Republic of Rwanda
MINISTRY OF YOUTH AND ICT

# SMART Rwanda Master Plan
## 2015 ~ 2020

A prosperous and knowledgeable society through SMART ICT

# Abbreviations and Acronyms

| | |
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| AISI | African Information Society Initiative |
| AMIS | Agriculture Management Information System |
| APP | Application |
| B2B | Business to Business |
| BNR | Banque National du Rwanda |
| BP | Best Practice |
| BPO | Business Processing Outsourcing |
| BRM | Business Reference Model |
| BSC | Broadband Systems Corporation |
| CAGR | Compound Annual Growth Rate |
| CAPEX | Capital Expenditure |
| CAS | Conditional Access System |
| CBHI | Community Based Health Insurance |
| CCTV | Closed-Circuit Television |
| CD | Community Development |
| CERT | Computer Emergency Response Team |
| CMS | Content Management System |
| CNS-ATM | Communication Navigation Surveillance /Air Management |
| COMESA | Common Market for Eastern and Southern Africa |
| CS | Cyber Security |
| CSIRT | Computer Security Incident Response Team |
| CTC | Coordination Technical Committee |
| DB | Data Base |
| DCRS | Develop a Digital Court Recording System |
| DDoS | Distribute Denial of Service |
| DR | Disaster Recovery |

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| DTT | Digital Terrestrial Television |
| DVB-T2 | Digital Video Broadcasting-Second Generation Terrestrial |
| EA | Enterprise Architecture |
| EAC | East African Community |
| EAPP | East African Power Pool |
| EASSy | Eastern Africa Submarine Cable System |
| EDPRS | Economic Development & Poverty Reduction Strategy |
| E-GOV | E-Government |
| EHR | Electronic Health Records |
| EIU | Economist Intelligence Unit |
| EMIS | Education Management Information System |
| EMR | Electronic Medical Records |
| EQMS | Electronic Queue Management System |
| ERMS | Electronic Records Management System |
| ERS | Emergency Response System |
| ESS | Energy Saver System |
| ETCS | Electronic Toll Collection System |
| EWSA | Energy, Water, and Sanitation Authority |
| FDI | Foreign Direct Investment |
| FMS | Financial Management Systems |
| FSDP | Financial Sector Development Program |
| FTE | Full-Time Employee |
| FWG | Focus area Working Group |
| FY | Fiscal Year |
| G2B | Government-to-Business |
| G2C | Government-to-Citizen |
| G2G | Government-to-Government |

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| GAAP | Generally Accepted Accounting Principles |
| GBI | Government Business Intelligence |
| GCIO | Government Chief Information Officer |
| GDP | Gross Domestic Product |
| GIDW | Government Integrated Data Warehouse |
| GIS | Geographic Information System |
| GNI | Gross National Income |
| GNP | Gross National Product |
| GoR | Government of Rwanda |
| GPS | Global Positioning System |
| GSI | Government Secure Intranet |
| HIV | Human Immunodeficiency Virus |
| HLSC | High Level Steering Committee |
| HRMS | Human Resource Management System |
| IaaS | Infrastructure as a Service |
| ICT | Information Communication Technologies |
| ICT4D | ICT for Development |
| ID | Identification |
| IDC | Internet Data Center |
| IDI | ICT Development Index |
| IDS | Intrusion Detection Systems |
| INSEAD | European Institute for Business Administration (Institute Européen d'Administration des Affaires) |
| INVIL | Information Network Village |
| IPAR | Institute of Policy Analysis and Research |
| IPPS | Integrated Personnel and Payroll System |
| IPS | Intrusion Prevention Systems |
| ISP | Internet Service Provider |

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| ISPA | Internet Service Provider in Africa |
| ISS | Inspection Support System |
| ITA | Integrated Technical Architecture |
| ITU | Information Technology Union |
| IXP | Internet Exchange Point |
| JICA | Japan International Cooperation Agency |
| JIMS | Judicial Information Management System |
| JRLOS | Justice, Reconciliation, Law & Order Sector |
| JSWG | Joint-sector Working Group |
| KIST | Kigali Institute of Science and Technology |
| KMN | Kigali Metropolitan Network |
| KN | Knowledge Network |
| KPI | Key Performance Indicator |
| LMIS | Labor Management Information System |
| LTE | Long-Term Evolution |
| LUMIS | Land Use Management Information System |
| MAJ | Maison d' acess a la Justice |
| MDA | Ministry, Department, Agency |
| MDG | Millennium Development Goal |
| MINAGRI | Ministry of Agriculture and Animal Resources |
| MINALOC | Ministry of Local Government |
| MINECOFIN | The Ministry of Finance and Economic Planning |
| MINEDUC | Ministry of Education |
| MINICT | Ministry in charge of Information Communications Technology |
| MITIR | Monitoring Information Technology Impact in Rwanda |
| MOH | Ministry of Health |
| MTN | Mobile and Telecommunications Network |

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| MYICT | Ministry of Youth and ICT |
| NBB | National Fiber Backbone |
| NCAB | National Cyber Security Advisory Board |
| NCSRC | National Cyber Security Research Centre |
| NEIS | National Education Information System |
| NEPAD | New Partnership for Africa's Development |
| NHS | National Health Service |
| NICI Plan | National Information and Communications Infrastructure Plan |
| NICI I | NICI Plan Phase I (2000-2005) |
| NICI II | NICI Plan Phase II (2006-2010) |
| NICI III | NICI Plan Phase III (2011-2015) |
| NICI III+ | NICI Plan Phase III+(2013-2018), also referred to as ICT Sector Strategic Plan (SSP) |
| NICI IV | NICI Plan Phase IV (2016-2020) |
| NID | National ID |
| NISC | National ICT Steering Committee |
| NPD | New Project Development Division |
| NRI | Networked Readiness Index |
| NUR | National University of Rwanda |
| OECD | Organization for Economic Cooperation and Development |
| OpenMRS | Open Medical Records System |
| OPEX | Operational Expenditure |
| OS | Operating System |
| PaaS | Platform as a Service |
| PDA | Personal Digital Assistant |
| PEST Analysis | Political, Economic, Social and Technological analysis |
| PKI | Public Key Infrastructure |
| PPP | Public Private Partnership |

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| PPSS | Personal Policy Support System |
| PSD | Private Sector Development |
| PSF | Private Sector Federation |
| PSN | Public Sector Network |
| R&D | Research and Development |
| R&R | Roles and Responsibilities |
| RAMA | la Rwandaise d 'Assurance Maladie |
| RBS | Rwanda Bureau of Standard |
| RDB | Rwanda Development Board |
| RDB/HCID | Rwanda Development Board – Human and Institution Capacity Development Division |
| RDB/ICT | Rwanda Development Board – ICT Department |
| RICTA | Rwanda ICT Association |
| RIPPS | Rwanda Integrated Payment Processing System |
| RITA | Rwanda Information Technology Agency (predecessor of RDB-ICT) |
| RNP | Rwanda National Police |
| ROI | Return on Investment |
| RTN | Rwanda Telecentres Network |
| RTTA | Rwanda Tour and Travel Association |
| RURA | Rwanda Utilities Regulatory Authority |
| RwEdNet | Rwanda Education Network |
| S&T | Science and Technology |
| SaaS | Software as a Service |
| SCM | Supply Chain Management |
| SD | Skills Development |
| SME | Small and Medium Enterprises |
| SMS | Short Message Service |
| SMTE | Small and Medium Tourism Enterprises |

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| SNS | Social Networking Services |
| SOC | Secure Operation Centre |
| SRMP | SMART Rwanda Master Plan |
| SSA | Sub-Saharan Africa |
| STB | Set Top Box |
| TCS | Toll Collection System |
| TFT | Task Force Team |
| TRACnet | Treatment & Research AIDS Centre network |
| TVET | Technical, Vocational Education and Training |
| UC | Unified Communication |
| UNDP | United Nations Development Programme |
| UNESCO | United Nations Educational, Scientific, and Cultural Organization |
| UNIDO | United Nations Industrial Development Organization |
| VAT | Value Added Tax |
| VfR | Vision for Rwanda |
| VLP | Virtual Landing Point |
| VoIP | Voice over Internet Protocol |
| VUP | Vision 2020 Umurenge Programme |
| WAN | Wide Area Network |
| WBF | World Broadband Forum |
| WBN | Wireless Broadband Network |
| WDI | World Development Indicator |
| WEF | World Economic Forum |
| WHO | World Health Organization |
| WIBRO | Wireless Broadband (version of WiMAX service) |
| 12YBE | 12-Year Basic Education |

# Glossary

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| Application | A program, or group of programs, designed for the end user |
| Backbone Network | An enabling network that interconnects and provides a path for the exchange of information between various networks |
| Best Practice | A set of guidelines, ethics or ideas that represent the most efficient or prudent course of action |
| Big Data | Big data refers to exponential growth and availability of data, both structured and unstructured. The increasing analytics on larger data will lead to accurate analysis |
| Budgeting | Planned future income and expenditures often serve as a guideline for spending and saving |
| Business Investment | Set of investment in resources, generally in terms of fiscal and human capital, to enable specific business |
| Chasm | Period where effective investment is hindered, further reducing overall productivity/return of the investment |
| Cloud Computing | Providing the means through which everything from computing power to computing infrastructure, application, business processes to personal collaboration can be deliver to a user as a service wherever and whenever |
| Coefficient | A consistent number by which a variable is multiplied |
| Communication Evolution Model | Established and utilized by Korean government, measures the efficiency and development of communication between different governmental agencies and departments |
| Community Based Health Insurance | An emerging concept for providing financial protection and support against the cost of illness and improving access to the quality health services for low-income population in rural who are excluded from formal insurance |
| Computerized Registry | A term referring to the digitalized medical information of patients; information stored electronically |
| Consolidation | A process of bringing together separate parts into a single or unified whole from hardware perspective |
| Co-relationship | Cause and effect relationship between factors |
| Cost Benefit Analysis | Analyzing benefits of the input cost with quantitative measures |
| Cost Estimation | Approximated probable cost/expense of a product, program, or project |
| Cyber Crime | Term referring to any illegal activity that utilizes a computer and electronic devices as its primary means of commission |
| Cyber Threat | Potential cyber events that may cause unwanted outcomes, resulting in harm to a system or organization |
| Data | Facts translated into a form that is more convenient to move or process |
| Data Aggregation | A process in which information is gathered and expressed in a summary form (For example, for statistical analysis) |
| Data Base | An organized collection of data |
| Data Center | Facility used to house computer systems and associated components, including telecommunications and storage systems with redundant or back up power supplies, redundant data communication connections, environmental controls, and various security devices |
| Depreciation | Decreased asset value for a given time - allocation of the cost of an assets over useful life |
| Economic Value | The worth of a good or service as determined by people's preferences and the tradeoffs they choose to make given their scare resources, or |

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| | the value the market places on an item |
| Electronic Health Record | A systematic collection of electronic health information about an individual patient or population |
| Enterprise Architecture | A conceptual blueprint that defines the structure and operation of an organization |
| E-Storage | An online space in which information can be saved, accessed and shared |
| Extranet | A computer network that allows controlled access from the outside, for specific business or educational purposes |
| Foreign Direct Investment | Term referring to investment directly put into production or business by another country |
| Generally Accepted Accounting Principles | A term referring to the standard framework of guidelines for financial accounting established in each individual country |
| Green IT | The Green IT aims to reduce the carbon footprint generated by the Information System business while allowing reducing the cost |
| Human Capital | Economic value of human competence and capability |
| Implementation Roadmap | Set of schedules for implementing projects based on the urgency, strategic importance, and input resources |
| Industry Inducement Effect | By implementing specific initiatives, the impact of inducing or increasing overall effectiveness of industry either through productivity or job creation |
| Information | A term referring to accurate and specific data organized for a purpose |
| Information Platform | An online portal that aims to promote, share and exchange information |
| Integration | A process of bringing together the component subsystems into one functioning system from software perspective |
| Intellectual Property | A term referring to the creation of the mind such as art, music, software, literary work, and etc. for which exclusive rights are recognized; legal concept |
| Intranet | A term for a collection of private computer network technologies as a tool to facilitate communication, information sharing, operational systems, or computing services within an organization |
| Joint Venture | Business agreement in which the parties agree to develop, for a defined time, a new entity and new assets by contributing equity and related assets |
| Key Public Infrastructure | A system that enables users of an unsecure public network such as the Internet to securely and privately exchange data and money through the use of a public and a private cryptographic key pair, the digital certificate, that is obtained and shared through a trusted authority |
| National Budgeting | Estimated and planned government revenue and expenditure for the current and following year |
| NICI Plan | A National Information and Communication Infrastructure Plan consisting of policies, strategies and implementable programs; It's a guiding framework for integrating ICTs into national development programs, and a monitoring and evaluation tool of the role of ICTs in national development |
| National Maturity | For a given country, the measure of how far specific sector (ICT, Finance, etc.) have progressed in terms of utilizing technology, adopting new methods, and accepting new policies and procedures |
| Open DB | An initiative to build very large database like information systems, then make them publicly and freely available as open-source tools |
| PEST Analysis | Framework of macro-environmental factors used in the environmental analysis component of strategic management including political, |

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| | economic, social, and technological factors |
| Portal (Web) | A term referring to service that offers and brings broad and diverse information and resources together in a uniform way allowing access to end users |
| Process Automation | A technology term that is used to describe any process being automated through the use of computers and computer software requiring less human intervention and less human time to deliver |
| Process Optimization | A discipline of adjusting a process to optimize some specified set of systems by reducing some constraints; Maximizing efficiency |
| Public Private Partnership | A cooperative venture between the public and private sectors, built on the expertise of each partner, that best meet clearly defined public needs through the appropriate allocation of resources, risks, and rewards |
| Server | System responding to requests across a computer network |
| Share Infrastructure | Physical elements of an organization that is shared with other parts of the same organization |
| Shared Services | Operation or service that are used or shared by multiple parts of the same organization |
| SNS | Online service or platform to build social relations with other entities that share interests or activities |
| Social Infrastructure | Basic infrastructure to enable and set-up basis for enhancement |
| Social Security | Action programs that government promotes for the welfare and good of the population |
| Strategic Importance | The applied project or business effect to the industry or nation is significant |
| Supply and Demand Management | An effort to make an equilibrium between price and quantity; management towards creating a free market economy in which as supply increases the price decreases and as demand increases the price increases |
| Supply Chain Management | The management of the flow of goods as they move in a process from supplier to consumer; maximizing customer value and achieve a sustainable competitive advantage |
| Tax incentive | Country's tax code designed to incentivize, or encourage a particular economic activity |
| Telecenters | A term referring to a public or shared place where people can have access to ICT through devices including computers, the internet, and other digital technologies |
| Unified Communication | A term used to describe all forms of call, multimedia/cross-media, and instant messaging functions |
| Urgency | The nature of specific business or project is precedence to related development and that specific business and project act as an enabler for other projects or business to be developed |
| Vision 2020 | A vision to transform Rwanda's economy into a middle income and knowledge-based society with an annual growth rate of at least 11.5% with high levels of savings and private investment thereby reduces the country dependence on external aid. |

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# Foreword

The Government of Rwanda seeks to provide better, faster and more secure services to all Rwandans. This requires a strong move towards online services, better protection of private information, more collaboration between government departments, and a change in public service culture. The future of government ICT is not just about technology. It is also about how the government uses information and technology to deliver better services, create jobs and transform the Rwandan society and economy in a constantly changing environment. Achieving these objectives requires a transformation in our approach to ICT. This is the focus of the SMART RWANDA Master Plan.

The SMART Rwanda Master Plan, 2015-2020 describes how the priorities, as well as other environmental factors, will shape our ICT services and define our major ICT priorities over the next five years. The plan also links to the key actions and detailed plans that underpin those priorities.

The key deliverables of the SMART Rwanda Master Plan are:

- **24-hour Self-Service Government. –** All govt. services will be online by 2018
- **Cashless and Paperless govt. -** All govt. financial transactions will be made electronically and via mobile by 2018
- **Over US$50M saved through efficiency gains -** savings through outsourcing and reduction of future wage bill by foregoing recruitment of additional GoR ICT staff
- **Almost US$1BN value of opportunities for the private sector -** This is the approximate value of projects to be implemented by SRMP and most through the PPP model.
- **SMART Rwanda to contribute 10% to GDP-** Broadband access and other ICT infrastructure projects offer a platform for economic growth.
- **Close to 100,000 jobs to be created directly by investment based on the SMART Rwanda Master Plan –** foster an enabling environment for private investments to drive job creation, productivity and competitiveness supported by technology and innovation.

The SMART Rwanda Master Plan provides a foundation for the current government transformation agenda. As we look to continue to transform our society through more efficient processes, systems and infrastructure, we all need to lift our game to enable change. This SMART Rwanda Master Plan points the direction we need to take.

# Preamble

The Government of Rwanda (GoR) recognized in the late 1990s that ICTs could play an important role in accelerating the socio-economic development of the country and creation of an information and knowledge economy. Indeed, as the excerpt from H. E. President Kagame's speech at the official opening of the Regional ICT Investment Summit in Kigali, 4-6 May 2006, he remarked, " We have said it time and again: the role of ICTs in national, regional, and continental development and, specifically, in wealth creation, employment generation, and poverty reduction, cannot be over-emphasized. Disease, illiteracy, poverty and other ills are real social challenges that must be addressed if we are to attain a good quality of life. Fortunately, ICTs present themselves as key potent tools that can be used to address a number of these challenges."[1]

It is in this context that the SMART Rwanda Master Plan reviews and analyses the current national socio-economic development policies, strategy and provisions as well as ICT development, deployment and use in the country through a baseline study. The SRMP also identifies the progress made and the developmental challenges of the country and makes the case for accelerating the march towards a knowledge economy and society as a way of addressing these challenges.

**NICI Process**

Rwanda's NICI process commenced in 1998 with the first phase concentrated on a comprehensive ICT-led Integrated Socio-Economic Development Framework for Rwanda. This was followed by the development of an Integrated ICT-led Integrated Socio-economic Policy for Rwanda in 2000 aimed at facilitating the transformation of Rwanda into an information- rich, knowledge-based society and economy within twenty years.

The NICI I Plan (2001-2005), the first of four to be developed within the framework of the Vision for Rwanda (VfR), served as the cornerstone of the Government's socio-economic development plan over the period. The NICI I Plan was designed to provide details of how these policy commitments of the Government could be translated into concrete programs and initiatives for implementation.

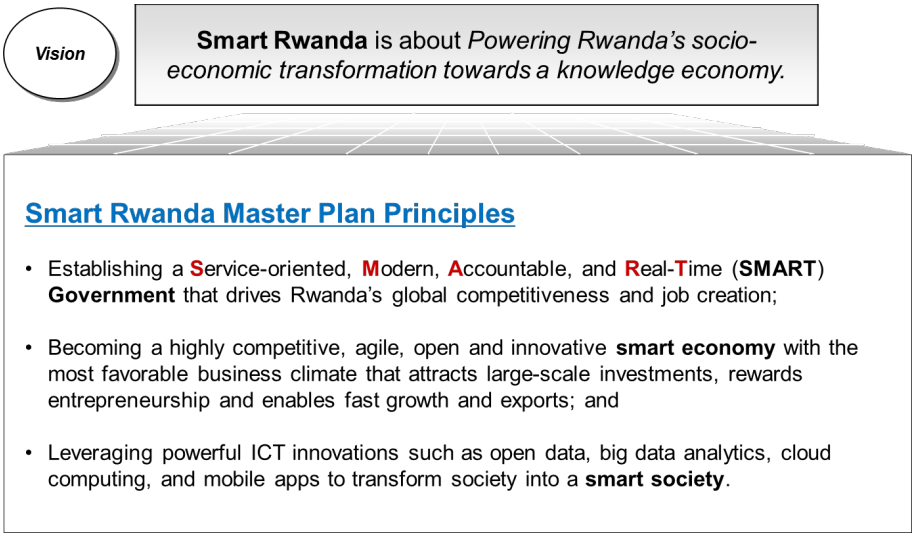
[1] *Speech by His Excellency Mr. Paul Kagame, President of the Republic of Rwanda, at the official opening of the Regional ICT Investment Summit in Kigali, Rwanda, 4-6 May 2006*

The timeframes of the other NICI Plans were:

- The NICI II Plan (2006 to 2010);
- The NICI III Plan (2011 to 2015); and
- The NICI IV Plan (2016 to 2020).

During implementation of the projects identified under NICI III, the Plan's objectives were reassessed and re-aligned to the second Economic Development & Poverty Reduction Strategy (EDPRS II, 2013 ~ 2018) and a new strategy the ICT Sector Strategic Plan (SSP) 2013 -2018 was the outcome. This is currently under implementation with all incomplete projects under the NICI III incorporated into the ICT SSP.

The SMART Rwanda Master Plan 2015-2020 objectives build on the past NICI Plans including the ICT SSP achievements to further strengthen Rwanda's economic base and improve its economic environment for accelerated growth towards achieving a predominantly information and knowledge-based economy.




**Box 1: SMART Rwanda Principles**

## Proposed Approach

A proposed "Think Big, Start Small, Scale Fast" approach would be undertaken to deliver success. The proposed approach implies:

- Think Big: Identify the long term (5 – 10 years) transformative trends, vision and outcomes for Smart Rwanda. The transformative trends could include significant industry change, business model disruption, the emergence of new ICT solutions and enablers.
- Start Small: From the trends, vision and outcomes, the implementation team identifies strategic starting points where Rwanda has a competitive advantage in demonstrating success. The implementation team the selects a number of small, experiential orientated projects to pilot. This "Start Small" experiences will give the implementation team an early win to demonstrate success, and gain better depth of insight into the challenges and opportunities. These insights could be converted into best practices for full-fledged implementations.
- Scale Fast: From those "Start Small" projects, the implementation team would be able to determine which areas need to be addressed in terms of moving forward more aggressively with the future. The experience gained and the best practices accumulated would facilitate a "scale fast" whole-of-country implementation.

## 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 development 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.

# 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 communication technology 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 V2020 and EDPRS I & II.

Despite the achievement of the NICI Plans, especially in building basic infrastructure and launching a highly successful healthcare system and increasing access to financial services, challenges still remain. An assessment of Rwanda's ICT maturity level (National ICT Competitiveness, 2012) ranks it globally at 88$^{th}$ out of 144, confirming the need of a significantly different national ICT strategy and matching investments to accelerate the delivery of the necessary information systems, processes, and skills to support the achievement of the economic objectives.

The current national ICT strategy, ICT Sector Strategic Plan 2013 ~ 2018 requires a review and re-orientation aligned to the new initiatives of SMART ICT as defined in the SMART Rwanda Conference held in June 2012. Further, the African Union Heads of State and Government at the end of the Transform Africa Summit in October 2013 confirmed this several months later by signing the SMART Africa Manifesto in Kigali. These efforts have as yielded a new national ICT strategy, the SMART Rwanda Master Plan (SRMP) replacing the ICT SSP. It is this SMART Rwanda Master Plan that underpins the current government transformation agenda.

The SRMP derived key initiatives through analysis and assessment from four perspectives: aligning national development vision and strategies, reflecting the achievements of NICI I~III and 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, Secured & Shared Infrastructure were identified. Seven pillars were also defined: SMART Agriculture, Finance, Business & Industry, Health, Education, Government, and Cities.

The process of developing SMART Rwanda also defined a vision statement: "A prosperous and knowledgeable society through SMART ICT". This vision is underpinned by projects in 20 focus areas based on ten core objectives covering all the seven pillars. 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 cost of the projects under SRMP is about US$500M, with an accumulated economic benefit[2] of US$1,722M with a 140 percent ROI and 21 per cent contribution to GDP, and more than 50,000 jobs created. Other expected benefits include increased innovation and capacity for ICT exports, economic productivity, reduce poverty and achieve national economic objectives.

In order to achieve the stated benefits above and address challenges of co-ordination, silo-approach, and poor project completion rate, a different governance and management structure is proposed. This structural change is accompanied by greater emphasis on performance management and resource allocation. The SRMP will continuously monitor 4 main global ICT indexes related to performance of the ICT investment. In addition, to efficiently manage and increase the success of the projects requires close collaboration with the private sector through PPP and other innovative models. This is to encourage greater private sector participation, allowing for even more increased productivity and return on investment.

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 creation of Rwanda Information Society Agency (RISA). RISA 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

[2] This is an estimate based on a model explained in Annex 3.

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 4 ICT indicators: ICT Development Index, Global Competitiveness 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.

# I. **Introduction**

## 1. Background

Despite a global economic recession resulting in an average global growth rate of 2.6 per cent, Rwanda has managed to show the highest annual economic growth rate of 8.2 per cent in the last 3 years. This continuous growth has been enabled in part by the government's aggressive investments in Information Communication Technology (ICT) and the rapid expansion of the mobile telecommunication sector. Furthermore, being landlocked has made it imperative for Rwanda's continued development and investment in ICT.

Having recognized the importance of the ICT investments in achieving the socio-economic growth, the GoR (Government of Rwanda) adopted the National Information and Communications Infrastructure Plan (NICI) in 2000. The first NICI Plan, NICI I (2000-2005) focused on establishing an enabling environment to promote the development and growth of Rwanda's ICT sector. The second plan, NICI II (2006-2010) focused on providing world-class communications infrastructure to serve as the backbone for current and future communication related requirements. The third plan, NICI III (2011-2015 Plan), focused on the development of services by leveraging ICTs to improve the delivery. NICI III's overarching goals focused on accelerating service developments through ICTs, thereby facilitating sustainable economic competitiveness and increasing ICTs' contributions to GDP.

Consequently, the adoption of aggressive ICT developments provides a basis for Rwanda to make a quantum leap forward to become a middle-income nation. In order for the ICT to be efficiently and proactively operated and managed, the strategy and plans require alteration and oriented in correlation to the current ICT and socio-economic status. This therefore calls for a new blueprint for ICT under the tag of SMART ICT.

Rwanda is currently at a critical point with 6 years to realizing the goals of Vision 2020, and this called for a reassessment of the current ICT strategy, the ICT Sector Strategy Plan, and affirmation of the strategic direction and progress. This assessment revealed a need to make significant changes to the strategy. The changes required can be summarized as the SMART Rwanda Master Plan.

## 2. **ICT for National Competitiveness**

*What is the role of ICT and appropriate direction of ICT investment?*

ICT has changed the course of global community over the last 30 years. The new wave of innovation has equally created opportunities and challenges. The rapid development of information

and communication is bringing various outcomes: new markets are created, and related policies are being impacted. Although developed nations are more advanced in the technical skills and knowledge for now, innovative technologies are presenting and providing the developing nations with room for new market opportunities to change the current market situations. Just as electricity played a key factor in an economic development during the industrialization period, ICT will serve as a core element in the knowledge-based economic development.

For developing countries, ICT investment is an essential driver that brings forth economic development. There is a positive correlation between ICT competitiveness and national competitiveness: a higher ICT competitiveness leads to a stronger national competitiveness according to The World Economic Forum (2011).

Rwanda recognized very early on that ICT investment plays an important role in the national growth and economic development. Although there is a consensus on the importance of the ICT investment, the limited ICT investment sources and resources are hindering the development. Hence, strategies with distinct methods to utilize the limited resources and maximize the return are required.

In developing SMART Rwanda Master Plan, a comprehensive and thorough analysis was conducted to identify focal areas of investments considering strategic impact, outcomes and required resources as well as identified critical success factors for the investment.

According to the WEF's "The Global Competitiveness Report - 2012," Rwanda is currently in the initial economic growth stage of development. In this stage, Rwanda is focused on providing basic ICT infrastructure to support healthcare and education. Maximizing the return of investment in ICT must consider the application and utilization of this investment through higher education and training to develop skills and improve capabilities for innovation and higher productivity.

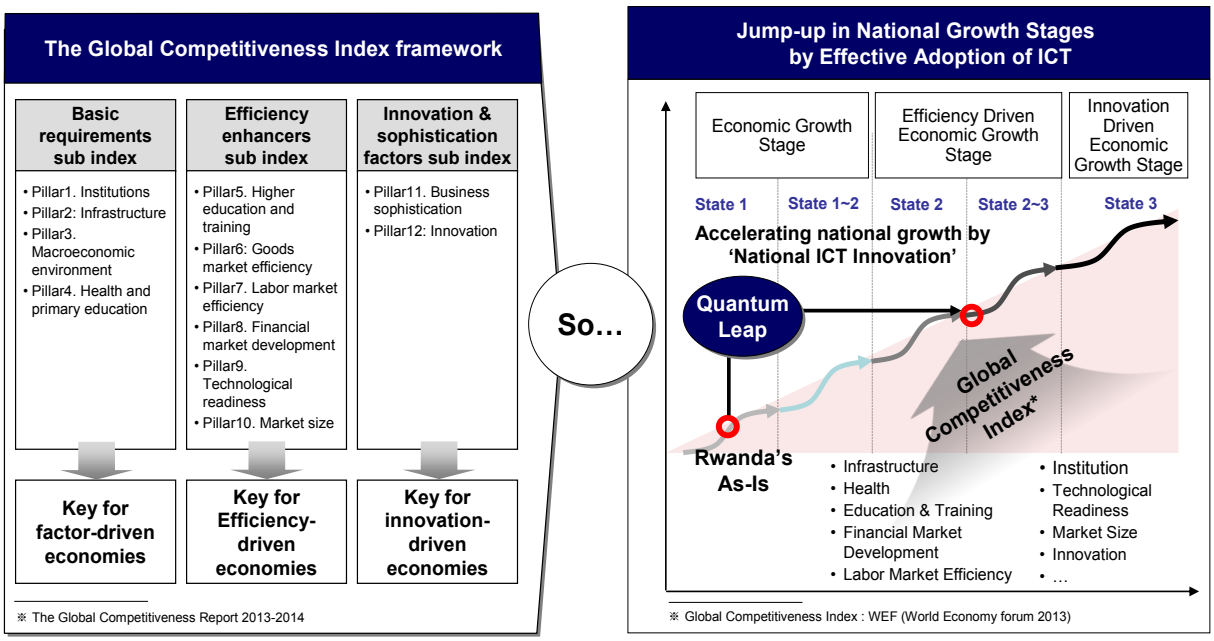



**Figure 1: ICT Investment driving national competitiveness**

The capacity of broadband utility and efficiency are the key drivers of an economic development in the developing countries. WBF (World Broadband Forum) has established a link between access and speed of BB to an increase in GDP.

Rwanda has invested significant amount of effort and resources in establishing an ICT infrastructure itself a significant step towards becoming the "regional ICT Hub". With the completion of "Rwanda's National Backbone Network Project" in December 2010,the project established a fiber optic backbone network covering over 3,000 km across the country.

Furthermore, Rwanda Utilities Regulatory Authority (RURA) is driving the broadband development by establishing a policy that promotes the responsibility of guaranteeing high Internet service quality from the telecommunication and Internet service providers.

Backbone networks for key main networks related to administration, education, finance, and national information security are currently being developed or have been established. However, limited access to the backbone network, has constrained the Internet penetration to 7% and this need to be addressed by installing last mile networks.

## Role of the Private Sector

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. The 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 private sector involvement also brings industry expertise and experience necessary to increase the success of the project implementation. The government is actively trying to attract multinational corporations through investment-friendly policies to develop a Techno pole, and also partner with the private sector on specific projects. The presence of multinationals should facilitate knowledge transfer, local skills development, and faster innovation.

## Financing

Achieving the vision of the SMART Rwanda Master Plan will require the mobilization of significant financial and human resources. Funding of the flagship projects in this SRMP will come from GoR, its development partners, and other public or private institutions through Private Public Partnerships (PPPs) and collaborations. Due to financial limitations in public and official development assistance, it is essential to develop innovative funding mechanisms to mobilize additional resources from other sources as outlined below. The private sector will be encouraged through development of suitable incentives including but not limited to Special Purpose Vehicles (SPVs), angel investors, waivers on licensing fees, tax incentives and tax breaks.

# 3. 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 "***a prosperous and knowledgeable society through SMART ICT***"

- Scope: To secure national ICT execution capability, expanding ICT accessibility, and establishing programs to enhance economic growth.
- Focus: To secure country's reliance on ICT by upgrading protection and security, agreeing on rights and responsibilities for data use on the basis of context, and driving accountability and enforcement.
- Image: To become a regional ICT Hub, enhancing Rwanda's international reputation 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.

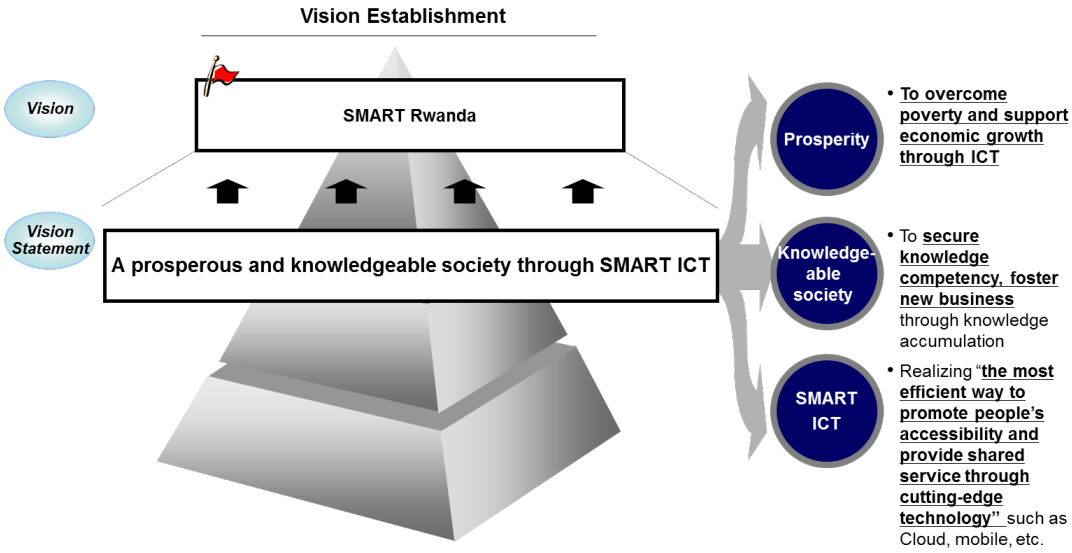



**Figure 2: SMART Rwanda Vision Statement**

- **Prosperity:** Sustained economic growth, poverty reduction and a reduction in income inequality
- **Knowledgeable society**: To secure and accumulate knowledge competency, as the driver of productivity and economic growth
- **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.

# 4. SMART Rwanda Implementation

### Background

Currently, strategic national ICT projects are implemented and managed by the ICT Department in RDB. However, the Rwanda Information Society Agency (RISA) is the proposed new structure for the governance, management and delivery of the goals and objectives of the national ICT Strategy, the SMART Rwanda Master Plan 2015~2020. It's objective is to bring about increased accountability, transparency, reduce duplication, and greater emphasis on performance to bring about the desired efficiencies and effectiveness and therefore an increased return on ICT investment. In addition to the creation of a RISA, other proposed changes in the governance, management and delivery of the

SMART Rwanda Master Plan (SRMP), include:

- Expansion of the mandate of the National ICT Steering Committee;
- Establishment of a Board that is representative of the key economic and social sectors and members from private sector;
- Relocation of the SRMP governance and management responsibility to RISA from Rwanda Development Board (RDB) where it is currently managed;
- Re-assignment of the M&E function from RDB to MYICT;
- Centralized management of government ICT under RISA to a drive common standards, infrastructure and capabilities strategy.

## Purpose

Currently, ICT governance, implementation and support in Government institutions are fragmented and operating in silos. The purpose of the RISA Strategy is to provide a clear institutional governance structure for the integrated and centralized management of all Government of Rwanda ICT strategies. RISA will also execute and manage the SMART Rwanda Master Plan (SRMP). RISA shall enhance the government's operations and strategic focus by the application and execution of Information and Communication Technologies (ICT) to support improvements in productivity, management effectiveness and ultimately, the quality of services offered to citizens. This should in turn reduce costs and provide high quality public services by removing unnecessary overlap between government ministries, agencies, and departments (MDAs) and avoid costly duplication of technology.

The RISA will therefore facilitate significant improvement of public services through better use of ICT, making the way government works, smarter, cost effective, and innovative. The strategy focuses on improving services through a shared ICT infrastructure, increased ICT Capability and improved ICT Governance.

## Strategic Principles

The RISA strategy is underpinned by a number of principles, summarized as follows:

- Expand and Improve quality of public services through adoption of greater standardization and simplification;
- Focus on innovation, interoperability and open standards to facilitate information sharing, collaboration and accessibility to deliver greater value for money;
- Invest in workforce to increase innovation, ability, capacity and professionalism;

- Utilize effective portfolio, program and project management techniques to maximize the impact of ICT-enabled change; and
- Benchmark ICT investment, costs, and performance annually.

## Objectives

The general objective of RISA shall be to develop, manage, and implement national ICT programs to support socio-economic transformation of the country.

Particularly, RISA shall have the following objectives:

1. To ensure coordination and implementation of National ICT programmes;
2. To drive strategies to ensure usage of ICT common standards, resources, infrastructure and capabilities across the Government;
3. To coordinate the Government's overall ICT investment by focusing on return on investment, impact creation and benefits realization;
4. To embed a Culture of Innovation and Process Improvement for increased efficiency in Government operations;
5. To advise the Government on national needs and policies in respect of all information and communications technology;
6. To coordinate and promote research and development relating to information and communications technology in conjunction with government institutions, Universities and other private institutions;
7. To define minimum standards and codes relating to equipment attached to telecommunication and radio-communication systems, and any equipment or software used independently or as an adjunct to or in conjunction with such systems within the Government and the monitoring of and access to such equipment and software;
8. To encourage, promote, facilitate, invest in and otherwise assist in the establishment, development and expansion of the information and communications industry in Rwanda, including information and communications technology manpower resources in Rwanda;
9. To work with all relevant stakeholders to provide facilities for the training of and do anything for the purpose of advancing the skills and knowledge of persons for any purpose connected with the information and communications industry in Rwanda;
10. To advise on, establish and maintain standards of education and training in information and communications technology in Rwanda;
11. To plan, promote, develop and implement information and communications technology systems and services for Government ministries, departments and agencies;
12. To establish and maintain information and communications technology data privacy and personal data protection;

13. To promote the use of the Internet and electronic commerce and to establish enabling frameworks for that purpose;
14. To provide consultancy and advisory services concerning information and communications technology;
15. To foster the development and expansion of information and communications services in the world in collaboration with other countries and international organizations;
16. To establish relations and collaborate with other regional and international agencies with the same attributions;
17. To act internationally as the national body representative of Rwanda in respect of information and communications technology matters;
18. To promote the acceptance and use of information and communications technology in Rwanda with due consideration to:
    a. Trends in the development of information and communications technology and evolution of standards and protocols used in the information and communications industry;
    b. Convergence between broadcasting services and other services using information and communications technology, and the need to accommodate technological change;

## Prioritization

The RISA Strategy consolidates a number of significant cross-government and agency programs already underway, and in some cases expanding their scope to meet the Government's transformation goals. New initiatives will be added as concepts and benefits are proven, and will typically require business cases as well subjected to portfolio management.

Early delivery of ICT investment planning changes and the development of a new operating model are both critical to the success of the RISA Strategy, and will both be prioritized by the RISA (and MDA's). This is a deliberate move towards a more disciplined approach, where the most important functions are prioritized and the emphasis is on quick delivery.

## Monitoring and Evaluation

The SRMP monitoring and evaluation framework describes the key indicators that will be used to measure progress and impact in the implementation of the SRMP. RISA will work in partnership with RURA and NISR to collect and analyze data to measure economic impact of ICT on development and the national economy.

## Benefits

The RISA Strategy is outcome-focused and SRMP outlines a clear step-by-step guideline for delivering the RISA goals, it must also remain flexible to be adjusted over time as priorities and circumstances change.

The benefits of the RISA Strategy are:

- Reduce complexity and duplication in ICT investment;
- Faster realization of savings and return on ICT investments;
- Improved access to integrated government information and services;
- Enhanced capability across all aspects of the public service delivery; and
- Improving the leverage of operational scale across government and effective engagement with the ICT industry.

**Risks**

The SMART Rwanda Master Plan requires a standardized, flexible and efficient ICT infrastructure to enable delivery of these objectives in an effective, secure and sustainable manner. Above all, it seeks to reduce inefficiency, replication of systems and duplication of effort. Currently, technology investment planning is agency-specific, often near-term focused, and is biased significantly towards the purchase of technology infrastructure capital assets. The RISA Strategy addresses these challenges by considering:

- The impact of emerging technologies: Technology continues to change at a rapid rate, and emerging technologies will have a dramatic effect on how public sector ICT is delivered. In the longer term, other technologies will begin to play a role. This strategy provides the flexibility for new technology developments and sector-specific requirements to be incorporated as they arise.
- Regional and International alignment and coordination: A key element of this strategy, therefore, is to ensure alignment and compliance with the SMART Africa Manifesto and other regional agreements, decisions and treaties. The RISA shall continue to share best practice and help solve common problems. This approach ensures continuation to exploit technology to its full effect in efforts to deliver constantly improving services.
- Governance: The governance structure, meanwhile, ensures that RISA strategic objectives receive the necessary high-level support, accountability and maintain visibility at the highest echelons of the government.

The implementation of the SRMP requires effective risk identification and management to ensure the realization of its objectives in an effective, secure and flexible manner. The risks associated with its

implementation may emerge before and during the implementation process. In order to manage these risks, identification of the risks and their mitigation will be done periodically at the start, middle and end each activity of the implementation process.

## Key Areas of the SRMP Strategy

### Common Infrastructure

At the heart of the RISA Strategy is the creation of a common, secure and flexible infrastructure that is available across the public sector. To achieve this, the strategy sets out the vision for the following:

- **Integrated Public Network & Communications:** A single holistic telecommunications infrastructure that will deliver converged voice, video and data communications.

- **The Government Cloud (G-Cloud)**: A government cloud infrastructure that enables public bodies to select and host ICT services from a secure, resilient and cost-effective shared environment. The Government Cloud is a key enabler as it shall provide a single access point for ICT services, applications and assets.

- **Data center rationalization:** A program of data center consolidation that will deliver large cross-government economies of scale, meet environmental and sustainability targets and provide secure, resilient services. Aligned with development of the Government Cloud, this program will reduce the number of data centers planned or already in use. Shared services will be provided via the Government Cloud to further exploit opportunities.

- **Desktop services:** While all public sector bodies need to provide their staff with access to functions such as email, word processing, spreadsheets, document management, and internet browsing, historically each public sector organization has separately specified, built and run its desktop service – creating additional cost and complexity. Instead, there will be a set of common desktop designs that conform to information assurance and sustainability requirements, setting this as a best practice across the public sector.

### Common Standards

All products, services and assets contained in the government ICT infrastructure will benefit from a suite of common standards for security, interoperability and data standards, which will facilitate data sharing and make it easier to integrate public services. The key focus being on:

- **Architecture and standards***:* The technical architecture and standards work underpins all elements of the RISA Strategy. This will ensure security, interoperability and common data standards that will facilitate transition of supplier or product, as well as data sharing and the joining up of public services.

- **Open Source, Open Standards, Reuse***:* Traditionally, the public sector has relied on commercial off-the-shelf (COTS) software or bespoke developments from global providers. This restricts the ability of the public sector to reuse solutions, reduces flexibility to manage assets efficiently and prevents government organizations from switching suppliers. The Open Source, Open Standards, Reuse Strategy provides government's approach to open source alternatives that meet public sector requirements. This strategy will build capability within the public sector to increase the amount of open source code and software in use and to make it available for reuse elsewhere.

- **Information security and assurance***:* Data losses within the public sector have rightly raised the profile of information assurance. However, data sharing is an essential element of integrated services. This means that there must be effective, proportionate management of information risk. By developing a secure infrastructure, as outlined above, will provide a trusted platform that will allow public sector bodies to match their information risk appetite with their information risk exposure: users of the infrastructure will be able to take information assurance for granted without feeling that their effectiveness has been compromised.

**Common Capability**

The RISA Strategy incorporates building capability as well as capacity in ICT. The strategy can only be delivered through the people who work within public sector ICT, and a cultural change in ICT usage and procurement.

- **ICT Skills & Capacity Building**: Increasing the capability will not only improve the performance of ICT, but it will also reduce the amount the public sector spends on ICT consultants and contractors. The RISA Strategy provides a focal point for increasing the professionalism of ICT delivery within the public sector. A Government IT Professional skills and competency framework will be used for recruitment, training and performance management of government ICT professionals.

- **Reliable project delivery:** Reliable project delivery is critical and the RISA will work closely with stakeholders to identify those major programs and projects that have a high complexity

and associated high delivery risk, and take a more proactive role in managing them and overseeing their success.

**Implementation**

The RISA is responsible for leading the overall government objectives to expand services and improve service delivery, generate efficiencies across departments, develop expertise and capability across the Public Service, and ensure business continuity. Change will be delivered through:

- Coordinating government's overall ICT investment, focusing on return on investment and benefits realization;
- Tightening planning and decision-making disciplines, and improving leadership, governance capability and assurance;
- Rationalizing and consolidating service channels;
- Uplifting government's capability to take advantage of new and emerging technologies

**Factors critical to successful implementation**

- **Providing clarity**: It is crucial that scope, governance and operating models for ICT functional leadership are well understood from the outset. Boundaries will be made clear, including the extent that the strategy will drive the MDAs, and also the role of the RISA. Decision-making arrangements will be streamlined and mechanisms for prioritizing investment requests will be clearly articulated. Actions like these will provide MDA leaders with an understanding of where they can operate independently and where the context of their sector and/or the integrated RISA takes precedence.
- **Committed leadership**: MDA leadership teams must be committed to and support the strategy. The RISA will assist the MDAs to understand the impact on how they utilize common ICT capabilities to deliver their business strategies and to move their services to an integrated digital channel delivery model.
- **Alignment:** MDAs will be asked to adhere to the objectives of the RISA. The respective ICT leaders will be responsible for leading the development and establishment of the changes and taking on some delegated responsibilities from the RISA.
- **Funding:** The action plan relies heavily on a "value-for-money" approach to support the plan's delivery capabilities. The approach provides clarity on how MDA's will be supported to transition from capital-intensive asset development to 'as-a-service' consumption using operational expenditure.

- **Assurance**: The RISA will provide assurance that ICT risks and processes are identified and effectively managed.

In order for the strategy to fully deliver its potential, the National ICT Steering Committee will coordinate, promote and embed the principles and approaches of the RISA Strategy through the establishment of the RISA and the RISA Council. This will mean working with the RISA Governance Structure to develop a shared vision of locally delivered public services aligned with the SMART Rwanda Master Plan. The implementation will also be supplemented through private sector organization exploiting the infrastructure and opportunities it brings to enable achievement of the SRMP objectives.

This integrated governance structure shall combine expertise from central and local government, and the wider public and private sector as well as include both technical and commercial roles. This will provide all public and private sector bodies with the opportunity to shape implementation of the RISA Strategy, and ensure that solutions never lose sight of the need for improved public services as well as increased efficiency. It will also mean that specific local requirements and the need for flexibility are not overtaken by a 'one size fits all' approach that will negatively impact service quality.

# 5. Policy Orientation

There are several key policies need to be considered to anchor the successful implementation of SRMP. These policies are:

5.1 Broad Band Policy

5.2 Cyber Security Policy

5.3 Private Sector Development Policy

5.4 eWaste Policy

5.5 Open Data Policy

## 5.1 Broad Band Policy Orientation

In 2013, GoR approved the broadband policy aimed at restructure the telecommunication sector under an infrastructure-sharing regime by way of a wholesale-only, open-access network as a means to accelerate rollout of broadband network and services, and eliminate duplicated investments – thus availing affordable broadband for all. The policy positioned broadband as a driver of economic growth, social cohesion, productivity and innovation across all sectors of the economy and promote guide initiatives to drive down the cost of end-user equipment; stimulate the development and uptake of relevant content; and driving aggressive digital awareness campaigns.

**Objective**

The major benefits that will come as result of improved connectivity:

- Improved quality and access of healthcare services will reinforce the use of advanced medical applications like telemedicine, the management and exchange of patients' electronic records information, across Rwanda.
- Improved government service delivery will greatly enhance the government's capability to communicate within government institutions, and with its citizens. Provide online service for informational and transactional purposes, which will drive down the cost to government, of service delivery.

- Improved quality of education by enabling delivery of digital contents for instruction, irrespective their location; it will also facilitate the relationship between institutions.
- Arts, culture and entertainment: citizens will experience an evolution in the entertainment scene: this will play a role in improving and expanding channels of knowledge dissemination.
- Reduced cost of communications and improved marketability for investment creates an environment that stimulates economic growth due to the lower cost of communications that attracts businesses to all parts of the country, and the streamlined distribution of products and services to all corners of the nation. With the improved access to the rest of the country and the world through Broadband, all areas of the country will be able to increase their marketability, and therefore attract more investment.
- Increased employment and growth of SMEs. Broadband connectivity unlocks creativity and creates economic activities that create jobs, more especially to the youth.

The availability of high-speed, reliable and secure Broadband will stimulate Hospitality industry, and attract more visitors to the country and drawing increased foreign exchange, and thus create a heavy impact on the economy. A significant number of SMART Rwanda Master Plan flagship projects rely on the presence of the BB infrastructure for successful roll out and implementation.

## 5.2 Private Sector Development

The private sector's role in ICT sector is undeniably crucial and this role can be defined in many ways depending on the vision in question. As private sector players, ICT Private Sector Development has been defined according to four major focus areas all of which contribute to the success of business proprietors.

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

- Grow Existing Indigenous ICT Businesses
- Cultivate New Local ICT Enterprises
- Export & FDI Expansion
- Improve Business & Industry Productivity and efficiency

**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. Improve Business and Industry Productivity & Efficiency**

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:

i) **Reducing Costs**
ii) **Improving service delivery**
iii) **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.

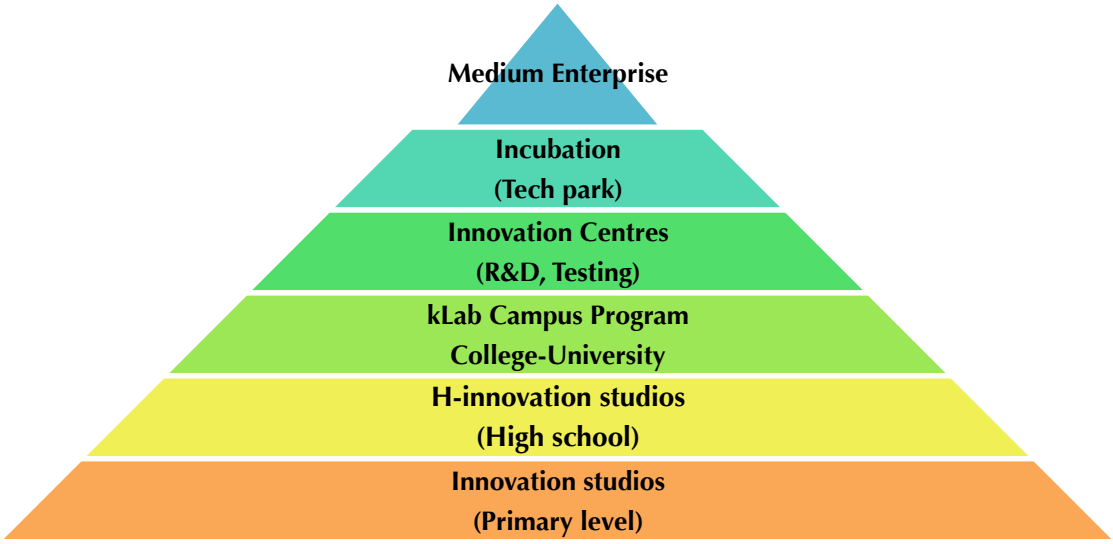
## Delivering ICT Private Sector Development

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 economy. As such knowledge and the culture to boost knowledge-based enterprises is a crucial input in achieving this goal.

The envisioned project for achieving this is the **National 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
- **1000** students placed in world class technology universities
- **$100Million** 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 **$100 Million**
- **$10 Million** new annual local investments
- **10,000** advanced technology jobs

### #3 Goal: Improve Business and Industry Productivity & Efficiency

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:

i) Reducing Costs
ii) Improving service delivery
***iii)*** 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 Cyber Security Policy Orientation

The GoR has significantly investment in ICT infrastructure and applications considered to be critical information assets for Rwanda. As Rwandan society becomes more and more dependent on ICT, the protection and availability of these critical assets are increasingly becoming a national issue; as such, cyber security becomes strategic national issue affecting all levels of our society.
Therefore, enhancing cyber security and protecting critical information infrastructures are essential to national security and economic wellbeing. This requires comprehensive, collaborative and collective effort to deal with cyber security at all levels which requires having in place appropriate and comprehensive cyber security policy framework to ensure the security and resilience of national information systems and services.

**Objectives**

The following constitute the major key areas:

- Enhance the security and resilience of critical ICT infrastructure
- Increase efforts to promote the adoption of appropriate ICT security measures among individuals and businesses
- Grow Rwanda's pool of IT security experts

**Proposed Cyber Security Governance Framework**

Securing Rwanda's national information assets requires a comprehensive governance structure for effective focus and coordination of national cyber security initiatives. It is necessary therefore to establish an efficient coordination mechanism for effective cyber security and resilience. The cyber security implementation framework is composed of the national cyber Security Council, the national cyber security agency, institutional cyber security units as well as specialized cyber security centers

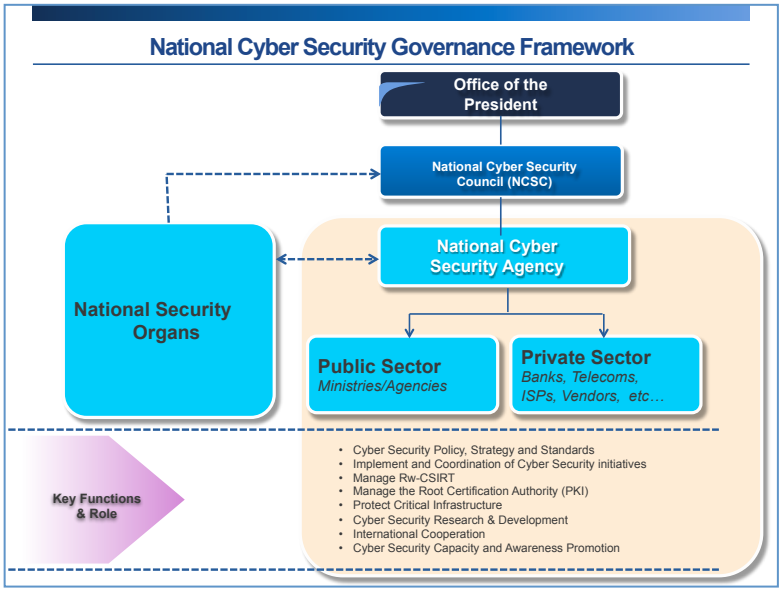



**Figure 3: National Cyber Security Governance Framework**

## 5.4 e-Waste Policy Orientation

In Rwanda, there are growing numbers of personal computers and other electronic and electrical tools in institutions, households, business facilities, etc. Besides, with the growth of the telecommunication sector, the number of citizens subscribing to the mobile network is steadily increasing. Thus, the waste generated by those EEE constitutes serious threat to human lives and environment. To manage resolve this issue, an E-Waste Management Policy and Bill governing electronic and electric waste management has been developed.

### Objectives

Proper management of Electrical and Electronic Equipment (EEE) Waste will yield the following main benefits for the country:

i) The promotion of sustainable E-waste management processes and systems
ii) Development of SMEs and job creation through investment in the area of E-waste management
iii) Protection of the environment from E-waste pollution and hazardous materials by the establishment of an adequate E-waste legal and regulatory framework
iv) The development of a skilled workforce in the area of E-Waste management

## 5.5 Open Data Policy Orientation

**Context**

The role played by data in the economy and society is changing. The growth of the Internet and the rise of 'big data' mean that access to large data sources in a usable form is an increasingly important feature in open and competitive economies. Innovators and entrepreneurs are using these large data sets to design new kinds of products, enhance their competitiveness, build social capital and engage in civic life.

The government generates a significant amount of data that is useful to citizens. However, this information is often hidden from view in line department archives or is difficult to access. Various data access policies and procedures within the organisation similarly impede public access to information.

The government and its agencies have numerous websites and portals. However, these are often not user-friendly and the information they contain is sometimes out of date and not in machine-readable format.

**Objectives**

1. Establish and incrementally populate a single online open data portal for information and data generated by the government that is free and accessible to members of the public.
2. Assist citizen engagement with the central and local government by making it easier for members of the public to access data. Enhancing transparency will empower citizens to hold the city government to account.
3. Make available information that is useful and empowering for citizens (for example, for information technology entrepreneurs, property developers or social organisations).

**Strategic Intent**

The strategic intent is to create an enabling environment to attract investment that generates economic growth and job creation. The policy shall support the EDPRS II programme on prioritising

competitiveness in business improvement initiatives, specifically where this relates to governance and oversight and improving the competitiveness of the broader economy.

**Policy Parameters**

The information infrastructure foundation concerns itself with the creation, continuous update, accessibility, and archiving of public information and other public accessible information in a manner that eases accessibility, communication, dissemination and processing to promote public service delivery, transparency, accountability, and enable the country to transition to a knowledge-based society.

Currently data and information is created and stored in disparate data formats and media, with the bulk being paper based. As a result, such information is difficult to access electronically. Additionally, in most instances, each Ministry, Department and Agency (MDA) has its own data set concerning a similar entity. For example, when a citizen visits a hospital, the hospital stores the medical information, which is not available to another hospital. This is critical especially during emergencies, which can even lead to loss of life. The scenario is replicated across various sectors resulting in fragmented data sets, duplication of effort, wasted resources and inconsistent data. Similarly, there is lack of data linkages between various data sets in instances where the need for cross-reference is required for a service to be completed. For example, when a citizen is applying for utilities such as electricity or water, there is a need to provide a unique ID which would be made easily available if the two data sets were linked via a data sharing mechanism.

Citizens are also obligated to reproduce documentation of personal information, which is already in the custody of other Government agencies. On the other hand, the Government does not benefit from intelligence information that other public agencies have, for various enforcement programs.

However, updating the available information that is online and provision of e-services is neither continuous, nor real time and therefore the expected benefits to users have been unsatisfactory. On the other hand, the trend in data and information is moving towards business intelligent and data mining of large data sets based on a unique identifier concept for policy, decision making, and wealth creation. This has been facilitated by the institutionalization and implementation of public data hubs.

This Master Plan proposes that Rwanda strategically develops and implements public data hubs based on a unique digital ID based on a secure infrastructure for efficient and effective citizen

centric services, enhance IT- enable democratic governance, and creation of data markets from the public data and information to spur innovative and commercial services and products. In so doing, the information infrastructure should be guided by the legal and regulatory framework.

**Approach**

Initially, the open data portal will focus on providing information in machine readable form to the public based on information generated from key economic sectors including statististical reports and underlying data, and departmental information and reports that are already publically available.

The data available on the portal will exclude the following:

- Third party data that is copyrighted or where the third party owner has prohibited the Government from publishing the data
- Information that discloses private information or in any way infringes on the privacy of individual citizens
- Information that exposes the Government to unacceptable risk
- Information that the Government is not legally permitted to disclose
- Confidential information
- Any other content that is determined to be inappropriate by the open data policy

**Stakeholders**

The principal role-players will be RISA who will be responsible for establishing and administering the open data portal. Further key role-players will be the Director General and Directors of all ministries and government agencies who will be designated to be responsible for;

1. Collating and publishing the open data to the portal. RISA shall also designate
2. Signing-off on data and information released from their department or ministry.
3. Determining the appropriate content categories for the open data portal and for vetting all content submitted for publication on the portal.

Key stakeholders include, but are not limited to, the following:

- RISA
- MDAs
- Local Government
- Other public entities, which can use or contribute content to the open data portal
- Private organizations and citizens

# II. **Analysis & Assessment**

## 1. *Major Consideration Factors*

SMART Rwanda Master Plan has been developed by aligning the strategy to the national economic vision, goals and objectives. The SRMP development process has taken 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.

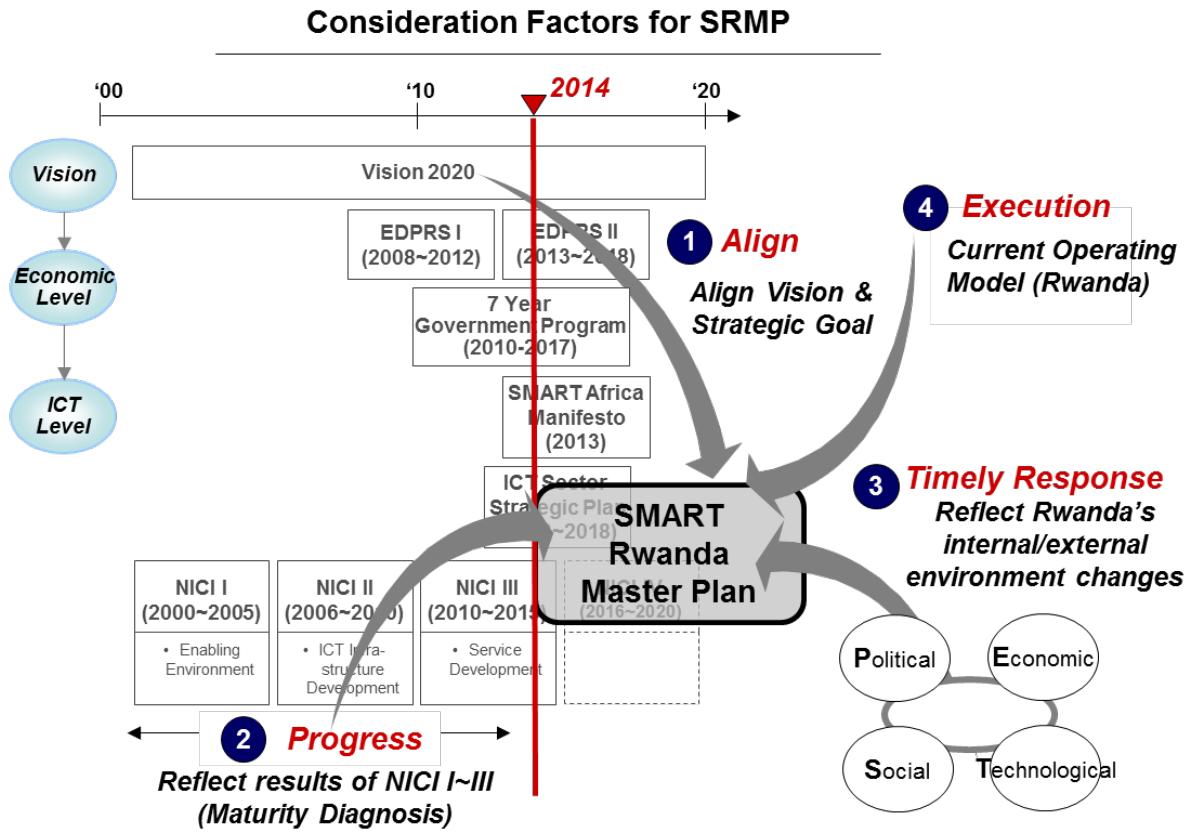



**Figure 4: Consideration Factors for SRMP**

① 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.

② 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.

③ 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) analysis to effectively capture on-going changes in Rwanda.

④ 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. Current ICT Status and Analysis Framework

## 2.1 Aligning Vision & Strategic Goal

The framework for the analysis considered and carefully reviewed the economic development goals to effectively capture previous strategies and core areas of improvement.

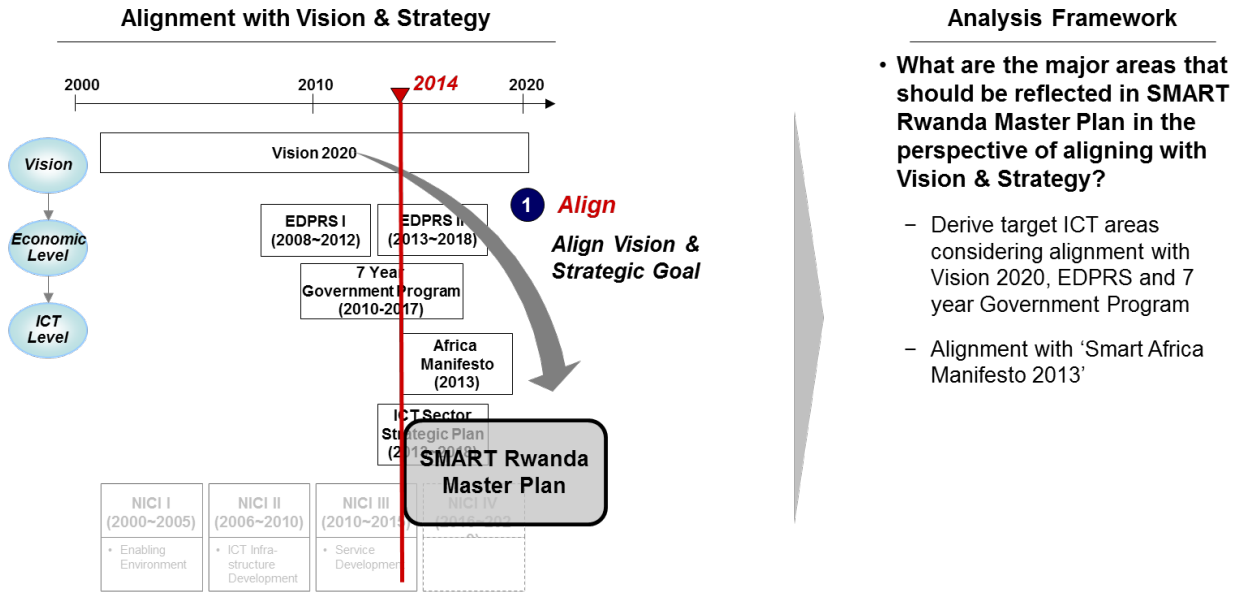



**Figure 5: Alignment with Vision 2020 & EDPRS II**

### 2.1.1 Vision 2020 Analysis

The Vision 2020 seeks to fundamentally transform Rwanda and become a middle-income country by year 2020. This will require achieving an annual per capita income of US$ 1,240 (US$ 290 in year 2000), a poverty rate of less than 30% (60% in year 2000) and an average life expectance of 55 years (49 years in year 2000). Vision 2020 appropriately identified ICTs to help the country achieve the stated economic targets.

Major objectives of the Vision 2020 are as follows:

- Short-term objective – Promotion of macroeconomic stability and reduce aid dependency: There's high reliance on foreign aid as it accounts for 40% of national budget. In order to

reduce aid dependency, the goal is to stabilize the economy at a macro level to transform and stimulate the development of public sector leading to enhancing and securing domestic resources and export. The emphasis on reducing foreign aid reliance and advancement to knowledge-based economy from agrarian economy resulting in increased national competitiveness remains a critical objective.

- Medium-term objective – Transformation from an agrarian economy to a knowledge-based economy:
  Agriculture is the highest employer and it is important to fundamentally enhance agricultural productivity and quality to support economic development.

- Long-term objective – Jobs creation and fostering entrepreneurship:
  In order to create employment, fostering both innovation and entrepreneurship is fundamental to the long-term.

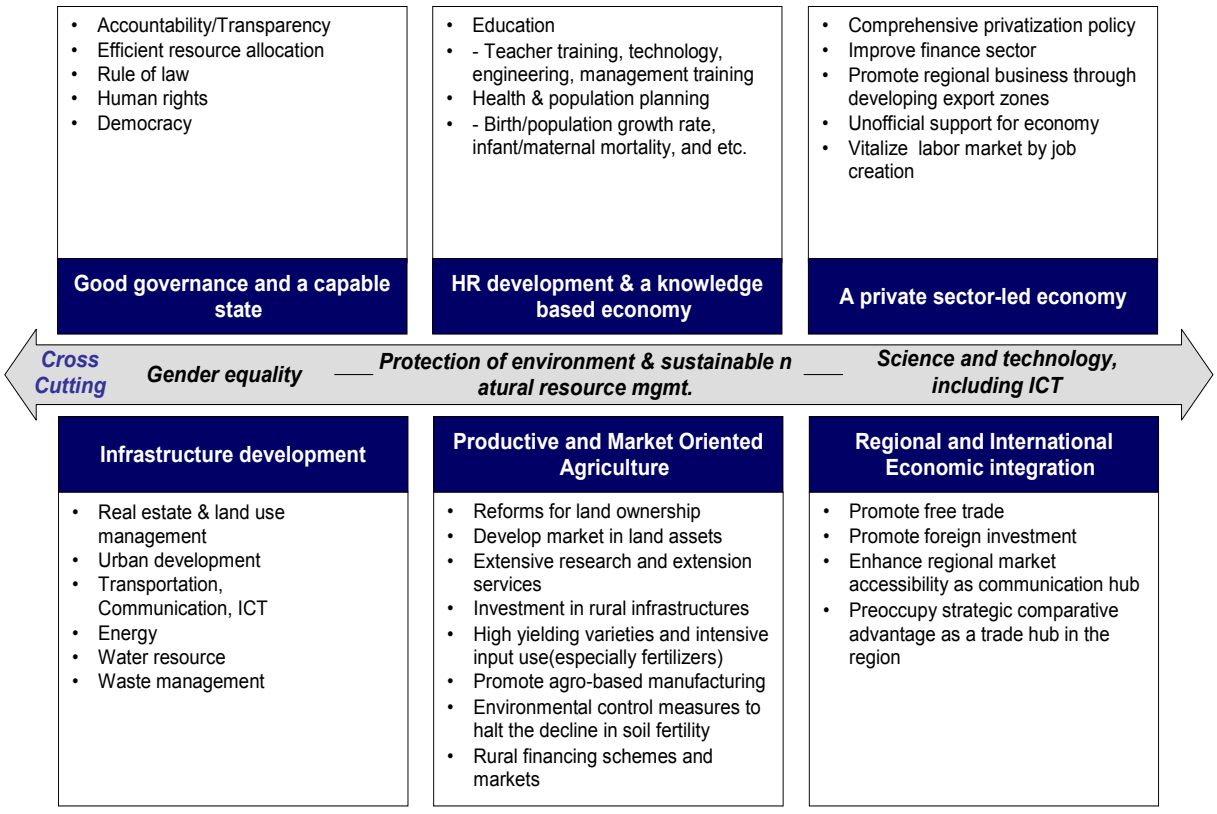



**Figure 6: Vision 2020 Key Themes**

### 2.1.2 EDPRS II Analysis

There are several key main objectives of EDPRS II: new job creation through sustainable growth, competitiveness enhancement through growth of exports, build capacity of the private sector through innovation and investment, improve productivity of agriculture, and increase access to ICT.

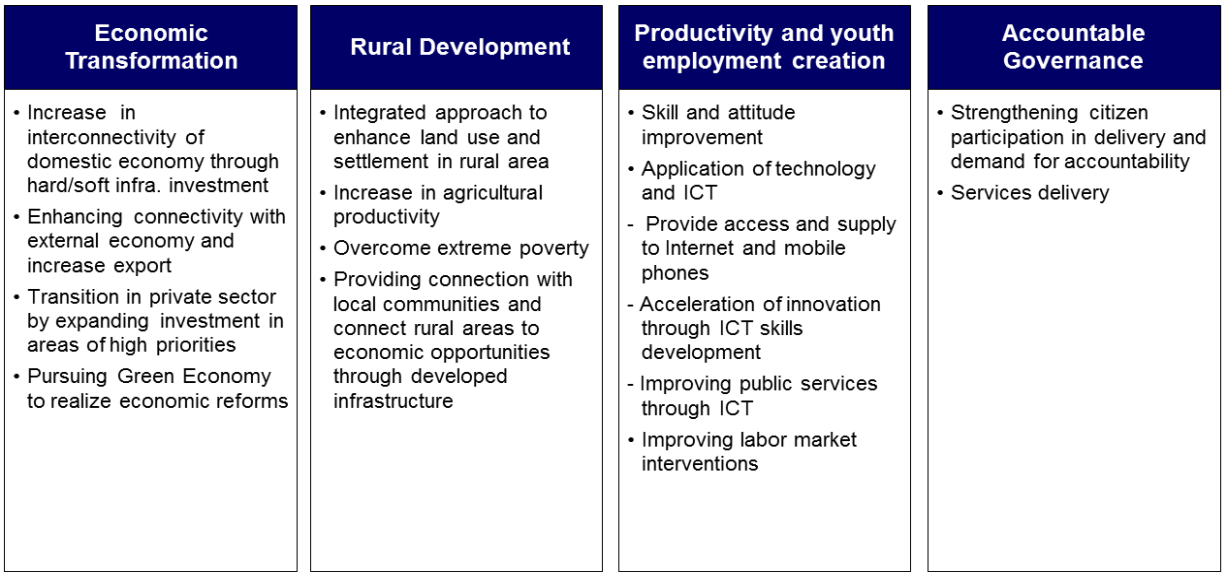



**Figure 7: EDPRS II Thematic Areas**

Four thematic areas of EDPRS II are:

- **Economic Transformation**:
  Transform Rwanda from a rural economy to an urban economy and sustain economic development with a high economic growth. The plan is to bring about 11.5% of economic development growth until year 2020 by establishing social infrastructure, higher export, integrated supply line, higher energy supply, green environment, and greater roles of public sector.

- **Rural Development**:
  The main idea of this development is to increase the economic benefits of rural population and their quality of lives through efficient utilization of land, support of agricultural production and social infrastructure.

- **Productivity & Youth Employment**:
  In order to advance into a mid-income country, 200,000 job needs to be created annually, promote labor market to fulfill the demands, provide vocational education, utilize ICT technology to increase productivity, and encourage higher youth employment.

- **Accountable Governance**:
  In the light of promoting transparency and accountability, more public involvement in policy-making and execution is encouraged. Higher public involvement and public services will strengthen the accountability of governance.

### 2.1.3 7-Year Government Program (2010~2017) Analysis

The Seven Year Government Program is the vision set forth by H.E. Paul Kagame on 6$^{th}$ September 2010 during his inaugural speech at his swearing-in ceremony to lead Rwanda for the next seven years. The program objectives are to develop four main pillars, Good Governance, Justice, Economy, and Social Wellbeing, to achieve the overall goal of shifting Rwanda to a middle-income country.

The four pillars of the Seven Year Government Program are briefly explained below:

1. Good Governance: "To keep promoting good governance consecrating national unity, identity and harmony, catalyzing capabilities to increase rapid production and development"

2. Justice: "To continue building a country where prevail the rule of law, human rights, and efficient justice that promote development"

3. Economy: "To speed up sustainable economic development through increased production and economic indicators with Rwanda shifting from poor countries to countries not relying on foreign aid"

4. Social Well-being: "A skilled, knowledgeable, healthy and wealthy citizen"

### 2.1.4 ICT Sector Strategic Plan (2013 – 2018) Analysis

In the course of the developing EDPRS II, it became necessary to align the NICI III Plan with the thematic areas of EDPRS II, and this resulted in an updated national ICT strategy, the ICT SSP.

The ICT SSP prioritized five areas:

1. ICT Skills Development: Developing a high quality skills and leveraging information and communication technologies based on knowledge through PPP (Public-Private Partnership) and knowledge transfer,

2. Private Sector Development: Developing a competitive and innovative ICT and private sector enabled by ICT,

3. Community Development: Empowering and transforming communities through enhanced access to information and services utilizing ICT,

4. E-Government: Improving government operational efficiency and public services delivery through ICT,

5. Cyber Security: Improving security of Rwanda's cyber environment (Infrastructure and Information assets).

### 2.1.5 **SMART Africa Manifesto (2013)**

SMART Africa is a bold and innovative commitment to accelerate sustainable socio- economic development on the continent and usher Africa into the knowledge economy through affordable access to Broadband and usage of Information and Communications Technologies (ICT).

The SMART Africa Manifesto lists five core principles to effectively implement ICT:

- To put ICT at the center of the national socio-economic development agenda
- To improve access to ICT, especially for broadband
- To improve accountability, efficiency and openness through ICT
- To put the private sector first
- To leverage ICT to promote sustainable development

## 2.2 **NICI Plans Progress Review**

The national ICT strategy and plans, NICI, were adopted by Rwanda in 2000 under the auspices of the United Nations Economic Commission for Africa, as a holistic approach to using ICTs for development.

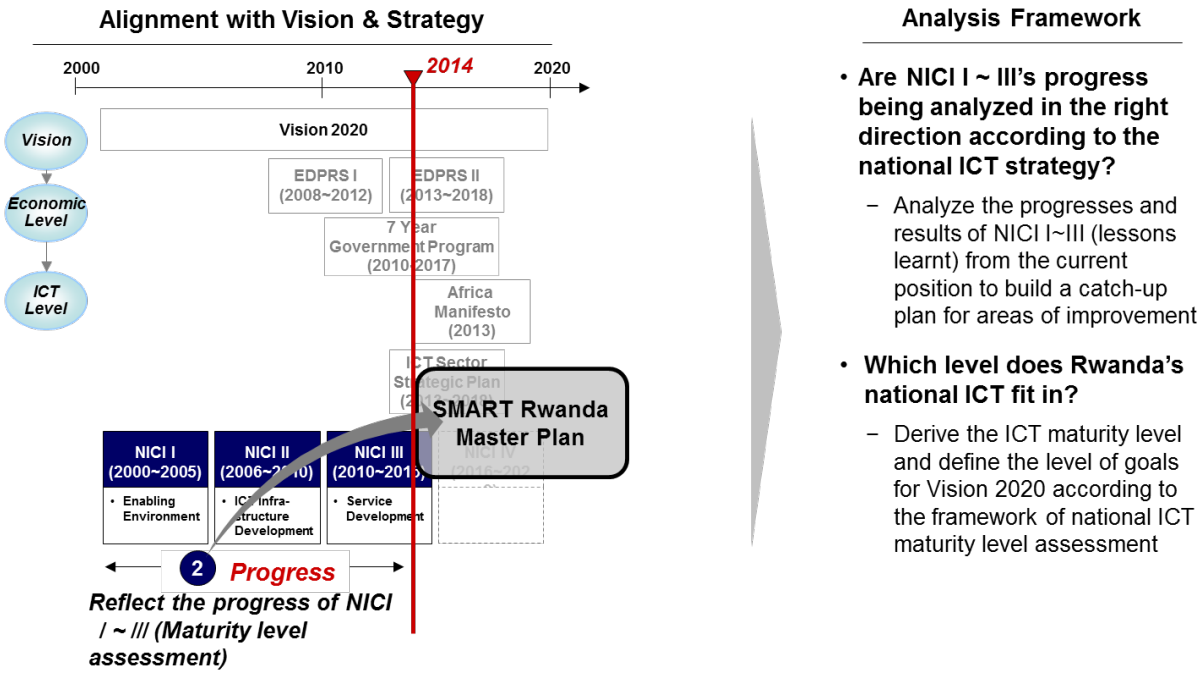



**Figure 8: Alignment of SRMP with the NICI Plans**

### 2.2.1 NICI I (2000 -2005): The Creation of an Enabling Environment

NICI I effectively focused on creating an environment conducive to using ICTs as tools for development in Rwanda by setting up an effective implementation and coordination mechanisms. These included, but were not limited to, the appropriate institutional, legal, and regulatory frameworks that would support rapid development of Rwanda's ICT sector, vitalize the telecommunications industry, and reduce entry barriers to the telecommunications market.

### 2.2.2 NICI II (2006 – 2010): The Development of ICT infrastructure

NICI II concentrated on establishing essential national ICT infrastructure. Significant investments have been made in developing efficient ICT infrastructure.

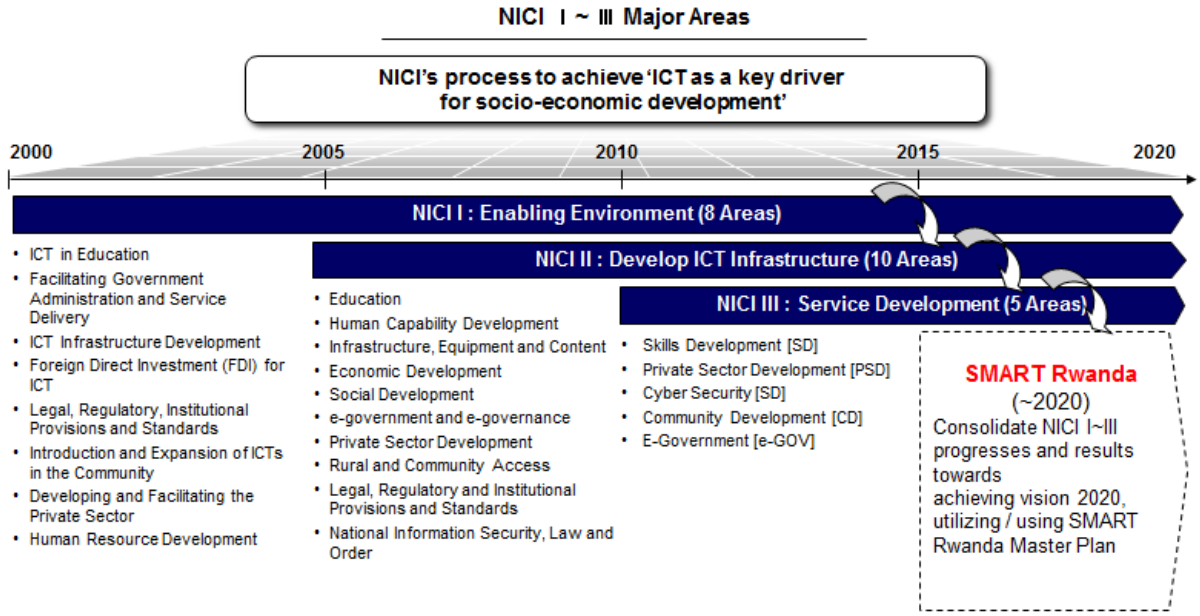



**Figure 9: Major Areas of NICI Plans**

Some of the key achievements are highlighted below:

- A high-speed fiber-optic backbone network now interconnects all districts and border points of the country. This network interconnects all government institutions and other private enterprises located in Kigali as part of the Kigali Metropolitan Network. In addition, Rwanda established submarine fiber-optic cables, international capacity equivalent to 2.5 gigabytes (GB), connecting to two international routes.

- Mobile phone/data coverage for Rwanda's population reached 96% in 2011 both through the efforts of aggressive public investment and the introduction of transparent competition among private-sector telecommunications operators.

- Established a tier-3 national data center, the first of its kind in the region, offering 99.98% reliability and cloud services.

- The Karisimbi ICT infrastructure project; a communications, navigation surveillance, and automated traffic management system to ease the flow of air traffic and reduce the risk of flight delays and cancellations in the busy airspace of the Common Market for Eastern and Southern Africa/ East African Community region.

- The establishment of a digital terrestrial television (DTT) transmission system to boost television, radio, and telecommunication coverage and the deployment of digital television transmitters to improve nationwide television coverage. The goal is to cover 95% of the nation (physical territory) to increase access to information.

- Multi-purpose community telecenters, public information kiosks, and ICT buses have been deployed across the country to increase access to ICTs, provide ICT literacy training, and raise ICT awareness, among other services. The establishment of an innovation center provides an ecosystem in which startups combine innovation and entrepreneurship to produce homegrown solutions for local challenges along with globally scalable knowledge.

### 2.2.3 NICI III (2011 – 2015): The Service Development through ICT

The third phase of the NICI plan, which covers the time period of 2011 – 2015, builds on the two previous phases to accelerate Rwanda to the final phase of the NICI process. In this phase, emphasis has been placed on service development across five focus areas - e-Government, Community Development, Private Sector Development, Cyber Security, and Skills Development.

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 overall results of the NICI Plans are summarized below:

| Major Area | NICI | | | Status | Scale |
|---|---|---|---|---|---|
| | I | II | III | | |
| Development for education/ICT capability & human resources | • | • | • | • ICT professional education and qualification program has been continuously promoted<br>• Connection between educational institutions of Rwanda and global research/education network (RwEdNet): still in the planning phase<br>• Digital Library: not well executed, ambiguous definition and direction | ◑ |

| Major Area | NICI | | | Status | Scale |
|---|---|---|---|---|---|
| | I | II | III | | |
| Frame/basic standards establishment for law, regulation & standard | • | • | • | • Lack of regulations on electronic government<br>• Laws and regulations for ICT Business Financing Mechanism are being made<br>• The Communications Act, the law related to Intellectual property right, electronic message, e-Signature, e-Transaction, info. Protection, cyber security, and government ICT application procedure were established<br>• Facilitating ICT environment through promoting new communication service provider and internet provider to liberalize telecommunication market | ◕ |
| ICT Infrastructure usage | • | • | | • Establishment and integration of national backbone network (financial network, administrative network, educational network) are required<br>• Established national Fiber Optic Backbone network, WIBRO, broadcasting infra, and aviation mgmt. system<br>• Need to secure efficiency by applying Cloud Computing technology to the National Data Center and systems for government agencies | ◑ |
| Private sector development | • | • | • | • ICT is applied in the areas of agriculture, medical treatment, tourism, and etc.<br>• E-Soko 2.0: in planning phase, nation-wide migration and integration is required<br>• Tourism Portal: at the level of providing simple information<br>• Open MRS: used by 50% of organization, but focused on HIV related services | ◔ |
| Public sector development | • | • | • | • Implementing system for national ICT is insufficient<br>• Computerization of each administration branch & connection between central-local government, common usage between departments and information integration are incomplete<br>• E-Procurement: not sufficient<br>• National ID & Smart Card: integration with other institutions is necessary for realization of value but it is not sufficient and policies need to be established<br>• JROS (Justice, Reconciliation, Law & Order Sector) Information System: interagency integration of 12 institutions is necessary, mobile access should be | ◔ |

| | | | | | |
|---|---|---|---|---|---|
| | | | | considered<br>• Services for government administrative tasks were developed such as e-Cabinet, e-Parliament, Document tracking, and workflow management system | |

| Major Area | NICI | | | Status | Scale |
|---|---|---|---|---|---|
| | I | II | III | | |
| Community development | ● | ● | ● | • Internet use in rural areas has been continuously promoted through distribution of telecenter<br>• Lack of network system to connect capital with local communities, access channel, and information sharing system<br>• Constructing ICT infra. of local government & enhancing availability: currently being established, focusing on video conference facilities, and unified Communication is necessary for future cost efficiency | ◔ |
| Cyber security | | | ● | • Anticipation of cyber terror, analysis, and defense system at a national level are insufficient<br>• National cyber security center is not established | ○ |
| Cross-cutting | | | ● | • Little application of Green ICT and energy efficiency in response to increasing energy demand of large scale ICT | ○ |

## 2.3 ICT Maturity Level Assessment – a quick diagnosis

In order to better address the current national maturity level, a quick-diagnosis of the national ICT maturity level in the areas of infrastructure, capability, governance, and service was conducted utilizing a composite framework of three different frameworks: the Network Readiness Index Framework from WEF, Korea's National ICT Maturity Model, and e-Gov. Maturity Model from Gartner. Each framework was selected for a specific area and the results reflected into the SRMP's quick diagnosis framework. For instance, drivers and impacts of maturity level were derived from WEF's framework and selection of which areas to analyze was mainly derived from the Korea's National ICT maturity model.

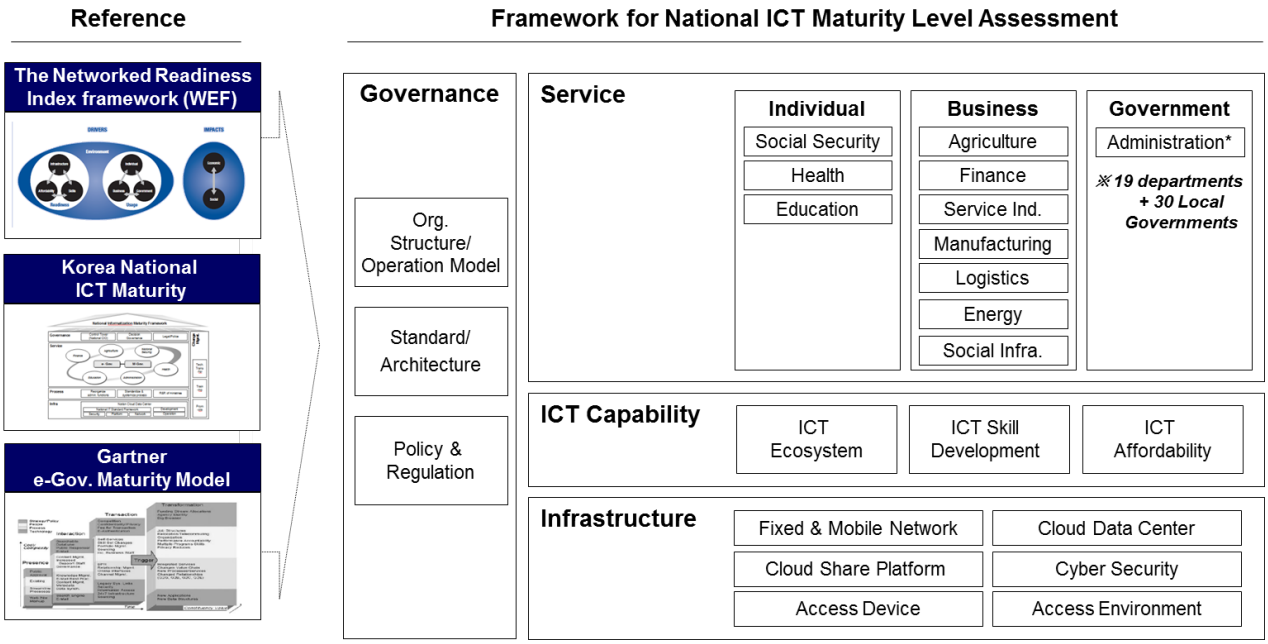



**Figure 10: Framework for Rwanda ICT Maturity Level Assessment**

The overall diagnosis indicates that Rwanda is currently at a maturity level between 1 ~ 2, that is, the Initiation/Integration stage. The lowest maturity level was found in areas *inter alia*: Cloud data center and shared platforms, Cyber security, ICT ecosystem, ICT skill development, ICT affordability, Organization structure, Architecture and Standards.

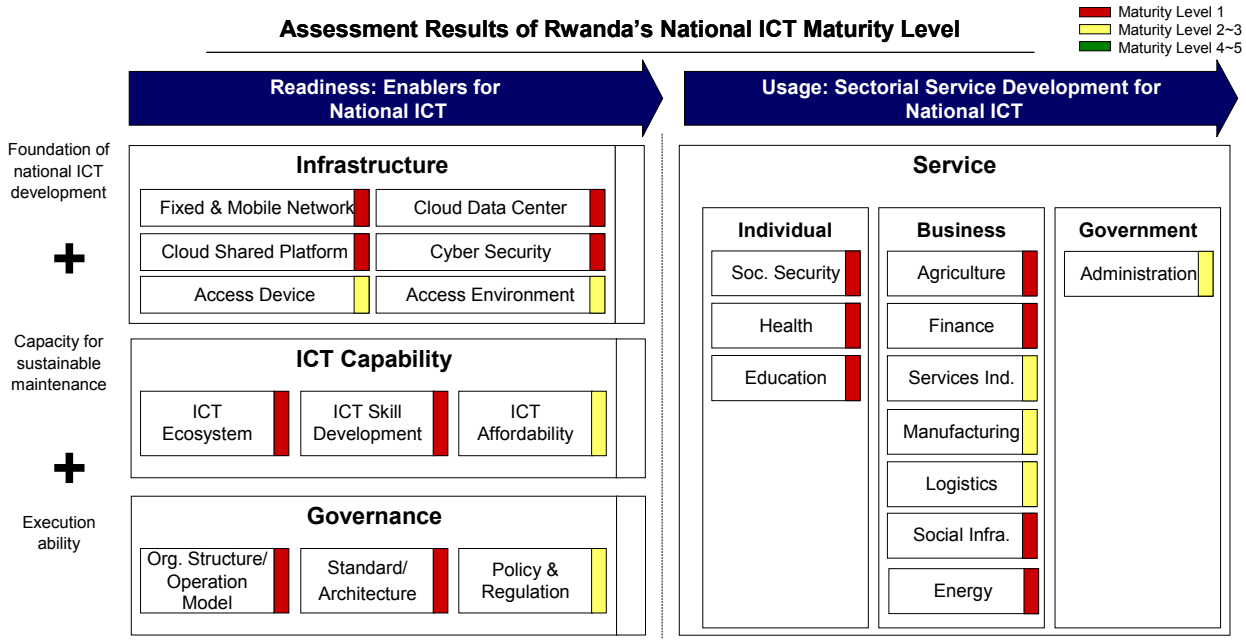



**Figure 11: Overview of Maturity Level Assessment**

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 related to common functions are defined for national ICT but limited applications to some areas only.

All individual services were are at the Initial phase, though 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.

According to the WEF and European Institution of Business Administration (INSEAD), which considers several factors, including market and regulatory framework in advancing ICT for inclusive development indicates that Rwanda is currently ranked 6$^{th}$ in Africa and 88$^{th}$ globally in relation to capacity to leverage ICT for growth and well being.

## 2.4 PEST Analysis

In order to effectively identify and capture on-going trends and external factors that may impact SRMP, a PEST (Political, Economic, Social, and Technological) analysis focusing on the implications to the SMART Rwanda Master Plan was carried out.

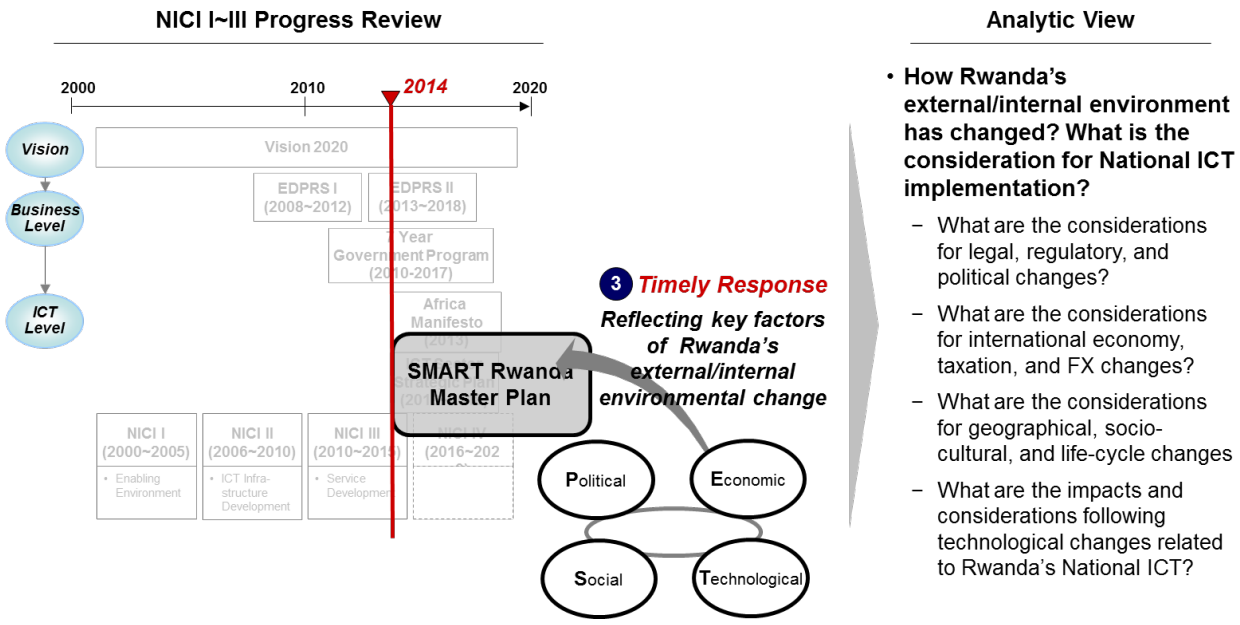



**Figure 12: PEST Analysis**

## 2.4.1 Political Environment Analysis

International relationship between neighboring countries impact Rwanda in many different ways: politically, economically, and socially. Geographically there are four neighboring countries around Rwanda: Democratic Republic of Congo, Uganda, Tanzania, and Burundi. As a landlocked nation, its geographical location poses challenges and higher logistics costs for its imports and exports. Therefore, the stability of the nation is highly dependent on its relationship with other neighboring nations and those countries' status.

The implications of the political environment analysis are:

- Provide opportunities & access to citizens to participate in their governance and contribute to the decision-making process through channels like e-Participation, e-Parliamentary, etc. These platforms allow for collecting, sharing and disseminating information and national decisions with citizens.

- Information systems linking the local and central government and to secure efficient collaboration and sharing between government agencies are needed.

- Integrated systems to facilitate inter-regional trading and reduce cost of doing business between Rwanda and the regional countries.

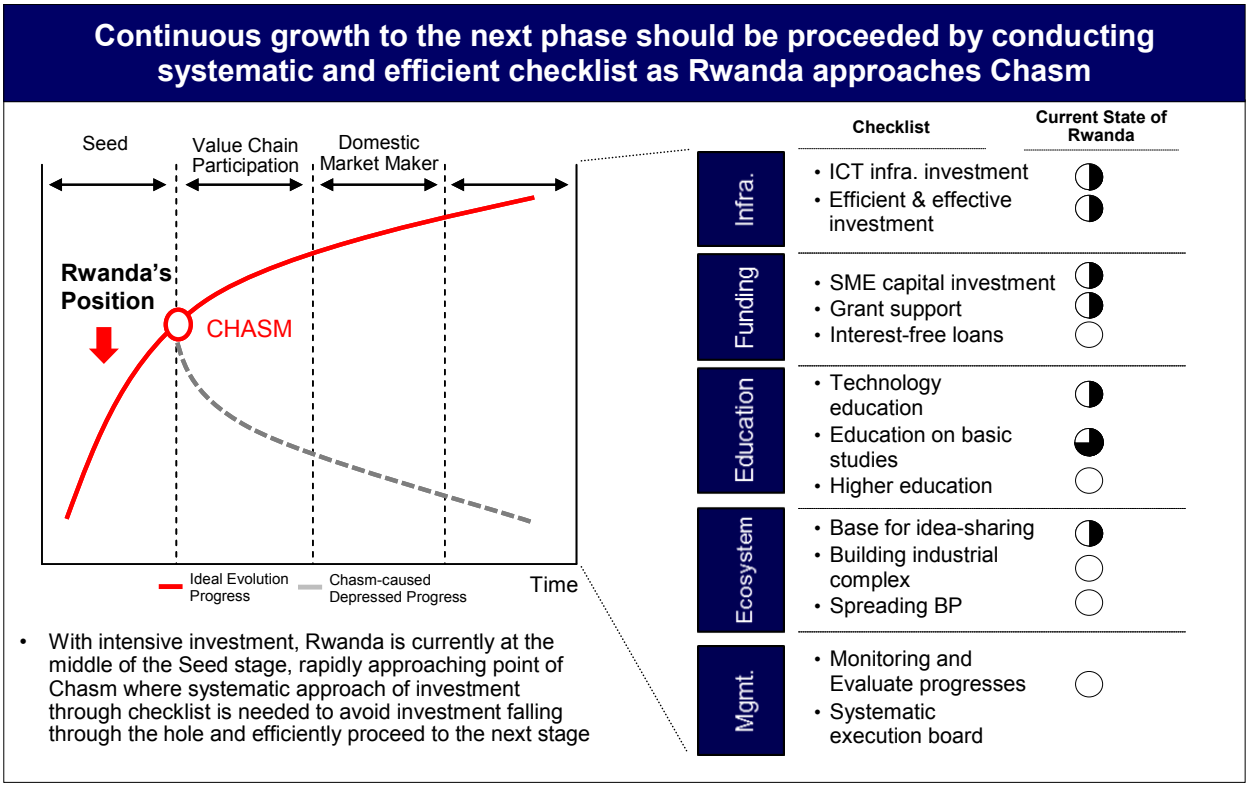
- Stable, secure financial systems for facilitating national and regional payment systems; this should also catalyze a dramatic increase of the population with access to financial services.

## 2.4.2 Economic Environment Analysis

According to World Bank, Rwanda's economy achieved 8% of GDP growth in 2011 and remains one of the highest annual GDP growth rate globally. In spite of the GoR efforts to diversify the economy, Rwanda is still heavily dependent on natural resource and commodities. Agriculture continues to be the largest source of employment, providing 73 per cent of the workforce, yet only accounts for 36 per cent of output. For the economic development to occur, agricultural innovation including agricultural product portfolio diversification and agriculture information systems are required to improve agriculture productivity and provide basis for industrialization.

The implications of the economic environment analysis are:

- Currently in initial stage of providing basic economic information but not integrated to support online commerce
- Finance infrastructure required to improve accessibility to financial services
- ICT knowledge and expertise lacking to support innovation necessary to support the domestic market and build an export market
- Promote and facilitate increased private sector participation: support new business development by establishing innovation centers and incubation hubs, and supporting technology financing through angel investment and funding.
- Continuously develop export product portfolio at a national level and provide new growth driver by managing and promoting export product along with diversification.
- Continue improve agriculture productivity, commercialization and industrialization




※ Chasm Theory Application to Various Sectors, S. Korea Framework (Geoffrey Moore)

**Figure 13: Phases of national development**

An effective system to manage various investment and supports for the industrial development will gear the direction of investment direction along with continuous feedback management to measure the investment efficiencies through the integrated system.

### 2.4.3 Social Environment Analysis

Rwanda has one of the youngest populations in Africa where the youth population (under 14 years old) consists of 43 per cent of the total population. To connect the growth of the youth population to nation's economic and social development, effective education and training systems are being developed. Providing more educational opportunities and accessibilities by developing ICT skills, diversifying and supporting social security services and medical services will facilitate the basis for higher labor forces.

The rate of urbanization is increasingly rapidly in Rwanda with the proportion of people living in urban areas increasing nearly threefold between 1990 and 2011. In light of Rwanda's rapid urbanization, high population density and high population growth, urbanization must be managed in such a way that it brings economic development, job creation and improved service delivery in order to improve the quality of life in Rwanda.

This would require getting urbanization right, in Kigali, which is the largest city. The City of Kigali is responsible for the development of Kigali City into a competitive urban city. The Government has already undertaken significant actions including the establishment of City Master Plans, National Land Policy, National Urban Housing policy and investment in fiber optic infrastructure nationwide.

A major challenge faced is the integration of traditional urban management data, policies and priorities and wider economic and social ones. This could improve decision making for policy makers and ensure that urbanization is inclusive and produces positive development outcomes. Information, while available, remains largely fragmented. Moreover given the Government's investment in ICT infrastructure, the City can leverage the potential of ICT to address some of the urbanization challenges and harness the opportunities it brings for growth and improved service delivery. The Kigali model would then be used to develop secondary cities thus easing pressure on Kigali.

Currently only 10% of the total population has access to electricity in Rwanda. In order to manage the high electricity costs and limited supply, efficient usage of electricity and demand management are necessary. As energy demand is expected to grow with national development in ICT and industries, adequate management of energy is critical. The implications of the social environment analysis are:

- Distribute devices (PC, smartphone, etc.) to increase accessibility to education, and establish various e-learning services to promote self-paced/directed learning system
- Internalize ICT capabilities through fostering experts utilizing ICT skill/capability development education, and developing certificates/licenses for experts
- Career training / development center enhancement and policy & regulation to enhance entrepreneurship
- Advancement in e-health services to improve access to medical services is needed
- Systematic prevention of possible diseases and health issues through management and sharing information related to medicine, disease, and etc.
- Facilitate growth and create synergy through application of ICT to social infrastructure services (air, logistics, traffic, etc.) that play essential part in the industrial growth

To provide and expand the access to variety of educational programs, diverse educational access through mobile and other channels should be established. "Anywhere & Anytime" education provision is important to enable the distribution of educational content to the youth to improve the student-teacher ratio. Distribution of electronic devices including PC, smartphone, tablet and other SMART devices will bring increased accessibilities to education. The implementation of SMART devices along with other various e-learning service establishments will promote self-paced and self-

directed learning system based on the improved educational contents, curriculum, and system. In parallel with the low accessibility in education, the provision of ICT skills and capability development training should increase ICT competencies.

The advancement in e-health services to improve and expand the accessibility of the medical services can significantly activate current healthcare system in terms of receiving and providing treatments to patients. Systematic prevention of possible diseases and health issues through management and sharing information related to medicine, disease, and other health issues should be installed to further prevent the health problems.

- **Supply of electricity and energy**

Rwanda currently has the lowest electricity consumption rate in the region, but with the growth fueled by ICT development, the energy demand is expected to grow significantly to support the ICT development and industrialization.

The goal for the government is to achieve up to 70% of electricity penetration rate by 2017. As the electricity demand rises, an integrated system to manage production, transmission, and distribution of electricity, is necessary for the efficient usage of energy and prepare Rwanda for the growth in the future.

### 2.4.4 Technological Environment Analysis

Considering Rwanda's current level of automation stage, requirements, national development plans and prevailing technology trends, 5 key technologies are selected for implementation. These technologies are; are Cloud Data Center, Green ICT, and Wireless Network, Cyber Security, Big Data.

- **Cloud/Data Center**

Cloud computing is a model for enabling ubiquitous, convenient, on demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.

The increasing awareness around cloud computing has also prompted the government to assess the new delivery model. Although concerns, especially around privacy, security and sovereignty of data, continue to inhibit adoption, the value proposition of moving to the cloud is too attractive to ignore.

Government-offered administrative services and the underpinning environments are also undergoing significant changes. There are diverging needs for various services and demands for further information disclosure as well as civil participation in administrative affairs. In order to overcome the challenges in terms of meeting such demands, the government should integrate scattered IT resources through data center consolidation and undertake initiatives to streamline cloud based ICT infrastructure to ensure stable operation and swift responsiveness towards increase of service demand.

In general, the transition mentioned above can be achieved through a four-stage framework. In the first stage, leveraging green IT technologies, computing rooms and surface areas of datacenters can be physically consolidated, leading to less power consumption and reinforced stability along with enhanced security. In the second stage, silo-type systems of individual ministries or government bodies can be integrated under the leadership of a single government authority (HW integration). Through application of virtualization technologies, infrastructure components can be standardized into specific type of models or sourced by a single manufacturer. As a consequence, HW introduction costs can be lowered by approx. 30 per cent. The third stage is software integration, which is converting the readily available common hardware and software into could compute. Through converting infrastructure and platforms into a cloud environment, 40 per cent of the deployment costs can be saved through avoiding redundant investments as well as unnecessary trial and errors. The last stage is service integration. By applying cloud computing to commonly available services, common services can be collectively managed in a manner to maximize service reusability.

- **Green ICT**

There are two 'green strategies' associated with ICT; "Green of ICT" and "Green by ICT". "Green of ICT" refers to environmental commitments along the entire life cycle of ICT products and services. "Green by ICT" implies tackling energy related problems through the application of ICT technologies such as ICT-enabled energy efficiency enhancement, SMART Grid and SMART working. In its initial stage of economic development, Rwanda can possibly adopt such Green ICT strategies to optimize electricity consumption and rationalize energy production as well as consumption across all social and industrial sectors. Among Green ICT solutions, Rwanda should preferably consider SMART building management, SMART manufacturing, and SMART eco-friendly street lighting.

- **Fixed/Wireless Network**

Government of Rwanda has been heavily investing on ICT infrastructure development, and established 2,000 km-optical fiber national network (with 9 regions connected to neighboring

countries), linked with submarine cable SEACOM ALC EASSY using optical fiber, and established a state of the art tier-3 Internet data center. Further work needs to be done especially on the last-mile connectivity.

- **Cyber Security**

Development of information society could be considered as double-edged sword that as almost every area is connected to the Internet, a cyber-accident may multiply dramatically and proliferate to every area. Advancement of Rwanda's national cyber security policy and implementation of higher levels of security technology are required for the protection of national information assets.

- **Big Data**

Big data is not merely the massive data itself, but needs to focus on the handling and analyzing such data, creating new economic value, resolving social issues and leading the new IT paradigm. In order to prepare for the future, training of big data professionals and the establishment of big data platform are required.

Overall, some of the implications of the technological environment analysis are:

- Efficient resource utilization based on cloud technologies
- Integrated management of dispersed IT resources to reduce CAPEX and OPEX (Data center consolidation)
- Policies and regulations to strengthen and foster implementation of Green IT technologies
- Last Mile policy expansion focused on fixed line compared to broadband leading to reduced time frame and securing profitability
- Strengthen Cyber Security through enhancement of related policies and procedures
- Utilize intelligent and advanced functions for cyber security to secure stability and control
- Rapid emergency response system for cyber terror to prevent and curtail damage across national information technology infrastructure and systems
- Policies for opening, sharing, communicating and collaborating public information while protecting user information

## 2.5 Key Initiatives

The key initiatives of SRMP considered the alignment between government initiatives, such as Vision 2020, EDPRS II, 7YGP, SMART Africa Manifesto, and ICT SSP. Further, the analysis of the NICI Plans I to III, national ICT Maturity diagnosis and PEST were also examined leading to selection of seven pillar and three enablers.

The seven pillars underpinning the SMART RWANDA Master Plan are:

- Health
- Finance
- Business and Industry
- Agriculture
- Education
- Governance
- Cities

While the three enablers are:

- Governance
- Capability
- Secured and shared infrastructure

# III. Strategic Planning

## 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

## 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.

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

❑ **Core Objective Rationale and Description**

- 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

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

❑ **Core Objective Rationale and Description**

- 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 information and content
- Strengthening ICT capability development and learning systems

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

❑ **Core Objective and Rationale**

- 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**

- **I**mproved 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

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

❑ **Core Objective Rationale and Description**

- 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

## 2.5 Objective #5. Promote entrepreneurship and business development by enhancing value of products and services

❑ **Core Objective Rationale and Description**

- 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

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

❑ **Core Objective and Rationale Description**

- 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

## 2.7 Objective #7. Sustainable urban development and management

- **Core Objective and Rationale Description**
  - Improve water management and delivery services in cities
  - Improve public transportation systems
  - Improve public safety

- **Major direction of change and benefit**
  - Reduce water wastage through reporting and tracking complaints as well as query bills
  - Increase coverage of public areas under integrated public safety systems using CCTV
  - Disaster management systems

- **Focus Areas**
  - Integrated public transit systems
  - Integrated public safety and disaster management systems

## 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

## 2.9 Objective #9. Transform the national ICT Governance and Regulatory structure to enhance ability and effectiveness of ICT

❑ **Core Objective Rationale and Description**.

- Establish efficient operation for government to operate with SMART technologies, cost-effective, and innovative measures
- Develop scope clarity, governance, operating model to enhance understanding of related internal and external stakeholders
- Sustain committed leadership from various government ministries, and agencies
- Adopt a "Value-For-Money" approach and method to effectively drive better ROI and lower cost of ownership

❑ **Major direction of change and benefit**

- Reduced complexity and minimized ICT investment redundancies
- Enhanced ROI for ICT investment - Faster realization of savings and returns
- Enhanced capability across all aspects of the public service delivery
- Improved access to the integrated government information and services
- Underpin the delivery of the national economic development goals and objectives
- Enhanced government and ICT industries' engagement along with leveraged operational scale across the government functions

❑ **Focus Areas**

- Establishing an effective national ICT governance and management body
- Improving performance-centered national laws, policies and regulations to support ICT

## 2.10 Objective #10. Enhance national governance through e-Governance 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 data aggregation and analysis

❑ **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. Implementation Roadmap

## 1. Approach

In the Implementation Roadmap stage, the projects in relation to 10 Core Objectives are 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: ~2014/15, focused on projects related to ICT enabler
- 'Short-term' projects: 2016/17 ~ 2017/18
- 'Mid-term' projects: 2018/19 ~ 2020
- 'Long-term' projects: after 2020

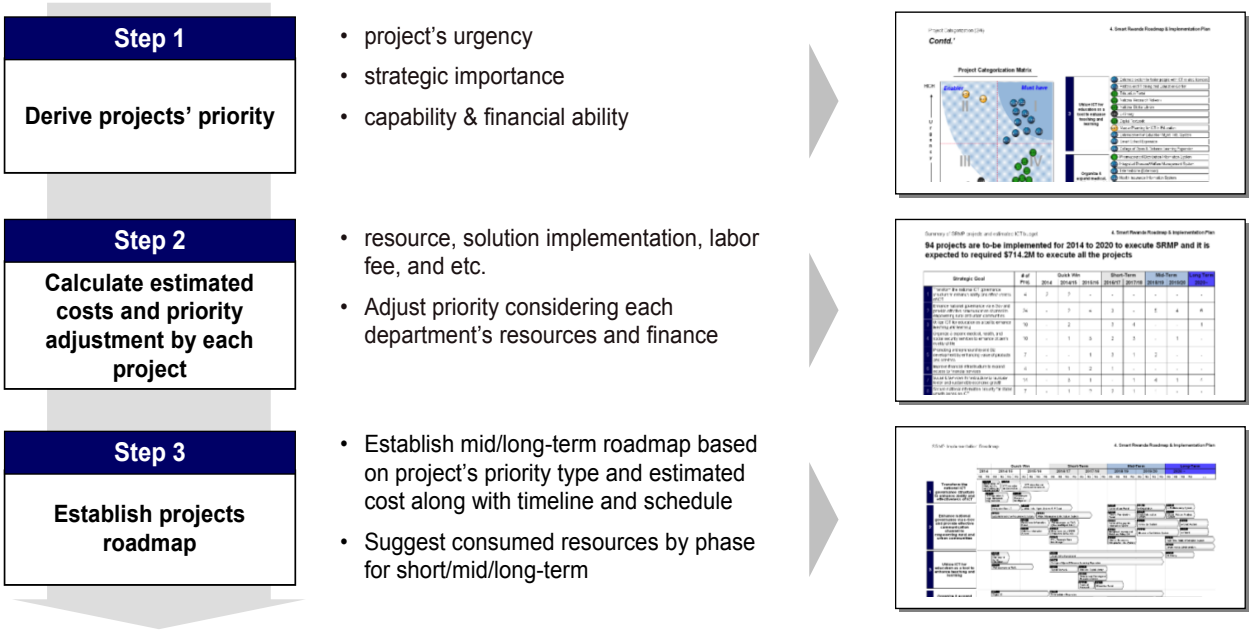



**Figure 14: Deriving the SRMP Implementation Plan**

- **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.

# 2. **Methodology**

## 2.1: **Project Priority**

### **2.1.1 Priority Evaluation of the Projects**

The projects were defined as either 'High, ''Middle,' 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 RISA, but post-implementation success and sustainability will be the responsibility of the project owner, either a ministry, department, or agency.

### 2.1.2 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 executed 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.

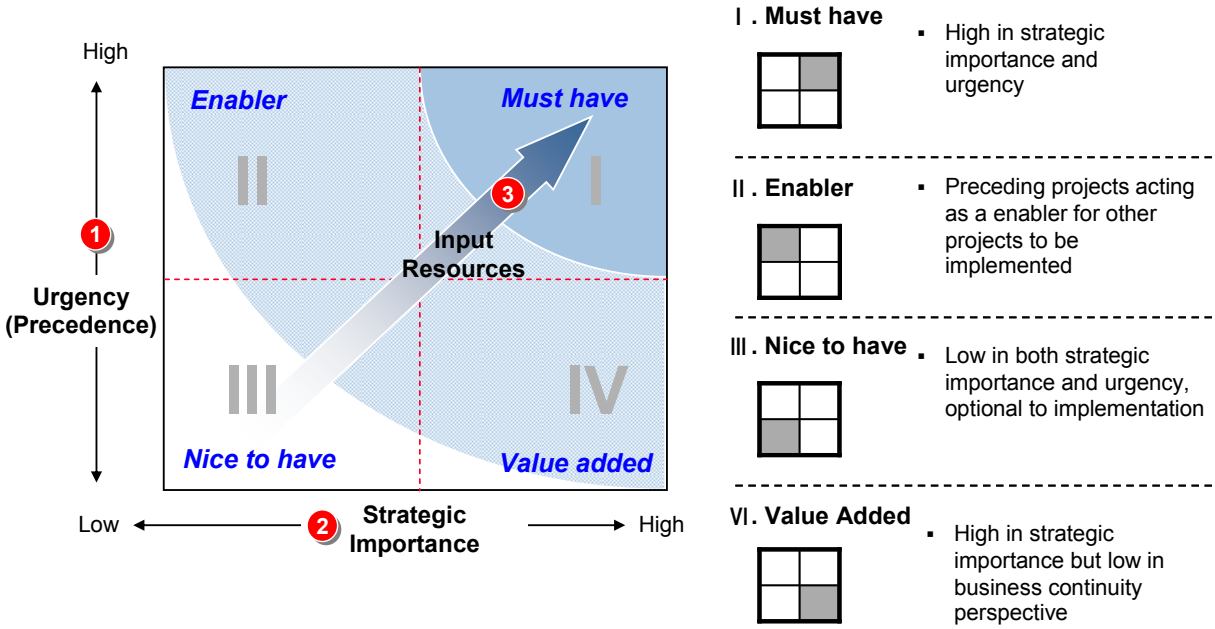



**Figure 15: Deriving Project Priority**

- I. **Must Have**: Projects with high priority in strategic importance and urgency. These projects clearly demonstrate socio-economic impact.

- II. **Enable**r: 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.

### 2.1.3 Estimated Costs

The costs associated with the implementation of the SRMP projects is estimated at US$500M but a more accurate budget shall be derived after conducting a more detailed review to determine the priority, resources, and capacity available.

## 2.1.4. 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.

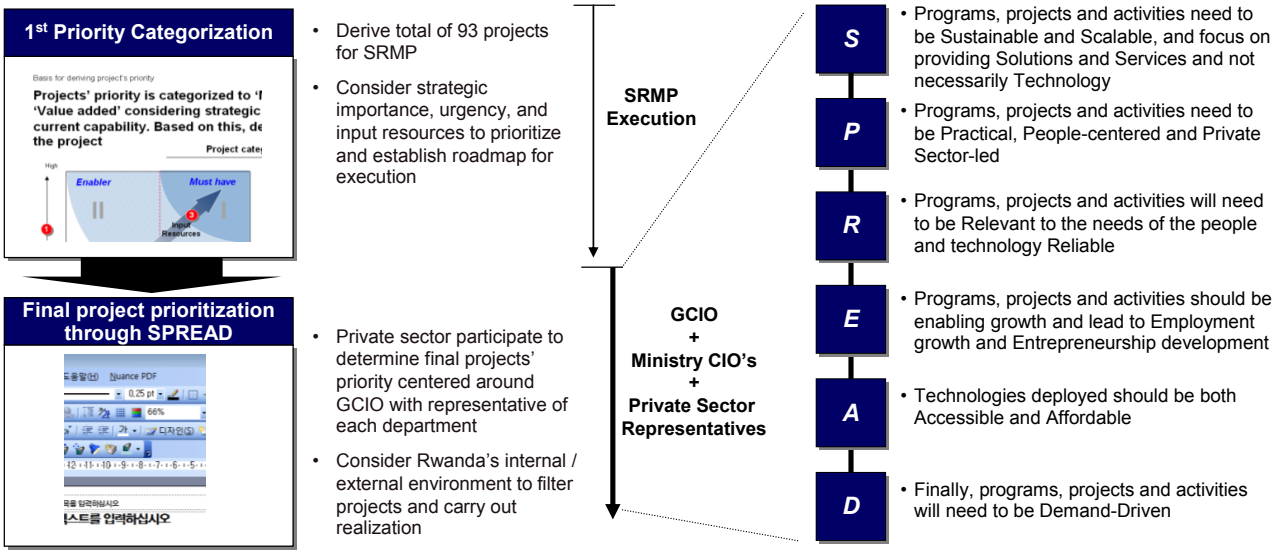



**Figure 16: SRMP Project Prioritization Criteria**

- **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**

# 3. **SRMP Execution Model**

## 3.1 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.

### 3.1.1 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.

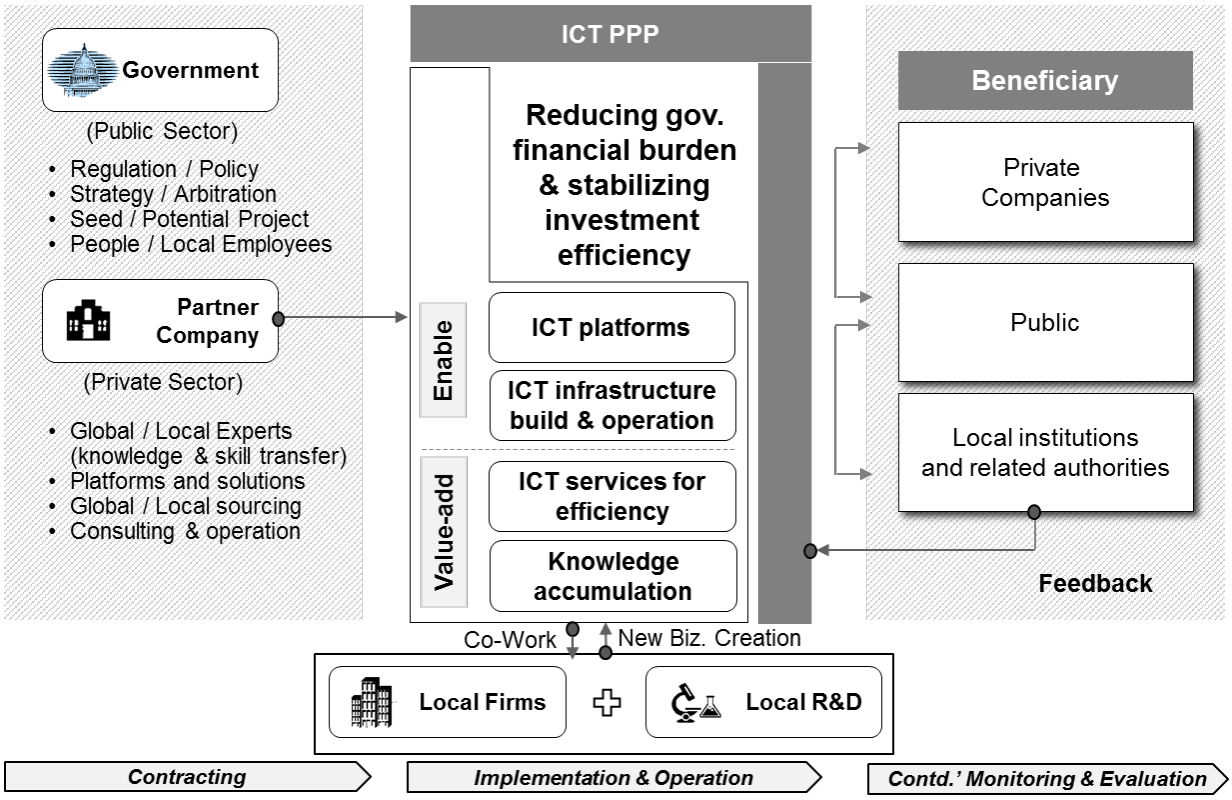



Figure 17: ICT Investment PPP Model

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, [...] [t]he 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.

# 4. 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..

## 4.1 ICT Competency and Skill Development Conceptual Framework

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

1. Competency and framework: Focuses on enhancing ICT penetration and usages, increasing teacher's capacity and capability along with content and access development to education.

2. 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.

3. Education programs: The education programs are aligned with government's on-going initiatives such as Open, Distance & e-Learning, Digital Library, and others.

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

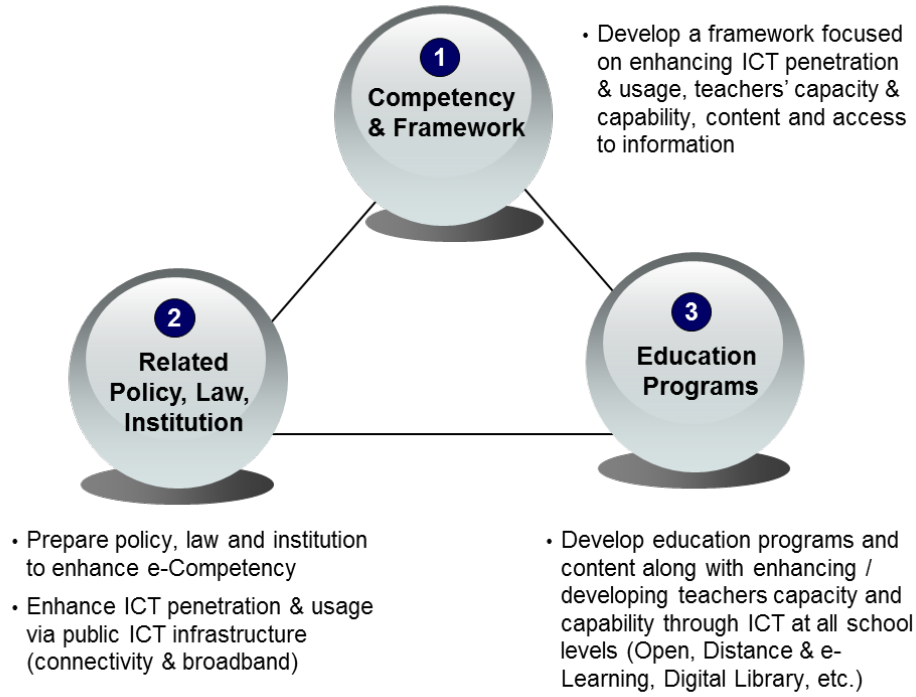



**Figure 18: ICT Skills & Competency Conceptual Framework**

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.

# V. Forecasting Expected Benefits

## 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.

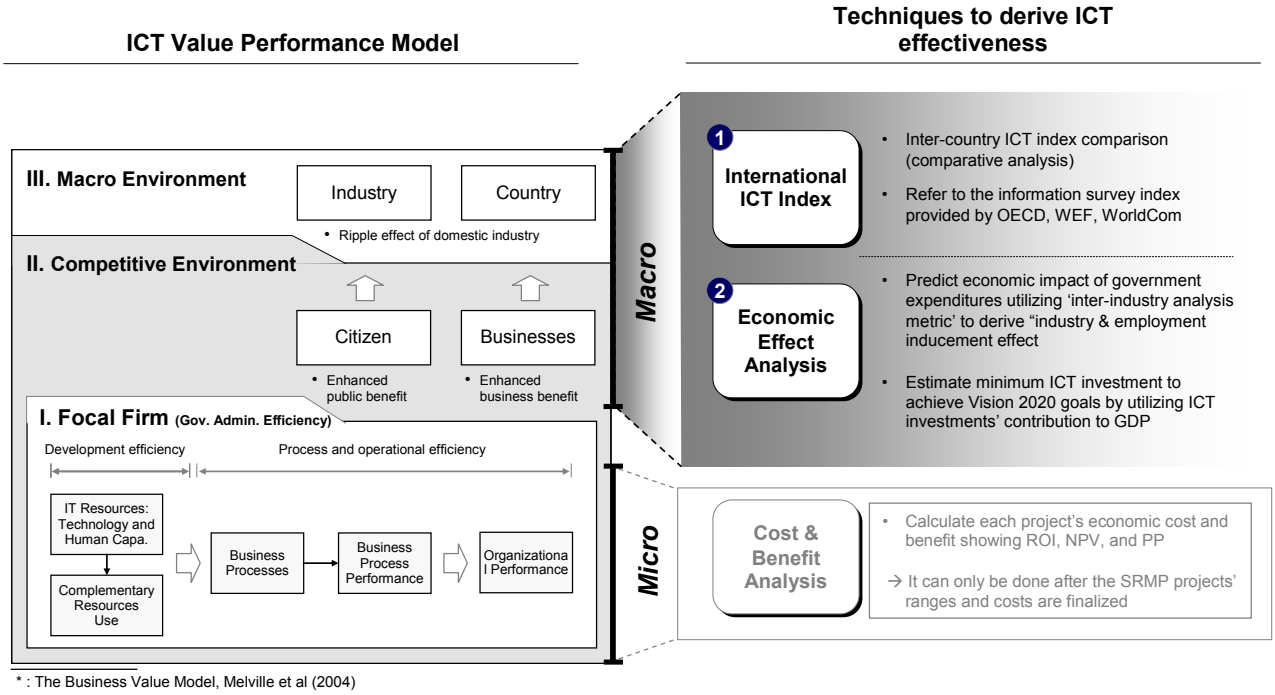



**Figure 19: Perspective and Range of the ICT Effectiveness Analysis**

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 through RISA in the times to come. Furthermore, values accumulated from the continuous evaluations and monitoring will provide basic foundation for other result-oriented projects.

## 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.

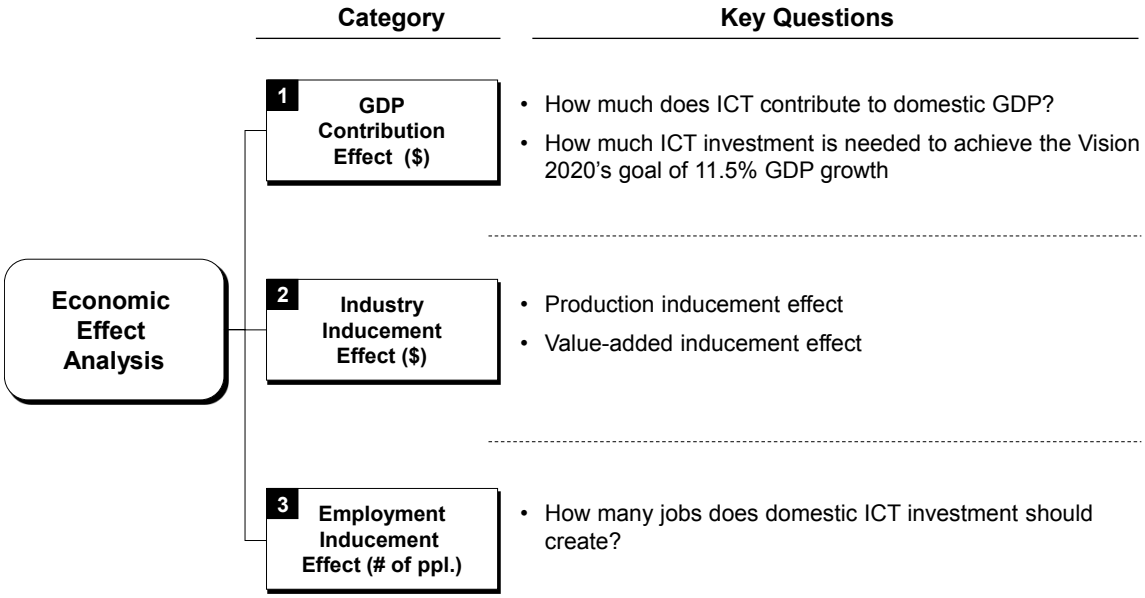



**Figure 20: Economic Effect Analysis View**

## 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 11.5%. The effect of ICT contribution to expected growth rate for seven years from 2014 to 2020 has been converted into economic value according to the statistical data provided previously. Total Rwandan GDP of 2013 was US$6.3B. Based on the current (2014) economic growth rate of 8.5%, an assumption of a 0.5% in GDP each year up to 2020 was made in order to meet the 11.5% target by 2020. The total expected GDP in 2020 is $64.18B and it is speculated that ICT contribution to the expected GDP will amount to $13.8B by 2020. In order to achieve the expected effects by 2020, an aggressive ICT investment and management through SRMP is required.

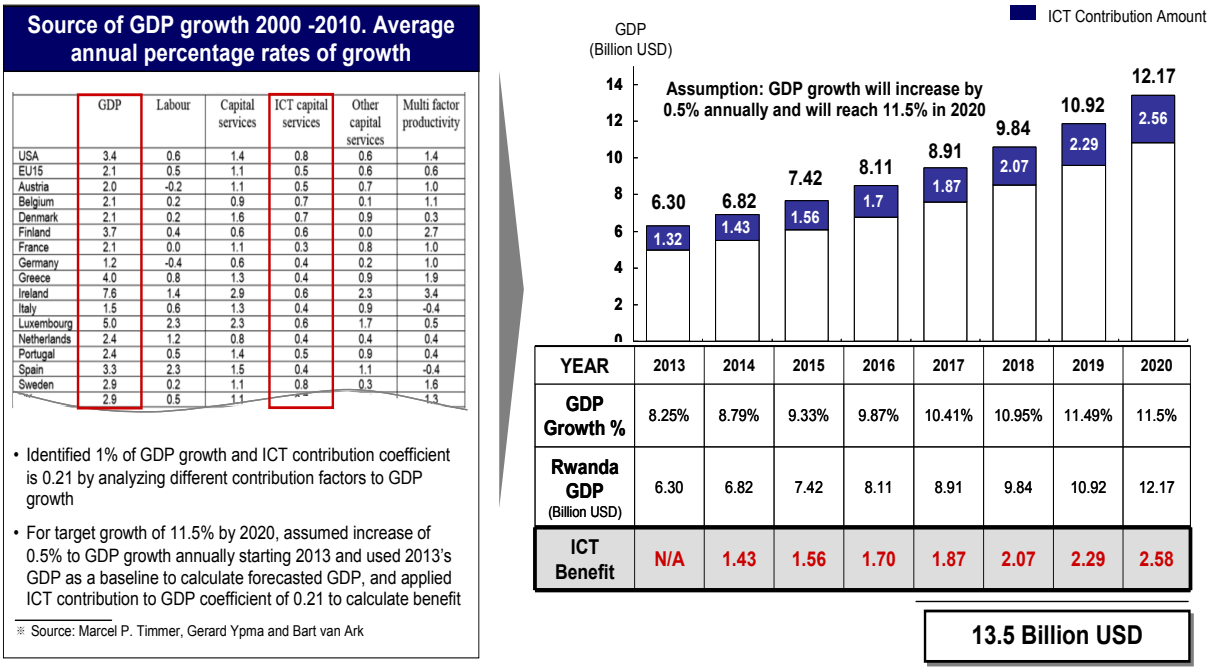



**Figure 21: ICT Contribution to GDP**

## 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[3]. 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.

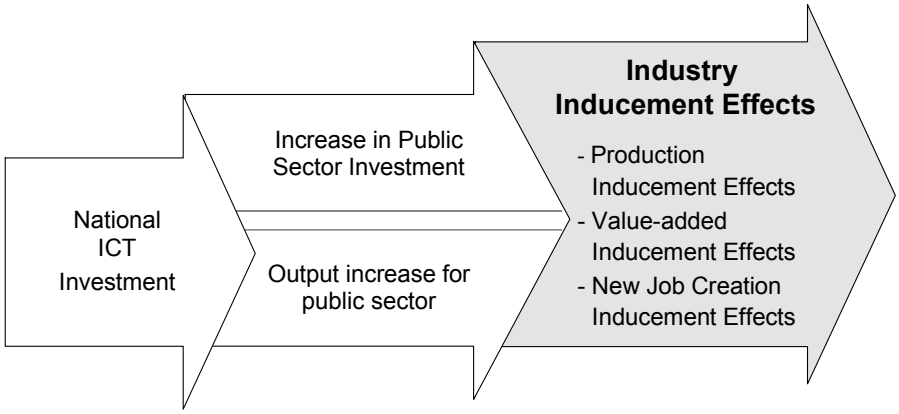



**Figure 22: Industry Inducement Effects**

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

[3] *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*

that all the members and sectors that are involved in the chain of production will both directly and indirectly benefit from the production.

**Industry Inducement Effect=**

**Σ {(ICT Invst. x Prod. Inducement Coefficient) + (ICT Invst. x Value Added Inducement Coefficient)}**

**ICT Investment**

| Year | Amt. (US M) |
|---|---|
| '14/15 | **78.6** |
| '15/16 | **81.0** |
| '16/17 | **82.3** |
| '17/18 | **82.8** |
| '18/19 | **81.0** |
| '19/20 | **119.0** |
| '2020 ~ | **189.5** |

**Industry Inducement Effects***

*Production Inducement* | *Value-Add Inducement* | *Employment Inducement*

| Industry | | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|
| Manuf. | … | | | | |
| Service | Comm. & Media | 1.850 | 1.880 | 1.883 | |
| | Finance & Insurance | 1.669 | 1.697 | 1.714 | |
| | **Public Sector** | **1.561** | **1.576** | **1.568** | **…** |
| | Education & Welfare | 1.573 | 1.572 | 1.569 | |
| | Social and Others | 1.958 | 1.940 | 1.910 | |
| | … | | | | |

**Figure 23: 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.

**Economic Value driven by Industry Effect**

Business Investment X Industry Inducement Coefficient* = Economic Value

| Year | Amt. (US M) |
|---|---|
| '14/15 | 75.6 |
| '15/16 | 81.0 |
| '16/17 | 82.3 |
| '17/18 | 82.8 |
| '18/19 | 81.0 |
| '19/20 | 119.0 |
| '2020 ~ | 189 |

| Production Inducement Coefficient |
|---|
| 1.682 |

| Value-added Inducement Coefficient |
|---|
| 0.741 |

| Economic Value (US M) |
|---|
| 183 |
| 196 |
| 200 |
| 201 |
| 196 |
| 288 |
| 458 |

※Production inducement coefficient: indicators reported from the bank of Korea,
*Current Rwanda's GDP growth is 8% which similar to S. Korea's growth rate in 1994 (8.5%), thereby applied S. Korea's industry inducement coefficient in 1994 to current Rwanda's case

**Result of ROI Analysis (Macro. Perspective)**

(Million USD)

| Year | Discount rate | Cost | | Benefit | | NPV | ROI |
|---|---|---|---|---|---|---|---|
| | 3% | Face Value | Present Value | Face Value | Present Value | | |
| '14/15 | 1.00 | 75.6 | 75.6 | 183 | 183 | 108 | |
| '15/16 | 0.97 | 81.0 | 78.6 | 196 | 191 | 219 | |
| '16/17 | 0.94 | 82.3 | 77.6 | 200 | 188 | 330 | |
| '17/18 | 0.92 | 82.8 | 75.8 | 201 | 184 | 438 | 142.3% |
| '18/19 | 0.89 | 81.0 | 72.0 | 196 | 174 | 540 | |
| '19/20 | 0.86 | 119.0 | 102.7 | 288 | 249 | 686 | |
| 2020 ~ | 0.84 | 189 | 158.3 | 459 | 384 | 911 | |
| Total | | 711 | 641 | 1,722 | 1,522 | | |

※ Discount rate: 3% of social discount rate was applied to convert estimated figure of efficacy and cost into present value in the evaluation of adequacy of mutual industrial investment.
(Source: report on estimation of social discount rate in mutual industrial evaluation, 2010)

**Figure 24: 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$1,168M[4] worth of economic value and a 142% of return on investment (ROI) will be created when US$527M is invested from 2014 to 2020 through the SMART Rwanda Master Plan.

## 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 53, 000 jobs shall be created if US$521 is invested over the 6 years from 2015 to 2020.

[4] *Note: This value has to be interpreted and approached in a value-oriented perspective rather than a quantified perspective*

# 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 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 | 2013 | 2020 Target |
| E-government development Index | 140th | 70th |
| Global Competitiveness Index | 66th | 30th |
| ICT Development Index | 141st (2012) | 80th |
| Network Readiness Index | 88th | 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 and impact from the implementation of SRMP.

These key performance indicators are illustrated below:

| OUTCOME | OUTCOME INDICATOR | BASELINE (YR) | BASELINE |
|---|---|---|---|
| A high quality skills and knowledge base leveraging ICT developed | Number of ICT students enrolling yearly in Higher Learning Institutions (HLIs) | 2012 | 1,000 |
| | Number of new certified individuals in international industry-related ICT courses | 2012 | 245 |
| | Percentage of schools using broadband internet | 2012 | 1% |
| A vibrant, competitive, and innovative ICT/ ICT enabled private sector developed | Cost of broadband access as a percentage of average monthly GNI per capita (average monthly income) | 2012 | 257 |

| | | | |
|---|---|---|---|
| | Number of new direct jobs created through ICT enabled BPO companies | 2012 | 200 |
| | Volume of committed investments in the ICT sector (USD Millions) | 2012 | 130 |
| Empowered and transformed communities through improved access to information and services using ICT | Percentage of individuals using the Internet. | 2012 | 26.2 |
| | Percentage of mobile cellular telephone subscriptions. | 2012 | 53.1 |
| | Percentage of individuals with mobile broadband subscription. | 2012 | 7.97 |
| | Computer literacy rate for the population aged 15 years and above. | 2011 | 3.3 |
| Improved government operational efficiency and service delivery using ICT. | Number of government services deployed through the Government's centralized electronic platform. | 2012 | 5 |

# VI. 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 country structural transformation faces three significant challenges:

- Productivity remains slow, particularly in agriculture, to support the development of employment in other sectors; lower food prices; and to ensure that farming is profitable
- High population density will continue to strain available natural resources and the environment
- Constraints in both domestic and external financing have hampered efforts to diversify the economy.

ICT enables economic growth by broadening thereach of technologies such as high-speed Internet, mobile broadband, and computing; expanding these technologies itself creates growth, and the fact that technologiesmake it easier for people to interact and make workersmore productive creates additional benefits

Despite of the well-executed government initiatives, there are some lessons to be learned. Some of the governmental initiatives have properly addressed areas of improvements but the execution may be insufficient to effectively carry out the plans. This will be addressed through the setup of RISA.

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 prosperous and knowledgeable society envision 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". The SMART Rwanda Master Plan responds to the challenges to achieve the national vision of Rwanda being a middle-income country with a sustainable knowledge-based economy.

# References:

**Table 2: References**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