Rwanda. The growth scenarios have been classified as: Low, Medium and High, depending on the rates at which the ICT GDP and the GDP of Rwanda is expected to grow.

Assuming that the GDP of Rwanda will grow at an annual rate of 7 per cent for the period 2016-2025 based on the following two premises:

- The median annual growth rate of GDP for Rwanda in the last five years (2010-2015) has been 7.2 per cent
- To achieve or finance the 'Vision 2020' of Rwanda, the Ministry of Finance & Economic Planning in Rwanda has assumed an annual GDP growth rate of 7 per cent for the period till 2020.

Using the above three probable growth scenarios of low, medium or high growth, the contribution of ICT to the GDP for Rwanda can grow to 4.5, 8.2 or 14.6 per cent respectively by the year 2025. Benchmarking Rwanda with other countries middle income and high countries selected: USA India Armenia Kazakhstan Estonia Ghana Botswana, the estimated GDP contribution estimated found to be reasonable.

✓ ICT Capital Investment (ICT Gross Fixed Capital Formation)

Empirical research has indicated that higher level of ICT capital stock per capita allows a typical economy to achieve a higher output growth rate. Taking the data on ICT investments made by private and public enterprises in Rwanda is as a proxy for ICT capital investment.

The average yearly ICT investment by the local and FDI between 2001-2015 was FRW 42.8 billion and the total investment was equivalent to FRW 641.8 billion.

Using the average of the last five years, yearly ICT investment is estimated at FRW 87.2 billion but it should be noted that capital flows (FDI) are mostly volatile and do not follow a smooth trend and linear trend. ICT investment projection is calculated based on the current trend, 5$ Billion value of opportunities for ICT projects and other ICT investment opportunities (SRMP's targets) and levels of ICT investments in other middle and high-income countries.

For estimating the ICT investment targets for Vision 2050, an average selected six high-income countries Denmark, Finland, Israel, South Korea, Netherland, and Sweden basing on their total ICT Investment by 2014. The average total investment for all those six countries is estimated at USD 27.8 billions

- ✓ **Number of new Technology Companies valued at over $25 Million in Rwanda**

The SRMP and the ICT Sector development strategy have set ambitious targets of realizing 5$ Billion investment opportunities for ICT related, creating over 100,000 jobs (direct and indirect) by 2023, and creating 100 home grown companies with a market capitalization of at least $50 million each by 2030.

- ✓ **Internet Penetration**

Rwanda Internet penetration growth has outpaced other Land Locked Developing Countries (LLCD) from 2012. There is positive and direct correlation between increase in GDP and Internet penetration.

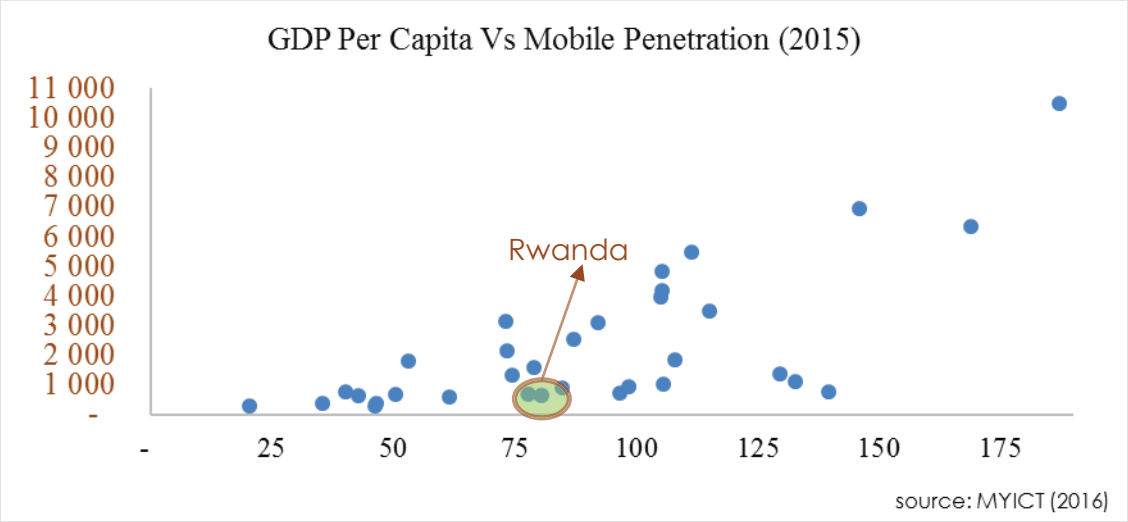

Fig. Annex.7.1: internet penetration

As described in the Table. Annex.7.2 below, a strong ICT framework propelled the growth of ICT infrastructure in Kazakhstan. In case of Armenia, the rapid growth in Internet penetration was attributed to the increase in household access to computers, growth in mobile phone subscriptions, and increase in international bandwidth from 1 083 Mbit/s to 10 547 Mbit/s . The sharp increase in Internet usage was, in part, made possible by the Armenian Government's program "Computers for All", which allowed Armenian citizens to rent desktop and laptop computers at a low price.

	Internet Penetration									
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
USA	68.93	75.00	74.00	71.00	71.69	69.73	74.70	71.40	73.00	74.55
Korea	78.10	78.80	81.00	81.60	83.70	83.76	84.07	84.77	87.87	89.90
India	2.81	3.95	4.38	5.12	7.50	10.07	12.58	15.10	21.00	26.00
Uganda	2.53	3.67	7.90	9.78	12.50	13.01	14.69	16.20	17.71	19.22
Ghana	2.72	3.85	4.27	5.44	7.80	9.00	10.60	12.30	18.90	23.48
Botswana	4.29	5.28	6.25	6.15	6.00	8.00	11.50	15.00	18.50	27.50
Kazakhstan	3.27	4.02	11.00	18.20	31.60	50.60	53.32	63.00	66.00	72.87
Armenia	5.63	6.02	6.21	15.30	25.00	32.00	37.50	41.90	54.62	58.25
Paraguay	7.96	11.21	14.27	18.90	19.80	24.76	29.34	36.90	43.00	44.38
Rwanda	0.03	0.05	0.08	1.6	8	7	8.4	19.55	28	33.5
Estonia	63.51	66.19	70.58	72.5	74.1	76.5	78.4	79.4	84.24	88.4

Source: ITU, Table. Annex.7.2: internet penetration

- Mobile Penetration

The same approach and assumptions as above for internet penetration was used to set the target for the Mobile penetration within the SSP.

	Mobile Penetration (Subscriptions per 100 Inhabitants)									
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
USA	76.29	82.06	85.21	88.62	91.31	94.44	96.01	97.08	110.20	117.59
Korea	85.00	93.27	95.28	99.54	104.77	107.74	109.43	111.00	115.71	118.46
India	14.52	20.16	29.53	44.12	62.39	73.20	69.92	70.78	74.48	78.84
Uganda	6.76	13.65	26.92	28.55	37.74	47.50	45.00	48.08	52.43	50.37
Ghana	23.73	33.76	50.07	63.77	71.87	85.27	100.99	108.19	114.82	129.74
Botswana	43.41	60.14	76.84	96.02	120.01	145.98	153.79	160.64	167.30	169.00
Kazakhstan	51.06	80.04	95.78	108.38	121.87	156.79	185.82	184.69	172.19	187.17
Armenia	41.95	62.76	48.43	73.83	130.43	108.34	111.91	112.42	115.92	115.15
Paraguay	53.75	76.64	92.86	88.52	91.66	99.33	101.59	103.69	105.60	105.39
Rwanda	3.25	6.40	12.94	23.07	33.40	40.10	53.10	63.50	70.00	78.00
Estonia	125.76	128.08	124.21	120.54	127.28	143.93	160.41	159.66	160.69	148.69

Table. Annex.7.3: Source: Mobile cellular telephone subscriptions per 100 inhabitants by ITU

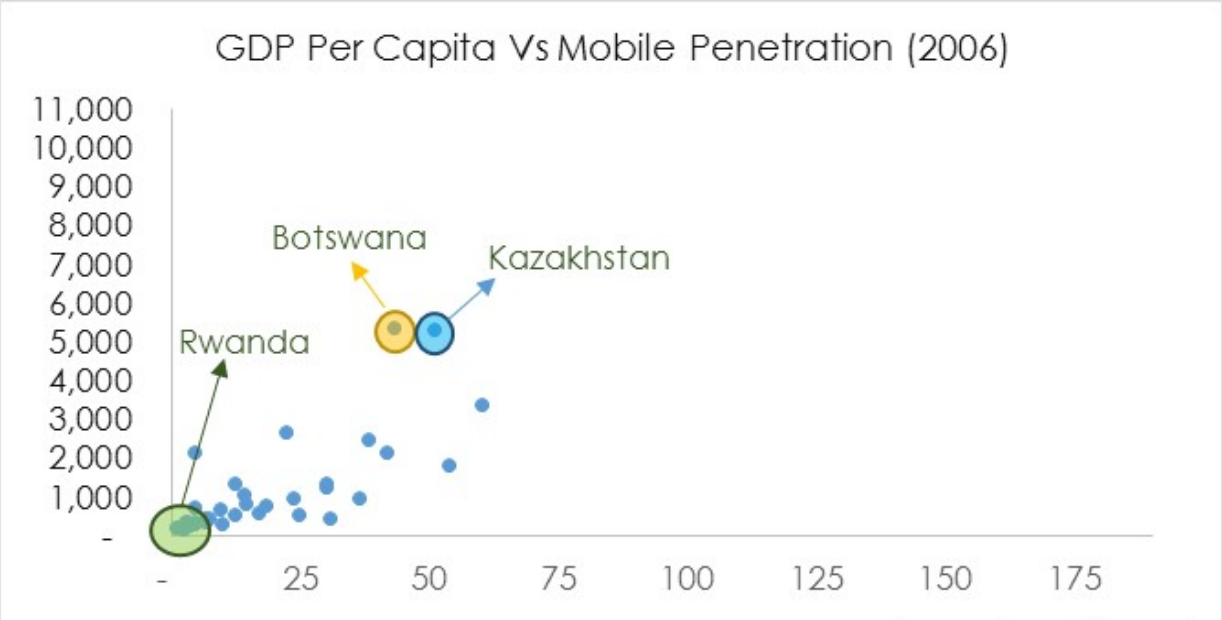

Figure. Annex.7.2: GDP per capita vs mobile penetration (2006)

The figure. annex.7.2 and figure. annex.7.3 illustrate how Rwanda has improved its mobile penetration vis-a-vis other LLDC's and African economies

It can be observed that Rwanda has improved its mobile penetration level fairly well in comparison to its landlocked peers in the last 10 years.

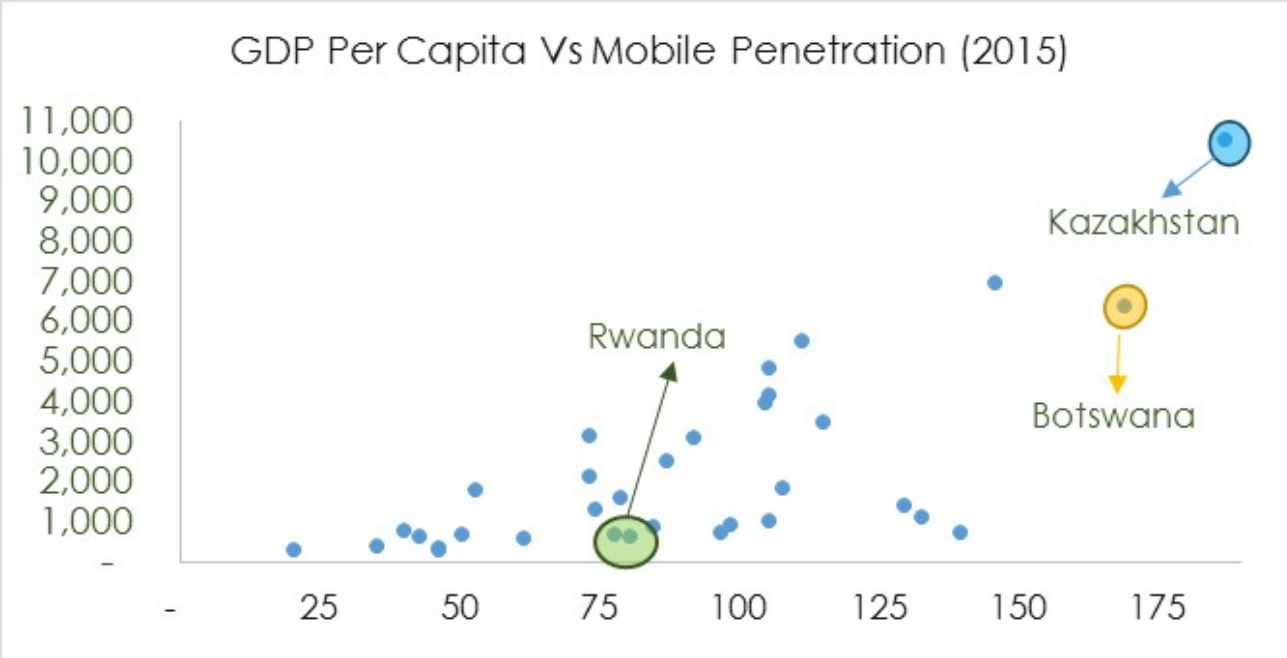

Figure. Annex.7.3 GDP per capita vs mobile penetration (2015)

For other key indicators and targets, the targets provided were based on the existing sector strategies, guessing based on the assumption that country is envisaging becoming an upper middle income country by 2035 and high income country by 2050