

Document of
The World Bank

Report No: ICR00003486

IMPLEMENTATION COMPLETION AND RESULTS REPORT
(IDA-H4260)

ON A

CREDIT

IN THE AMOUNT OF SDR 15.3 MILLION

(US\$24 MILLION EQUIVALENT)

TO THE

REPUBLIC OF RWANDA

FOR A

REGIONAL COMMUNICATIONS INFRASTRUCTURE PROGRAM (PHASE 2)
RWANDA PROJECT

UNDER THE

REGIONAL COMMUNICATIONS INFRASTRUCTURE APL PROGRAM

December 15, 2015

Transport and ICT Global Practice
Rwanda – Eritrea, Kenya, Rwanda, Uganda Country Management Unit
Africa Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective July 31, 2015)

Currency Unit = Rwandan Francs (RWF)

US\$ 1.00 = 690.00 RWF

US\$ 0.717 = SDR1

FISCAL YEAR

July 1 – June 30

ABBREVIATIONS AND ACRONYMS

AOS	Africa Olleh Services Ltd.
ARTEL	Telecommunications Company
BSC	Broadband Systems Corporation
CMU	Country Management Unit
CPS	Country Program Strategy
EDPRS	Economic Development and Poverty Reduction Strategy
GDP	Gross Domestic Product
GIS	Geographical Information System
GoR	Government of Rwanda
GOVNET	Government-wide Network
GPRS	General Packet Radio Service
ICT	Information and Communication Technology
IDA	International Development Association
IFMIS	Integrated Financial Management Information System
IRU	Indefeasible Rights of Use
ISP	Internet Service Provider
ISR	Implementation Status Report
LAN	Local Area Network
M&E	Monitoring and Evaluation
MYICT	Ministry of Youth and ICT
NCB	National Competitive Bidding
NICI	National Information and Communication Infrastructure
NTB	National Tender Board
ORN	Olleh Rwanda Networks
PAD	Project Appraisal Document
PDO	Project Development Objective
PFM	Public Financial Management
PRSC	Poverty Reduction Support Credit
PSCBP	Public Sector Capacity Building Project
QAG	Quality Assurance Group
QEA8	Quality at Entry Assessment

RCIP	Regional Communications Infrastructure Program
RCIPRW	Regional Communications Infrastructure Program – Rwanda
RDB	Rwanda Development Board
RITA	Rwanda Information Technology Authority
RURA	Rwanda Utilities Regulatory Authority
RVP	Regional Vice President
SAP	Service Access Point
SIDA	Swedish International Development Cooperation
TRACNET	Treatment and Research AIDS Centre
USAID	United States Agency for International Development
VLP	Virtual Landing Point
WIBRO	Wireless Broadband
Wi-Fi	Wireless local area networking technology
WIMAX	Worldwide Interoperability for Microwave Access

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REPUBLIC OF RWANDA
Regional Communications Infrastructure Program (Phase 2) – Rwanda Project

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Country:	Africa	Project Name:	Regional Communications Infrastructure Program (Phase 2) - Rwanda Project
Project ID:	P106369	L/C/TF Number(s):	IDA-H4260
ICR Date:	11/02/2015	ICR Type:	Core ICR
Lending Instrument:	APL	Borrower:	Republic of Rwanda
Original Total Commitment:	XDR 15.30M	Disbursed Amount:	XDR 15.23M
Revised Amount:	XDR 15.30M		
Environmental Category: B			
Implementing Agencies: Rwanda Development Board (RDB)			
Co-financiers and Other External Partners:			

B. Key Dates

Process	Date	Process	Original Date	Revised / Actual Date(s)
Concept Review:	01/07/2008	Effectiveness:	01/16/2009	01/16/2009
Appraisal:	08/28/2008	Restructuring(s):		01/29/2014
Approval:	09/30/2008	Mid-term Review:		03/23/2012
		Closing:	01/31/2014	07/31/2015

C. Ratings Summary

C.1 Performance Rating by ICR

Outcomes:	Satisfactory
Risk to Development Outcome:	Moderate
Bank Performance:	Moderately Satisfactory
Borrower Performance:	Moderately Satisfactory

C.2 Detailed Ratings of Bank and Borrower Performance (by ICR)

Bank	Ratings	Borrower	Ratings
Quality at Entry:	Satisfactory	Government:	Satisfactory
Quality of Supervision:	Moderately Satisfactory	Implementing Agency/Agencies:	Moderately Satisfactory
Overall Bank Performance:	Moderately Satisfactory	Overall Borrower Performance:	Moderately Satisfactory

C.3 Quality at Entry and Implementation Performance Indicators			
Implementation Performance	Indicators	QAG Assessments (if any)	Rating
Potential Problem Project at any time (Yes/No):	No	Quality at Entry (QEA):	None
Problem Project at any time (Yes/No):	No	Quality of Supervision (QSA):	None
DO rating before Closing/Inactive status:	Satisfactory		

D. Sector and Theme Codes		
	Original	Actual
Sector Code (as % of total Bank financing)		
Public administration- Information and communications	21	21
Telecommunications	79	79
Theme Code (as % of total Bank financing)		
Administrative and civil service reform	17	17
Infrastructure services for private sector development	33	33
Regional integration	33	33
Regulation and competition policy	17	17

E. Bank Staff		
Positions	At ICR	At Approval
Vice President:	Makhtar Diop	Obiageli Katryn Ezekwesili
Country Director:	Diarietou Gaye	Mark D. Tomlinson
Practice Manager/Manager:	Boutheina Guermazi	Philippe Dongier
Project Team Leader:	Arleen Cannata Seed	Mark D. J. Williams
ICR Team Leader:	Arleen Cannata Seed	
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F. Results Framework Analysis

Project Development Objectives (from Project Appraisal Document)

To contribute to lower prices for international capacity and to extend the geographic reach of broadband networks

Revised Project Development Objectives (as approved by original approving authority)

Not applicable

(a) PDO Indicator(s)

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Indicator 1:	Volume of International Traffic			
Value quantitative or Qualitative)	235	600		11,684
Date achieved	09/30/2008	01/31/2014		07/31/2015
Comments (incl. % achievement)	Overachieved by 1,947%. Target reached: 09/30/2010. Measured in Megabits per second (Mbs/s). The connection to the fiber optic enabled this dramatic growth.			
Indicator 2:	Volume of National Traffic: Internet user penetration			
Value quantitative or Qualitative)	726	4,500		2,515,689
Date achieved	09/30/2008	01/31/2014		07/31/2015
Comments (incl. % achievement)	Overachieved by 55,904%. Target reached 12/31/2011. It is measured as number of broadband subscribers. The introduction of mobile broadband significantly contributed to this dramatic growth. The purchase of international capacity enabled this dramatic growth.			
Indicator 3:	Volume of National Traffic: Total teledensity (fixed and mobile)			
Value quantitative or Qualitative)	9.4	15		71.23
Date achieved	09/30/2008	01/31/2014		07/31/2015
Comments (incl. % achievement)	Overachieved by 475%. Target reached 12/31/2009. It measures access to telephone services for fixed mainlines and cellular phones per 100 people. The rapid growth of cellular telephony penetration was underestimated at appraisal and contributed to this growth.			
Indicator 4:	Price of wholesale international capacity link from Rwanda to European hub			
Value quantitative or Qualitative)	10,000	4,000		125
Date achieved	09/30/2008	01/31/2014		07/31/2015
Comments (incl. % achievement)	Overachieved by 3,200%. Target reached 12/31/2009. The connection to the fiber optic in Kenya and Tanzania, both landing points for international cables, substantially supported this growth. The purchase of international capacity further enabled this drop.			

(b) Intermediate Outcome Indicator(s)

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Indicator 1:	Expenditure in previous Fiscal Year on 10 biggest projects as % of budget			
Value (quantitative or Qualitative)	80	80		100
Date achieved	09/30/2008	01/31/2014		07/31/2015
Comments (incl. % achievement)	Overachieved by 125%. Target reached 09/30/2010. It measures the expenditure per the GoR fiscal year on IT projects to assess improvements in the capacity of RITA to fulfill its mandate.			
Indicator 2:	% of targeted institutions with working broadband Internet connection			
Value (quantitative or Qualitative)	0	100		111
Date achieved	09/30/2008	01/31/2014		07/31/2015
Comments (incl. % achievement)	Overachieved by 111%. Target achieved 07/31/2015. It measures the increase in institutional access to broadband connectivity. The original target was 100% of 700 institutions. The unit was changed during the last ISR to absolute numbers.			
Indicator 3:	Average monthly price of 128kbit/s broadband connection			
Value (quantitative or Qualitative)	130	100		51
Date achieved	09/30/2008	01/31/2014		07/31/2015
Comments (incl. % achievement)	Overachieved by 196%. Target reached 12/31/2009. It measures the average monthly price of broadband on the retail level. It originally measured 128Kbit/second however as the development of the technology, the unit was modified to 256Kbit/s.			
Indicator 4:	Retail price of Internet services (per Mbit/s per month in US\$)			
Value (quantitative or Qualitative)	1,015	781		201.17
Date achieved	03/17/2009	01/31/2014		07/31/2015
Comments (incl. % achievement)	Overachieved by 388%. Target reached 09/30/2010. This indicator was not part of the PAD but added later as a core indicator. It serves as another proxy to measure the retail price of broadband Internet.			

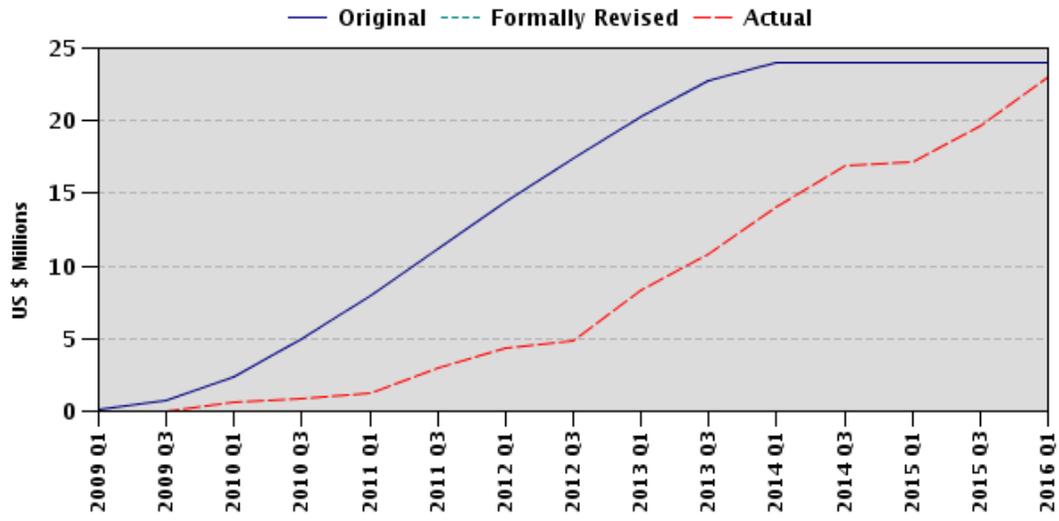
G. Ratings of Project Performance in ISRs

No.	Date ISR Archived	DO	IP	Actual Disbursements (USD millions)
1	05/05/2009	Moderately Satisfactory	Satisfactory	0.00
2	12/18/2009	Satisfactory	Satisfactory	0.60
3	06/20/2010	Satisfactory	Moderately Satisfactory	1.03
4	04/17/2011	Moderately Satisfactory	Moderately Satisfactory	3.48
5	01/29/2012	Moderately Satisfactory	Moderately Satisfactory	4.89
6	01/31/2013	Satisfactory	Moderately Satisfactory	10.72
7	10/22/2013	Satisfactory	Moderately Satisfactory	14.29
8	06/24/2014	Satisfactory	Moderately Satisfactory	16.91
9	12/25/2014	Satisfactory	Moderately Satisfactory	19.24
10	03/11/2015	Satisfactory	Satisfactory	19.60
11	09/10/2015	Satisfactory	Satisfactory	22.85

H. Restructuring (if any)

Restructuring Date(s)	Board Approved PDO Change	ISR Ratings at Restructuring		Amount Disbursed at Restructuring in USD millions	Reason for Restructuring & Key Changes Made
		DO	IP		
01/29/2014		S	MS	16.49	Restructuring included (i) an extension of the closing date by eighteen months from January 31, 2014 to July 31, 2015, and (ii) a reallocation of the specific component 2 was carried out pursuant to the letter dated August 26, 2013 from the Ministry of Finance and Economic Planning of the Republic of Rwanda. The extension was therefore proposed to allow for completion of the activities under the project and full achievement of the PDO.

I. Disbursement Profile¹



¹ Please note that the operations portal does not generate a “Formally Revised” graph for credits.

1. Project Context, Development Objectives and Design

1.1 Context at Appraisal

1. Rwanda is a small and landlocked country that had emerged from a devastating genocide a bit more than a decade before the project was conceived. In 2008, it was one of the world's poorest countries with the per capita GDP at US\$353² and 60 percent of the population living below the poverty line. It had one of the highest population densities in the world and a highly rural population.

2. The Country's Development Strategy was focused on transforming this, largely agriculture-based economy to a knowledge and service-based economy, in an effort to reach lower-middle income status by 2020. This was articulated in the Vision 2020 document which was endorsed by Cabinet in 2000. The Government of Rwanda ("Government" or GoR) emphasized its intention to use investment in ICT as the key driver for this transition and as a vehicle for improving the delivery of public and private services, particularly in the rural areas. The government's development strategy was supported by the World Bank, as outlined in the Country Assistance Strategy 2002-2006 (Report No. 24501-RW) and the Interim Strategy Note (Report No. 35331-RW).

3. It was recognized that as a landlocked country, expensive and unreliable international telecommunications, along with energy shortages, were major bottlenecks to the country's economic development. ICT services in Rwanda were still costly at the start of the project. Despite a clear commitment by the GoR to the use of ICT in government and the wider economy, tariffs in Rwanda had remained high and the quality of service was low. Teledensity³ remained low at approximately 9.7 percent compared to the average for Sub-Saharan Africa of 19 percent; at that time, subscribers were concentrated in the urban areas. The primary reason for this poor sector performance had been lack of network coverage, limited technical expertise and outdated technology. Therefore, the Government began to take some steps towards rectifying this by reforming the regulatory framework and by increasing competition.

4. The limited infrastructure primarily served Kigali and Butare. The Government decided to maintain an active role in the sector to ensure infrastructure expanded to the under-served countryside. To achieve this objective, it had implemented the following measures:

- a) It provided broadband connectivity to selected institutions through a state-owned VSAT operator, ARTEL. The company also operated as a wholesaler of international satellite connectivity to private companies and large consumers in the country.

² Source: IMF March 2008.

³ Teledensity is defined as the number of telephone connections for every hundred individuals living within a geographic area.

- b) Out of the US\$100 million revenue generated by the sale of Rwanda Telecom in October 2007, the Government of Rwanda decided to re-inject US\$40 million into the country's ICT infrastructure. The bulk of this funding was to be devoted to developing a national backbone infrastructure down to district level. The government intended to construct this network itself while engaging a private company to operate the network. The government subsequently entered a partnership worth approximately US\$5 million with Korea Telecom to roll-out wireless broadband services (WiBro, the Korean version of WiMAX which is the emerging technology standard for broadband wireless data connectivity) in Kigali, with the stated intention to privatize this network, once completed.
- c) The state-owned electricity company, Electrogaz, was also undertaking a major rollout of a fiber optic backbone network using the ground-wires of the transmission network to provide control systems for the electricity network itself. However, additional spare fibers were built into the network design, which were to be made available at low-cost for use in the telecommunications sector. Of the total transmission network, it was estimated that approximately 550km could be used to provide inter-district connectivity.

5. Despite these measures, Rwanda still faced critical constraints to achieving its objective of emerging as a regional ICT hub and transforming into a knowledge economy. Although telecommunications infrastructure was expanding, improvements in access and services were slow, and remained costly and inefficient. This also raised the cost of doing business.. For Rwanda to achieve higher and sustained growth, it needed to accelerate the development of its telecommunications infrastructure with increased capacity capable of delivering advanced ICT services throughout the country. This was also needed to reduce the cost of doing business and significantly contribute to efficiency in public sector service delivery.

Rationale for Bank involvement

6. High consumer prices for broadband access, which made it unaffordable to all but a very small segment of the population, prevented expansion of the broadband market in Rwanda. In order to lower the costs of international telecommunications, including Internet, the country required increased international connectivity and bandwidth capacity. The presence of the private sector at the time was nascent, and confidence on the part of private investors was limited by the country's having emerged only 14 years earlier from a severe civil conflict. Public intervention in the market was required to help break the cycle of low demand due to high prices. Although the GoR and the operators had already taken steps to expand broadband capacity and international connectivity, additional public sector measures were deemed necessary to further reduce the barriers to Internet access and usage and catalyze private sector investment. Increased capacity was also needed to support government connectivity as a contributor to increased efficiency in government administration and public service delivery, which required public sector investment.

7. The World Bank was initiating the Regional Communications Infrastructure Program (RCIP) to support all the countries in Eastern and Southern Africa to improve and integrate the essential utility of telecommunications. A Phase I RCIP project had been initiated in Burundi, Madagascar and Kenya. Rwanda was included as Phase II with the same aim of decreasing regional and national telecommunications costs, increasing reliability and capacity of the

networks, and setting the foundation for improved government efficiency and effectiveness through technology.⁴

8. Prior government successes in the use of ICT in the Rwandan economy and the public sector also provided a foundation for the project. These included the installation of GovNet to link the Ministries, the initiation of the TracNet system for health, the creation of strategic ICT plans for Ministries, and the establishment of certified institutions of higher learning providing degrees in technology. These efforts were supported by the World Bank in particular through:

- a) The Rwanda Development Gateway (2000-2009), which established the Regional IT Training Center at Kigali Institute of Science and Technology, strengthened the GIS center at the National University of Rwanda, and created a gateway portal to share government information on Rwanda.
- b) Public Sector Capacity Building Project (PSCBP, 2004-2011), which was a US\$24 million grant, and which include ICT training for government officials.
- c) The eRwanda project, (2006-2010), a US\$10 million grant which focused on the development of eGovernment applications and government websites, the provision of Local Area Networks (LAN), and additional capacity building in ICT for the government.

9. These efforts had enabled further eGovernment expansion and attracted future investments in ICT, but their impact was limited by the need to increase broadband bandwidth and access. The RCIPRW project therefore complemented these efforts and supported the Government of Rwanda's and the World Bank's strategic objective of increased regional integration and improved international connectivity. The support for the purchase of international capacity and its linkage to nearby regional networks (rather than expensive satellite links through Europe) by the project was designed to facilitate cross-border communications traffic, hence boosting international trade and economic activities, and overall regional integration.

1.2 Original Project Development Objectives (PDO) and Key Indicators (as approved)

10. The development original objective of RCIPRW was **“to contribute to lower prices for international capacity and to extend the geographic reach of broadband networks”**, as recorded in the Project Appraisal Document (PAD) and Financing Agreement (FA).

11. The key indicators chosen to measure the project's results at the time of Board approval were:

- a) Volume of international traffic (Mbits/s) to assess trends in international and regional communications integration;
- b) Volume of national traffic using the proxies of Internet user penetration as measured by the number of broadband subscribers and total teledensity to assess level of access to communications services within Rwanda;

⁴ Phase III countries comprise Malawi, Tanzania and Mozambique; Phase IV Comoros; and Phase V consists of Uganda. South Sudan and Somalia are under preparation.

- c) Average price of international communications using the proxy of the price of wholesale capacity link from Rwanda to a European Internet Hub to assess the competitiveness of the country with regards to cost of capacity.

1.3 Revised PDO (as approved by original approving authority) and Key Indicators, and reasons/justification

12. PDO and key indicators remained unchanged throughout the entire duration of the project. One additional core indicator - Retail Price of Internet Services (per Mbit/s per Month, in US\$) - was added in the Implementation Status and Results Report. This was redundant and was not formally included under the restructuring.

1.4 Main Beneficiaries

13. The main beneficiaries of the project were the Government of Rwanda at both the central and local levels and public institutions such as schools, health centers; Rwandan Internet Service Providers (ISPs), and the ICT sector more broadly, including the mobile telephony and broadband consumers in the country. The project aimed to support them by:

- a) Increasing international telecommunications capacity and leveraging government demand for bandwidth to drive down regional prices for all market participants and spur further investment into regional network infrastructure;
- b) Expanding broadband connectivity through funding broadband connections to government institutions; and,
- c) Contributing to the implementation of the eGovernment program of Rwanda.

14. The RCIPRW was also intended to result in positive impact for the private sector in two ways. First, the project intended to contribute towards lowering the cost of doing business in Rwanda by reducing the cost and increasing the quality of telecommunications services. Second, the majority of the funds under the project were to be channeled to private companies which were going to be selected through a competitive bidding process. In itself, this was likely to provide a major stimulus to the sector and facilitate network development across the country as well as a demand for both skilled and unskilled labor.

1.5 Original Components (as approved)

15. Component 1 – Enabling Environment (US\$2.67 million). This component provided capacity building support to the agencies and ministries concerned with the project. These included, the Ministry of Youth and ICT, Rwanda Development Board /Information Communication Technology and Rwanda Utilities Regulatory Authority (RURA). Part of this component was to provide capacity building to these institutions to ensure that the government’s objectives in Vision 2020 would be met. This support was provided through a combination of technical advisory support, training and one-off studies. The component provided the preparatory work required for the connectivity contracts to be undertaken, supporting the main focus of the project. Technical assistance related to international connectivity issues, the formulation of governance and disbursement mechanism for the connectivity component activities were also part of the component.

16. Component 2 – Connectivity (US\$18 million). This component aimed to lower the barrier for investment from operators to extend the geographic coverage of broadband access. This took the form of financial support to connect public institutions across the country to the

broadband network connectivity. The component also complemented efforts led by RURA under the Universal Access Fund initiative.

Subcomponent 2.1 – Support to the rollout of the national broadband infrastructure (US\$4 million). The focus of this subcomponent was the rollout of the broadband access networks through the provision of a basic package of broadband services at low-cost and connectivity to public institutions across the country. This rollout was planned to be executed through a competitive minimum-subsidy (OBA) basis and open to any licensed operator or ISP willing to invest and provide the specified services. This subcomponent was to complement the other investments that the government and the private sector were undertaking to boost connectivity and the capacity of the backbone network linking district centers.

Subcomponent 2.2. – This subcomponent was the most substantial part of the project (US\$13 million). It financed the purchase of bulk international broadband capacity on regional and international networks and the construction of a Virtual Landing Station to allow internet service providers (ISP) to have access to the wholesale connectivity.

Subcomponent 2.3 – The subcomponent enabled the establishment of third party Virtual Landing Station (US\$1 million) or a “tele house” as a neutral exchange point for the termination point for international cables and to allow operators and ISPs to interconnect.

17. Component 3 – Project Management (US\$2.19 million). The project was primarily implemented by RDB/ICT⁵, in close cooperation with RURA. This component established a small project implementation within RDB/ICT, leveraging the prior eRwanda project implementation team. The project team reported to the Head of RDB/ICT. This component also allowed for the recruitment of additional technical staff to strengthen the project team, including (a) a RCIP lead technical manager; (b) a technical network engineer; and (c) a senior telecommunications network procurement expert.

1.6 Revised Components

18. The components as designed at appraisal remained unchanged until project closing.

1.7 Other significant changes

19. The Government liquidated Rwandatel in 2011 and eventually sold its assets in 2013 to Liquid Telecom, a subsidiary of South Africa-based Econet Wireless Group. In the process, the Government decided to use the proceeds to finance the extension of the national broadband infrastructure. Initially, the Government sought to do this through one or more of the existing operators, but this was not successful. Subsequently the Government signed a contract with Korea Telecom of South Korea to extend high-speed internet to the majority of the national population. As a result, US\$4 million under Subcomponent 2.1 were reallocated in 2014 to other activities in the same subcomponent. These included increasing the Wi-Fi connectivity of institutions across the country to make the broadband more accessible to larger segments of the

⁵ Formerly RITA (Rwanda Information Technology Authority)

population and to address the constraints of last mile connectivity. This change did not affect the PDO since it contributed to increase the connectivity of beneficiary institutions.

20. Other implementation arrangements and funding allocations remained largely as planned during project appraisal. Due to factors related to broadband service negotiations in Uganda and to the complexity of the tenders, some delay in contracting for Subcomponent 2.2 occurred. As a result, the project was restructured in 2014 to extend the closing date by 18 months from January 31, 2014 to July 31, 2015 and to reallocate funds to allow sufficient time for the completion of the activities and ensure full achievement of the PDO.

2. Key Factors Affecting Implementation and Outcomes

2.1 Project Preparation, Design and Quality at Entry

21. The Government had done extensive preparatory, planning and policy development work in the ICT sector. At the base of this were the NICI Plans, which provided a comprehensive description of government policy and plans for the ICT sector in Rwanda. The other World Bank projects, referenced above, provided a foundation for the project preparation and design. Over the 12 months prior to the project, extensive technical advisory work had been carried out in the area of ICT needs, broadband and international connectivity.

22. Project preparation was accelerated and took place without any complications, benefiting from the support received from the eRwanda project management unit as well as the extensive preparatory work mentioned above. The project concept note was approved in January 2008 and project appraisal took place in August 2008. The Board approved the project in September 2008, nine months after the concept review, and it became effective in January 2009, just 3 months after the Board approval.

23. The design of the project built on the lessons learned from the experience of eRwanda and other RCIP projects. The first phase of RCIP operations for Kenya, Burundi and Madagascar were reviewed by the World Bank Quality Assurance Group (QAG) as part of the eighth Quality at Entry Assessment exercise (QEA8), which identified a number of areas which could be improved. These lessons included:

- a) The first lesson that the project adopted was to ensure close working arrangements between the World Bank and the GoR to reach timely effectiveness. The eRwanda project experienced some delays in obtaining parliamentary approval. Through the proactive approach of the Minister responsible for the sector during the preparation and appraisal of RCIPRW, such delays were avoided.
- b) Another lesson was the importance of mitigating weak implementation capacity by basing the project in a government agency that already has experience with World Bank projects. Therefore the project leveraged the existing eRwanda project management unit and the responsible agency.
- c) Another key lesson was the need for simplifying monitoring arrangements to ensure easy and timely collection of indicators. As a result, RITA became responsible for monitoring the project activities and RURA for collecting sector-specific data as it already had that mandate. This included emphasis on measurable indicators, which the project incorporated in consultation with the government.
- d) The project's design recognized the importance of complementing infrastructure with the development of applications and locally relevant content. Experience in other countries

showed that developing applications without having the appropriate infrastructure can be problematic. At the same time, infrastructure on its own is not sufficient to impact demand and result in increased use.

- e) Last, RCIPRW was based on the well-learned lesson that the private sector is better placed to develop and operate ICT infrastructure, as it is generally able to provide investment for infrastructure rollout. The role of the government was to address market inequalities by providing the right incentives for infrastructure and services to reach areas unattractive for the private sector.

24. Quality at entry was supported through the analysis conducted in the sector and the experience of the Rwanda gateway and eRwanda. Nonetheless, leveraging the eRwanda implementation for RCIPRW did not fully eliminate delays in implementation as the project team required further staffing and capacity building.

25. The assessment of risks and mitigation actions the team prepared at appraisal proved to be largely adequate. The overall project risks were rated as Moderate and appropriate mitigation measures were introduced. As, in the cases of procurement risk and absorptive capacity risk, the mitigation measures were insufficient to prevent related delays in project implementation.

2.2 Implementation

26. Following project effectiveness, implementation and disbursement of project funds experienced initial delays. In 2009, there was a change in senior government staff involved in the project, which caused disruptions to the project implementation. There were initial challenges to effectively handle financial management and procurement as well as M&E in the project team. Administratively, the government restructured RITA into the larger RDB and this caused some initial problems with process and transaction flow. As a result, project implementation was downgraded from Satisfactory to Moderately Satisfactory. This issue improved in 2010 through adequate staffing and the capacity building under Component 1 of the project.

27. Between 2010 and 2012, the implementation progress for Component 1 accelerated, rated Highly Satisfactory, however the project experienced a second delay in implementation for Component 2, which was graded as Moderately Satisfactory. As a result, overall Implementation Progress remained Moderately Satisfactory. The primary output of Component 2 was the purchase of international bandwidth capacity for the government. The preparation and tendering of the Indefeasible Right of Use (IRU) contracts took much longer than anticipated due to a lack of experience with such contracts on the part of the client and the Bank and a lack of technical capacity. Furthermore, as this tender was significantly larger than other procurements, it required substantial review by the Bank.

28. The implementation of Component 2 accelerated when the two largest contracts for the pre-purchase of international Internet bandwidth for the Government were successfully awarded and signed in mid-2012. The project underwent a mid-term review on March 23, 2012, which was recorded in ISR6 without any additional comments or issues raised. By early 2013, the project had made significant progress to achieve its objectives and its disbursement rate improved significantly: over 72 percent of the grant amount had been disbursed and over 82 percent had been committed.

29. In mid-2013, however the implementation of the second contract for the international capacity purchase (bandwidth from Europe delivered to Rwanda through submarine cables and terrestrial fiber in Kenya and Uganda) slowed due to quality of service issues on the fiber optic infrastructure on the part of the vendor. Therefore the full bandwidth activation date had to be extended. This, combined with previous delays in the implementation of Component 2, resulted in project restructuring in 2014, which included (i) an extension of the closing date by eighteen months from January 31, 2014 to July 31, 2015, and (ii) a reallocation of funds within the specific activities under Component 2. This was carried out pursuant to the letter dated August 26, 2013 from the Ministry of Finance and Economic Planning of the Republic of Rwanda. The extension was therefore proposed to allow for completion of the activities under the project and full achievement of the PDO.

30. During the time of restructuring, the GoR undertook a new approach towards the rollout of broadband services, as previously mentioned under section 1.7. As a result, the US\$4 million originally allocated for national broadband infrastructure were redirected for last mile connectivity access and equipment to more institutions, and the final procurements proceeded quickly. At project closing, disbursement rate was at 99.54 percent, and as direct payments were applied for the last procurement, no funds needed to be returned the World Bank from the GoR.

2.3 Monitoring and Evaluation (M&E) Design, Implementation and Utilization

31. The M&E design of the project was consistent with RCIP project designs and principles at the time of appraisal. The PDO determined in the PAD illustrated adequately what the project was aiming to achieve. PDO indicators in the PAD provided quantitative and measurable baseline and target indicators against which progress towards objectives were assessed.

32. Nonetheless, there should have been greater effort placed in ensuring the adequacy of the M&E framework and relevance of the indicators during implementation as most targets were surpassed at an early stage of the project and to a dramatic extent by project closing. Although all but one of the indicators were surpassed prior to the Midterm Review or the project restructuring, they were never amended to reflect this progress. This makes the effective utilization of the M&E framework towards establishing attribution challenging.

33. During project preparation, the targets for indicators were deliberately set very low. This was based on the standard indicators for RCIP projects at the time as well as limited local capacity. In particular, targets for Internet penetration and fall in wholesale prices were underestimated during project design. This was due to Task Team's and the GoR's lack of ability to predict the impact of fiber optic cable connections to the neighboring countries and the rapid extension and take-up of mobile broadband technologies in Rwanda. Given rapid changes in the technology and the emergence of mobile broadband, this was a general challenge in the ICT sector at the time. However, as targets were reached, the World Bank and the GoR would have been advised to iterate and revise them to reflect the changes in the sector.

34. The indicators were slightly modified during the project duration to include one core indicator prescribed by new World Bank corporate standards as a result of changes in the ICT sector. This indicator aimed to track access to Internet services based on the number of subscribers per 100 people, where data was added from the ITU.

35. The units of measurement for the two results indicator changed during the course of the project due to technological changes in the sector. The one intermediate indicator to measure the

average price of 128kbit/s broadband connection was changed to measure that of 256kbit/s. As a result of changes in the sector, in particular the emergence of mobile broadband, the unit measured by the key indicator on Internet users also transformed from project appraisal with the inclusion of mobile broadband subscribers.

36. The results indicators measured the geographic expansion of broadband through the increase in international volume. The project management team decided to also track geographic coverage by mapping out all beneficiary institutions of the project. This map of beneficiary institutions that received Internet access through the project is included in section 3.2 of this ICR.

2.4 Safeguard and Fiduciary Compliance

37. The project complied with the World Bank's safeguard and fiduciary rules and regulations throughout implementation.

38. The project had an overall Category B rating for its safeguards. It triggered two safeguard categories: environmental (OP BP 4.01) and social (Involuntary Settlement, OP BP 4.12).

- a) **Environment.** Under the agreed design of the RCIPRW, the actual physical components of this project were limited and comprised of (a) building wireless networks using existing fixed infrastructure; (b) indirect financing for the laying of some fiber-optic cable; and, (c) support for the establishment of a third-party virtual landing station in Kigali (a building which houses telecommunications equipment and is aimed as a point of interconnection between networks). A draft Environment and Social Management Framework (ESMF) was prepared and disclosed by the Government but since the project did not end up financing fibre optic cables and the virtual landing station was housed in an existing building, this was never applied.
- b) **Social.** Land acquisition for terrestrial facilities would only be required in the case of the Virtual Landing Station and was to be acquired by the entity in charge of operating that facility (not the Government). A draft RPF had been prepared and disclosed by the Government. As the Virtual Landing Station was set up at the Telecom House, within existing infrastructure and not requiring new land acquisition, it did not trigger the social safeguards.

39. The project provided a procurement and a financial manual in the Project Implementation Manual. The project's external financial audits were initially qualified, but after FY 2012 the audits were unqualified and submitted within the stipulated deadlines. Interim Financial Reports on the other hand were submitted with varied quality, though they were on time and improved as the project progressed. Financial management was rated Moderately Satisfactory throughout the project, mainly due to the lack of an accounting manual and internal audits, which would have reviewed day to day compliance with the internal control systems. The project used an accounting manual that was developed for a previous project (eRwanda), which was never updated to reflect subsequent changes arising from RCIPRW.

40. Procurement progressed in compliance with the legal agreement between the World Bank and the GoR, however experienced delays as previously described. In 2013, the post-review identified some irregularities in the area of filing, which were corrected. There were procurement delays for Component 2, which are described above.

2.5 Post-completion Operation/Next Phase

41. The Rwanda Development Board staff and consultants hired under RCIPRW have been retained under government employment. Their remit now includes other ICT projects in the country, many of which were follow-ons from RCIPRW. These projects include continued support to the Virtual Landing Point, management of the broadband rollout to the rest of the country, monitoring of the use of the Wi-Fi in TVET centers and secondary schools, and expansion of the services provided by the Rwanda Online Service Access Points (SAPs).

42. The pre-purchase of international bandwidth was signed as a 10-year contract and this will run until 2022, requiring continual monitoring and management of the supplier. Handover to the Rwanda Online SAPs was initially done when the hardware was delivered, but the support which RDB-IT will be providing to the SAPs will continue as more services are added to the online portal (i.e., only 8 services are currently available, but the government plans to offer over 100 services within a year). Maintenance and operations contracts were signed and will continue to be monitored by RDB-IT; additional monitoring of the sector, which RURA's responsibility, will continue as well.

43. In terms of the World Bank's continued relationship with Rwanda in the ICT ecosystem, there are several areas of potential support in the pipeline. The Bank is committed to supporting the Smart Africa (and Smart Rwanda specifically) through a series of trust funds to provide technical and material inputs to the Smart Africa Summits, Secretariat and activities. The ICT unit is preparing a roadmap which would support East African countries in activities which will improve their civil registration systems and pave the way for a regional electronic ID. This has been requested by Rwanda, Kenya and Ethiopia, and interest in participation has also been received from Uganda and Tanzania. Additional opportunities to provide ICT support throughout the portfolio are being explored, such as in eProcurement, social protection, and analytical work.

3. Assessment of Outcomes

3.1 Relevance of Objectives, Design and Implementation

Rating: Substantial

44. **The relevance of the project's objectives remains Substantial.** The project offers foundational support for the CPS 2014-18, the GoR's third national ICT Plan (NICI 2015) as well as the Government's Economic Development and Poverty Reduction Strategy (EDPRS2):

- a) It directly contributes to increasing access to internet services across the country.
- b) It supports the growth of the private sector and the knowledge economy by helping to lower the price of international connectivity and through the provision of technical advisory services to improve regulation and public-private partnerships. The redirection of project funds to deploy Wi-Fi connectivity in universities and TVET centers helps to strengthen these institutions in enabling their students with better access to curricula and practical materials, which can boost their employability.
- c) It supports improved government service delivery and accountability through the expansion of eGovernment applications such as IFMIS.
- d) Last, it promotes greater regional integration through increased international capacity, and more broadly, connectivity linkages to neighboring countries and regional markets.

45. The World Bank's 10-year vision in the Regional Strategy for Africa underlines the high relevance of RCIPRW as it places ICT as a key enabler to promote the region's economic and social development through improving connectivity and bandwidth. The competitiveness and the employment pillar as well as the governance and public sector capacity strategy refer to the significant potential of ICT to support transformation and sustained growth in Africa.

46. **The relevance of the project design is Substantial:**

- a) The project design identified the appropriate activities to support the PDO, which largely remain relevant.
- b) Through the modifications to Subcomponent 2.1, the project ensured relevance and reflected shifting government priorities. This enabled RCIPRW to supply equipment to the Rwanda Online⁶ service points under the broader government initiative called Smart Villages as well as provide equipment and Wi-Fi access to a greater number of educational institutions, which are a current government priority
- c) International capacity remains relevant to ensure adequate bandwidth to cater to growing demand. The purchase of international capacity built on the pre-existing and planned investments into the underlying infrastructure, and has helped to dramatically reduce the price of wholesale Internet.
- d) The capacity building and training under Component 1 remains relevant. The trained staff are retained and continue working on other projects. The training they received through RCIPRW catered to cross-cutting management and technical skills, which are needed for the effective design and implementation of these projects.

47. **The relevance of implementation remains Substantial.** The project team that led the implementation will remain in place and continue to work on the ICT sector and follow up items from RCIPRW, such as international capacity. It will also work on complementary initiatives by the GoR, including Rwanda Online.

3.2 Achievement of Project Development Objectives

Rating: Substantial

48. The PDO comprised two main intended outcomes: lower prices for international capacity and extended geographic reach of broadband networks. The project surpassed all of its targets by closing. However, the low targets determined at appraisal including the under-estimated impact of exogenous factors - such as the connection to the fiber optic cables to neighboring countries and the introduction of mobile broadband - also directly contributed to the over-achievement of project targets. As such, the project was highly successful, but the results cannot be solely attributed to the project itself in isolation.

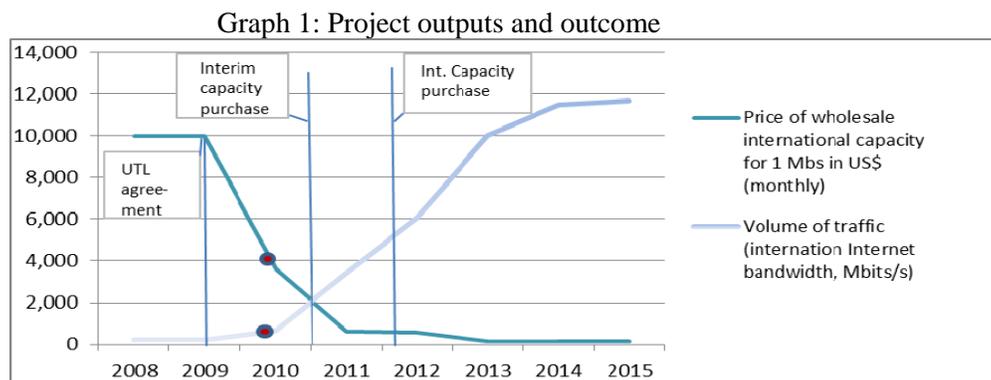
49. Regarding lower prices, the project tracked the price of wholesale international capacity to Europe. Rwanda had been largely frozen out of the boom in the region that had seen a number of international submarine cables connect countries of East Africa to the rest of the world. International connectivity had to rely primarily on highly expensive satellite services, severely

⁶ Rwanda Online did not exist at the time of project preparation. RCIPRW responded to this new government priority by funding equipment for 200 rural access points.

limiting the extension of broadband services and creating an obstacle for the government to achieve its stated goals. As a result, the Government had to rely on agreements with telecom operators in its neighboring nations for international connectivity.

50. The project built on the government’s parallel development of its optic fiber cable to its neighbors between 2009 and 2011. In 2009, following RCIPRW appraisal and agreement on the inclusion of international capacity purchase in the project, Rwandatel and sister telco Uganda Telecom (UTL) agreed to purchase international broadband capacity from SEACOM, which in turn secured a backhaul solution for Rwanda on the two regional players’ terrestrial networks between Ugandan capital Kampala and Kigali. Rwanda received 155Mbps of newly available broadband capacity in October 2009, when Rwandatel’s connection to the cable system via microwave links was launched, enabling it to deliver high speed services to a growing number of clients without experiencing capacity problems. Furthermore, Rwandatel and UTL contracted Green Future in September 2009 to deliver SEACOM’s fiber connection to both countries. These steps spurred the initial drop in wholesale prices and the increase in traffic (see Graph 1 below).

51. In April 2012 the GoR signed ten-year contract with Tanzania Telecommunications Company Limited (TTCL) for the provision of an additional 1.244Gbps of international bandwidth to improve the country’s Internet connectivity, funded through RCIPRW. This, following upon the RCIPRW-funded interim purchase of international Internet bandwidth in 2010, further contributed to the increase in traffic and continued decrease in price.⁷ The purchased bandwidth catered for the needs of both the government and private sector. Broadband Systems Corporation (BSC) was given the mandate in 2012 to manage the international bandwidth by supplying it to government institutions and selling the excess capacity to ISPs. The additional international capacity that was acquired through the project served as a market catalyzer; it has considerably reduced the price and allowed for wholesale operators, such as MTN, Liquid Telecom and Airtel, to buy bulk capacity and sell it competitively on the market.



Source: RCIPRW Results indicator data from RDB/IT, RURA and the operators. Targets set for the project are marked with a circle. While early successes reached the original targets, the project continued to deliver substantially better results over time.

52. These complementary efforts led to a dramatic drop in the wholesale price of international connectivity from US\$3,600/month first to US\$640/month and then to US\$580 within that timeframe, reaching US\$125/mbps at project closing. This is the lowest cost among the other countries that had a regional connectivity infrastructure project – as demonstrated in the

⁷ TeleGeography

table below. This drop in the wholesale prices was followed by a decrease in retail prices in the country, from US\$130 to US\$50.

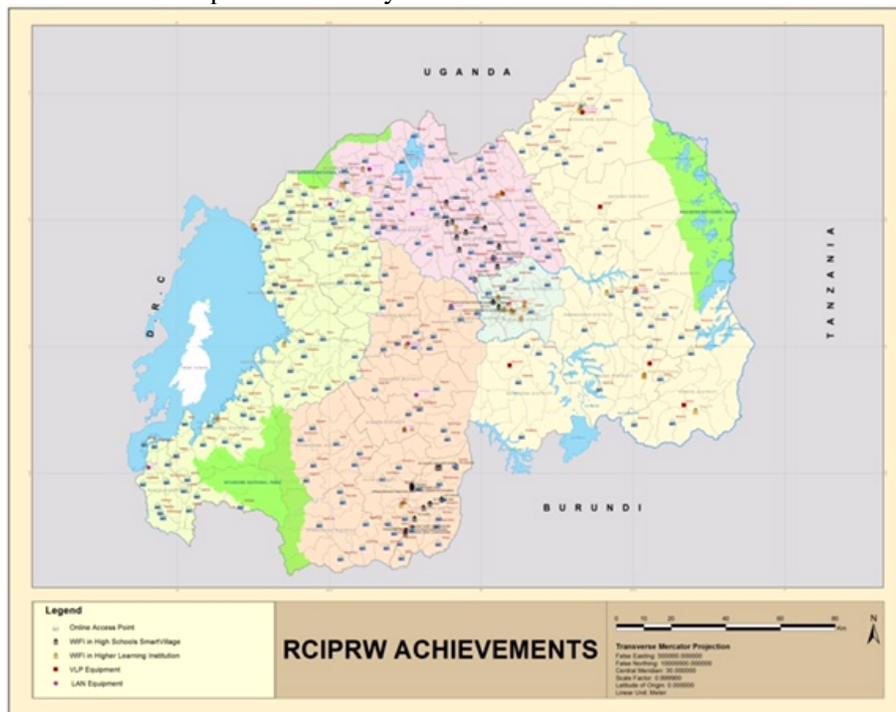
Table 1: International connectivity wholesale prices

	2008	2009	2010	2011	2012	2013	2014
Sao Tome			\$9,000	\$9,000	\$9,000	\$2,500	\$2,500
Kenya	\$7,500	\$800	\$800	\$650	\$650	\$650	\$287
Madagascar	\$10,000	\$5,721	\$4,897	\$1,776	\$1,367	\$1,115	\$844
Burundi	\$8,000	\$6,500	\$6,500	\$6,500	\$2,800	\$500	\$300
Rwanda	\$10,000	\$7,200	\$2,800	\$640	\$580	\$290	\$125

Source: project M&E data from WB projects P094103 (Kenya), P094103 (Madagascar), P094103 (Burundi), P106369 (Rwanda)

53. The combined effects of the Government’s prior capacity purchases plus the project-financed capacity purchases and construction of the Virtual Landing Station led to a surpassing of the project’s targets for the expansion of broadband access. Teledensity in the country exceeded 70 percent at the end of the project from a baseline of 10 percent and far outperformed the target of 15 percent. The number of broadband subscribers grew from 726 in 2009 to an astonishing 2.5 million in 2015. The international Internet volume of traffic reached 11,684 mbits/second, grossly exceeded its target of 600 mbits/second. The project originally targeted 700 institutions including schools, local government offices and health clinics, for broadband access. It exceeded this target in 2015 and continued to connect 783 in total, either through Wi-Fi access points or through the Rwanda Online telecenters.

Map 1: Beneficiary institutions of RCIPRW



Source: RDB. Widespread delivery of services were designed to reduce urban-rural disparities in access.

54. Through the increased Internet access thanks to the project, local government officials have switched from manual to more automated and digital working processes, contributing to potential improvements in their efficiency. It has also meant that citizens in remote and rural parts

of the country can access national public services through Rwanda Online and other mechanisms, rather than having to travel to the capital for administrative processes.

3.3 Efficiency

Rating: High

55. The design of the project has been based on a model of competitive, private-sector service delivery. This is fully consistent with international experience, which shows that this is a more cost-effective way of delivering telecommunications services than direct government provision.

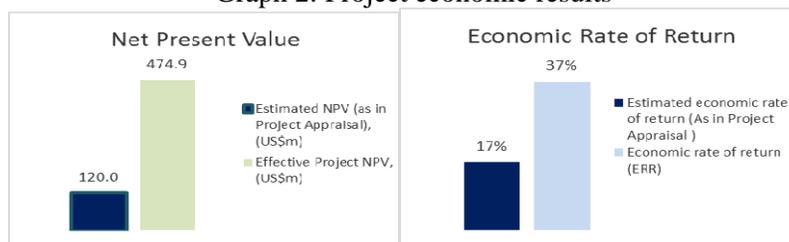
56. The economic model used at project appraisal evaluated the impact of RCIPRW by taking into account overall market value of broadband services in Rwanda, as well as overall costs of delivering such services. The issue of attribution was tackled by comparing the value added of the project to a scenario without the project. However, the model faced limitations in terms of accounting for exogenous factors, and the consumer surplus calculation attributes the reduction in prices to the project. To more clearly determine results attribution, an additional “without project” scenario was assessed based on the case of Uganda, which has a comparable market and did not have an RCIP project.

57. During appraisal, the Economic Rate of Return of the project was predicted to be positive. Under the project, the government planned to invest US\$24 million towards broadband services. In return for this, it expected to receive direct benefits through the consumption of broadband services. In addition, the economy was to benefit through the expansion of the broadband market, directly generating economic value-added which are in addition to the consumer benefits.

58. It was estimated that the Net Present Value (NPV) of these economic benefits would equal to approximately US\$120 million compared with US\$80 million if the project did not happen. The expected internal rate of return on the project was therefore approximately 17 percent. The project also forecast that the broadband industry would contribute approximately US\$60 million in tax revenues to the government over a 10-year period. This excluded any initial license fee payments made when companies entered the market and any salary taxes paid by employees.

59. At closing, based on the original economic model applied at project appraisal, the project significantly exceeded its goals for economic benefits, reaching US\$474.9 million for its NPV, and 37 percent for its economic rate of return. It must be noted that these results are not attributable only to the project, but reflect the combined effects of the project plus the other measures taken by the Government and the private sector just before the project’s approval and during its implementation, as outlined in previous sections of this ISR.

Graph 2: Project economic results



60. When compared with the case of Uganda, which has not had a Regional Communication Infrastructure project, RCIPRW still shows impressive results. The Effective NPV of the project is US\$508 million, and the NPV through the “without project” scenario based on Uganda is US\$42.7 million. Please see Annex 3 for the details of the economic model.

3.4 Justification of Overall Outcome Rating

Rating: Satisfactory

61. The overall rating for the project’s outcome is Satisfactory, based on the ratings for Achievements, Relevance and Efficiency.3.5 Overarching Themes, Other Outcomes and Impacts

(a) Poverty Impacts, Gender Aspects, and Social Development

62. The project has supported Rwanda in addressing broader development challenges. Through the increase in international Internet bandwidth and the expansion of the reach of broadband, it contributed towards a continued transformation of Rwanda’s economy as well as that of the everyday life of its citizens. It has provided a basis for further development to improve economic growth, boost employment, increase accountability and efficiency of public services and support social inclusion. These in turn impact poverty reduction and sustainable development.

63. The project’s support to public institutions through Wi-Fi and telecenters have increased access to Internet services and brought tangible impact in terms of improved service delivery and administration at these institutions. Local government and their constituents can now leverage Internet access and online services to improve both the quality and speed of government services. Health clinics can also enhance the quality and increase the speed of their processes, which can make a critical difference for much-need healthcare. Students and administrators at education institutions that benefited from the project experience more efficient processes, better access to curriculum and ability to apply learning through the Internet. The project has also contributed to increased technical skills development among civil servants and administrators, by assisting them to switch from manual to more automated and digitized processes.

64. However, this impact is constraint in the short-term due to two reasons. On one hand, many students at the educational institutions that benefited from the project do not have Wi-Fi-enabled devices. The project did not conduct an assessment in this regard but anecdotal evidence suggests that only 20 percent of students have computers or phones that are able to utilize Wi-Fi, although there is now an increasing availability of less expensive devices in the Rwandan market. On the other hand, for those institutions that do provide access to devices, e.g., through computer labs, there is a further need for increased Internet bandwidth to satisfy all the demand from students and administrators at the same time.

65. The project did not target women specifically as a key beneficiary group; rather it included them as part of the overall Internet users. As 51 percent of the population of Rwanda is female, based on World Bank data from 2013, the potential of the project to benefit women is high. They benefit from increased availability and access to the Internet, which raises their ability to enter and expand into markets inside and outside of the country at a lower cost. As time and mobility constraints tend to be more severe for women than for men given their traditional roles in the family. Women stand to benefit even more from improvements in eGovernment services and increased Internet access in general.

66. The project did not set any climate change related targets, however its support towards the development of a knowledge economy can boost low-carbon emission sectors. Through the increased availability of eGovernment services based on the connectivity that the project provided, it also contributes to the reduction of transportation needs since citizens and civil servants can conduct processes online.

(b) Institutional Change/Strengthening

67. The project provided extensive training under Component 1, which was essential to strengthening and sustaining the government's capacity to manage the sector. It contributed to the training of staff from RDB and RURA in both technical and project management, which can positively impact staff capacity and capabilities to design and manage other, current and future projects in the sector and beyond.

(c) Other Unintended Outcomes and Impacts (positive or negative)

68. The project has contributed to the development of Rwanda's ICT sector through the increased capacity. According to the World Economic Forum's Global Information Technology report for 2015, Rwanda topped the global chart in the cluster for 'Government success in ICT promotion', and 45 percent of Foreign Direct Investments (FDI) between 2010 and 2015 were directed to the ICT sector. However overall FDI remains a relatively small contributor to the Rwandan economy.

69. According to the Ministry of Youth and ICT of Rwanda, ICT contributed 3 percent to the Rwandan economy in 2014, which is significantly greater than the average of 1.1 percent in the context of Africa.⁸ Out of the 22 countries in Africa and elsewhere where the mobile network operator MTN operates, Rwanda has one of the highest consumption of internet per person. All technologies and spectrum are available and accessible in Rwanda.⁹

70. Under an initiative championed by the Minister of Youth and ICT and the Mayor of Kigali, 10Mbs of data are provided to all mobile data subscribers daily free of charge, leveraging the increased Internet capacity that was provided through RCIPRW. This initiative has been extended to other towns in Rwanda where Wi-Fi connectivity exists. This has contributed to increased usage per capita. However, the very heavy capital investments made by the government and the industry over the period have helped to create more supply capacity in the ICT sector. There still remains a high amount of unused capacity that needs to be filled by bringing more new users on board.¹⁰

⁸ http://www.myict.gov.rw/press-room/latest-news/latest-news/?tx_ttnews%5Btt_news%5D=216&cHash=3ab7393897aff0a46d7f29612935c05e

⁹ <http://www.independent.co.ug/column/comment/9518-ict-investment-innovation-and-beyond>

¹⁰ <http://www.independent.co.ug/column/comment/9518-ict-investment-innovation-and-beyond>

4. Assessment of Risk to Development Outcome

Rating: Moderate

71. As the international broadband capacity was pre-purchased until 2022, there is low risk to sustaining the key development outcome. The GoR intends for the private sector, such as operators Liquid Telecom, MTN and Airtel, to finance any additional capacity purchases beyond that period. Consumption by the private sector and citizens is increasing, balancing the initial high concentration of demand by the government. The private sector is also continuing with its infrastructure and services expansion.

72. For the connected institutions, the project also ensured that all equipment provision would be paired with a sustainability and maintenance plan. Thereby it mitigated risks to the intended outcomes of these outputs. Technology does evolve, so the sustainability plans as well as the capacity building provided under Component 1 were also designed to include relevant assessments to inform this process and the government's ability to allow for the update of the technology as needed. It is worth noting that over 200 of the beneficiary institutions, including schools that are closed over the summer period, were connected in the last 4 months of the project. Therefore it is challenging to fully assess the impact of the project on them at this early stage following implementation.

73. The fiscal sustainability of the project is to be achieved through cost-sharing with recipient institutions. The government is committed to further expanding the use of ICT in public institutions and has indicated that the cost of the broadband connectivity provided to institutions will be shared by the institutions themselves. The level of this contribution will vary according to the type of institution, however the GoR has not shared detailed plans that outline the exact nature of the cost-sharing.

74. At the same time, private sector development in the sector is still limited, and the government continues to play an active role. There are concerns by development partners and the private sector that the GoR's association with Korea Telecom, ORN and AOS may crowd out other private sector investment into the telecom sector. However, the GoR maintains that this association was a strategic move to extend high-speed broadband rollout across the country and that the model allows for a competitive market as it delivers broadband access through one wholesale network capable of open access to multiple retail service providers who compete on value added services as opposed to access to infrastructure. Through this approach, the GoR aims to rapidly extend broadband while mitigating the risk of crowding out the private sector.

5. Assessment of Bank and Borrower Performance

5.1 Bank Performance

(a) Bank Performance in Ensuring Quality at Entry

Rating: Satisfactory

75. Project design at entry proved to be appropriate and successful in the large sense; the project achieved its development objective without the need to go through any major restructurings. The Bank team heavily invested in extensive preparatory work to support project design, and incorporated lessons learnt in particular to mitigate the risk of low implementation

capacity. It also recognized that heavy advisory support and capacity building would be needed for the implementing agency.

76. The Bank Task Team also ensured that the project design would promote donor harmonization. Therefore, the project included the establishment of a consultative group to ensure that its activities are well communicated and that stakeholders are involved in the decision-making process. It was decided that this consultative group would be part of the existing donor reporting mechanism, according to the Aide Memoire for the project appraisal mission in 2008 and the World Bank assisted in the formation of this group.

77. The Task Team set indicator targets extremely low for the project. At the time of project approval, the political environment in the region and in Rwanda was still unsettled enough that the Bank proceeded with highly conservative targets for sector achievements under the project. Therefore it severely underestimated the targets for the results indicators, as previously discussed. This followed the generally risk averse approach of the Bank with respect to target setting upon entry.

(b) Quality of Supervision

Rating: Moderately Satisfactory

78. The World Bank ensured appropriate supervision for the majority of the project duration, however it provided weak supervision at times of low disbursement. After strong Bank engagement at the preparation and initial implementation stages of the project, the number of missions and amount of supervision documentation significantly declined between 2011 and 2013. The delays during 2011-2013 were partly due to a difference of views between the Government and the then-TTL of the project over the approach taken by the Government to extend high-speed internet to the majority of the national population, as outlined in section 1.7 above.

79. The Bank introduced changes in its Task Team and increased the intensity of supervision in 2014. Such changes contributed to a quick resolution of the differences surrounding the Subcomponent 2.1 as explained above. As a result, implementation and disbursement rates accelerated considerably but the Bank could have been more proactive in promptly resolving this divergence of views in order to minimize its effects on project implementation.

80. As previously discussed, although the project's targets were surpassed early on, the World Bank failed to identify this as an issue and to appropriately modify the targets, despite a Midterm Review and a restructuring. While this did not significantly affect the outcomes, it would have been helpful if the targets could have been modified to be able to more accurately assess the level of achievements of the project. This is an important lesson learned for similar transformational projects.

(c) Justification of Rating for Overall Bank Performance

Rating: Moderately Satisfactory

81. Combining the two ratings of Bank performance in quality at entry and supervision yields an overall rating of Moderately Satisfactory.

5.2 Borrower Performance

(a) Government Performance

Rating: Satisfactory

82. The GoR showed high interest in and commitment to the project from the onset, building on prior collaboration and operations with the World Bank in the sector through the Rwanda Gateway and eRwanda. Throughout the most important phases of the project (namely negotiations and the launch of the second operator), the Government was generally very prompt to react and showed ability to take decisions under changing conditions and complexities in the sector. The Ministry of Science, Technology, Scientific Research and Information Communications Technologies, later reformulated as the Ministry of Youth and ICT, played a key role in ensuring relevance of the design throughout the project. It demonstrated proactive leadership in driving the project towards its objectives and towards the accelerated development of its telecommunications.

(b) Implementing Agency or Agencies Performance

Rating: Moderately Satisfactory

83. The initial implementing agency was RITA¹¹, which was transformed into the Rwanda Development Board-ICT Department (RDB-ICT) by 2010. The regulatory aspects of the project were undertaken by RURA. The project team demonstrated commitment towards the project. Nonetheless, the project implementation unit experienced lengthy periods of Moderately Satisfactory ratings for implementation; for financial management, M&E and procurement. This was due to low capacity to effectively handle these key functions.

84. Although the project leveraged the eRwanda project team, which had prior experience with Bank operations, it did not have sufficient staffing to manage both projects in parallel during the first phase of RCIPRW, nor the required technical skills to effectively handle complex tender documents under the project.

85. By the second half of the project, the Government improved capacity as a result of proactive action to change personnel and the technical training provided by the project under Components 1 and 3.

86. Throughout the project, RITA complied with all safeguards and fiduciary aspects satisfactorily, and overall, reports and audits were submitted in a timely manner. The project team also demonstrated a high level of understanding of the project's relevance, and their efforts contributed to ensure solid project results, through acceleration of disbursements and completion of all activities by project closing. The SPIU at the RDB has also undertaken the finalization of all outstanding tasks for the project following project closing.

¹¹ Which later merged into the RDB.

(c) Justification of Rating for Overall Borrower Performance

Rating: Moderately Satisfactory

87. In light of the above, the overall performance of the borrower is rated Moderately Satisfactory based on the above assessment.

6. Lessons Learned

88. A number of lessons emerge from the project implementation experience, being the following most relevant:

- a) The standards for key results indicators for the ICT projects need to be reexamined on a regular basis. Given the rapidly changing nature of ICT, Task Teams and project implementation units need to not only closely monitor the achievement of the result indicators, but periodically check their validity and amend them as necessary to better reflect the reality of the sector at the time.
- b) In order to enhance adoption of installed connectivity capacity it is useful to envisage actions to stimulate demand so that the effects of improved connectivity reach the local population faster. The project provided both supply- and demand-side interventions, setting an example for other RCIP projects that highlighted this as an area for improvement.¹² The next generation of RCIP projects can further enhance this through supporting the necessary skills and content development to boost uptake and application.
- c) Substantial and persisting delays in project implementation due to a difference in approaches in implementation design should be avoided. Such cases should require the application of active and adequate negotiation and resolution between the World Bank and the implementing agency, including senior management, and result in quick action in terms of any changes to the project.
- d) When considering the expansion of Wi-Fi networks for educational and other public institutions, it is important to examine the nature of the demand. It is recommended to develop a comprehensive assessment and program for optimal use, including teachers' and other staff training, access to Wi-Fi-enabled devices, digital content, sustainability models and device distribution channels. It is also important to assess if there is adequate broadband access, including links to the fiber networks, for institutions that are equipped with Wi-Fi connections and or supported with ICT equipment such as laptops. In the case of certain beneficiary institutions that received laptops through the project, the GoR had not provided the broadband access yet at the time of project closing.
- e) It is important to adequately communicate the objectives and results of projects. There was lack of awareness of the project's achievements in the country, and specifically of the World Bank's role in the project. Other donors in Rwanda noted the successes of the project and confirmed the value that it brought to Rwanda, in particular through the purchase of international capacity. USAID, KOICA and JICA noted however that communications about the project's successes and challenges could have been stronger

¹² ICR for WB Project P117652 IDA H6420

by both the GoR and the World Bank. The project had an allocation to communications, which was underutilized, and could have been applied to increase awareness of its components and results.

7. Comments on Issues Raised by Borrower/Implementing Agencies/Partners

89. Comments by the Implementing Agency are provided in Annex 5.

90. The Borrower's comments pertaining to paragraph 65 are reflected in paragraph 72 as the ICR draft was updated following their review. The wording of the ICR was reflected to incorporate the client's explanation. The international capacity purchased through the project was used as a market catalyzer, and as a result, private sector operators such as Liquid Telecom, MTN and Airtel can buy bulk capacity and sell that on the market. Hence the private sector will lead the market going forward and provide the required capacity.

91. The Borrowers' comments pertaining to 68 are reflected in paragraph 75. The ICR has been amended to incorporate the GoR's response to the risks highlighted by the private sector and development partners.

92. The Borrower's observation regarding paragraph 78 in the draft ICR have been incorporated and reflected in paragraph 86 of this ICR following clarifications on any outstanding tasks post-project completion.

Annex 1. Project Costs and Financing

(a) Project Cost by Component (in USD Million equivalent)

Components	Appraisal estimate (USD million)	Actual/latest estimate (USD million)	Percentage of appraisal
C1: Enabling environment			
Subcomponent 1: Capacity building and advisory support to sector agencies	0.87	2.86	328.70
Subcomponent 2: Formulation of specifications, process design and transaction support	1.20	0.62	51.46
Subcomponent 3: Implementation of the ESMF and RPF	0.50	NA	NA
Subcomponent 4: Communications	0.10	0.01	7.60
<i>Total</i>	<i>2.67</i>	<i>3.48</i>	<i>1.31</i>
C2: Connectivity			
Subcomponent 1: Supply of broadband connectivity to institutions	4.00	3.16	78.90
Subcomponent 2: Purchase of international wholesale connectivity	13.00	12.80	98.49
Subcomponent 3: Enabling the establishment of a third-party virtual landing station	1.00	1.62	162.10
<i>Total</i>	<i>18.00</i>	<i>17.58</i>	<i>97.67</i>
C3: Project Management			
Subcomponent 1: Core RITA technical project management team	1.35	1.93	142.62
Subcomponent 2: RITA project support team (shared with eRwanda)	0.36	0.00	0.00
Subcomponent 3: Other operating costs	0.48	0.10	20.83
<i>Total</i>	<i>2.19</i>	<i>2.03</i>	<i>92.48</i>
Contingency	1.14	NA	NA
TOTAL BASELINE	22.86	23.09	101.01
TOTAL with Contingency	24.00	23.09	96.21

Note: The procurement plans at appraisal was only developed for the first 18 months and did not cover the full project amount. Figures are based on SPIU accounting records. Several figures are below 100 percent given fluctuations in the exchange rate between SDR and US\$ throughout project implementation. There are some figures that are above 100 percent due to reallocations of funds within components.

(b) Financing

Source of Funds	Type of Cofinancing	Appraisal Estimate (USD millions)	Actual/Latest Estimate (USD millions)	Percentage of Appraisal
Borrower		0.00	0.00	.00
IDA Grant		24.00	23.09	96.21

Annex 2. Outputs by Component

Components	Intended output	Actual output	Date of actual output
C1: Enabling environment			
Subcomponent 1: Capacity building and advisory support to sector agencies	Training and capacity building for agency staff	Training 16 staff from RURA (short and long trainings)	2009
		Training for 2 staff from Ministry of ICT in the Office of the President	
		Training for 1 RDB staff (Workshop)	
		Training for 5 staff from RURA (short and long trainings)	2010
		Training for 14 staff from RDB (short and long trainings)	
		Master program for one staff from the Ministry of ICT in the Office of the President	
		Training for 6 staff from RDB (short and long trainings)	2011
		Training for 2 staff from the memorial of genocide against Tutsi	
		Training for 15 staff from RDB (short and long trainings)	2012
		Training for 9 staff from RDB	2013
		Training for 1 staff from MyICT (short training in MIT)	2014
		PDU Payment for Project Management Office staff of RDB	
		Training for 22 staff from RDB (short and long trainings)	2015
		Training for 4 staff from RURA (short and long trainings)	
		PMP training for 30 RDB/IT staff training (first intake)	2011
		PMP training for 15 RDB/ICT staff training (2nd intake)	2012
5 Network administrator of the National Data Center mentored by a IT Network Consultant hired by RCIP	2012		
35 district ICT officers were trained in LINUX system administration	2011		

		270 local government staff from 18 districts were trained in basic computing	2011
		14 staffs from RDB/ICT and other 5 staff from different GoR institutions were trained in TOGAF	2012
Subcomponent 2: Formulation of specifications, process design and transaction support	Detailed technical feasibility study, financial analysis, tender design, advisory support	19 consultancies (see attached document for more details)	Throughout the project duration
Subcomponent 3: Implementation of the ESMF and RPF	Environmental and Resettlement impact assessment and mitigation	NA	N/A
Subcomponent 4: Communications	Communications of project objectives and activities	Stakeholders Workshops to sensitized on RCIP Activities and projects	Aug-11
C2: Connectivity			
Subcomponent 1: Supply of broadband connectivity to institutions	Supply of broadband connectivity to 700 institutions	200 Rwanda online points established	Jul-15
		546 institutions connected to fiber	Mar-11
		37 schools and TVETs connected with LAN and WiFi	Jul-15
Subcomponent 2: Purchase of international wholesale connectivity	IRU contracts to prepurchase international wholesale capacity	Interim purchase of international capacity	Aug-10
		IRU 1 – long term pre-purchase of international capacity	Jul-12
		IRU 2 – long term pre-purchase of international capacity	Apr-12
Subcomponent 3: Enabling the establishment of a third-party virtual landing station	Development of virtual landing station in Rwanda	Virtual Landing point established	May-13
C3: Project Management			
Subcomponent 1: Core RITA technical project management team	Recruitment of Lead Technical Manager and other technical support	Lead Technical Manager and other technical support on board	2009
Subcomponent 2: RITA project support team (shared with eRwanda)	Procurement ad financial management	Procurement ad financial management Specialist on board	2009
Subcomponent 3: Other operational activities	Office consumables, equipment, furniture, transport, telecommunications, etc.	Operationally set up PIU	Throughout the project

Annex 3. Economic and Financial Analysis

1. At appraisal, the forecast of the project’s economic rate of return was predicted to be favorable. Under the project, the government planned to invest US\$24 million in broadband services. In return for this, it would receive economic benefits through the consumption of broadband services. In addition, the economy would benefit through the expansion of the broadband market, directly generating economic value-added in addition to the consumer benefits. It was estimated that the Net Present Value of these economic benefits would equal to approximately US\$120 million compared with US\$80 million if the project did not happen. The expected internal rate of return on the project was therefore approximately 17 percent.

2. The economic model used at project appraisal evaluated the impact of RCIPRW by taking into account overall market value of broadband services in Rwanda, as well as overall costs of delivering such services. The issue of attribution was tackled by comparing the value added of the project to a scenario without the project.

3. For the purposes of this ICR, there were multiple assumptions reviewed to update this model to reflect changes in the most recent data and analytics:

- a) On the cost side, the updated model accounts for capital expenditures resulting from building the infrastructure around broadband networks, as well as operating expenditures, administrative and sales costs and customer premises equipment costs. These cost categories cover the cost to society at large, that is, costs incurred by both service providers (CAPEX, OPEX, admin & sales) and consumers (CPE).
- b) On the benefit side, there were three sources identified for value delivered. First, post-tax cash flow accounts for benefits to broadband service providers. Second, consumer surplus due to price reductions is the benefit reaped by consumers. Third, economic value added due to taxes paid and GDP increased can be seen as benefit to society at large.

4. The model calculates the economic impact of RCIPRW by accounting for costs and benefits throughout the duration of the project, and also projecting relevant costs and benefits into the future. The model covers the period from 2009 throughout 2018. The economic impact is approximated as effective net present value (NPV) of the project, which is calculated in three steps. First, the NPV of developing Rwanda broadband infrastructure with RCIP is identified: it discounts net benefits of the project throughout the period 2009-2018 back to the date of inception. Second, it calculates the NPV of developing Rwanda’s broadband infrastructure without RCIP. Finally it calculates effective project NPV, which is the difference between the NPV of the “with project” and the “without project” scenarios.

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Year into the project	0	1	2	3	4	5	6	7	8	9
Subscribers	726	2,640	116,512	368,411	689,531	1,347,992	2,515,689	2,969,333	3,441,770	3,939,000
Broadband penetration	0.01%	0.02%	1.05%	3.22%	5.86%	10.83%	20.60%	23.74%	26.87%	30.00%
Network CAPEX per sub (US\$)	2,594	2,283	2,009	1,768	1,556	1,369	1,205	1,060	933	821
Total new network CAPEX (US\$m)	1.9	4.4	228.7	445.3	499.5	901.4	1406.7	480.9	440.7	408.2
OPEX (US\$m)	0.9	2.7	94.5	254.0	406.4	656.7	999.9	1023.1	1009.3	963.5

Total CPE costs	0.3	0.7	32.2	50.3	37.2	76.4	135.5	52.6	54.8	57.7
Admin and sales costs	0.2	0.2	10.5	33.2	37.2	72.8	113.2	133.6	154.9	141.8
Opex as % of cumulative capex	46.0%	43.1%	40.2%	37.3%	34.4%	31.6%	28.7%	25.8%	22.9%	20.0%
Cumulative capex m(US\$m)	1.9	6.3	235.0	680.3	1179.8	2081.2	3487.9	3968.8	4409.5	4817.7
CPE cost per sub	450	367	283	200	116	116	116	116	116	116
Total cost (US\$m)	3.2	8.0	366.0	782.7	980.4	1707.3	2655.2	1690.2	1659.7	1571.2
Pre-tax revenue/sub/month	130	50	50	50	30	30	25	25	25	20
Total subscription revenue	1.1	1.6	69.9	221.0	248.2	485.3	754.7	890.8	1032.5	945.4
OBA		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total revenue pre-tax	1.1	1.6	69.9	221.0	248.2	485.3	754.7	890.8	1032.5	945.4
Tax	0.2	0.3	15.0	47.5	53.3	104.3	162.2	191.4	221.9	203.2
Post-tax cash flow	-2.4	-6.8	-311.1	-609.1	-785.5	-1326.3	-2062.7	-990.9	-849.1	-829.0
Capex to revenue	166%	276%	327%	201%	201%	186%	186%	54%	43%	43%
Opex to revenue	76%	170%	135%	115%	164%	135%	132%	115%	98%	102%

Benchmarks

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Population (in mln)	10.53	10.84	11.14	11.46	11.78	12.45	12.21	12.51	12.81	13.13
Total GDP (in mln US\$)	5309	5699	6407	7220	7521	7890	8474	9118	9811	10556
GDP per capita (US\$)	504.19	525.85	574.89	630.11	638.67	634.01	694.01	728.85	765.87	804.00

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Consumer surplus (US\$m) - with project		1.3	55.9	176.8	413.7	808.8	1584.9	1870.7	2168.3	2599.7
Total value added (US\$m)	0.5	0.7	31.0	98.1	110.1	215.3	334.9	395.3	458.2	419.5
Broadband Value added as % of GDP - with project	0.0%	0.0%	0.5%	1.4%	1.5%	2.7%	4.0%	4.3%	4.7%	4.0%
Total Net Benefits, (US\$m)	-1.9	-4.8	-224.1	-334.2	-261.7	-302.2	-142.9	1275.1	1777.4	2190.2
Present value of cash flows	-1.9	-4.0	-156.0	-194.0	-126.7	-122.1	-48.2	358.4	416.7	428.3

Net Present Value (NPV) - with project	550.6
Net Present Value (NPV) - without project	75.8
Effective Project NPV, (US\$m)	474.9
Economic rate of return (ERR)	37%

5. Based on the model used at appraisal, the consumer surplus from the project far surpassed that without the project.

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Consumer surplus (US\$m) - with project		1.3	55.9	176.8	413.7	808.8	1584.9	1870.7	2168.3	2599.7
Consumer surplus (US\$m) - without project		0.7	2.9	6.8	12.4	20.5	28.9	40.3	53.9	70.9

Original assumptions used by the project team		
	Assumption	Explanation / source
CAPEX (capital expenditure) per cell site (US\$)	129,700	Pyramid/Winrock (data from RM, email 15/4/08)
Min # subscribers per cell site	50	Assumption by the project team
Max # subscribers per cell site	500	Pyramid/Winrock (data from RM, email 15/4/08)
Average CAPEX /sub (max)	2,594	Calculated based on total CAPEX and minimum # of subscribers per cell site
Average CAPEX/sub (min)	259	Calculated based on total CAPEX and maximum # of subscribers per cell site, higher than Pyramid (\$430 falling to \$180)
Starting cost of CPE (customer premises equipment) per subscriber	450	Pyramid/Winrock (data from RM, email 15/4/08)
OPEX - operating expenditure (% of cumulative CAPEX) (2009)	46%	Pyramid/Winrock (data from RM, email 15/4/08)
OPEX (% of cumulative CAPEX) (2018)	20%	Assumption by the project team
Admin and sales costs (% of gross revenue)	15%	Burundi benchmarked, project team assumption

Tax/Revenue	21%	MTN Group annual report (2006), adjusted for Rw specific taxes and rebased for GR including VAT
Value-added as % of gross revenue	44%	MTN Group annual report (2006), adjusted for Rw specific taxes and rebased for GR including VAT
Assumptions for the ICR (updated)		
	Assumption	Explanation / source
Annual change in capex per sub	-12%	Based on Winrock assumptions, revised downwards compared to project team's model
Annual change in CPE price	83.5	As calculated based on 2009 and 2013 CPE numbers
GDP growth 2015	7.40%	World Bank forecast as of July 15 2015
GDP Growth 2016	7.60%	World Bank forecast as of July 15 2015
Population 2015	12,210,000	University of Denver Global Forecasting
Population 2016	12,510,000	University of Denver Global Forecasting
Population 2017	12,810,000	University of Denver Global Forecasting
Population 2018	13,000,000	University of Denver Global Forecasting
Target broadband penetration rate (2018)	30%	BuddeComm projection
CPE cost per subscriber as of June 2013, (US\$)	116	RURA (Rwanda Utilities Regulatory Authority)
Discount rate	20%	Calculated using CAPM model
risk-free rate	3.08%	Relying on 30-year treasury yield curve as of 21.07.2015
Unlevered beta (telecommunications equipment)	1.2	Relying on data from the web-site of A.Damodaran of Stern School of Business
Market risk premium for Rwanda	14%	Relying on data from the web-site of A.Damodaran of Stern School of Business

6. Based on the model used at appraisal, the project far surpassed its estimated NPV, reaching US\$479.9 million, and its estimated Economic Rate of Return, reaching 37 percent. However, the model faces limitations in terms accounting for exogenous factors and the consumer surplus calculations attributes the reduction in prices to the project. To more clearly determine results attribution, an additional “without project” scenario was assessed based on the case of Uganda, which has a comparable market and did not have an RCIP project.

Model based on comparison with Uganda:

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Year into the project	0	1	2	3	4	5	6	7	8	9
Subscribers	726	2640	116512	368411	689531	1347992	2515689	2969333	3441770	3939000
Broadband penetration	0.00	0.00	0.01	0.03	0.06	0.11	0.21	0.24	0.27	0.30

Network CAPEX per sub (US\$)	2,594.00	2,282.72	2,008.79	1,767.74	1,555.61	1,368.94	1,204.66	1,060.10	932.89	820.94
Total new network CAPEX (US\$m)	1,883,244	4,369,126	228,745,344	445,291,527	499,537,407	901,391,357	1,406,682,774	480,910,073	440,732,677	408,198,421
OPEX (US\$m)	866,292	2,695,466	94,521,303	253,974,650	406,384,734	656,739,904	999,864,890	1,023,071,242	1,009,295,519	963,548,390
Total CPE costs	326,700	701,481	32,225,776	50,253,850	37,249,920	76,381,476	135,452,852	52,622,707	54,802,692	57,678,676
Admin and sales costs	169,884	237,600	10,486,080	33,156,990	37,234,674	72,791,568	113,206,005	133619986.2	154,879,651	141,804,000
Opex as % of cumulative capex	0.46	0.43	0.40	0.37	0.34	0.32	0.29	0.26	0.23	0.20
Cumulative capex m(US\$m)	1,883,244	6,252,370	234,997,714	680,289,242	1,179,826,649	2,081,218,007	3,487,900,780	3,968,810,854	4,409,543,531	4,817,741,953
CPE cost per sub	450	366.5	283	199.5	116	116	116	116	116	116
Total cost (US\$m)	3,246,120	8,003,673	365,978,503	782,677,018	980,406,736	1,707,304,306	2,655,206,521	1,690,224,009	1,659,710,540	1,571,229,489
Pre-tax revenue/sub/month	130	50	50	50	30	30	25	25	25	20
Total subscription revenue	1,132,560	1,584,000	69,907,200	221,046,600	248,231,160	485,277,120	754,706,700	890,799,908	1,032,531,008	945,360,000
OBA		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total revenue pre-tax	1,132,560	1,584,000	69,907,200	221,046,600	248,231,160	485,277,120	754,706,700	890,799,908	1,032,531,008	945,360,000
Tax	243,404	340,425	15,024,123	47,506,286	53,348,662	104,293,455	162,197,982	191,446,488	221,906,664	203,172,284
Post-tax cash flow	-2,356,964	-6,760,099	31,1095,427	609,136,704	785,524,239	1,326,320,641	2,062,697,803	990,870,589	849,086,196	829,041,773
Capex to revenue	1.66	2.76	3.27	2.01	2.01	1.86	1.86	0.54	0.43	0.43
Opex to revenue	0.76	1.70	1.35	1.15	1.64	1.35	1.32	1.15	0.98	1.02

Assumptions by review team (updated) - based on Uganda		
	Assumption	Explanation / source
Annual change in capex per sub	-10%	Based on Winrock assumptions, revised downwards compared to project team's model, (note: CAPEX decreases slower than in case of project scenario, as fewer subscribers mean lower economies of scale)
Annual change in CPE price	83.5	As calculated based on 2009 and 2013 CPE numbers
GDP growth 2015	0.10	World Bank forecast as of July 15 2015
GDP Growth 2016	0.10	World Bank forecast as of July 15 2015
Population 2015	12,210,000	University of Denver Global Forecasting
Population 2016	12,510,000	University of Denver Global Forecasting
Population 2017	12,810,000	University of Denver Global Forecasting

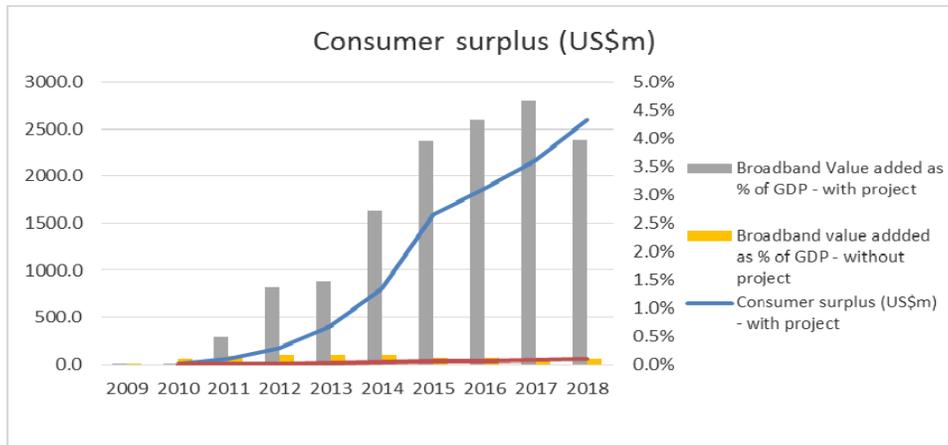
Population 2018	13,130,000	University of Denver Global Forecasting
Target broadband penetration rate (2018)	0.30	BuddeComm projection
CPE cost per subscriber as of June 2013, (US\$)	116.0	RURA (Rwanda Utilities Regulatory Authority)
Discount rate	0.2	Calculated using CAPM model
Risk-free rate	0.0	Relying on 30-year treasury yield curve as of 21.07.2015
Unlevered beta (telecommunications equipment)	1.20	Relying on data from the web-site of A.Damodaran of Stern School of Business
Market risk premium for Rwanda	14%	Relying on data from the web-site of A.Damodaran of Stern School of Business
Pre-tax revenue per subscriber in Uganda (2008), USD	170	Data from user reports online, we rely on Uganda as a comparison case
Pre-tax revenue per subscriber in Uganda (2012), USD	120	Data from user reports online, we rely on Uganda as a comparison case
Pre-tax revenue per subscriber in Uganda (2015), USD	43	Data from user reports online, we rely on Uganda as a comparison case
Pre-tax revenue per subscriber for years 2010, 2011, 2013, 2014		Linearly extrapolated from available data (data points for 2008, 2012 and 2015 available)

Benchmarks

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Population (in mln)	10.53	10.84	11.14	11.46	11.78	12.45	12.21	12.51	12.81	13.13
Total GDP (in mln US\$)	5309	5699	6407	7220	7521	7890	8474	9118	9811	10556
GDP per capita (US\$)	504.19	525.85	574.89	630.11	638.67	634.01	694.01	728.85	765.87	804

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Consumer surplus (US\$m) - with project		1.27	55.93	176.84	413.72	808.80	1584.88	1870.68	2168.32	2599.74
Total value added (US\$m)	0.50	0.70	31.02	98.08	110.15	215.33	334.89	395.27	458.16	419.48
Broadband Value added as % of GDP - with project	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Net Benefits, (US\$m)	-1.85	-4.79	-224.15	-334.21	-261.66	-302.19	-142.93	1275.08	1777.39	2190.18
Present value of cash flows	-1.85	-4.00	-155.97	-193.99	-126.69	-122.05	-48.15	358.35	416.69	428.31

Net Present Value (NPV) - with project	550.64
Net Present Value (NPV) - without project	42.67
Effective Project NPV, (US\$m)	507.96
Economic rate of return (ERR)	36%



7. According to the International Telecommunications Union (ITU), broadband can be considered affordable when it is at or below 5 percent of the average monthly income. The World Bank does not provide up-to-date information on the average income or income distribution in Rwanda. Using the most recent data available on per capita income in Rwanda, which is provided by the United Nations Development Program (UNDP) from 2012, the monthly Internet retail price of US\$28 for mobile broadband in 2015 is above the 5 percent of their monthly income of RWF64,410 (US\$87.46 based on the exchange rate for October 13, 2015) --noting the severe limitation of this analysis in terms up-to-date information on current income levels and distribution within the country. In addition to the costs of Internet, the cost of devices also affects affordability. Based on the price of one of the most widely used smart phones in the local market, a monthly cost of US\$3.7713 could be added to the affordability assessment. This highly limited analysis, using income data from 2012, suggests that broadband services are not yet affordable for the majority of the population.

¹³ The price for mid-range smart phone with Internet connectivity in Rwanda (Tecno Y4) is RWF50,000, or US\$67.89 based on October 2015 exchange rates. Assuming a usage life of 18 months, US\$3.77 would be the monthly impact on affordability coming from device on top of the monthly Internet cost.

Annex 4. Bank Lending and Implementation Support/Supervision Processes

(a) Task Team members

Names	Title	Unit	Responsibility/ Specialty
Lending			
Mavis A. Ampah	Lead ICT Policy Specialist	GTIDR	ICT Coordinator for Africa
Laurent Besancon	Manager	LLILD	ICT Coordinator for Africa
Kaoru Kimura	ICT Policy Specialist	GTIDR	Team Member
Juan Navas-Sabater	Program Leader	ECCU1	Former Program Leader
Maria Isabel A. S. Neto	Senior Operations Officer	GEEDR	Advisor
Michele Ralisoa Noro	Operations Analyst	GTIDR	Program Assistant
Arleen Cannata Seed	Sr. ICT Policy Specialist	GTIDR	Task Team Leader
Mark D. J. Williams	Senior Economist	TWICT - HIS	Task Team Leader
Supervision/ICR			
Otieno Ayany	Financial Management Specialist	AFTME - HIS	Financial Management
Alan Carroll	Consultant	GTIDR	Advisor
Doyle Gallegos	Lead ICT Policy Specialist	GTIDR	Task Team Leader for the APL
Chantal Kajangwe	Procurement Specialist	AFTPE - HIS	Procurement
Samia Melhem	Lead ICT Policy Specialist	GTIDR	Team Member
Michele Ralisoa Noro	Operations Analyst	GTIDR	Program Assistant
Cecilia Paradi-Guilford	ICT Policy Specialist	GTIDR	Primary Author of the ICR
Tasneem Rais	Program Assistant	GTIDR	Program Assistant
Arleen Cannata Seed	Sr. ICT Policy Specialist	GTIDR	Task Team Leader
Peter Silarszky	Sr. Economist	GTIDR	Task Team Leader
Gurcharan Singh	Sr. Procurement Specialist	GTIDR	Procurement
Dimitrie Mukanyiligira Sissi	Executive Assistant	AFMRW	CMU Assistant
Yasmine Umutoni	Consultant	GFADR	Program Assistant
Mark D. J. Williams	Senior Economist	TWICT - HIS	Task Team Leader

(b) Staff Time and Cost

Staff Weeks	Labor	Travel	Other	Total
FY 2008				
49.47	180,247.77	119,710.13	6,743.85	306,701.75
FY 2009				
23.09	90,713.80	68,662.93	1,723.69	161,100.42
FY 2010				
7.24	33,170.39	17,556.14	1,137.74	51,864.27
FY 2011				
11.52	52,736.99	33,776.19	5,209.60	91,722.78
FY 2012				
11.21	50,847.39	8,587.25	1,437.49	60,872.13
FY 2013				
11.55	53,117.22	13,147.91	991.86	67,256.99
FY 2014				
12.66	56,722.92	10,493.16	328.25	67,544.33
FY 2015				
18.86	91,655.01	48,379.88	223.53	140,258.42
FY 2016				
-	-	13,276.90	301.06	13,577.96
TOTAL				
145.60	609,211.49	333,590.49	18,097.07	960,899.05

Annex 5. Summary of Borrower's ICR and/or Comments on Draft ICR



Date: 25th / 11 / 2015
REF: RDB/2015/1680/2015

Arleen Cannata Seed
Task Team Leader – RCIPRW
The World Bank

Dear Arleen

Re: Review of the draft ICR for Regional Communications Infrastructure Program - Rwanda

This is to acknowledge receipt of the draft Implementation Completion Report for the RCIPRW project.

We have reviewed it and below are the points we would like to bring to your attention before you finalize the report.

Paragraph 65:

ICR observation: As the international broadband capacity was pre-purchased until 2022, there is low risk to sustaining the key development outcomes. The GoR has verbally confirmed but has not provided details on its plans for financing additional capacity purchases beyond that period. Consumption by the private sector and citizens is increasing, balancing the initial high concentration of demand by the government. The private sector is also continuing with its infrastructure and services expansion.

RDB comment: The RCIPRW purchase of international Internet capacity was used as a market catalyzer and it has considerably reduced the price and increased the market. Due to this development, private sector wholesale operators such as Liquid Telecom, MTN and Airtel are buying bulk capacity and sell on the market at the price equal or less than the one purchased by government through RCIPRW. The private sector will continue to lead the market and provide the required capacity.

Paragraph 68:

ICR observation: There are concerns by development partners and the private sector that the GoR's association with Korea Telecom, ORN and AOS may crowd out other private sector investment into the telecom sector. This would also raise the risk for the optimal use and sustainability of the capacity.

Corner Blvd. de L'Umuganda & Nyarutarama Road, P. O. Box 6239, Gishushu, Kigali, Rwanda.

A small, handwritten signature in blue ink, located in the bottom right corner of the page.

RDB comment: The joint venture of GoR and KT was a strategic move to accelerate the development of Rwanda's ICT skills and to speed up rollout of high speed broadband across the Country. The model is to deliver broadband access through one wholesale network capable of open access to multiple retail service providers who will compete based on value-added services as opposed to connectivity infrastructure.

Paragraph 78:

ICR observation: It was noted that there were no clear arrangements as to who would undertake the finalization of outstanding activities such as making the remaining payments and preparing final IFR and final audit after project closing.

RDB comment: The RCIPRW project is one of the projects implemented under the RDB Single Project Implementation Unit (SPIU), established to manage and implement all the projects under RDB.

The post close responsibilities of RCIPRW will be handled under the SPIU including payments, ICR report and monitoring the infrastructure established by the project.

Sincerely,



Mark NKURUNZIZA
CFO – RDB

Cc: Grace MUTSINZI,
COORDINATOR – RDB SPIU
Francois Regis GATARAYIHA
Head of ICT - RDB

Corner Blvd. de L'Umuganda & Nyarutarama Road, P. O. Box 6239, Gishushu, Kigali, Rwanda.

Summary of the ICR prepared by the RDB:

1. At the inception of RCIPRW, Rwanda being a land locked country, the internal policies, regulations and investments contributed to the development of the ICT sector but still the cost of international Internet bandwidth was still very high and this was a critical barrier to deliver quality and affordable services. Here comes the need of an affordable and reliable international internet bandwidth.
2. The development original objective of RCIPRW was **“to contribute to lower prices for international capacity and to extend the geographic reach of broadband networks”**, as recorded in the Project Appraisal Document (PAD).

3. The key indicators chosen to measure the project's results at the time of Board approval were:
 - Volume of international traffic (Mbits/s) to assess trends in international and regional communications integration;
 - Volume of national traffic using the proxies of Internet user penetration as measured by the number of broadband subscribers and total teledensity to assess level of access to communications services within Rwanda;
 - Average price of international communications using the proxy of the price of wholesale capacity link from Rwanda to a European Internet Hub to assess the competitiveness of the country with regards to cost of capacity.
4. The primary beneficiaries of the project were:
 - Government agencies and ministry concerned with the project namely the Ministry in Charge of Science, Technology Scientific Research and Information Communication Technologies in the Office of the President, RITA and RURA were to be supported through a combination of project management, technical advisory support, training and studies;
 - 700 public institutions including health centers, local government buildings, primary and secondary schools and universities campuses were to be supported through provision of broadband connectivity; and
 - Operators and ISPs by facilitating the interconnection through the VLP.
5. The broad ICT sector in the country was to be supported by the project through resulting improvements in broadband internet connectivity and had to benefit from project funds through implementation of different contracts.
6. The project components were:
 - Component 1: Enabling Environment. This component provided capacity building support to the agencies and ministries of government concerned with the project. The component also provided the preparatory work for connectivity tenders to be undertaken as the main focus of the project, including detailed technical designs and transaction advisory support. The component was supposed to support any environmental impact assessment work that would be required but the implemented activities did not require such an activity.
 - Component 2: Connectivity. The component focused on improving connectivity and lowering the cost of international telecommunications services by providing broadband access to targeted public institutions within the country and to provide wholesale broadband connectivity to the submarine fiber-optic cables. The three main activities for this component include the support to the roll out of broadband services, connectivity and the establishment of a virtual landing point
 - Component 3: Project Management. Primarily an experienced project management team was established under RITA working as one team with the eRwanda project team. In addition to the finance, procurement, M&E and administration team, the recruited staff included the Lead Technical manager, 3 broadband specialists and a communication specialist.
7. The project components were not revised throughout the project lifetime. However some activities within the components have been revised to fit in the update context of the country and the ICT sector in particular without changing the overall project development objectives. The subcomponent 2.1 Support to the roll out of broadband services was not implemented by

establishing a network between the public institutions as it was planned due to the fact that Government has engaged a private investor to establish a country wide 4G LTE network. The project funds have been reallocated to activities helping the broadband demand side including installation of local area network in different sectors, provision and installation of Wi-Fi equipment in secondary schools, TVET centers and universities, provision of computers labs to secondary schools and installation of computer access points in different sectors.

8. The preparation and design of RCIP was backed by the Government of Rwanda NICI plans, the established infrastructure and eRwanda project finance by the World Bank.

- Government plans: The Rwandan development (ICT4D) or NICI process began in 1998. The process is designed to put in place and implement the necessary policies and plans capable of addressing Rwanda's developmental challenges in the information and technological age to accelerate the country's socio- economic development process and move it towards an information and knowledge based economy and society.
- Infrastructure: During the implementation of NICI I (2000-2005) and NICI II, that was half way during the project design, Government of Rwanda and its private partners have established infrastructure including 150km and 85km fiber optic owned by Rwandatel and MTN respectively, a government owned VSAT operator, a decision to invest in the fiber optic backbone among others.
- Prior experience: RCIP project benefited from being implemented from the eRwanda experience under a joint implementation team with prior experience in project management and set clear procedures to manage the projects in compliance with the Bank's rules but also in line with the Government of Rwanda ICT vision.

9. RCIPRW implementation experienced some initial delays. The grant agreement was signed on October 20th, 2008 and the project was declared effective on January 16th, 2009. At the early stage of implementation, the RCIPRW project experienced delays due to late recruitment of the project coordinator and the technical team. When the team was on board, they established the procurement plan and initiated some of the project activities. However after a short period of time the procurement specialist and the project coordinator left the project early 2010, which again delayed the project at its early stage of implementation, which was then ranked Moderately Satisfactory. At the end of 2010, all the positions within project management were refilled and implementation took off, ranked Satisfactory.

10. Following the resolution of issues with the project implementation team, Component 1 proceeded with smooth and timely implementation, however Component 2 experienced further delays. Prior to the implementation of the subcomponent, the government established a policy towards connecting the entire country in a period of 3 years using private investment. The government committed to contribute the spectrum and existing backbone infrastructure as share equity to the private investor who would be willing to invest in a countrywide network, thereafter a private investor was mobilized to do so using a 4G LTE technology within a period of 3 years. With the new policy, it was not wise to establish a separate network connecting government institutions in parallel to the broad 4G LTE network and Government proposed to the Bank to restructure the subcomponent.

11. After discussions with the Bank, it was agreed that the funds under the subcomponent would be used to provide last mile connectivity to different institutions and this included:

- Providing Wi-Fi network covering 36 high learning institutions;
- Providing Wi-Fi equipment and computer labs to 28 secondary schools;

- Providing access points in 200 sectors across the country.

12. The subcomponent on international connectivity also experienced delays. The tendering process was complex and took considerable time under design and review. During this time, the GoR and the Bank agreed to purchase international internet capacity for a short period for 155MBPs for a period of one year. The tendering process was initiated for the Long-term lease and the first lot (Kigali-Rusomo-Dar-es-salaam) was awarded by April 2012 and the related (1.244Gibps) capacity was delivered from July 2012 for a period of ten years. Considerable delays were experienced on the second lot as the procurement process experienced a drop out of the best bidder due to an error he had made in his offer but also when the lot was awarded, the successful bidder was obliged to establish the physical fiber connectivity between Gatuna (the border between Rwanda and Uganda) and Mbarara (in central Uganda). The contract for the second lot was signed in July 2012 and the full capacity of 1.244Gibps Mbps was delivered from August 2013 for a period of 10 years as well.

13. Last, the landing point under Component 2 was established by the project within the Telecom house though also experienced delays in procurement.

14. As a result of these delays, the project needed to be restructured. The Government requested for an extension of 18 months and the main reasons included:

- Restructuring of the Subcomponent 2.1 Support to the roll out of broadband services to accommodate the current broadband rollout policy
- Spare enough time to the project team to monitor the delivery of the international capacity and complete the related payments;
- Complete the procurement of the Virtual Landing Point equipment;
- Reallocate the funds reserved under the contingency to be used for the project activities.

15. The RCIPW project has been designed with clear PDOs and it was in line with the government overall ICT policy. From the PDO, clear outcome and result indicators were designed in the PAD and were assessed throughout the project execution period. The ICT context and situation in the country of the project design period influenced the initial indicators to be very low. As the development of ICT sector in Rwanda took off exponentially, the set indicators were achieved in the mid of the project implementation due to the project implications or other ICT initiatives in the country.

16. The project achieved its development objectives and surpassed its results indicators. Key conclusions include:

- The RCIPRW project was designed in line with the country's ICT context as it was complementing government efforts invested in the National backbone and other ICT initiatives in the country;
- The project facilitated regional integration as the delivery of the international capacity through Kenya and Uganda catalyzed the establishment of a new fiber connection between Gatuna and Kampala but also increased fiber connections within the region;
- The project was a key supporter and enabler to the private sector in the country by lowering down the international internet connectivity prices to 125/Mbps/month, supporting the drafting and improving ICT regulation through interconnectivity model, tower infrastructure sharing policy.

- The project has been a key enabler to government in achieving its overall and especially ICT and objectives by:
 - a) It helped connect more than 800 institutions to internet broadband,
 - b) It facilitated the establishment of points of access for online services,
 - c) It helped connect universities and TVET centers to WIFI connectivity,
 - d) It supported the installation of computers labs and Wi-Fi connectivity in secondary schools,
 - e) It provided several and relevant trainings to government staff and officials,
 - f) It offered technical support to institutions to enhance their service delivery.
- Through purchase international connectivity using short-term contract the prices dropped from USD 2000/MBPS/month up to USD 700/MBPS/month and when the long term IRUs were signed the prices dropped down to USD 125/mbps/month.
- The broadband access increased exponentially during the project implementation where the number of broadband subscribers reached 2.5 million and the internet volume of traffic reached 11,684 in 2015. Thanks to the project efforts to reduce the prices of internet bandwidth, the government National Backbone and the penetration of the smart phones.

17. Post-completion phase will support the sustainability of the project's objectives:

- Through the SPIU the RCIPRW staff were retained and will continue to support the activities accomplished by RCIPRW including a smooth transfer to different responsible institutions and monitoring the warranty and after sale services from different contractors and vendors.
- The acquired international Bandwidth will be delivered until 2022. A management Memorandum of Understanding was signed between BSC Ltd and RDB to manage the bandwidth, the virtual landing point and the related contracts. Handover of the Wi-Fi network and equipment has been done between the project and respective universities and secondary schools at completion of installation, however a final handover is scheduled between RDB and the Ministry of Education.
- The project equipped 200 service access points across the country to facilitate the citizens to access the services offered online through the Rwanda online project and the handover was done between RDB and different district offices where the SAP are located. A final handover including a business management models will be done between RDB and the Ministry of Local Government.

18. Key lessons learned include:

- ICT is a constantly rapidly changing sector and related project design should take into consideration this nature both in determining the PDOs and designing the activities. At the same time, project midterm review to accommodate the changes of the overall ICT context should be taken into consideration. For the RCIPRW case the midterm review was not properly conducted and reported.
- Of the delays experienced during the RCIPRW project implementation, a big part is due to the processes of approval at different levels within the World Bank but also to misunderstanding between the World Bank and the

government to accommodate changes needed in the project in result to new development in the country context and policies. In the future the World Bank and the implementing agency should take the necessary actions on time in the interest of the project success.

Annex 6. Comments of Cofinanciers and Other Partners/Stakeholders

Not applicable

Annex 7. Overview of the telecom sector in Rwanda

1. The country's multi-sector regulator, Rwanda Utilities Regulatory Agency (RURA), was established in September 2001 under Law No.39/2001. It is responsible for the electricity, gas, transport, water and telecoms markets and is defined by law as a national institution with legal powers, autonomous administrative and financial management. RURA before they can start providing services. RURA's main objective in the telecoms sector is regulating operators and issuing licenses. In March 2013 Law No.9/2013 reviewed and updated Law No.39/2001, giving RURA the mandate to regulate telecoms, information technology, broadcasting and converging electronic technologies including the Internet and any other audiovisual information and communication technology, while also providing for the legal, financial and administrative autonomy of the authority.¹⁴

2. The GoR's first National ICT Plan, which concentrated on the creation of an environment to facilitate the development of ICT initiatives, was launched in 2000 and ran until 2005. The second (2006-10) placed an emphasis on the development of key ICT infrastructure such as the laying of fiber optic cables and other ICT infrastructures. The government's third National ICT Plan (NICI III, also known as NICI-2015) was unveiled in January 2011 with the aim of increasing access to Internet services across the country. The plan, which is scheduled to run from 2011 to 2015, focuses on service development across five areas: skills, the private sector, the community, e-Government and cyber security. With regards to the development of the community, the NICI III is focused on awareness of the availability and affordability of ICT services, especially in remote areas. Other targets of the five-year plan include the doubling of local and foreign investors in the ICT sector, and ensuring that all secondary schools and 50 percent of primary schools are connected to the internet. The plan will also encourage entrepreneurship in ICT by linking technical colleges, universities and the private sector.¹⁵

3. The Rwandan Information Technology Authority (RITA) was set up during NICI II as a statutory and autonomous national agency to act as the national ICT implementation and coordination body. RITA has since been replaced by the Rwanda Development Board-ICT Department (RDB-ICT). Its main responsibilities include: coordinating national ICT initiatives and projects; facilitating the implementation of NICI Plan programs; providing advisory and technical support services to the ministry as well as to public and private sector organizations; developing national ICT standards and guidelines; and providing public awareness and education role in the area of ICT.¹⁶

4. The GoR's ICT initiatives that aim to foster private sector development include several business and career development support services; online trade information portals; business incubators; online tax calculators; credit reference bureau; a land administration and management information system; electronic case management system; and improvements in online banking

¹⁴ TeleGeography

¹⁵ TeleGeography and MYICT

¹⁶ TeleGeography

and e-transaction regulatory system. These initiatives have greatly improved Rwanda's business environment. In 2010, Rwanda was the top global reformer in the World Bank's "Ease of doing business" ranking, moving up from 143rd in 2009 to 67th, the biggest jump ever recorded by any country. Online business registration was key to Rwanda's improved ranking in 2011, where it currently ranks 58th. Construction completion of publicly funded Business Development Centre - BDC (Telecenters) to support and improve the delivery of public and private sector services. Currently 30 BDCs are equipped with IT equipment and are operational.¹⁷

5. In November 2001 Law No.44/2001 was passed, which governs the country's telecoms sector and marks the beginning of its liberalization. The law states that all telecoms operators must receive a license from RURA before they can start providing services. As a result, there are four telecom operators in Rwanda: MTN, TIGO, BSC and Airtel.¹⁸

6. MTN Rwanda and Millicom Rwanda (Tigo) operate under unified licenses under a regime implemented in 2006, allowing them to operate in the wireline and wireless arenas, while state-owned New Artel has held a license to provide telecoms services to rural areas at subsidized rates since 2004 under the Universal Access. In June 2013 Liquid Telecom gained access to the Rwandan wireline and broadband markets by acquiring the fixed assets of incumbent telco Rwandatel for US\$4 million. Market leader MTN Rwanda claimed a subscriber base of 3.525 million as at 31 March 2014, up from 3.452 million one year earlier, and equivalent to a market share of 51.6 percent. Meanwhile, at the end of 1Q14 Tigo claimed 2.295 million users, making it the country's second largest wireless operators based on the number of subscribers.

7. The Government has taken some steps to improve Rwanda's extremely low broadband penetration; in October 2008 it signed a US\$40 million deal with South Korean incumbent telco KT Corp to construct a national fiber optic backbone throughout the country. KT agreed to supply and install a network comprising 2,300km of cable, which links 317 institutions (97 in Kigali and 220 outside the capital) in all 30 districts, and connect all nine of Rwanda's borders. Physical rollout of the backbone, which included cross-border fiber installation at the Uganda and Tanzania borders, was completed towards the end of 2010, and the network became fully operational by the end of April 2011. In 2007 KT was also contracted by the government to deploy a RWF4.5 billion 10,000-user capacity wireless broadband (WiBro) network in the capital Kigali, as well as the Kigali Metropolitan Network (KMN), a large fiber-optic computer network that spans the capital. The WiBro system was launched on a trial basis in December 2009, with Rwandatel acting as local partner. Meanwhile, the KMN was also launched in December 2009, increasing broadband availability to public institutions.¹⁹

8. Rwanda's landlocked location has meant that it has been largely frozen out of the boom that has seen a number of international submarine cables connect Africa to the rest of the world, and the government has been forced to rely on agreements with telecoms operators in its neighboring nations to connect to the likes of the Eastern African Submarine Cable System (EASSy), The East African Marine System (TEAMS) and SEACOM. In 2009, following RCIPRW appraisal and agreement on the inclusion of international capacity purchase in the

¹⁷ <http://www.myict.gov.rw/ict/documentation/tracing-major-developments-in-rwandas-ict-sector/>

¹⁸ TeleGeography

¹⁹ TeleGeography

project, Rwandatel and sister telco Uganda Telecom (UTL) agreed to purchase international broadband capacity from SEACOM, which in turn secured a backhaul solution for Rwanda on the two regional players' terrestrial networks between Ugandan capital Kampala and Kigali. Rwanda received 155Mbps of newly available broadband capacity in October 2009, when Rwandatel's connection to the cable system via microwave links was launched, enabling it to deliver high speed services to a growing number of clients without experiencing capacity problems. Furthermore, Rwandatel and UTL contracted Green Future in September 2009 to deliver SEACOM's fiber connection to both countries. In April 2012 the government announced that it had signed ten-year contract with Tanzania Telecommunications Company Limited (TTCL) for the provision of an additional 1.244Gbps of international bandwidth to improve the country's Internet connectivity, funded through RCIPRW.²⁰ Both connections came to the Virtual Landing Point (VLP) established under the project in the GoR's Telecom House. At this point, BSC was managing the internal backbone which was built by KT Corps and needed to distribute the new capacity split among the network in Kigali, the fiber optic under the GoR and the remaining 600 Mb, which was offered to the operators for purchase (Tigo, Airtel and other ISPs).

9. In 2012, MTN had its own capacity and retail operations. Meanwhile, Tigo and Airtel were selling retail 2G services and they needed last mile connections. They bought the excess capacity for their towers and set up wireless connections for phones. They brought their own towers and sold 2G at 256 kbps. But as the fiber ended at the district level, and not reaching all the towers. Therefore they needed to cover the remainder of their towers by cable to the wireless which required a different technology. This led to the introduction of 4G/LTE which can provide fiber speed on wireless connections. The RURA chose not to divide the available spectrum and therefore it offered the operators the option to form a consortium to share the spectrum along with other infrastructure. According to the GoR, the operators were not interested to pursue this option, hence RURA opened up the tender to an external bidder.

10. In March 2013 the RDB selected South Korea's KT Corp to establish a public-private joint venture company, dubbed Olleh Rwanda Networks (ORN) Ltd. The new partnership has developed and operates a nationwide 4G Long Term Evolution (LTE) network, as well as wholesale LTE infrastructure services to customer-facing telcos and mobile virtual network operators (MVNOs). KT controls the management of the firm, while the Rwandan government provides financial and administrative support. ORN is set to cover 95 percent of the population by 2017.

11. In January 2014 the government signed another agreement with KT Corporation, for the establishment of another joint venture, Rwanda Olleh Services (ROS) Ltd, which is responsible for improving the provision of online services in the country, such as ICT solutions for public and private institutions. These two joint ventures with Korea built on a series of partnership deals between Rwanda and KT Corp, with the South Korean telco previously collaborating with the government to launch wireless broadband 'WiBro' services and also to develop the country's fiber-optic backbone.

12. In contrast to the wireline and wireless sectors, regulation of broadband services in Rwanda remains limited, and internet service provider (ISP) licenses are awarded on an ad-hoc basis. At the end of March 2014 a total of nine companies had been licensed by RURA as ISPs, all of them operational at that date: state-owned New Artel (licensed in 2004), wireless network

²⁰ TeleGeography

operator MTN Rwanda (2006), ISPA (2006), mobile operator Millicom Rwanda (Tigo, 2008), fiber and wireless internet provider Broadband Systems Corporation (BSC, 2010), 4G Networks (2011), cellular market newcomer Airtel Rwanda (2011), Liquid Telecom (2013) and AXIOM (2013). MTN Rwanda and Tigo operate under unified licenses, allowing them to provide services in the wireline and wireless arenas; former state-owned incumbent Rwandatel was also in possession of a similar unified concession, although its mobile authorization was cancelled in April 2011 after it failed to meet license obligations.²¹

²¹ TeleGeography

Annex 8. ICT Glossary

Glossary of ICT terminology used by the Project and ICR

Term	Technical/Common Meaning
Application Architecture	Framework of strategies and plans for developing e-services. Not solely about ICT infrastructure to build online services but sets out all the structures – business processes as well as technology – for effective e-services.
CERT	Computer Emergency Response Team (for Internet) for computer security incidents
e-Government	“Digital interactions between a government and citizens, government and business/commerce, government and employees, and also government and government/agencies”. (Wikipedia)
e-Government Interoperability Framework (e-GIF)	is the UK eGovernment Interoperability Framework
Enterprise Architecture	High-level strategic technique to help senior managers achieve business and organizational change; a “coherent set/whole of principles, methods and models used in the design and realization of an enterprise’s organizational structure, business processes, information systems and infrastructure (Lankhorst et al, 2005).
e-Service	Role of technology in facilitating delivery of services. “.... deeds, efforts or performances whose delivery is mediated by IT including e-tailing, customer support and service delivery”. Three main components: service provider, service receiver, and service delivery (technology). (Wikipedia)
Government-wide Network (GovNet)	A communication Infrastructure aimed at connecting all government agencies onto a single shared and secured communication platform to promote eGovernment, enhance productivity within government and foster transparency in in governance.
Integrated Financial Management Information System (IFMIS)	An IT-based budgeting and accounting system that manages spending, payment processing, budgeting and reporting for governments and other entities. An IFMS bundles many essential financial management functions into one software suite. Benefits of using IFMIS include: <ul style="list-style-type: none"> •Enhanced management of cash, debt and liabilities •Ability to use historical information to provide better budget modeling processes •Reduced cost for financial transactions •Increased decision-making efficiency (Technopedia)).
International Public Sector Accounting Standards (IPSAS)	A set of accounting standards issued by the IPSAS Board for use by public sector entities around the world in the preparation of financial statements. These standards are based on International Financial Reporting Standards (IFRS) issued by the International Accounting Standards Board (IASB). (Wikipedia)
Interoperability Standards and Framework	Means to enable public administrations to collaborate; framework for ICT-enabled governance; not only a means of improving public services but of enabling multi-level governance; supports information sharing among ICT-enabled

	administrations including across borders. (Wikipedia)
LAN	Local Area Network
Mobile number portability regulations	Mobile number portability (MNP) enables mobile telephone users to retain their mobile telephone numbers when changing from one mobile network operator to another. (Source: Wikipedia)
National IT Architecture	Organized set of consensus decisions on policies and principles, services and common solutions, standards and guidelines as well as specific vendor products used by IT providers both inside and outside an IT entity. IT architecture is designed to plan, acquire, build, modify, interface and deploy IT resources throughout departments. – identifying technologies which work together to satisfy user needs. (Wikipedia).
Organizational Interoperability	Modeling organizational processes, aligning information architecture with organizational goals and helping these processes cooperate via ICT. Has specific relevance to e-government, i.e., not only technology but a broad concept of modernization of public administration including new skills and cultures. (Kubicek, Cimander and Scholl).
Payment gateway/e-payment platform	<p>A payment gateway is an e-commerce application service provider service that authorizes credit card payments for e-businesses, online retailers, bricks and clicks, or traditional brick and mortar.[1]</p> <p>A payment gateway facilitates the transfer of information between a payment portal (such as a website, mobile phone or interactive voice response service) and the Front End Processor or acquiring bank. (Wikipedia)</p>
Portal	A specially-designed web-page at a website which brings information together from diverse sources in a uniform way. Usually, each information source gets its dedicated area on the page for displaying information; the user can configure which ones to display. (Wikipedia)
Subscriber Identity Module (SIM) Registration Regulations	In general, the key objective of SIM card registration is to enhance the basic data collection of phone users, which could enhance the security as well as lead effective implementation of other value-added services such as Number Portability Service. In Ghana, the SIM card registration was implemented successfully.
Telecom Sector Roadmap	Technology/telecom roadmap is a plan that matches short-term and long-term goals with specific technology solutions to help meet those goals. Three major uses: helps reach consensus on a set of needs and technologies required to satisfy them; provides a mechanism to help forecast technology developments; and, provides a framework to help plan and coordinate technological developments.
WAN	Wide Area Network

Annex 9. List of Supporting Documents

Project Appraisal Document for a Regional Communications Infrastructure Project (Phase 2) – Rwanda Project (RCIPRW)

Implementation Support Reports for Regional Communications Infrastructure Project (Phase 2) – Rwanda Project (RCIPRW)

Aide Memoires prepared for Regional Communications Infrastructure Project (Phase 2) – Rwanda Project (RCIPRW)

Financial Agreement between the Government of Rwanda and the International Development Association for Regional Communications Infrastructure Project (Phase 2) – Rwanda Project (RCIPRW)

Project Implementation Manual for Regional Communications Infrastructure Project (Phase 2) – Rwanda Project (RCIPRW)

ICT for Burundi Communication Infrastructure Project (IDA-H2830)

ICR for Central Africa Backbone Project (IDA H6420)

M&E data from World Bank projects P094103 (Kenya), P094103 (Madagascar), P094103 (Burundi)

TeleGeography GlobeComms Report on Rwanda, 2014

