SMART RWANDA 2020
MASTER PLAN

Towards a Knowledge Based Society

Kigali, October 2015

Investment in ICTs is essential in taking any country to the next level of productivity and efficiency. Investing in ICTs is not at the expense of other sectors, investing in ICTs results in benefits for every sector and the earlier you start the better.

H.E President Paul Kagame

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EXECUTIVE SUMMARY

In 2000, the government of Rwanda (GoR) established Vision 2020 as an economic blueprint to achieve a knowledge-based economy and become a middle-income country by 2020. Along with Vision 2020, the first of the Economic Development and Poverty Reduction Strategy 2007 - 2012 (EDPRS I) and later EDPRS II 2013 -2018, further acknowledged ICT as a key driver for this economic growth. The national information and communications Infrastructure plans, NICI Plans I~III 2000 – 2015 were later initiated to guide the ICT4D programs and initiatives linked to the objectives and goals outlined in Vision 2020 and EDPRS I & II.

NICI I (2000 – 2005) focused on putting in place the foundational legal and regulatory framework to allow the liberalization of the telecommunication sector and attract private sector investments. During this time several institutions were put in place to drive the implementation of the new ICT policy. These include an Independent Regulatory Authority and a National ICT Agency.

During NICI II (2006-2010), the focus was put on accelerating infrastructure rollout to connect the people through increased coverage of telecommunication networks, licensing of more operators and implementation of the National Fiber Optic Backbone. Backhaul links to the submarine cable at the East African cost were also put in place. Several ICT flagship initiatives were also initiated. They include the OLPC (One Laptop Per Child) and eRwanda project.

NICI III (2011 – 2015) focused on Services – extending the benefits of increased connectivity to people through transformation of services to government and citizen and business. Five key domains were in particular targeted: Skills development, Cyber Security, Community Development, e-Government and Private Sector Development.

Despite the achievement of the NICI Plans, an assessment of Rwanda's ICT maturity level and an analysis of leading international ICT index (Global ICT Development Index, 2014 by ITU - 148/186, Network Readiness Index 2014, by WEF - 83/143 and e-Government Index 2014 by UNDESA – 125/193) confirms the need to sustain the gains accomplished while initiating a new strategy to accelerate the delivery of the necessary investments in infrastructure, capacity and services to support the achievement of Rwanda's economic objectives, while positioning the country as Africa's ICT Hub.

Smart Rwanda 2020 Master Plan constitutes in fact the fourth generation of NICI Plans (2016 – 2020). It seeks to build on all previous generations as well as the ICT Sector Strategic Plan (ICT SSP 2013 ~ 2018) that was prepared to go in tandem with the EDPRS II. SRMP also drew orientation from the Smart Africa Manifesto that was launched during the TransformAfrica Summit in October 2013 where the African Union Heads of State signed the SMART Africa Manifesto in Kigali.

The SRMP therefore derived key initiatives through analysis and assessment from four perspectives: aligning national development vision and strategies, reflecting the achievements of NICI I~III and EDPRS/ ICT SSP, assessment of Rwanda's internal and external environment challenges, and the current execution and management performance.

Based on the analysis, three enablers, ICT Capability & Capacity, Governance & Management, and Secured & Shared Infrastructure were identified. Seven pillars were also defined: SMART Agriculture, Finance, Trade & Industry, Health, Education, Government, Women and Youth Empowerment in ICT.
The process of developing SMART Rwanda also defined a vision statement: "Towards a Knowledge Based Society". This vision is underpinned by projects in 20 focus areas based on ten core objectives covering all the seven pillars and three enablers. The strategy development process also established a prioritization and implementation roadmap for each of the projects having considered their strategic impact, urgency, and resources. Further, these projects were filtered on the "SPREAD" principles to further narrow down projects that are realizable and actionable.

The expected investment value of the projects under SRMP amounts to more than US$500M covering 67 identified priority projects, some of which are already underway. The accumulated economic benefit has been estimated at US$1,182M which is a 142 percent ROI. By 2020, it is projected that ICT sector contribution will grow from 3% today to 5%, while 100,000 new jobs will be created. It also expected that increased innovation and mainstreaming of ICT across multiple economic sectors will drive more productivity and expand Rwanda's export base especially through BPOs and creative industries.

In order to achieve the stated benefits above and continuing adapting to a fast-changing technology sector and address challenges of performance and coordination, an enhanced governance and management structure is paramount.

Strategic Reasons for Adopting Smart Rwanda Master Plan

- The existing ICT Strategy (NICI III) will end with 2015. SRMP will be the next ICT strategy for the next 5 years leading to Vision 2020 and beyond.
- SRMP comes with a particular focus to digitize the economy and position ICT as one of key exports of the country and also contributing significantly to job creation and GDP growth.
- SRMP is necessary for the operationalization of the Smart Africa initiative that Rwanda spearheads.
- The global technology landscape is changing rapidly with new opportunities as well as challenges. Rwanda needs a plan to ensure that the opportunities are harnessed and challenges mitigated.
- The SRMP aims at providing a platform for increased private sector participation in ICT investment and development through public-private-partnerships.
- While the previous 3 generations of NICI plans focus successively on Liberation, Access and Services SRMP will focus on "Innovation", leading to job creation and digitization of the government and economy.

Key expected outcomes of the Smart Rwanda 2020 Master Plan

The plan is organized in three key focus areas: Business and Innovation, National Digital Transformation and Future Planning that shall drive Rwanda toward attaining "a knowledge based society".

➤ **THE BUSINESS AND INNOVATION AREA** will focus on Exports Promotion and harnessing opportunities for Foreign Direct Investment in the sector with such projects as Kigali Innovation City as well as nurturing our home grown ICT businesses.
The key messages under this area are:

- Rwanda as Africa's ICT Hub: Position Rwanda as Africa's ICT hub by leveraging leadership in such areas as Smart Africa Alliance, Africa's Technology Innovation Fund as well as building on Rwanda's excellent position in doing business, competitiveness and security. More efforts will be needed to increase available tech talent though a combination of domestic education as well as attracting Rwandans in diaspora and foreign talent.

- Private sector driven economy: 1 Billion $ value of opportunities for ICT projects in the SRMP and other ICT investment opportunities, creating over 100,000 jobs by 2020. Working with the Private Sector Federation, a 2030 vision was developed and the overall goal is to

have 100 home grown companies with a market capitalization of at least $50 million each by 2030.

➤ **THE NATIONAL ECONOMIC DIGITAL TRANSFORMATION AREA** is underpinned by flagship projects covering seven (7) pillars and three (3) enablers. The 7 SMART pillars are: **SMART Agriculture, Finance, Trade and Industry, Health, Education, Government, and Women & Youth Empowerment in Technology (WOY-Tech). The 3 SMART enablers are: ICT Capability & Capacity, Secure & Shared Infrastructure as well as Governance & Management.**

The key messages here are:

- **Government Digital Transformation by 2018:** 24-hour self-service Government with 95% of Government transactions happening online by 2018, driving cashless and paperless economy. This is expected to deliver productivity gains of more than $ 50M.
- **Broadband for all by 2020:** Broadband is basic need for all Rwandans. This shall be realized through 4G rollout program and smart device penetration.
- **Digital Literacy for all:** Efforts shall be made to transform Rwanda into a digitally literate nation, targeting all categories including local communities, civil servants, ICT professionals who should be internationally certified, teachers and students, children with special needs, etc.

➤ **THE FUTURE PLANNING AREA** will focus on Research and Development and leveraging global technology trends so as to feed exports and economic digital transformation. Several trends with great potential have been identified in areas of Smart Cities and Smart Communities, the Internet of Things, Big Data and Analytics, Drone Technology, 3D Printing, creative industries and cyber security.

KEY POLICY PRINCIPLES

The ICT sector is built around an architecture with five important pillars:

- **Access:** Ensuring that citizen, businesses and government are connected to broadband and affordably so.
- **Security:** Ensuring that Rwanda's cyber space is protected and resilient
- **Capacity**: Individual and institutional ability to effectively use techology
- **Services:** Content and applications that deliver the benefits of being connected.
- **Governance:** Policy and institutional environment providing for the growth of the sector and maximization of ICT impact on the society.
- While implementing the Smart Rwanda Master Plan ~ 2020, the Government shall adhere to the following policy principles:

Those areas are governed by several sub-sector policies that are already in place or being elaborated with a target of having them submitted for approval by January 2016. The following section illustrates selected policy principles that need to be adhered to across all sectors:

Access

Cloud first-approach. The cloud provides a shared, secure, resilient and cost-effective environment. While setting up new systems and applications, public sector organizations shall prioritize business models and solutions that are cloud-based over stand-alone or individually hosted services.

Mobile by Default: more than 90% of Rwandans access the internet on their mobile devices. Government services to citizen (G2C) and business (G2B) shall be optimized for hand-held devices by default with other interfaces (desktop) provided as second option.

Infrastructure sharing: Development of systems in silos has led to inefficient use of resources as well as putting government data at risk in hosting facilities that do not meet the necessary security and reliability standards. Moving forward, new systems shall be hosted in the National Data Centre or any other Government designated centrality located facility. A program of data centre consolidation shall be undertaken to progressively bring scattered assets under central hosting. The Private sector is encouraged to embrace the same principles for efficiency, reliability, security and cost-effectiveness.

Bring Your Own Device (BYoD): With mobility becoming a dominant trend, it has become increasingly difficult to separate users' personal and professional use of handheld devices. A framework will be put in place for allowing civil services to use their own personal mobile devices (laptops, tablets, and smart phones) to their workplace, and access privileged government information and applications under defined conditions and protocols. Government shall facilitate its employees to acquire personal devices that are used in the work place and this is in turn expected to increase the penetration of smart devices in the country.

ICT Affordability: Rwanda shall continue to put up dynamic policy, legal and regulatory regimes to drive effective broadband structures, enhanced competition, spectrum allocation, and infrastructure sharing models leading to ICT affordability for societal transformation. Particularly, ICT Sector shall ensure ICT affordability by driving broadband universal access, availability and affordability of ICT devices abd services.

Security

Security by design: Systems designed for Government shall be designed with highest security standards as opposed to applying security patches to vulnerabilities that are identified after systems are in

use. The Cyber security Policy and Strategy shall be used as a guiding framework.

Services, data and innovation

Open by default: In line with Government commitment to openness and transparency, as well as recognition of the enormous potential that lies in data use for business and decision making, government shall enforce an open data policy on its data in line with the national open data policy. Data shall therefore be availed for public use, unless there is a specific restriction that derives from the need for personal data protection or security considerations.

Efficient Business Processes: Existing and new services shall be re-engineered to optimize the business processes for efficient service delivery and citizen satisfaction. Public institutions shall reduce the lengthy, bureaucratic and unnecessary work flows within their services and deliver services through Irembo as soon as their processes are automated. In particular, paper will be maintained only when no electronic service alternative is available.

Privacy Data Protection: While promoting openness, the Government is conscious of the need to ensure citizen privacy and protection of personal data.

Innovation and Private-Public Partnerships: In recognition of the difficulty to procure innovation under existing public procurement frameworks, the need to promote foreign direct investment in ICT sector and support the growth of local ICT private sector, the Government will give precedence to PPP mode of ICT services procurement. Due consideration and preference will be given to partners that promote local technology transfer and job creation.

ICT Skills & Capacity Building:

Rwanda will embrace the policy approach to increase ICT skills in the general population. Particularly civil servants shall undertake professional ICT certifications courses to increase their productivity. Students shall graduate from high schools and universities with the appropriate ICT proficiency certifications. A national effort shall be undertaken to increase the available professionally qualified ICT professionals as well as attracting Rwandans in the diaspora and foreign talent to support the growth and transformation of Rwanda's economy under this SRMP 2020. A National Digital Talent policy shall be enacted for this purpose.

Governance

In order to ensure seamless integration and interoperability of different Government services and data resources, all public institutions will have to abide by th Government Enterprise Architecture. Government ICT investments in new services will have to be validated by the Enterprise Architecture Board.

The Future Trends Rapid changes in the technology landscape requires measures to prepare Rwandans to enter into hyper connected future, that is already shaping the global economy. A number of technologies are set to disrupt how individuals, businesses and governments work. Necessary investments and measures will be put in place to harness the potential of those technologies as well as mitigate possible negative impacts that accompany them. In particular, the following trends will be followed and leveraged:

1. **Creative industries:** By leveraging existing eco-system of innovations, talents, home-grown solutions, investments and a huge potential of the younger generation, Rwanda shall prioritize to make necessary investment in research and development of the local innovations to build creative industries.

2. **Internet of Things (IOT):** Internet of Things: A network physical objects or "things" connected to computer-based systems presents a huge potential to exchange useful data, spurring innovation and socio-economic transformation. Rwanda shall make necessary research and investment to leverage potential of connected objects and data for the development of home-grown solutions leading to social-economic transformation, accuracy and efficiency.

3. **Big data/analytics:** Billions of connected devices and people combined with an increasing number of information systems as the economy gets digitized, are expected to generate enormous amounts of data can be leveraged for business across multiple domains of the public and private sectors. Rwanda considers data as a critical resource hence necessary research, investment and policy environment, shall be put in place to promote this area.

4. **Cyber security:** The phenomenon of national cyber security continues to be critical as the global community becomes more connected with new cyber-attacks increasing. Rwanda shall harness to become a regional hub for cyber security through ensuring a secure and resilient cyber space. To achieve this, more research and development in this field shall be undertaken to put in place a conducive policy, legal, institutional framework and investments.

5. **Mobility and digital lifestyle:** A multitude of electronic devices like digital cameras, MP3 players, Touch iPod, iPad, Android tablets digital TV's, digital play stations, PDAs, laptops and PCs among others are on Rwandan market today and used by the community. A range of such devices are able to work and connect to each with power of internet or other terminal consoles to seamlessly exchange content at any location, anytime. Rwanda shall thus make necessary research and investment to promote a mobility and digital life style of Rwandans to tap unprecedented potential of hyper-connected services derived from innovations.

SRMP and SDGs

SRMP 2020 is initiated as the World adopts the Sustainable Development Goals, agenda 2030. Rwanda will sustain the efforts that made ICT an important tool for the achievement of the MDGs throughout the SDG timeframe.

TRANSFORM AFRICA SUMMIT 2013
Kigali - Rwanda

I. SMART RWANDA VISION

SMART Rwanda Master Plan articulates the alignment of key initiatives and implications with the overall national economic goals. It is from this alignment that the guiding vision is derived. The SMART Rwanda Vision Statement is "**Towards a Knowledge-Based Society**"

- The Scope: To consolidate and accelerate Rwanda's progress in transforming its economy into a knowledge-based economy by 2020.
- The Focus: NICI I focused on institutional development and ICT sector liberalization, NICI II focused on Infrastructure development, NICI III focused on service development. Smart Rwanda Master plan will focus on Rwanda's digital transformation.
- The Image: To become a regional ICT Hub, enhancing Rwanda's international position as a knowledge-based middle-income nation.

SRMP's vision statement is clear about Rwanda's continued reliance on the effective and efficient utilization of Information and Communication Technologies. With the implementation of the SMART Rwanda Master Plan, Rwanda can improve citizens' quality of life while at the same time developing capability of the private sector key industries to achieve a sustainable socio-economic growth.
Knowledgeable society: To secure and accumulate knowledge competency, as the driver of productivity and economic growth.

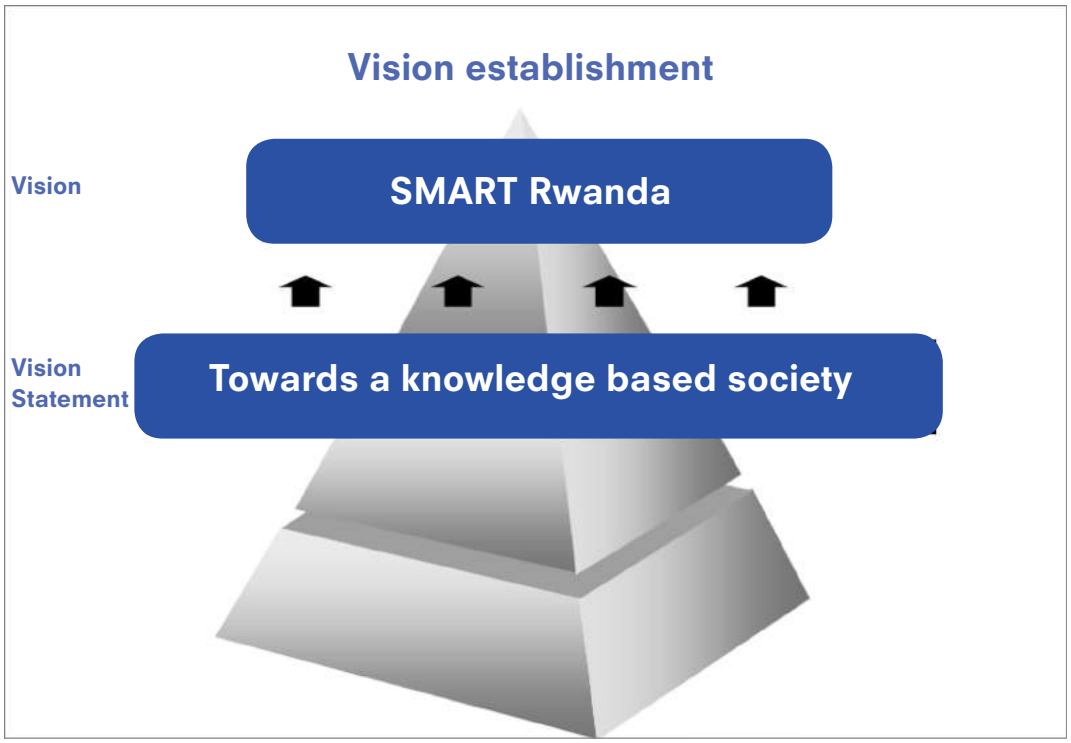


Figure 1: SMART Rwanda Vision Statement

- **SMART ICT:** To develop the infrastructure, appropriate skills and competencies, necessary to develop innovative products that help increase the social, economic, and environmental sustainability and support increase in productivity and competitiveness.

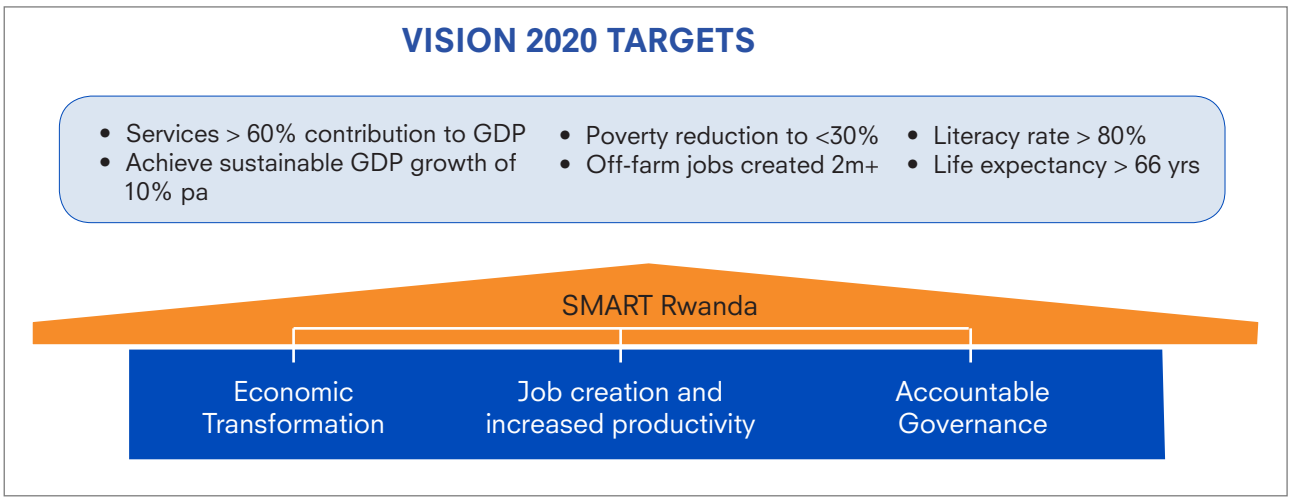
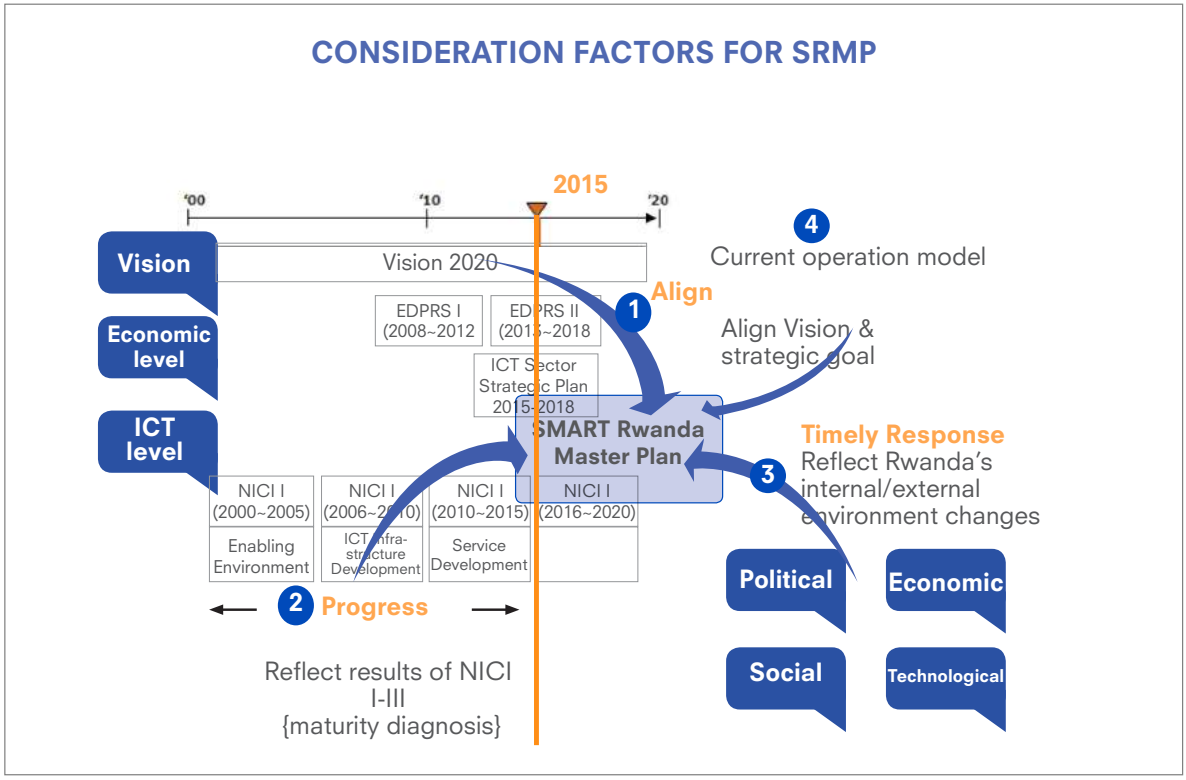


Figure 2: Vision 2020 Target

II. NATIONAL ICT ANALYSIS & ASSESSMENT

2.1. MAJOR CONSIDERATION FACTORS.

SMART Rwanda Master Plan was developed by aligning the strategy to the national economic vision, goals and objectives. The SRMP development process took into account the progress of the NICI Plans along with a quick diagnosis of the national ICT maturity, analysis of the internal and external environmental and the challenges of the current operating model



Align (aligning vision and strategic goal):

- **Align (Aligning vision and strategic goal)**
  In order to effectively derive SRMP without any redundancies, SRMP reflected on the key initiatives including Vision 2020, EDPRS, 7-Year Government Program, NICI Plans, SMART Africa Manifesto, and the current ICT Sector Strategic Plan.
- **Progress (Reflecting results of NICI I~III along with maturity diagnosis):** Reflected on the on-going projects under the ICT SSP to reduce duplication of efforts, optimizing investment and implementation.
- **Timely Response (Reflecting Rwanda's internal/external environment changes):** Reflected on Rwanda's internal and external environment challenges through a PEST (Political, Economic, Social, and Technological changes in Rwanda) analysis to effectively capture on-going
- **Execution (Current Operating Model):** Current operating model for executing and implementing ICT related projects' was reviewed, challenges identified and recommended changes to address the challenges required to effectively carry out SRMP.

2.2. ICT MATURITY LEVEL ASSESSMENT – A QUICK DIAGNOSIS

The overall diagnosis indicates that Rwanda is currently at a maturity level between 2~ 3, that is the Initiation/Integration stage. The lowest maturity level was found in areas inter alias: shared platforms, ICT skill development, ICT Affordability, Organization structure, Architecture and Standards.

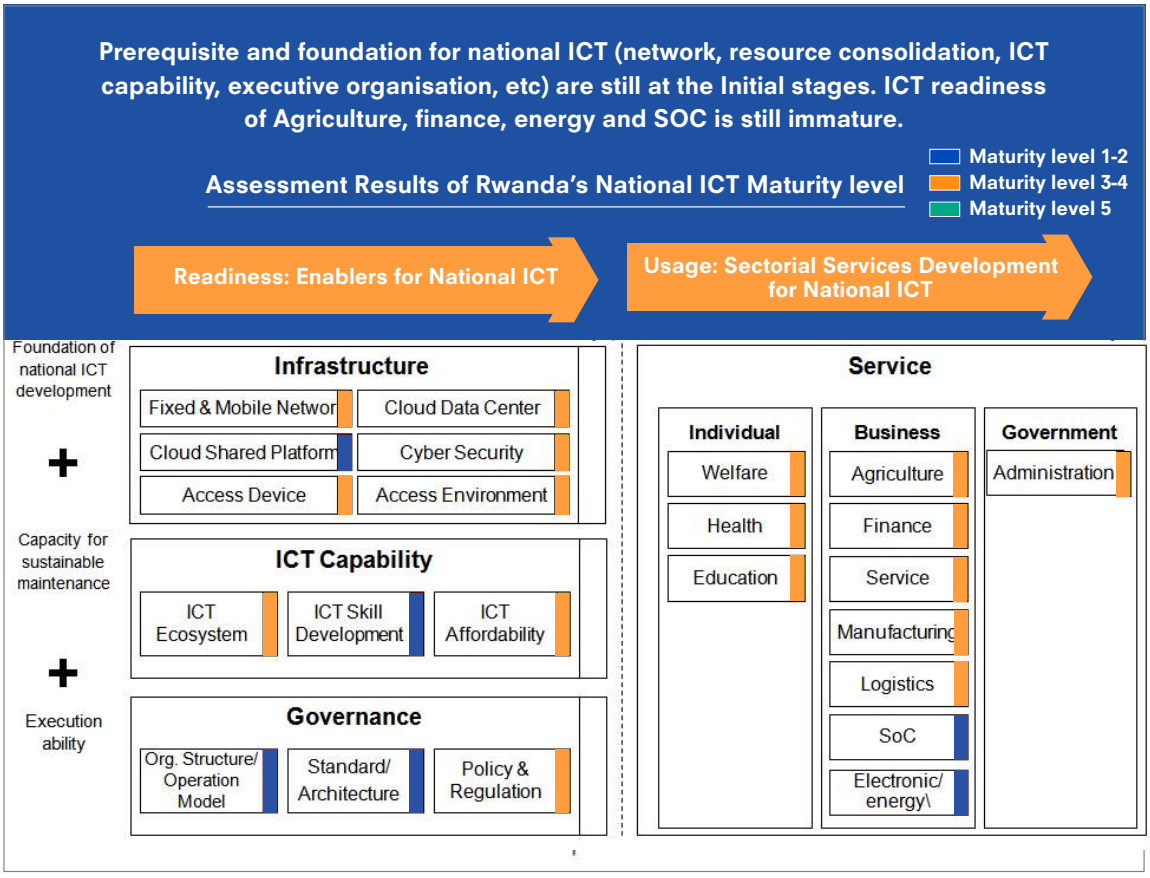


Figure 4: Assessment of Rwanda's National ICT Maturity Level

Most of ICT Capability diagnosis areas are still at an initial phase where ICT ecosystem is currently existing but still needing support and ICT skills. ICT affordability is at level two, indicating further government support is required to provide access to ICT.

In terms of Governance, except for policy & regulation, all areas are at initial level. ICT standards have been developed for national ICT skills, and partially defined some standards for ICT related development and skills.

ICT shared service's standardization and development framework enshrined under ICT Enterprise Architecture has been developed and defined for national ICT but started with specific areas.
All individual services are at the Initial phase, while some Social Security systems have been established, there are some improvements needed in terms of digitizing the national registration information for age group under 16. In health, significant progress has been made in digitized medical data, medical history management, and basic disease information. In terms of education, some basic ICT infrastructure has been established through digitized information for students, teachers, and schools.

2.3. LESSONS LEARNED

The Rwanda NICI process, being among the first in Africa and judged as one of the most successful, does have a number of key lessons that continue to remain relevant towards the success of the SMART Rwanda Master Plan:

- The continued need for high-level political championship for the plan to succeed.
- Resource mobilization to implement the policy and the plan is crucial if a high proportion of the initiatives and projects identified are to succeed.
- Stakeholder participation in the policy and plan development process is crucial for ensuring buy-in and acceptance of the need to pursue an ICT4D agenda; and
- A clear vision, mission, and strategy and a well-scheduled execution plan with a step-by-step approach including specific milestones and expected outputs are crucial.

NICI I~III accomplished establishment of basic infrastructure through ICT adoption for educational institutions, technical education system, and framework for law/regulation/system, however the capacity of the private sector development is still insufficient. Integration of public service delivery between the central and local government is weak and additional development is needed in this key area.
Overall, attaining a higher ICT maturity level is hindered by low accessibility – inadequate distribution of key backbone networks, cloud, and other access channels. Further, acceleration of growth is constrained by lack of an effective ICT implementation organization.

The key strategic differences in the SRMP to previous NICI Plans include:

(i) Execution Model - restructured the leadership and governance structure to make it more accountable, streamlined and responsive. This will involve strengthening the mandate of the National ICT Steering Committee, and the enhancement of ICT governance organization. The new structure will be accountable for the execution and success of the SRMP and also implement a strategy to drive common capabilities, infrastructure and standards across the public sector. This should significantly drive down the current operating, administrative and recurrent costs, and leverage on existing investments to increase efficiency and productivity.

(ii) Performance management - Monitor and aggressively track the ROI and progress of the strategy execution using 3 ICT indicators: ICT Development Index, Networked Readiness Index, and e-Government Development Index. A further 20 KPI's for each of the 10 core strategies will be also monitored.

(iii) Program and project selection process and management – embed best practices; allocate adequate resources and rigorous program management through effective engagement of stakeholders and project team integration to significantly improve the success rate of projects. A clear linkage between the project outcomes, the key strategic priorities and agreed measures of success will be mandatory prior to project implementation.

(iv) Monitoring and evaluation – regular reviews and continuous monitoring and evaluation of the achievement of the stated objectives and outcomes. Furthermore, a mechanism will be developed for evaluating the impact of the SRMP execution on jobs creation, ICT literacy, and infrastructure growth, alongside the other relevant ICT indicators.

(v) Private sector participation – implement a partnership program between government, private investors and development partners through models like PPP to share the investment burden of the national ICT investment costs.

The vision of "knowledge-based economy" requires that the economy be directly based on the production, distribution and use of knowledge and information. This should be reflected by growth in high-technology investments, high-technology industries, more highly skilled labor and associated productivity gains. In this view, investments in research and development, education and training and new managerial work structures is key, and SMART Rwanda Master Plan shows how.

III. STRATEGIC PLANNING

The SRMP initiatives are derived from the different government initiatives and programs, such as Vision 2020, EDPRS II, 7YGP, SMART Africa Manifesto, and ICT SSP leading to selection of seven pillars and three enablers as shown below.

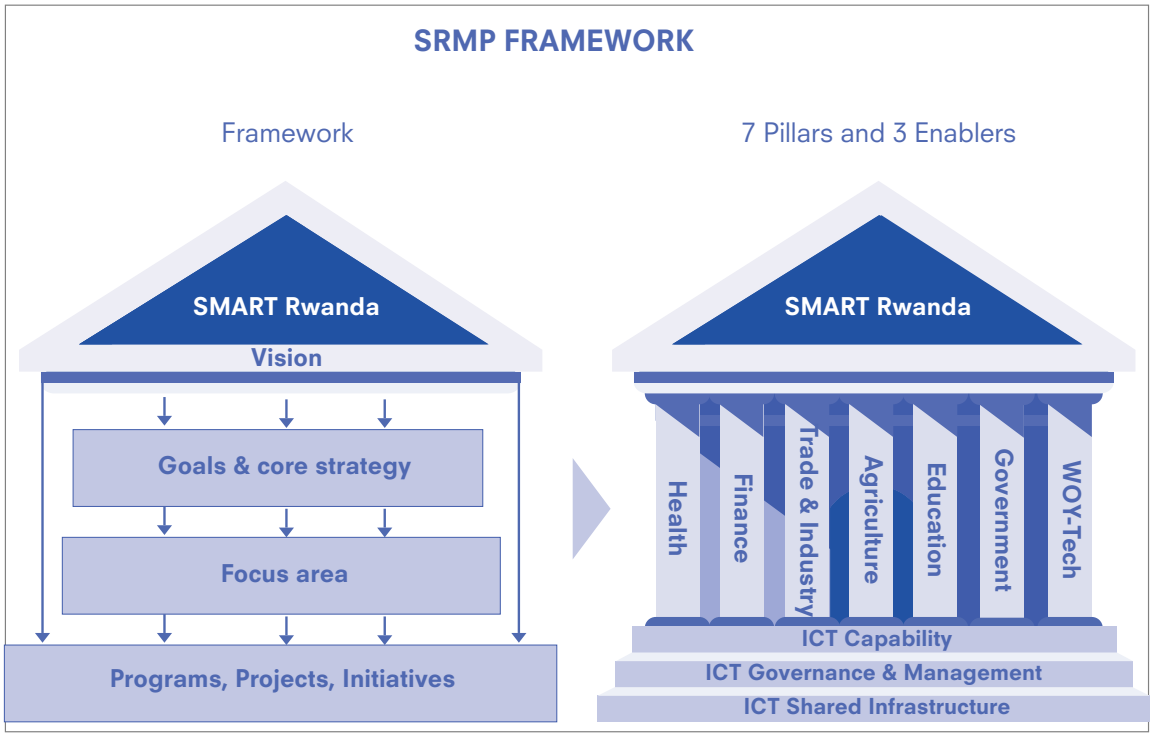


Figure 5: SRMP Framework

The seven pillars underpinning the SMART RWANDA Master Plan are:

1. Health
2. Finance
3. Trade and Industry
4. Agriculture
5. Education
6. Government
7. Women and Youth Empowerment in Technology – WOY-Tech

The seven sectors were strategically selected holding a multiplier effect to mainstream ICT in all facets of socio-economic development. To ensure effective implementation of each pillar, respective sector Ministries and Agencies shall develop and implement own smart and comprehensive ICT strategies.

While the three enablers are:

1. Effective ICT Governance and Management
2. ICT Capacity and Capability
3. Secured and Shared Infrastructure

3.1 GOALS

The Vision statement is linked to the key initiatives, which are in turn linked to the 7 Pillars and 3 Enablers to deliver 3 goals through SRMP.
The 3 overarching goals are:

1. Economic Transformation
2. Job Creation and Increase in productivity
3. Accountable Governance

SMART RWANDA MASTER PLAN: OVERVIEW

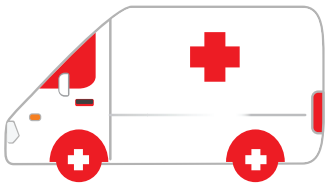
Vision	"Towards a knowledge based society"
Theme {7 - Pillars, 3 - Enablers}	SMART Education; SMART Government; SMART Health; SMART Trade & Industry; SMART Agriculture; SMART Finance; WOY-Tech SMART ICT Capability; SMART ICT Governance; SMART ICT Shared infrastructure
Goal {3}	Economic Transformation; Job creation and increased productivity; Accountable Governance
Core objectives {10}	1 Expand medical and health services to enhance citizens quality of time 2 Utilize ICT for education as a tool to enhance teaching and learning 3 Boost Agricultural productivity, industrialisation and commercialisation 4 Improve financial infrastructure to expand access to financial services 5 Promote trade and industry development by enhancing value of products and services 6 Improve and expand access to ICT skills and innovation capacity 7 Advance women and youths social economic empowerment through ICT 8 Build a shared,robust & resilient infrastructure to uderpin service delivery & support national ICT initiatives 9 Enhance the national ICT Governance and Regulatory structure 10 Transform digital Government through E-Gov and effective service delivery

Figure 6: SRMP Overview

3.2. CORE OBJECTIVES AND FOCUS AREAS

Each of the ten core objectives has two focus areas defined. The subsequent Action Plan is based on the projects under each focus area and addresses the core objectives.

3.2.1 Objective #1. Expand medical and health services to enhance citizen's quality of life.



Core Objective

- Provide better social security and higher quality of lives through enhancement of information sharing between government institutions
- Increase access to medical information and service and provide digitalized network for health information (e-Health)
- Provide technology platform for an integrated health information system and digitalized insurance claim system to systematically manage information for preemptive and efficient response measures

Major direction of change and benefit

- Ensure universal access to affordable preventive, curative, and rehabilitative health services of the highest attainable quality.
- Empowering and transforming communities through improved access to health information and services
- Have an effective infrastructure, applications and information systems supporting effective and efficient delivery of healthcare services

Focus Areas

- Expanding telemedicine and consultation systems
- Enhancing consumer healthcare systems

3.2.2 Objective #2. Utilize ICT for Education as a tool to enhance teaching and learning

Core Objective

- Achieve knowledge-based economic developments through education and human resources development and utilization
- Enhance human resources at a national level, improve educational opportunities and access through expansion of information digitalization and e-learning programs
- Enhance domestic human resources and social security through development of education and skills training.

Major direction of change and benefit

- National education materials and contents available via online
- All learning institutions are connected to the national education network with full access to digital contents
- Increased education opportunities and information for ordinary for citizens

- Reduced education costs and improved service quality
- Enhanced students/teacher interaction through open and distance learning
- Integrated students and teachers information
- Focus Areas
- Improving accessibility to digital education information and content
- Strengthening ICT capability development and learning systems

3.2.3 Objective #3. Transform agricultural practices to enhance productivity, and increased commercialization and industrialization

Core Objective

- Enhance overall productivity of agriculture and provide basis for industrialization
- Promote agriculture productivity by providing timely and relevant information to the farming community

Major direction of change and benefit

- Improved productivity and increased efficiency in the agriculture value chain
- Diversified agriculture product portfolio
- Evolve from subsistence farming to commercial farming with export potential

Focus Area

- Providing information for enhancing agricultural productivity
- Establishing entire value-chain foundation for ICT-based agricultural commercialization and industrialization.

3.2.4 Objective #4. Expand financial infrastructure to increase access to financial services

Core Objective

- Enhance basic infrastructure for financial transactions including credit card terminals and call centers to promote stability
- Establish web-based financial transaction core systems including e-payment, and online banking system along with enhancing current financial infrastructure
- Enhance financial security system including authentication system
- Expand financial transaction channels to facilitate utilization

Major direction of change and benefit

- Revitalize national commerce, trade, and industry through public access to financial infrastructure
- Enhanced online financial services via establishments of commercial websites, e-Procurement, e-Government, and e-Trade
- Improved tax revenue management (collection, transparency, disbursement

Focus Areas

- Enhancing electronic financial transactions
- Implement systems to support financial inclusion

3.2.5 Objective #5. Promote trade and industry development by enhancing value of products and services

Core Objective

- Diversify the sources of profit to promote national economic growths by developing new products and service portfolios beyond the current agriculture.
- Fortify social infrastructures including transportation and electricity to increase business opportunities and expansion of industrial development
- Empower all key economic sectors by enhancing the ICT productivity

Major direction of change and benefit

- Increase the competitiveness of private sector
- Provide one-stop services and established integrated channels to support companies
- Created business-friendly environments by enhancing the public participation
- Facilitated well-managed foreign investment management system to effectively regulate potential risks even during the global economic fluctuations
- Improved transportation system to enhance the productivity and reduce the transportation costs and delivery time
- Enhanced the electricity monitoring system to maximize the "stability of power supply" and minimize the "systemic energy loss"

Focus Areas

- Promote BPO, Hospitality, Transport & Logistics service industries
- Improving industrial and social infrastructure.

3.2.6 Objective #6. Improve and expand access to ICT skills and innovation capacity

Core Objective

- Improve ICT utilization by extending the penetration rate to enhance the accessibility for citizens
- Maximize the security and stability of networks by separating function based network from the just backbone establishments
- Promote national development plans by considering the regional characteristics of Rwanda
- Improve accessibility to broadcasting contents through government led development of the broadcasting industry
- Enhance the transition towards a knowledge-based society by implementing education policies to eliminate the digital divide and guarantee equal opportunities for citizens

Major direction of change and benefit

- Promote research and development of ICT innovation

Focus Areas

- Establish a national innovation centers to promote specialized ICT skills
- Establish ICT R&D centers in collaboration with international ICT companies.

3.2.7 Objective #7. Promote Women and Youth's social economic empowerment through ICT

Core Objective

- Promote the development of ICT applications to increase women's productivity,
- Promote job creation for Youth in ICT sector especially through Business Processing outsourcing (BPO) initiatives,
- Promote Youth innovative projects in ICT

Major direction of change and benefit

- Enhanced ICT-based business initiatives, and various economic activities for women,
- Promoted Youth's participation in ICT related business and various economic activities

Focus Areas

- Facilitate Women and Youth in ICT capacity building projects through talent detection, financial support and mentorship.
- Facilitating projects related to increasing Women and Youth participation in ICT related business through mobilization of both private and public sector.

3.2.8 Objective #8. Build a secured, shared robust and resilient infrastructure to underpin service delivery and support national ICT initiatives

Core Objective and Rationale Description

- Establish e-Government infrastructure with standardized government ICT architecture and framework
- Promote efficient usage of limited resources through data center integration and transition towards Cloud-based ICT infrastructure

Major direction of change and benefit

- Establish Government ICT Enterprise Architecture and e-Government framework
- Developed systematic and standardized ICT service systems
- Consolidated data centers through Cloud technology for efficient budget and resource management.

Focus Areas

- Consolidation of an integrated and shared national ICT infrastructure " Cloud-first" policy
- Strengthening cyber-security, disaster prevention and response systems; and resilience capabilities.

3.2.9 Objective #9. Enhance the National ICT Governance Structure for effectiveness implementation of ICT programs.

Core Objective Rationale and Description

- Initiate programs geared towards building ICT creative industry, Research & Development and Future Planning.
- Develop scope clarity, governance, operating model to enhance understanding of related internal and external stakeholders.
- Adopt a "Value-For-Money" approach and method while implementing ICT programs to effectively drive better ROI and lower cost of ownership.

Major direction of change and benefit

- Reduced complexity and minimized ICT investment redundancies across the sector.
- Enhanced ROI for ICT investment - Faster realization of savings and returns
- Enhanced government and ICT industries' engagement along with leveraged operational scale across the government functions.
- Empower Enhanced capability across all aspects of the public service delivery.

Focus Areas

- Improving performance-centered national laws, policies and regulations to support ICT strategic goals.
- To enhance the national ICT governance and management structure to effective adopt and cope up with ever changing ICT demands

3.2.10 Objective#10. Transform digital government through e-Government and provide effective public service delivery to empower rural and urban communities

Core Objective Rationale and Description

- Implement e-Government by integrating all government services to enhance operational efficiency and the quality of service delivery to citizens and businesses
- Establish effective communication channels to enable and empower both rural and urban communities, increasing citizens' participation in governance

Major direction of change and benefit

- Computerized majority of government processes and systems - Software integration and hardware consolidation
- Developed communication channels for government organizations, citizens, and businesses
- Developed access to government services and information via web and mobile
- Implemented and enhanced relevant policies through public data aggregation and data sharing.

Focus Areas

- Facilitating government service delivery, information sharing and communication channels (G2C, G2B)
- Developing a common platform of national Internet information services "local internet".

IV. SRMP IMPLEMENTATION ROADMAP

4.1. ICT GOVERNANCE ENHANCEMENT

The ICT sector continues to exponentially grow in a fast-changing technology environment with dynamic domestic and external demands, ambitions targets geared to deliver Rwanda's future today.

In order to adopt and tackle ever changing ICT demands, there is a need to strengthen governance and management structure of ICT to address challenges related to performance and coordination. With an objective to develop and implement national ICT programs to enable national socio-economic transformation leading to a knowledge based society, the enhanced governance shall be empowered as a control-tower to capably manage and handle ICT implementation.

Effective ICT Governance becomes even more critical at a time when Rwanda positions herself as Africa's ICT Hub with a need to focus on strategic and forward looking programs including building an ICT Creative and Innovative Industry, Research and Development, Future Planning, Significant Private Sector Growth, Digital Literacy among others. Particularly, the new Governance framework shall be agile enough to include research and development for the future technology trends mentioned in the executive summary.

4.3 SRMP IMPLEMENTATION ROADMAP

4.3.1 Approach

In the Implementation Roadmap stage, the projects in relation to 10 Core Objectives were categorized and mapped based on strategic importance, priority, and resources required. The project implementation schedule was finalized after reviewing the lead-lag or precedence relationship of each project and required resources.

Four types of projects are defined:

- 'Quick Win' projects: ~2015/16, focused on projects related to ICT enabler
- 'Short-term' projects: 2016/17 ~ 2017/18

- ‘Mid-term’ projects: 2018/19 ~ 2020
- ‘Long-term’ projects: af

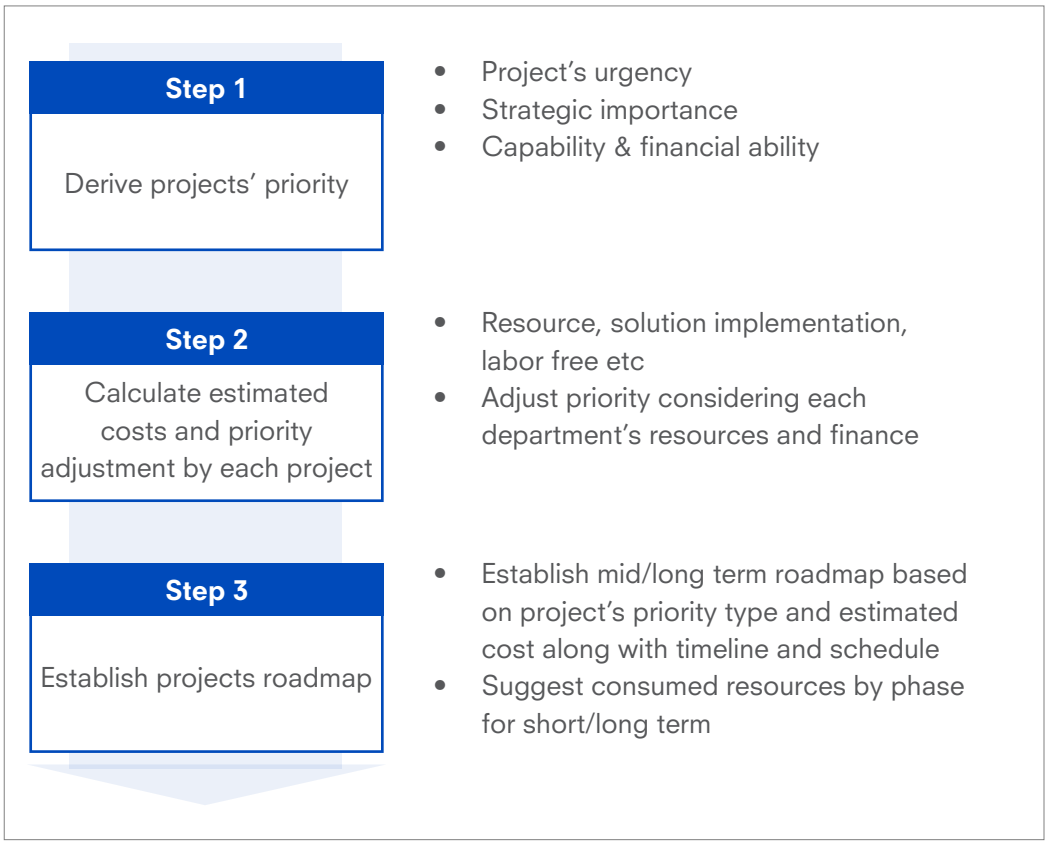


Figure 7: Deriving the SRMP Implementation Plan

Step1. Derive projects’ priority
Derive the priority using a top-down and bottom-up analysis, and defined quick-win projects, some of which are currently in progress.
Step2. Calculate estimated costs and priority adjustment by each project
Calculate the estimated costs based on the project’s impact, expected infrastructure resources and other project related costs. Adjustments then made after consideration of the implementation agency’s resources and capabilities.
Step3. Establish projects’ roadmap
Establish a roadmap based on project’s category, estimated costs, and timelines. Suggest consumed resources for each phase according to their short/mid/long-term time periods. The roadmap will be filtered based on the SPREAD principles to finalize the projects to be implemented.

4.3.2 Priority Evaluation of the Projects

The projects were defined as either ‘High,’‘Medium,’ and ‘Low’ based on their strategic importance (socio-economic impact), priority and input resources (capacity and capability) to execute a specific project. The urgency of a project will be decided based on the project’s contribution for the ICT growth as an ‘Enabler”. Furthermore, the long-term projects’ input resources are assessed by the amount of the investment vis-à-vis the government ICT budget.
Strategic Importance: consider scaling and enabling effects of a project based on urgency and input resource

- Urgency: project is a preceding enabler for other related projects and requires early adoption as an enabler
- Input Resource: any resources either in the form of tangible or intangible, capacity and capability that is required to execute a specific project
- Beneficiaries of the projects are categorized into G2G, G2B, and G2C.
- G2G (Government to Government): The project beneficiaries are other government or bureaucratic departments and projects may enable information sharing and exchange.
- G2B (Government to Business): The project involves active participation of the business and government in order to improve overall business and government's interaction between business.
- G2C (Government to Citizen): The project involves providing services, infrastructure and enabling environment to the citizens to improve quality of life. The active participation of the citizens in the development and implementation phase of project is necessary to capture the needs of the citizens.

The execution responsibility will lie with the proposed new structure, but post-implementation success and sustainability will be the responsibility of the project owner, either a ministry, department, or agency.

4.3.3 Portfolio Analysis

The portfolio analysis is conducted in order to derive projects' type based on urgency and strategic importance. The projects are pooled into four categories that can further enhance the execution of the project roadmap. The four categories are 'Enabler,' 'Must have,' 'Value added,' and 'Nice to have.'

The precedence relationship between projects are also considered, with projects that are defined as 'Enabler' need to executed as "quick-wins" that is, within a very short period to provide the enabling environment or infrastructure for the related projects to follow.

Projects that are defined as 'Must have' are categorized as short -term projects. These projects are high in urgency as they may provide high socio-economic impact.

Projects that are defined as 'Value added' are projected to execute as a medium-term project with prevalent impact to majority of the citizens and have strong strategic importance.
Projects that are defined as 'Nice to have' are low in both urgency and strategic importance but may provide additional values to citizens. Their low prevalent impact to the citizens marks them as long-term projects.

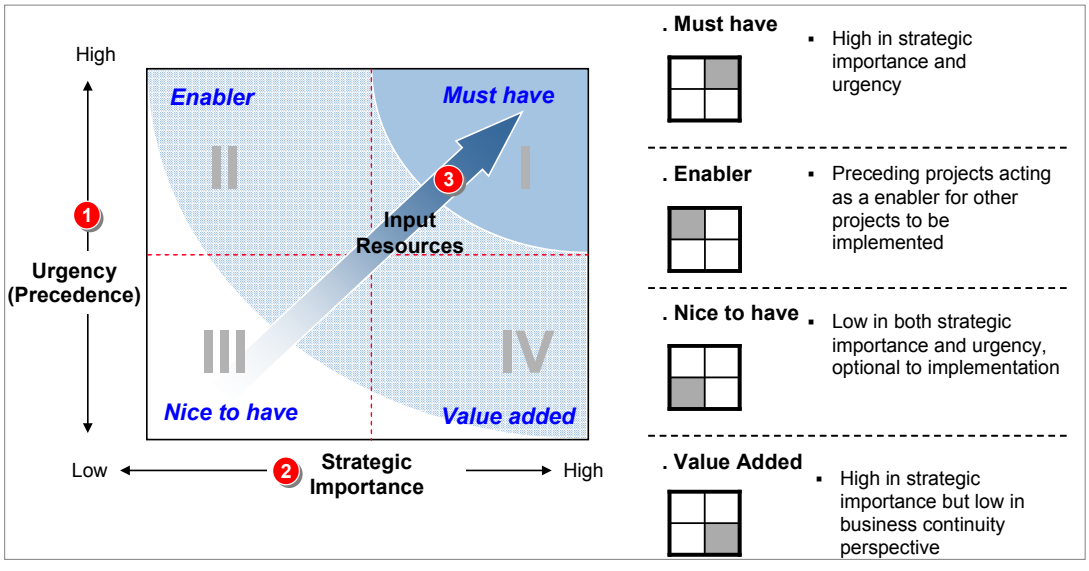


Figure 8: Deriving Project Priority

I. Must Have: Projects with high priority in strategic importance and urgency. These projects clearly demonstrate socio-economic impact.
II. Enabler: Strategic importance is relatively low but these projects are required to provide enabling conditions for other projects. In this case, the preceding projects act as an enabler for other projects (usually quick win or short-term projects).
III. Nice to have: Low in both strategic importance and urgency; implementation is optional. Nice-to-have projects are under limited input resources, have low priority and could be excluded.
IV. Value Added: High in strategic importance but low urgency; they can be implemented either as medium or long-term projects.z

4.3.4 Estimated Costs

The costs associated with the implementation of the SRMP projects is estimated at US$519M but a more accurate budget shall be derived after conducting a more detailed review to determine the priority, resources, and capacity available.

4.3.5 Projects Selection using "SPREAD" Principles

The proposed projects will be finalized by applying the "SPREAD" acid test, a guiding principle developed during the implementation of the ICT Sector Strategic Plan. SPREAD is an acronym, which represents the merits, which all programs, projects and activities need to fulfill for them to be considered priority for the ICT sector.
The "**SPREAD**" acid test will used to confirm feasibility and possibility to execute the project. The "SPREAD" test principles are explained further, below.

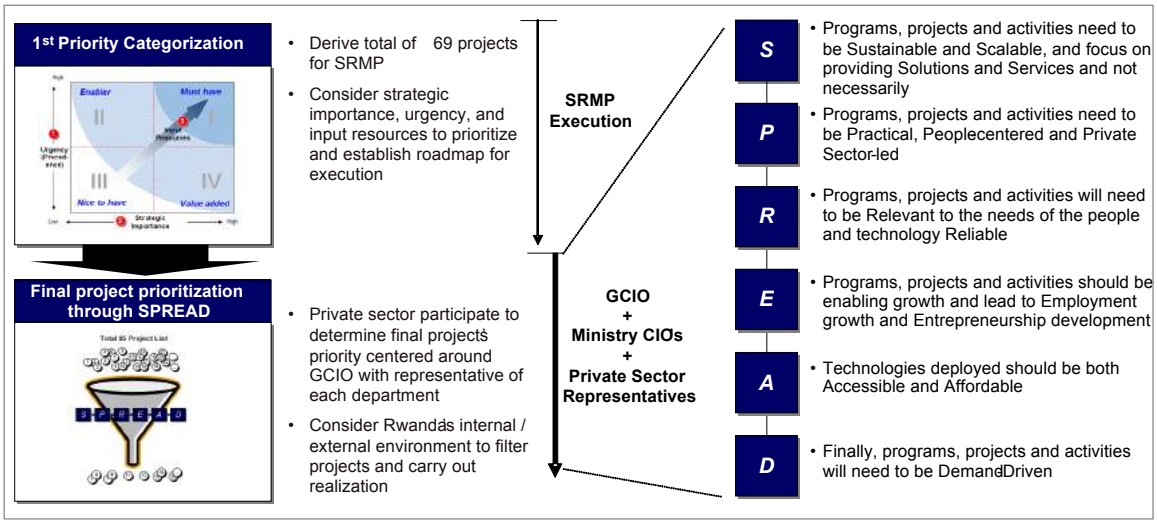


Figure 9: SRMP Project Prioritization Criteria

S: Programs, projects and activities need to be **Sustainable** and **Scalable**. Rather than focus on Technology, they should focus on providing Solutions and Services
P: Programs, projects and activities will need to be **Practical, People-centered** and **Private Sector-led.** Unlike previously where government has been taking the lead in implementation of projects, the focus now and in the future is to let private sector take the lead in the implementation of ICTs.
R: Programs, projects and activities will need to be **Relevant** to the needs of the people and technology **Reliable.** More importantly, they should be relevant to and targeting the Rural population and should help

transform Rwanda into an ICT Regional hub
E: Programs, projects and activities should be enabling growth and should lead to **Employment growth** and **Entrepreneurship development**
A: Technologies deployed should be both **Accessible** and **Affordable** to the population
D: Finally, programs, projects and activities will need to be **Demand-Driven**

V. SRMP EXECUTION MODEL

5.1. PRIVATE SECTOR PARTICIPATION (PUBLIC- PRIVATE PARTNERSHIP)

Public- private partnerships could make strides in delivering infrastructure, developing ICT capabilities, or delivering e-government, education, and health services. Companies from different sectors may need to collaborate to deliver new products and services: banks and telecom operators have partnered to provide mobile financial services, for instance, while e-commerce depends on cooperation from multiple players to set standards, create payment platforms, and develop logistics.
Participation and collaboration between the public and private sectors is expected to play an important role in the effective execution of SRMP. This is important to reduce government's burden of meeting the SRMP investment costs and inviting ICT expertise to increase the chance of success in enhancing innovation and jobs creation.
The collaboration can be viewed in four phases: strategy and planning, budgeting, procurement and execution, and monitoring and evaluation.
At the strategy and planning phase, the collaboration shall involve sharing of ideas on approach, methodology to derive innovative and revolutionary ideas.
The second phase is budgeting and various institutional funds will be managed along with government investment and support. The joint investment between government and the private sector will occur where private sector may initiate the investment and government will provide returns through a mix of incentives and other benefits.
Third phase is procurement and execution. Private sector shall participate throughout the entire SRMP process either as a service developer or provider.
The final phase is monitoring and evaluation through a special committee comprising both public and private sector members composed to support expert and objective evaluation including investment performance and ROI analysis to measure the effectiveness of project.

5.1.1 ICT Public-Private Partnership (PPP) Model

The ICT PPP Model illustrates effective investment into specific project with private sector participation. The private sector's participating companies can either be an international or local and local expert to enable knowledge and skill transform. With expertise, the private partner can provide on-going consultation and operation advice in order to maintain the project's success.
Government will be involved in the PPP by providing support through regulation and policy, strategy and arbitration management, setting guidelines and providing seed capital.

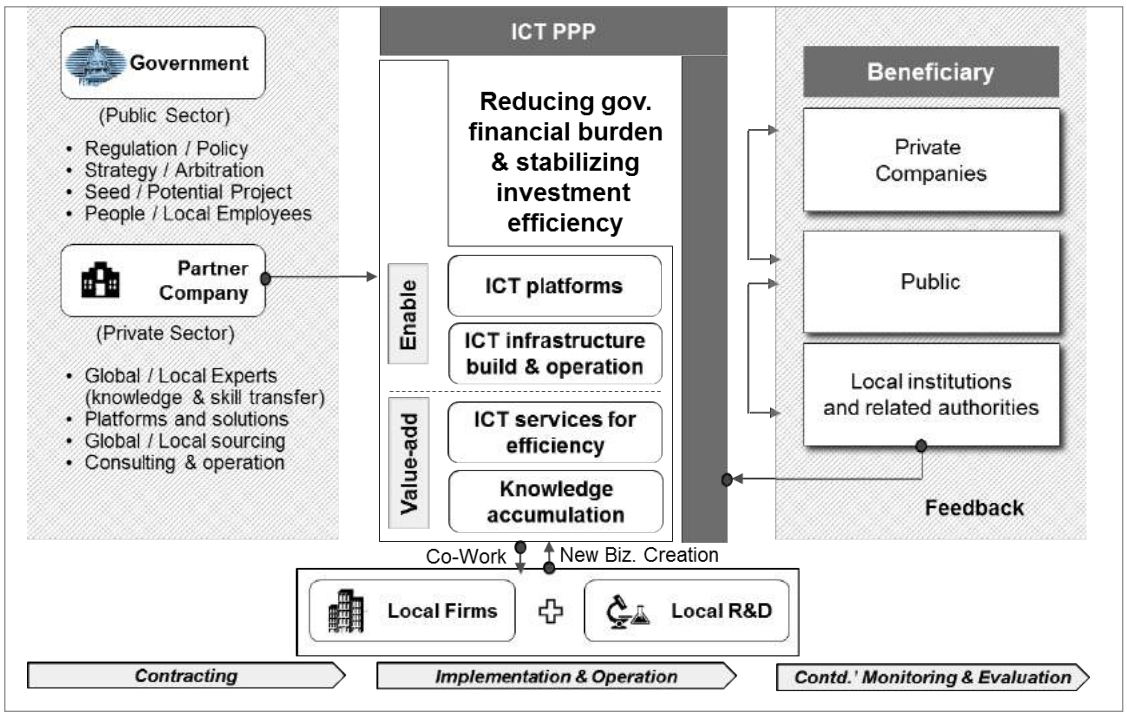


Figure 10: ICT Investment PPP Model

The objective of the PPP Framework is to reduce the government's financial burden and stabilizing investment efficiency while increasing the success of the project through ICT platforms, ICT infrastructure building and operation to enable the project and provide value add services to increase ICT service efficiency and provide basis for knowledge accumulation. The other PPP model objective is to private-sector transformation as Vision 2020 affirms, "The Government of Rwanda will not be involved in providing services and products that can be delivered more efficiently by the private sector, [...] the State will only act as a catalyst" (MINECOFIN 2000, p. 14).
The GoR has achieved a policy environment that is favorable for the private sector, yet private sector investment remains low due to lack of a skilled labor force. The success therefore of the private sector development agenda is dependent on achievements in education and training.

In addition, partnership between local and international firms working together with the public sector shall provide local firms the necessary expertise and experience through knowledge transfer garnered from the PPP process. It is now time to shift gears in private-sector development. This means fostering public-private partnerships to enhance entrepreneurship and private sector growth, but also looking to scale down and phase out public funding where possible.

5.2. THE PRIVATE SECTOR DEVELOPMENT STRATEGY

The role of private sector is crucial in development of a National ICT strategy in terms of both infrastructure investment and driving innovation. The government has facilitated this with creation of a business environment that is conducive to investment and private sector participation will stimulate and build sustainable value chains, which are the basis for shared growth, and reduce the government's burden to finance and provide the resources for the ICT development. The government is also actively attracting international corporations through investment-friendly policies to develop a Kigali Innovation City, and also partner with the private sector on specific projects. The presence of multinationals should facilitate

knowledge transfer, local skills development, and faster innovation.
The importance then of the private sector development remains a critical factor in the SRMP. The development of the ICT Private Sector Development has been defined according to four major focus areas all of which contribute to the overall achievement of the SRMP objectives.

5.2.1. The four focus areas defining ICT-Private Sector Development are:

- Grow Existing Indigenous ICT Businesses
- Cultivate New Local ICT Enterprises
- Transform Non-ICT Businesses with Technology
- Export & FDI Expansion

1) Grow Existing Indigenous ICT Businesses
Rwanda has recorded great statistics in World Bank doing business reports, however up to now it is hard to keep track of the progress of private companies operating in Rwanda, their growth or failure. It is against this and other reasons that the ICT-PSD is envisioned as first being able to track the progress and growth of local ICT companies by developing an appropriate index to measure the growth of the private sector against set targets.

2) Cultivate New Local ICT Companies
The second aspect of ICT-Private Sector Development addresses the development of new local ICT companies. Although a number of initiatives have been put in place to foster entrepreneurship and particularly technology related, there's still a lack of a coherent framework that tracks the development of new enterprises both in technology and other sectors.
The development of new local ICT companies, goes hand in hand with the first aspect of the definition of the ICT-PSD that is, growing existing indigenous ICT companies. In order to attain nationwide growth and prosperity stimulated by ICT, a national framework to support the emergence and development of local ICT companies is required.

3) Transform Non-ICT Businesses with Technology
Unlike other sectors ICT is crosscutting, as such this means that although it may not be seen at the forefront of all operations, it is an enabler adding value in organizations; big and small, public and private.

As a result, ICT Private Sector Development cannot be seen only as inward progress for ICT companies but rather as how it contributes to the development of other sectors. At sector level it has the potential to offer value in 3 main ways both to private and public organizations:
1. Reducing Costs
2. Improving service delivery
3. Creating new revenue streams

Consequently, one of the defining factors of ICT Private Sector Development focuses on its value and advancement in other sectors particularly in private organizations. This value and progress too needs to be tracked in order to ascertain that the envisioned targets and pursuits are achieved.

4) Exports & Foreign Direct Investment Expansion
Rwanda has continuously performed well in global and Africa investment rankings resulting into more capital flows in all sectors not excluding ICT. The last focus area of ICT-Private Sector Development looks at how ICT contributes to the expansion of the economy through Foreign Direct Investments and ICT products and services exports. Over the last 20 years Rwanda has recorded tremendous growth in the sector most of which can be attributed to foreign direct investment in the telecoms sector. However, there's been little recorded on the export side of ICT products and services. This has been due to a number of reasons

primarily skills capacity but also the fact that over that period the sector has focused on solving challenges at home. In light of the SMART Rwanda and other initiatives, the private sector will seek to expand its exports potential and attraction of foreign direct investments.

5.2.2. Delivering ICT Private Sector Development

In order to reach the definition set out in the definition of the ICT-Private Sector Development, a number of projects have been envisioned. These projects are developed with the aim of being enablers that facilitate sector operators and stakeholders to track progress and identify gaps. The focus areas identified in the definition form the basis of the projects and consequently the projects help in outlining the potential key indicators, activities and policy requirements for the achievement of the set out goal.

#1 GOAL: CULTIVATE NEW LOCAL ICT ENTERPRISES

Cultivating new local ICT enterprises builds on a strong foundation of education institutions, particularly in light of the national vision of becoming a knowledge-based society. As such knowledge and the culture to boost knowledge-based enterprises is a crucial input in achieving this goal.

NATIONAL INNOVATION FRAMEWORK:

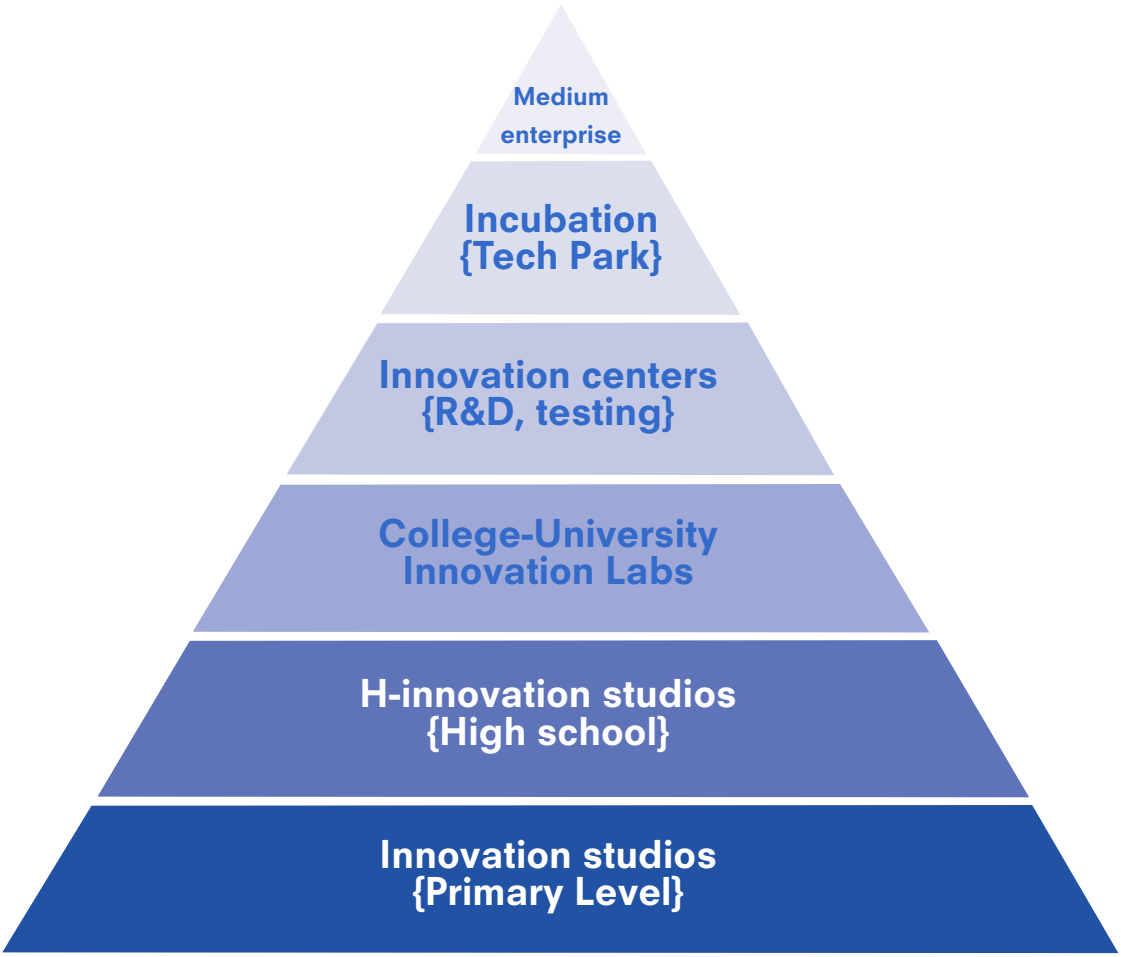


Figure 11: National ICT Skill Innovation Framework

The National Innovation Framework aims at ensuring that the Education System is adding to national economic development through a progression framework tracking innovative and entrepreneurial talent from the ground up. As indicated the proposed system targets to identify talent from the earliest education level, primary school and tracking that through high school to college, university and beyond.

Goal Output:

- **100** Innovation Studios in Primary & High Schools
- **200 supported** new projects from universities, colleges
- **100 start-up companies** with market capitalization of $50M
- **$250 Million** in New Venture Funds to support tech entrepreneurs created

#2 GOAL: GROW EXISTING INDIGENOUS ICT COMPANIES

The purpose of this goal is being able to facilitate existing indigenous companies in their competitiveness and growth to global player status. This will be achieved through a competitiveness index project looking at the investment readiness of the indigenous companies, under a flagship project Rwanda ICT Business Investment Readiness Index.

Goal Output:

- **50** stock market list-able companies
- **100** indigenous companies with market capitalization of **$50 Million**
- **$10 Million** new annual local investments
- **10,000** advanced technology jobs

#3 GOAL: TRANSFORM NON-ICT BUSINESSES WITH TECHNOLOGY

Maximizing the potential ICT brings to business and industry starts with knowing the added value and tracking it. The sector's contribution to economic development can come in three broad categories both to private and public organizations:

1. Reducing Costs
2. Improving service delivery
3. Creating new revenue streams

Goal Output:

- **500,000** Farmers trained and tracked for ICT impact on business
- **500,000** businesses using ICT in their business
- **1,000,000** new ICT & ICT enabled jobs

#4 GOAL: EXPORT AND FOREIGN DIRECT INVESTMENT EXPANSION

In order to expand the private sector ICT exports and foreign director investments in the sector will seek to expand its exports potential and attraction of foreign direct investments.

Goal Output:

- **$100M** New Export Revenue

- **50** Exporting companies
- **$1Billion** in operational Foreign Direct Investments
- **100,000** export jobs

5.3. SKILL DEVELOPMENT FRAMEWORK

ICT competency and skill usually refers to an ability to solve problems by utilizing ICT, and it applies to work process and performance enhancement. The proposed skills development framework will enable Rwanda to foster experts and internalize ICT technologies and operation skills. Further, with a skills framework, Rwanda should instigate skills development for ICT competency and skill for public sector, citizens, and the private sector focusing on developing actual ability rather than potential ability.

5.3.1 ICT Competency and Skill Development Conceptual Framework

There are three main components to the national ICT competency and skills development framework:

- Competency and framework: Focuses on enhancing ICT penetration and usages, increasing teacher's capacity and capability along with content and access development to education.
- Related policy, law, and institution: Policy, law, and institutions shall be developed to support and enhance e-competency. With effective policy and law, ICT penetration and usage can be enhanced utilizing existing ICT infrastructure.
- Education programs: The education programs are aligned with government's on-going initiatives such as Open, Distance & e-Learning, Digital Library, and others.

The above three elements have to be developed in parallel to effectively impose an ICT competency and skill development.

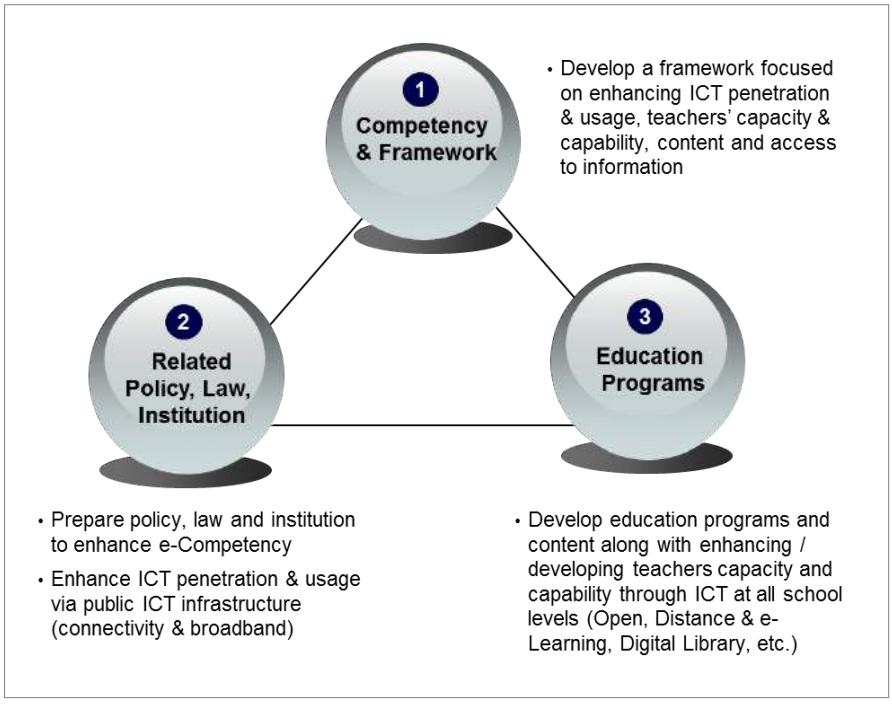


Figure 12: ICT Skills & Competency Conceptual Framework

The overarching objective of the Skills and Competency Framework is threefold: develop highly skilled manpower, create and disseminate high-quality research, and deliver direct technical assistance and ICT training to the citizens of Rwanda.

VI. FORECASTING EXPECTED BENEFITS

6.1. APPROACH

According to the Business Value Model (Melville et al 2004), enhancement of efficiency in governmental administrations through IT investments will increase the benefits of the citizens and businesses, and further impact the industry and nation as a whole. According to the model, there are two classifications on the effects to the ICT: micro-effects and macro-effects. This is an efficient classification for a long-term master plan as it is hard to measure the micro level of performances of each individual project. In such a case, the limitation is supplemented with a macro perspective measurement to value the outcomes of the long-term project.

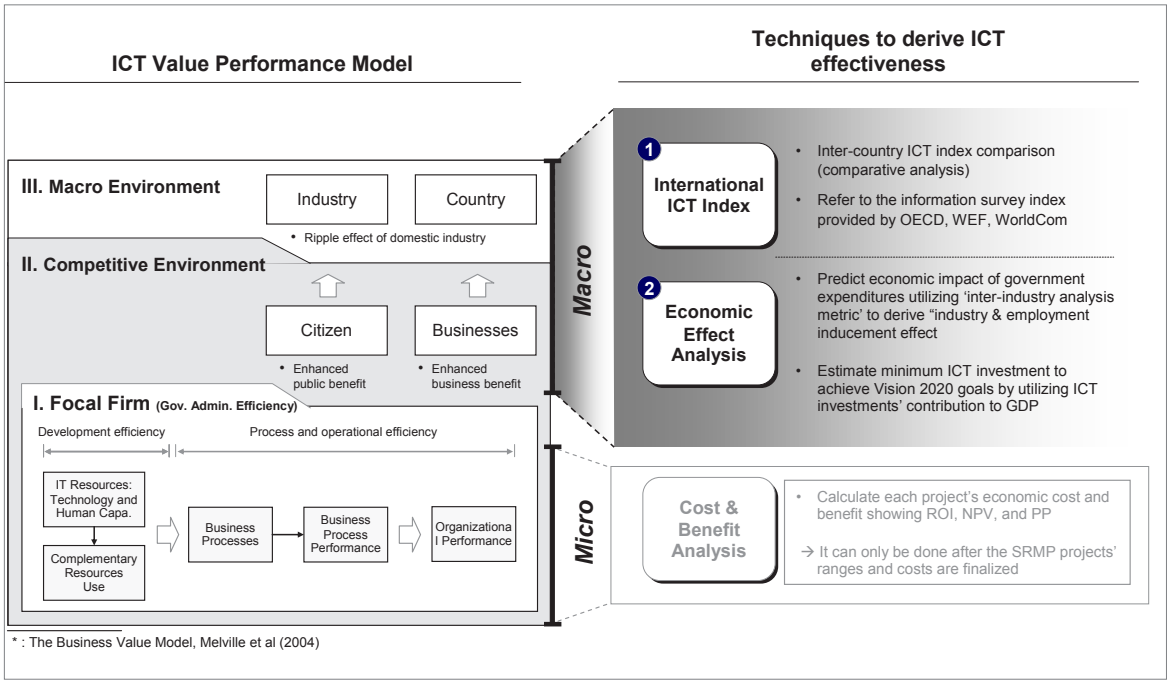


Figure 13: Perspective and Range of the ICT Effectiveness Analysis

The analysis of micro measurement is possible when the direction and major basic functions of the project are specified. Furthermore, micro-perspective measurements require a financial analysis of return on investment (ROI) based on unit cost of the input and expected effects of each project. In other words, it is important to have quantifiable financial values such as exact unit cost and expected effects of each project. For example, the indicators should be able to measure the quantified values of the increase in the operational efficiency, reduction in time consumption, and cost-savings through the implementation of the project. In the macro perspective, on the other hand, should be able to measure and analyze the direct and indirect effects of the economic value added on both national and international level and number of the new jobs creations through the ICT investment in the competitive environment. The macro

measurements further entail the quantification of the domestic level of ICT advancement and comparative advancement of national ICT level against other countries. In order to measure the expected effects of the SRMP, determination of target values of future financial effects and level of international ICT status to be achieved have to set in advance according to the relevant international index and economic effect analysis. These quantifications will be used as evaluating tools to measure whether the SRMP is operated in the right direction in the times to come. Furthermore, values accumulated from the continuous evaluations and monitoring will provide basic foundation for other result-oriented projects.

6.2. ECONOMIC EFFECT ANALYSIS

Economic Effects have been analyzed in three main perspectives: 1) GDP Contribution Effect, 2) Industry Inducement Effect, and 3) Employment Inducement Effect.

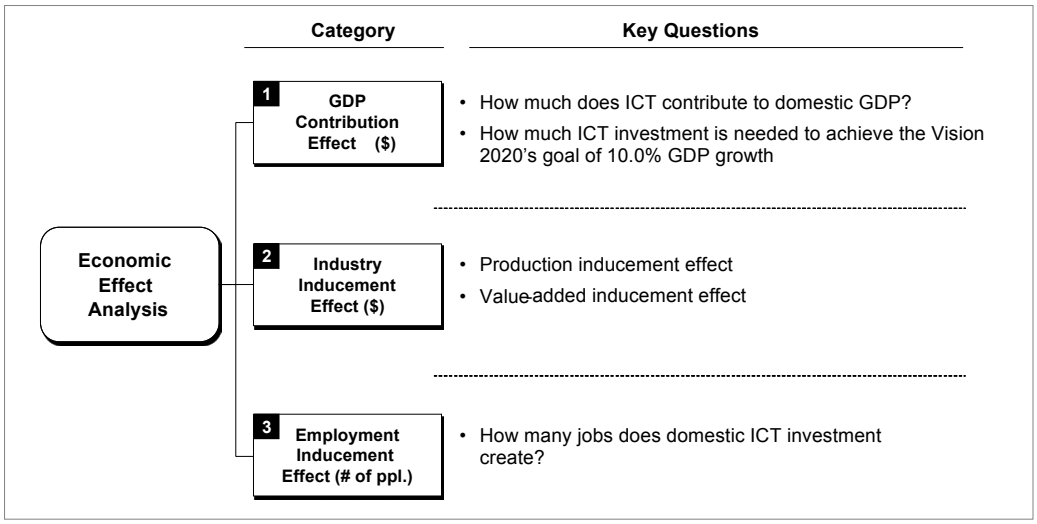


Figure 14: Economic Effect Analysis View

6.2.1 GDP Contribution Effect

The concept of the GDP Contribution effect is based on the economic contribution of ICT in the GDP growth. At the World Economic Forum in 2011 it was declared that there is a correlation between national economic growth and the level of the ICT competitiveness. In addition, according to the research of **Marcle P. Timmer** based on the analysis of the factors that contribute to GDP growth of some of the world's influential countries, indicated that ICT contributed 0.21% to growth when the GDP increased by 1%. The economic growth target for Rwanda in 2020 is 10.0%. The effect of ICT contribution to expected growth rate for six years from 2015 to 2020 has been converted into economic value according to the statistical data provided previously. Total Rwandan GDP of 2013 was US$7.5B. Based on the current (2015) economic growth rate of 7.5%, an assumption of a 0.5% in GDP each year up to 2020 was made in order to meet the 10.0% target by 2020. The total expected GDP in 2020 is $63.40B and it is speculated that ICT contribution to the expected GDP will amount to $13.3B by 2020. In order to achieve the expected effects by 2020, an aggressive ICT investment and management through SRMP is required.

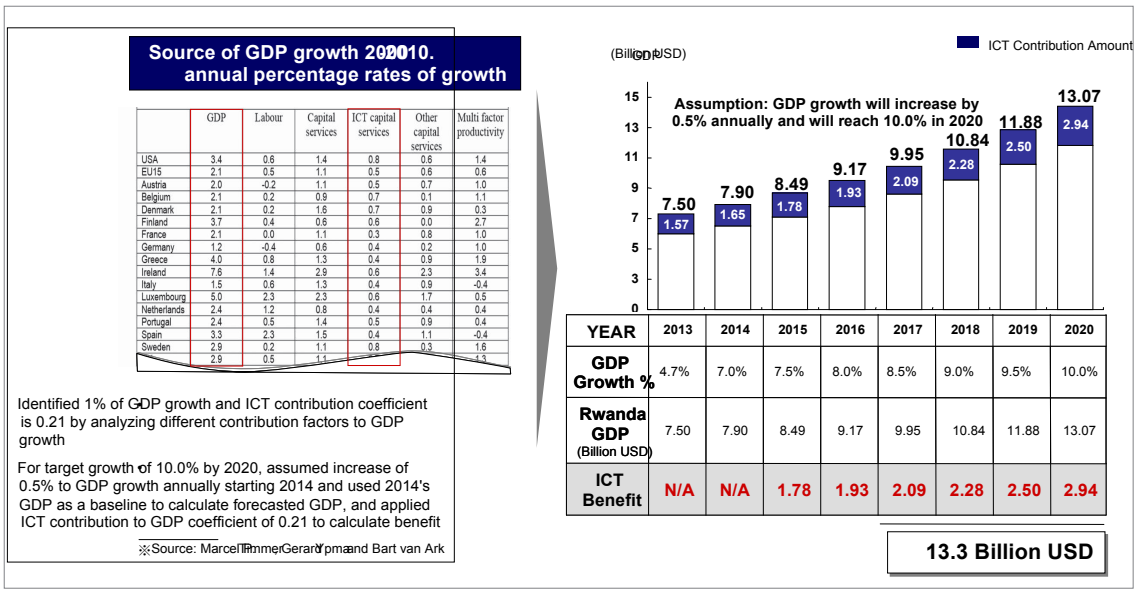


Figure 15: ICT Contribution to GDP

6.2.2 Industry Inducement Effect

Industry Inducement Effect is a measurement of the direct and indirect economic influence ICT investment on industries. These effects are estimated in two categories: Production Inducement Effect and Value Added Inducement Effect[1]. These values are calculated based on the Industry analysis. The basic idea is to measure the indirect ripple effect created to satisfy one unit demand of a good on the operation of public policy.

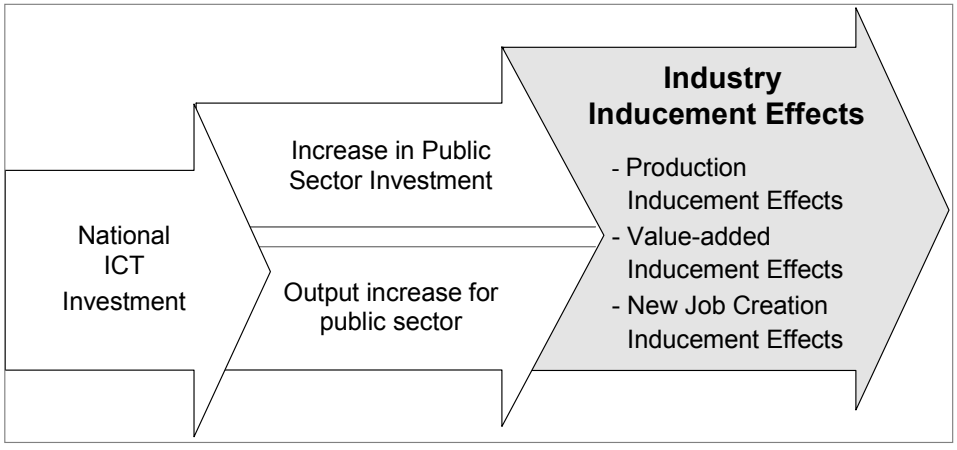


Figure 16: Industry Inducement Effects

1 *The Bank of Korea calculates this concept every year. The inducement figures are applied to measure the economic ripple effects on society and investment validity of certain industries in South Korea*

Two basic presumptions underlie the industry inducement effect, (i) there is an increase in the total supply and demand of related industries due to the ICT investment and its results in the public projects; and (ii) that an increased in productivity and cost-savings in the information system or other related institutions due to the ICT investment generates a similar ripple effect in other related technology or operation.

Based on these presumptions, Industry Inducement Effect creates economic value in two main perspectives: Production Inducement coefficients and Value-added Inducement coefficient. First, Production Inducement coefficients are the amount of money which will encourage people to produce a certain product or service. This is a segment where enough fiscal profits will be available to satisfy the producers/providers' economic needs in producing a product or service. This means that all the members and sectors that are involved in the chain of production will both directly and indirectly benefit from the production.

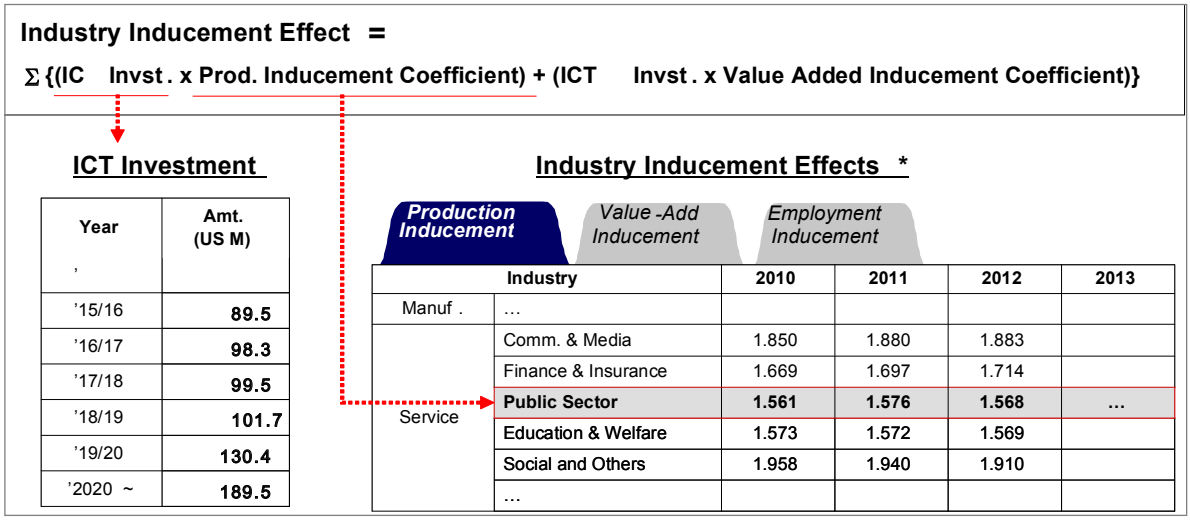


Figure 17: Calculating Industry Inducement Effects

Therefore, the more inducements of production there are, the higher fiscal liquidity there will be in the market. Secondly, Value Added Inducement Coefficient is a value that is added onto the completed goods. It is some type of additional fiscal benefits that will be put on top of the final product or service. It should be borne in mind that this value is created only after the producing activity is completed. In other words, the product has to be out in the market as a whole functioning item in order to create the value added inducement and gain the extra value. Therefore, it is important for the industry or the producers to complete the production process.

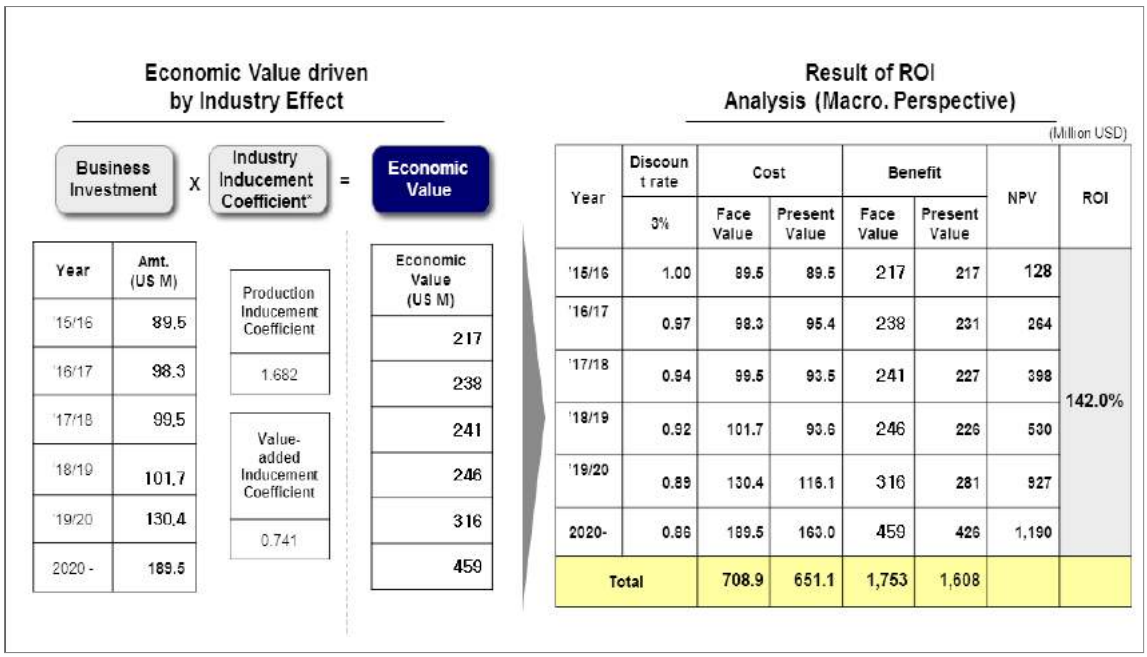


Figure 18: Analysis of Industry Related Effects

Due to the discrepancy between the current GDP and the GDP growth levels of Rwanda and South Korea, the production inducement coefficient (1.682) and value added inducement coefficient (0.742) rates corresponding to the similar growth rate of Rwanda.
The overall benefits shows US$1,182M worth of economic value and a 142% of return on investment (ROI) will be created when US$519M is invested from 2015 to 2020 through the SMART Rwanda Master Plan.

6.2.3 Employment Inducement Effect

Employment Inducement Effect is the measurement of number of jobs induced both directly and indirectly in a specific industry and other related industries when and only when the specific industry's total supply amounts to one billion. Approximately 100,000 jobs shall be created if US$519M is invested over the 5 years from 2015 to 2020.

6.3. INTERNATIONAL ICT INDEX

Performance of the SRMP shall be tracked and progress measured against internationally acknowledged ICT indexes. The selected indexes are from major reliable sources such as United Nations (UN), International Telecommunication Union (ITU), Economist Intelligence Unit (EIU), World Economic Forum (WEF), World Trade Organization (WTO), etc. Four international ICT indexes are selected for continuous monitoring.

Table 1: SRMP 2020 Global ICT Development Targets

SRMP 2020 KEY INDEX		
SRMP ICT Index	**2014**	**2020 Target**
E-government Development Index	125th /193	70th
ICT Development Index	148th/166	70th
Network Readiness Index	83th/143	50th

In addition to the global targets, socio economic targets shall also be monitored and tracked. These targets shall be used to evaluate the outcomes every year and impact from the implementation of SRMP.

Table 2: Key performance indicators

OUTCOME	OUTCOME INDICATOR	BASELINE (2014)
A high quality skills and knowledge base leveraging ICT developed	Number of ICT students enrolling yearly in Higher Learning Institutions (HLIs)	2504
	Number of new certified individuals in international industry-related ICT courses	2174
	Percentage of tertiary institutions connected on internet	100%
	Percentage of secondary schools connected internet	16.9%
	Number of ICT Start-ups/Innovations supported	71
Empowered and transformed communities through improved access to information and services using ICT	Number of Irembo Centers	432
	Percentage of mobile cellular telephone subscriptions.	74 % (July~2015)
	Percentage of individuals with mobile broadband subscription.	31.5% (July~2015)
Improved government operational efficiency and service delivery using ICT.	Number of government services on Irembo Platform.	10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VII. CONCLUSION

Rwanda has steadily made progress towards achieving the vision set in in 2000. Notable in this effort has been a strong and sustained emphasis on information and communication technology (ICT). Starting from dire conditions, the country has put ICT at the core of a reform agenda geared towards reconstruction and higher levels of development. However, Rwanda's ICT challenges mainly concern structural and cultural change. For instance, awareness for the benefits of ICT is still not widespread, a labor force highly skilled in ICT is still not a reality, and a fledgling private sector has not yet grown enough to make the ICT sector broadly independent of government and donor funding.

The ICT enables economic growth by broadening the reach of technologies such as high-speed Internet, mobile broadband, and computing; expanding these technologies itself creates growth, and the fact that technologies make it easier for people to interact and make workers more productive creates additional benefits. Therefore policies that create a favorable climate for stability, predictability and fair competition at all levels should be developed and implemented in a manner that not only attracts more private investment for ICT infrastructure development, but also enables universal service obligations to be met.

An educated and skilled human resource or human capital is the most valuable asset and it should be recognized that the cooperation between academic institutions and the ICT industry must be strengthened if the market realities are to be reflected in educational programs. Awareness and literacy in ICTs are also an essential foundation in this regard. Knowledge is important in encouraging innovation and creativity. The creation of a knowledge economy does not happen in isolation but is highly correlated with the existence of the human capital, a conducive operating environment, a legal and regulatory regime, access to financial resources, a clear rule of law that respects individual and commercial rights, intellectual property to encourage innovation and creativity. The ability for all to access and contribute information, ideas and knowledge is essential in building the knowledge based society as envisioned by the SMART Rwanda Master Plan.

The next several years will be utmost important period for Rwanda as it works towards achieving Vision 2020 using "SMART ICT".

REFERENCES

Source	Title of Document	Published Date
VISION 2020	Rwanda Vision 2020	2000
EDPRS III	Economic Development and Poverty Reduction Strategy (2013 – 2018) Shaping Our Development	2013
NICI I, II, III	National Information and Communication	2000,2006,2010
7 Year Program	Government Programme (2010 -2017)	Oct., 2010
ICT SSP	ICT Sector Strategic Plan (2013-2018)	2013
SMART Africa Manifesto	SMART Africa Manifesto	Oct., 2013
WEF (World Economic Forum)	The Global Competitiveness Report	2014-2015
WEF (World Economic Forum)	The Global Information Technology Report	2015
Master of Science in Business Information Technology	Stage Maturity Model of m-Government	2011
DIGIECO	East Africa Country Report	12/2013.
KOICA (Korea International Cooperation Agency)	Country Partnership Strategy for Rwanda	2013
Marcel P.Timmer, Gerard Ypma and Bark van Ark	IT In the European Union: Driving Productivity Divergence?	2003
NIA (National Information Society Agency)	Global e-Government Development Report	2011
UN (United Nations)	E-Government Survey	2014
EIU (Economist Intelligence Unit)	Government Broadband Index	2013
ITU (International Telecommunication Union)	Measuring the Information Society	2014
WTO (World Trade Organization)	World Health Statistics	2013
The World Bank	Information and Communications for Development; Maximizing Mobile	2012
KSII (Korean Society for Internet Information)	An Analysis of the Economic Effects on the Project to Construct SMART Network	2011
NIA (National Information Society Agency)	Characteristics and Implications of ICT investment in the country	2013

PRIORITY PROJECTS
SMART RWANDA 2020 MASTER PLAN

Priority type by project (1/10)

Focus Area		Project List		Strategic Import. Budget Size	Urgency Duration	Input Resource		Benefi-ciary	Responsible Department	Priority
1-1	**Expanding remote medical/healthcare services and enhance accessibility**	1.1.1	Telemedicine (Extension)	High	Mid	USD10m	36months	G2C	Ministry of Health	Must have
		1.1.2	Health Management Information System(enhancement)	High	Mid	USD 5m	18months	G2C	Ministry of Health	Value added
		1.1.3	District Hospital ICT Infrastructure	High	Mid	USD 13m	18months	G2G	Ministry of Health	Must have
		1.1.4	National Electronic Health Record (Enhancement)	High	Mid	USD 7m	18months	G2G	Ministry of Health	Must have
		1.1.5	Health System interoperability	High	Mid	USD 5m	24months	G2G	Ministry of Health	Value added
		1.1.6	Health Information exchange point project	Mid	Low	USD 5m	12months	G2C	Ministry of Health	Value added
		1.1.7	Digital Health Information on smart devices	Mid	Mid	USD5m	12months	G2C	Ministry of Health	Enabler
		1.1.8	Digital ID and Social security services	High	High	USD7.5m	24months	G2C	NID/RDB	Enabler

Priority type by project (2/10)

		Strategic Import. Budget Size	Urgency Duration	Input Resource		Benefi-ciary	Responsible Department	Priority
2.1.1	Develop Curriculum for student centered ICT skills.	Mid	Mid	USD2m	12months	G2C	Ministry of Education	Enabler
2.1.2	World Class Research Infrastructure (High Performance Computing center)-HPC	Mid	Mid	USD0.2m	12 months	G2B	Ministry of Education	Value added
21.3	Broadband connectivity in schools	High	High	USD 7m	24months	G2C	Ministry of Education	Enabler
2.1.4	E-book digital content	Mid	Mid	USD7m	12months	G2E	Ministry of Education	Value added
2.1.5	Computing Device for students in HLIs and IPRCs	High	High	USD14.8m	24months	G2C	Ministry of Education	Must have
2.2.1	Carnegie Mellon University (PPP)	High	Mid	USD46.5M	60months	G2B2C	RDB	Value added
2.2.2	ICT in Education Master Plan	High	High	USD0.07m	6months	G2E	Ministry of Education	enabler
2.2.3	MIS for Education decision making	High	High	USD5m	18months	G2B	Ministry of Education	Must have
2.2.4	ICT education and promotion for bridging digital divide for citizens and government-related parties.	High	Mid	USD10m	18months	G2C	Ministry of Education	Value added
2.2.5	Smart School Expansion	High	Mid	USD4m	5months	G2E	Ministry of Education	Must have
2.2.6	ICT training for teachers, head teachers and education officers	High	Mid	USD 5M	60Months	G2G2C	Ministry of Education	Value added
2.2.7	College of Open & Distance Learning Expansion	High	Mid	USD0.8m	5months	G2E	Ministry of Education	Must have

Priority type by project (3/10)

Focus Area		Project List		Strategic Import. Budget Size	Urgency Duration	Input Resource		Benefi-ciary	Responsible Department	Priority
3-1	**Establishing a foundation for ICT based agricultural commercialization transaction**	3.1.1	Enhancing Esoko / (e-Soko 2.0)	High	high	USD4m	12months	G2B2C	Ministry of Agriculture	Must have
3-2	**Providing information for enhancing agricultural productivity and quality**	3.2.1	Agro-smart traceability	High	Mid	USD2m	9months	G2B	Ministry of Agriculture	Value added
		3.2.2	Agriculture information Service Center	Mid	High	USD2m	9months	G2B2C	Ministry of Agriculture	Enabler
		3.2.3	Farmer Management Support System	High	Low	USD2m	12months	G2B2C	Ministry of Agriculture	Value added
		3.2.4	Meat Processing Management System	Mid	Mid	USD5m	12months	G2B2C	Ministry of Agriculture	Value added
		3.2.5	Agriculture Growth Management System	Mid	Mid	USD5m	12months	G2B2C	Ministry of Agriculture	Value added

Priority type by project (4/10)

Focus Area		Project List		Strategic Import.	Urgency	Budget Size	Duration	Benefi-ciary	Responsible Departmen	Priority
4-1	**Enhancing financial transaction and management systems**	4.1.1	Establishment of a spoke and hub Clearing for MFS.	High	High	USD10m	12months	B2B, G2C	Ministry of Finance	Must have
		4.1.2	Establishment of Online payment gateway for e/m commerce	High	High	USD5m	12months	B2B, B2C	Ministry of Finance/BNR	Must have
		4.1.3	Government E-Procurement System	High	High	USD7m	24months	G2B	Ministry of Finance	Must have
4-2	**Establish plans for financial transaction authentication & data link**	4.2.1	Increase financial data coverage over the country	Medium	Medium	USD5m	24months	G2C, B2C	Ministry of Finance	Enabler
		4.2.2	Finalise the PKI infrastructure for financial institution	High	Medium	USD5m	24months	G2C, B2C	Ministry of Finance	Enabler

Priority type by project (5/10)

5-1	**Developing new ICT business opportunity and providing future entrepreneurs supporting system**	5.1.1	E-commerce portal (for SMES and Cooperatives)	Mid	Mid	USD12m	12months	G2C2B	Ministry of Trade and Industry	Value added
		5.1.2	Electronic International Trading System	High	Mid	USD2.5m	12months	G2B, B2B	Ministry of Trade and Industry	Value added
		5.1.3	Foreigner Portal(Investment support service for foreign investors)	Mid	Low	USD5m	12months	G2G2B	RDB	Value added
		5.1.4	Buy RWANDA	Mid	Mid	USD10m	18 months	G2G2B	Ministry of Trade and Industry	Value added
5-2	**Improving industrial infrastructure (social infrastructure)**	5.2.1	Road Intelligent Transportation System	Mid	High	USD10m	18months	G2G	Ministry of Infrastructure	Must have
		5.2.2	Smart Grid Master plan	High	High	USD2m	12~20 months	G2G	REG	Enabler

Priority type by project (6/10)

Focus Area		Project List		Strategic Import.	Urgency	Budget Size	Duration	Benefi-ciary	Responsible Departmen	Priority
6-1	**Accelerating development of Kigali-centered ICT innovation hubs**	6.1.1	Kigali ICT Innovation City	High	Mid	USD 137m	40 months	G2B2C	RDB	Must Have
		6.1.2	ICT Innovation Center	High	Mid	USD5.6m (PPP)	24months	G2B2C	RDB	Must have
		6.1.3	ICT Innovation Fund for 100 startups	High	High	USD 250M (PPP)	36 months	G2B	RDB/MYICT	Must have
		6.1.4	BPO	High	High	USD5M	60 months	G2B	RDB/MYICT	Value added
6-2	**Increasing and expanding accessibility through implementation of ICT related systems, common platform and networks (admin, finance, defense, education)**	6.2.1	Irembo Centers	High	Mid	USD 10 m	36 months	G2C	MYICT/MINALOC/RDB	Must have
		6.2.2	4G LTE roll out (PPP)	High	High	USD 19m	60 months	G2B, G2C	RDB	Value added
		6.2.3	Distribution and expansion of SMART device (Viziyo Program)	High	Low	USD 10m	36 months	G2C	RDB/MYICT/MINEDUC	Must have
		6.2.4	Enterprise architecture	High	Mid	USD 5m	36months	G2B	RDB/MYICT	Value added

Priority type by project (7/10)

7-1	**Facilitate Women and Girls in ICT capacity building**	7.1.1	Enhance Girls in ICT Competitions (Cod camp, TechKobwa)	High	High	USD3M	18months	G2C	MIGEPROF	Must have
		7.1.2	Women and Girls literacy training program for business and community women	High	High	USD2M	18months	G2C	MIGEPROF	Must have
7-2	**Facilitate Projects related in increasing women and girls in ICT related business**	7.2.1	Women and Girls in ICT incubation program for business and entrepreneurship	High	High	USD3M	18months	G2C	MIGEPROF	Must have
		7.2.2	Mobile based ICT solutions to support digital financial and business inclusion	High	High	USD2M	18months	G2C	MIGEPROF	Must have

Priority type by project (8/10)

Focus Area		Project List		Strategic Import	Urgency	Budget Size	Duration	Benefi-ciary	Responsible Department	Priority
8.1	**Establishing E-Government centered infrastructure**	8.1.1	Establishing Public Information Sharing System(Integrated Back-End System)	High	High	USD10m	24months	G2G	MYICT	Enabler
		8.1.2	Open Government Data System	High	Mid	USD7m	12months	G2G	MYICT	Must have
		8.1.3	Rwanda Online	High	High	USD35m (PPP)	Progressive	G2C2B	RDB	Must have
		8.1.4	Government Command Center(Backend MIS)	High	High	USD4m	24months	G2G2C	RDB	Enabler
8.2	**Efficient operating administrative tasks and constructing information sharing foundation**	8.2.1	Smart Government Administration System	High	High	USD4.5m	12 months	G2G	RDB / MYICT	Must have
		8.2.2	Real-estate Information Portal	Mid	Low	USD5m	12months	G2C	Ministry of Trade and Industry	Enabler
		8.2.3	Postal Information System	Mid	Low	USD5m	12months	G2C	RDB	Value added
		8.2.4	National Geographic Information System	Mid	Low	USD15m	12~24 months	G2G	Ministry of Natural Resources	Value added
		8.2.5	Integrated Electronic Judiciary Case Management	Mid	High	USD5M	24Months	G2C	Ministry of Justice	Enabler
		8.2.6	Public Contacts Management System	Mid	Low	USD1M	12Months	G2C	MINALOC	Value added

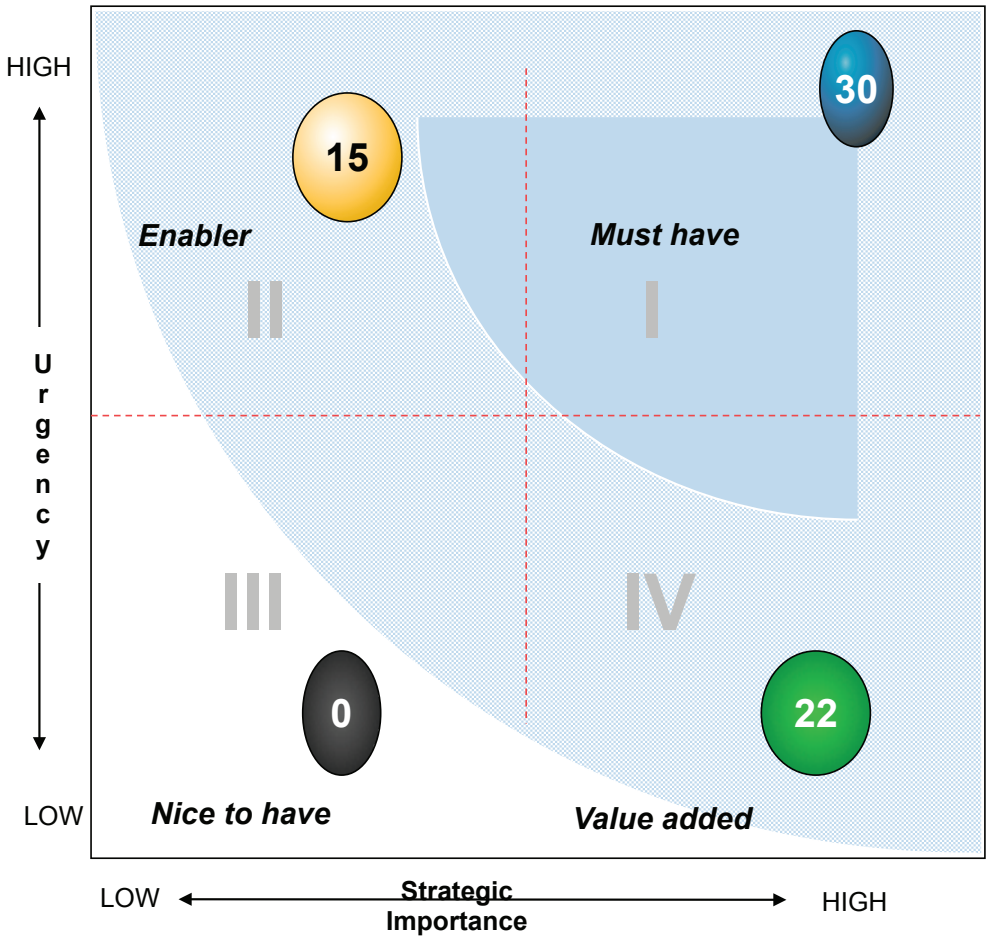
Priority type by project (9/10)

Focus Area		Project List		Strategic Import. Budget Size	Urgency Duration	Input Resource		Benefi-ciary	Responsible Department	Priority
9-1	**Improving performance centered national ICT laws and regulations making and monitoring system**	9.1.1	ICT regulation & legal framework improvement	High	High	USD1m	Progressive	G2G	MYICT	Enabler

Priority type by project (10/10)

Focus Area		Project List		Strategic Import. Budget Size	Urgency Duration	Input Resource		Benefi-ciary	Responsible Department	Priority
10-1	Improving common platform of national information resource	10.1.1	Establish Cloud-based National Data Center Integration	High	High	USD 20m	36 months	G2G, G2B	MYICT, RDB	Must have
		10.1.2	National IT Standard Framework' (incl. cloud-based share platform development and standardization)	High	High	USD 3m	12 months	G2G	MYICT, RDB	Must have
10-2	Enhancing prevention/ response system for cyber threats/ disaster and securing social safety/ credibility	10.2.1	Public CCTV	High	High	USD 12m	24 Months	G2C	Ministry of Defense	Enabler
		10.2.2	Cyber Crime investigation project	High	mid	USD1m	18 months	G2G, G2C	Ministry of Internal Security	Must have
		10.2.3	Government DR Center (Cloud)	High	High	USD 20m	12 months	G2G	MYICT/NCSA	Must have
		10.2.4	National computer security and incidence response center (Enhancement)	High	High	USD 1.5m	12 months	G2G	MYICT/NCSA	Must have
		10.2.5	Establish cyber threat information sharing system	High	High	USD 1.5m	6 months	G2G, G2B	MYICT/NCSA	Must have

SUMMARY OF PROJECTS BY CATEGORY



A initial total of 67 projects identified for implementation between 2015- 2020, at a cost of US$519.4M to execute all the projects

Core Strategy		# of Proj. 2015/16	Quick Win		Short-Term		Mid-Term		Long Term
			2016/17	2017/18	2018/19	2019/20	2020/21	2021/2022	
1	Expand medical and health services to enhance citizen's quality of life	8	2	2	1	1	2	-	-
2	Utilize ICT for education as a tool to enhance teaching and learning	12	3	2	2	2	3	-	-
3	Enhance agricultural productivity and industrialization providing basis for an economic growth	6	1	1	2	1	1	-	-
4	Improve financial infrastructure to expand access to financial services	5	2	1	2	-	-	-	-
5	Promote trade and industry development by enhancing value of products and services	6	1	1	2	1	1	-	-
6	Improve and expand access to ICT skills and innovation capacity	8	1	2	2	1	2	-	-
7	Advance Women and Youth's social economic empowerment through ICT	4	1	1	1	1	-	-	-
8	Build a shared robust and resilient infrastructure to underpin service delivery and support National ICT initiatives	10	2	2	2	2	2	-	-
9	Enhance the national ICT Governance and Regulatory structure	1	-	-	1	-	-	-	-
10	Transform digital Government through E-Gov and effective service delivery	7	1	1	1	2	2	-	-
Sub Total		67	14	13	16	11	13	-	-
Project Budget (Million USD)		**519.4 M**	**89.5 M**	**98.3M**	**99.5 M**	**101.7M**	**130.4 M**	**189.5 M**	**0M**

Project List Beyond 2020 (1/2)

Project List		Description	Benefi-ciary	Responsible Department
1	Citizen Petition Analysis System	Automatic analysis system for public petition aggregated through citizen participation portal	G2G	Ministry of Local Government
2	e-Parliamentary System	Support the operation of Parliamentary from initiating bills, overseeing and sharing information with citizens Include parliamentary document management system, legislation enactment support system, parliamentary portal	G2G	RDB
3	e-Court Auction	Computerized management system for court auction : One-stop portal for citizen to query auction items and to participate in bidding backed up by settlement and payment system	G2C	Ministry of Justice
4	Real-Time Traffic Information System	Integrated Traffic Information System : Data collected from diverse sources, and the processed information provided to many sources of demand in real-time basis	G2C	Ministry of Infrastructure
5	e-Patent	Computerized registry and management system for intellectual property and electronic trial for patent infringement and dispute	G2B2C	Ministry of Justice
6	Smart Mobile Administration	Mobile devices with applications to enable public officials to work from outside home office	G2G	RDB/MYICT
7	U-Library	Building an integrated DB and management system of university libraries with education materials (books, journals, magazines, course materials, etc.) to be shared within the member network	G2B2C	Ministry of Education
8	Public Transportation Information System	Integrated Information System on Public Transportations : Provides the general public with arrival & departure time of bus transit at each bus stop	G2C	Ministry of Infrastructure
9	Road Taxation System (Toll Collection System)	Toll Collection System for Road Maintenance Financing : Both manned(conventional TCS) and Electronic Toll Collection System(ETCS) can be considered and implemented	G2G	Ministry of Infrastructure

Project List Beyond 2020 (2/2)

Project List		Description	Benefi-ciary	Responsible Department
10	DVB(Digital Video Broadcasting) Service System	RBA's DVB-T2 Service consulting & system building : Extending business by providing managed customer care service, managed call center service, and running installation/AS	G2C	RBA (Rwanda Broadcasting Agency)
11	Pay TV Service Platform	Presenting Feasibility Study of RBA's Pay TV Business	G2C	RBA (Rwanda Broadcasting Agency)
12	N-Screen service platform	N-Screen broadcasting platform for smart phone, Pad, Note Book, and PC	G2C	RBA (Rwanda Broadcasting Agency)
13	Mobile App Development Center	Create and maintain the state of the art in computing platform for quality mobile software development	G2G, G2B, G2C	RDB

Ministry of Youth and ICT
(MYICT)