ENSURING AVAILABILITY AND SUSTAINABILITY OF WATER SUPPLY SERVICES THROUGH FULL LIFE CYCLE INVESTMENT PLANNING

Gicumbi District, Rwanda Case Study

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Water For People
WATER FOR PEOPLE IN RWANDA
A BRIEF ABOUT RWANDA

SIZE
26,338 sq. km

POPULATION
11.5 million

LIFE EXPECTANCY
64.5 years

POP. GROWTH RATE
(2016): 2.6%

GDP
US$826/capita

ADMINISTRATIVE DIVISIONS
4 provinces and City of Kigali
30 Districts (27 rural and 3 urban)
14,000 villages
GEOGRAPHICAL COVERAGE

- Registered in 2008
- Activities in Rulindo, Kicukiro and Gicumbi Districts targeting about 1 million people
- Two largest programs in terms of investment: Rulindo Challenge and Gicumbi WASH Programs
- Sanitation in seven districts in partnership with SNV and World Vision (USAID funded project)
- Sanitation marketing approaches in EF and non-EF districts
- Support Central Government
DISTRICT WIDE APPROACH
• The District Wide Approach (DWA) is a continuation of the Everyone Forever model at national level that seeks to provide systemic support to districts in their WASH service authority functions, while also recognizing the need for a strong supportive enabling environment at the national level.

• The DWA focuses on the district as the geographical entry point with the goal of the district having the systems, plans, finances, human resources, skills, knowledge, coordination and accountability mechanisms to achieve sustainable universal access.

• The DWA has been piloted in Rulindo, Gicumbi, Bugesera, Karongi, Ngorero, Nyamagabe, with the support of Water for People, WaterAid and WASAC.
Coordinated piloting of EF/ DWA in 5 districts
GICUMBI DISTRICT
The Gicumbi District is one of the 30 districts of Rwanda that assessed all required costs to ensure availability and sustainability of water supply services in the district.

These costs include:

i. Capital Expenditures (CapEx)
ii. Capital Maintenance Expenditures (CapManEx)
iii. Operational Expenditures (OpEx)
iv. Direct Support Cost (DSCExp)
v. Costs required for water resources management

Now the Gicumbi District is in the process of writing its full life cycle costing investment plan which will guide the district annual budgeting for water supply.
STEPS FOR DEVELOPING A WASH PLAN

**STEPS**

- Assessing services, assets and capacities
- Visioning and strategy development
- Estimating the costs of achieving the vision
- Identifying sources of funding
- Revisiting assumptions

**ACTIVITIES**

- Household survey
- Asset inventory
- District and service provider capacity assessment
- Engagement with district water office
- Discussion and questioning
- Calculation/projection of CapEx, OpEx CapManEx, DSexp
- Calculation/projection of tariffs, taxes and transfers for WASH in the district
- Engagement with district water office
- Discussion and questioning

**OUTPUTS**

- Service level mapping
- Asset registry
- Analysis of capacities and gaps
- Long term vision
- Approach to implementation
- Targets and milestones
- Individual costs
- Consolidated costs for achieving the vision
- Consolidated financial resources
- Gap between costs and resources
- Consolidated WASH plan
THE LIFE CYCLE COSTS

- CapEx
- OpEx
- Indirect Support
- Direct Support
- Cost of Capital
- CapManEx

SOURCES OF FINANCING

- Taxes
- Tariffs
- Transfers

The “3 Ts”
Identifying the funding gap between overall costs and financial resources
DATA COLLECTION

• **Service level assessment**
  • Done through AKVO FLOW
  • Used to check the baseline
  • Not used in the costing

• **Asset inventory**
  • Collected using AKVO FLOW by visiting all the existing water systems, component by component
  • Used to identify investments for costing capital maintenance needs

• **District capacity assessments**
  • Excel-based tool, capturing required staff, time dedication and skills
  • Used as input for calculating required direct support costs

• **Service provider assessment**
  • Done in five districts through interviews and guiding questions to POs
  • Answers helped to get operation and maintenance cost system by system

• **Water resources assessment**
  • A water resources management plan developed
  • Used to plan local protection works (CapEx) and larger catchment management that can be included in broader DDS
**TOOL USED**

- **Capital Expenditure**
  - Through detailed engineering design
  - Used freelance engineers
  - Used for 1) projecting investment costs and 2) fund mobilization

- **Operation and minor maintenance expenditure**
  - Used AtWhatCost model based on PO data

- **Capital maintenance expenditure**
  - Done through Excel tool using data from WASAC asset inventory

- **Direct support costs**
  - Done through Excel tool to calculate difference between actual and required staffs
  - What could be the cost implication in bringing more staffs

- **Water resources assessment**
  - A water resources management plan developed
  - Used to plan local protection works (CapEx) and larger catchment management that can be included in broader DDS

- **Consolidation of costs**
  - Excel sheet that draws on results of previous tools
  - Allows spreading costs over time
RESULTS
Gicumbi 2016 Water Service Level

- No Improved System: 5.3%
- Inadequate Level of Service: 4.2%
- Basic Level of Service: 6.7%
- Intermediate Level of Service: 38.3%
- High Level of Service: 45.6%
**Design parameters**

- Design period = 25 years starting in 2018
- Population growth = 3% (2019 – 2029), 2% (2029 – 2044)
- Population density = 6 people per household (HH)
- Leakage Factor = 15%
- Tap Run-Time per Day = 6 hours
- Peaking Factor (PF) = 4 (24 hours / Tap Run-Time per Day)
- Flow to Tap = [Peaking Factor] x [Average Daily Flow]
- Residual Pressure Head at Tap = 10 – 20 meters
- Friction coefficients:
  - For PVC, $n = 0.021$
  - For galvanized steel, $n = 0.02$ to 0.03
  - For cast iron/ductile iron, $n = 0.03$ to 0.035

**Data collected**

- Geographic coordinates of different existing water infrastructures and pipeline route
- Identification of water sources and estimation of their discharge using bucket and stopwatch
- Geographic coordinates of new and extensions water networks based on planned village settlement
- Shapefiles of administrative boundaries (NISR)
- Population data (district documents)
- Water Supply Standards from RBS
- Other similar studies
• 92 water supply systems have been designed
• 29 systems are new water systems
• 51 are to be totally rehabilitated
• 11 are partial rehabilitations
• 17 pumping water systems
• 75 gravity systems
• One reinforcement of Gicumbi city water supply network

The total cost is 42,220,896,838 Frw equivalent to $45 million
• Used AtWhatCost tool developed by Water For People and IRC
• Interviews with POs
• Filled out with general information about expenses, costs of investment in the system (calculated to determine the cost of minor replacement)
• Detailed calculation of all the projected costs for a certain period, differentiated between operation and maintenance, minor repairs, and major repairs/rehabilitations
• Gicumbi has two private operators: Ayateke Star Company and PAKAAM Ltd
• Both manage 21 water supply systems
• Both use the same tariffs and will get a new system to manage as soon as they are completed
Gicumbi OpEx Assessment

Year | Amount
--- | ---
2017 | RWF 150,000,000.00
2018 | RWF 200,000,000.00
2019 | RWF 250,000,000.00
2020 | RWF 300,000,000.00
2021 | RWF 350,000,000.00
2022 | RWF 400,000,000.00
2023 | RWF 450,000,000.00
• Used an Asset Registry tool used to identify, catalog, and classify all water systems within a district.

• It helps to flag, prioritize, and classify different water systems within a district based on risk and need for repair.

• For prioritization, the following areas are considered:
  o Age of water system components
  o Physical state of water system components
# Physical State

**Definition**

**Life cost cycle step**

<table>
<thead>
<tr>
<th>Physical State</th>
<th>Definition</th>
<th>Life cost cycle step</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>The current physical state does not impact the functionality of the particular component. Minor repairs and/or more in-depth maintenance might be needed to prevent future problems, but these deficiencies that will need eventual repairs do not inhibit the functionality of a component at the time of the assessment.</td>
<td>OpEx Minor Repair</td>
</tr>
<tr>
<td>Poor</td>
<td>The current physical state is such that the functionality of that component is impacted and inhibited. The component will need repairs or replacement to function at full capacity.</td>
<td>CapManEx Major Repair</td>
</tr>
<tr>
<td>Does not function</td>
<td>The component is not functional whatsoever given the significance of the repairs needed and is likely impacting the overall function of the water system itself. It will need full-scale replacement or rehabilitation, or large-scale repair to function again.</td>
<td>CapManEx Construction/Replacement</td>
</tr>
</tbody>
</table>
CAPITAL MAINTENANCE COST ASSESSMENT

Cost reference units
Two types of cost are provided:

- **Overview of the investment needed for CapManEx based on physical state**
  
  When the physical state of a component is considered “poor” or “does not function” the tool considers the cost of major repair or construction/replacement respectively from the cost reference units. This is generally true, but there are exceptions noted in the CapManEx categories tab, such as tap stands, which are always OpEx even if the condition is poor/does not function.

- **Overview of the investment needed for CapManEx based on remaining useful time**
  
  When the physical state of a component is considered “normal”, the tool considers the cost of construction/replacement for that component and projects it into the corresponding year of replacement. The reference design lifetime information is obtained through a reference sheet tab.
Overview of the investment needed for CapManEx
This tool is used to evaluate if the district has the required resources (financial & human) to ensure sustainability of WASH services.
Gicumbi District developed district water supply sources management plans to ensure sustainability of water supply services.

The study showed a perceived imbalance between water demand and supply in some sectors (administrative entities).

Water quality results showed that among the seven parameters tested, total coliforms were observed in most of the springs and lower values of pH.

The study recommended agroforestry with progressive terraces/cutoff drains, agroforestry with cutoff drains/horizontal trenches, agroforestry with radical terraces/gully treatment, forest plantations, and natural forests as collection measures at catchment levels.

Diversion ditches, fences, planting, eucalyptus removal, and progressive terraces were recommended at immediate sources catchment level.

To deal with the water quality aspect, the studies recommended installation of chlorination units (as disinfection facilities) and pH regulators.

The water resources management plan implementation cost for immediate source catchment level were imbedded in the water system capital investment cost. The collective measures at catchment level were recommended to the Gicumbi District and the Ministry of Environment for consideration in their annual planning for ecosystem protection.
The tool used aggregates all costs calculated in separate tools at district level and provides an overview of all expenditure required to provide and maintain water services for the coming 10 years.

<table>
<thead>
<tr>
<th>Service provider</th>
<th>CapEx + WRMP</th>
<th>CapManEx</th>
<th>OpEx</th>
<th>DSexp</th>
</tr>
</thead>
<tbody>
<tr>
<td>WASAC utility</td>
<td>Entity: WASAC Dvpt, Source: Central government transfers, Local taxes and District development partners</td>
<td>Entity: WASAC Dvpt, Source: Central government transfers, Local taxes and District development partners</td>
<td>Entity: WASAC utility, Source: Tariff</td>
<td>Entity: District, Source: Central government transfers, Local taxes, Royalties and District development partners</td>
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<tr>
<td>Private operator</td>
<td>Entity: WASAC Dvpt, District, Source: Central government transfers, Local taxes and District development partners</td>
<td>Entity: WASAC Dvpt, District, Source: Central government transfers, Local taxes and District development partners</td>
<td>Entity: PO, Source: Tariff</td>
<td>Entity: District, Source: Central government transfers, Local taxes, Royalties and District development partners</td>
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<tr>
<td>Community/Individual</td>
<td>Entity: WASAC Dvpt, District, Source: Central government transfers, Local taxes and District development partners</td>
<td>Entity: WASAC Dvpt, District, Source: Central government transfers, Local taxes and District development partners</td>
<td>Entity: community, Source: Tariff</td>
<td>Entity: District, Source: Central government transfers, Local taxes, Royalties and District development partners</td>
</tr>
</tbody>
</table>
## CONSOLIDATED COST

<table>
<thead>
<tr>
<th>Year</th>
<th>Gap</th>
<th>Tariff</th>
<th>Royalties</th>
<th>OpEx</th>
<th>Local taxes</th>
<th>District development partners</th>
<th>DirSup</th>
<th>Central government transfers</th>
<th>CapManEx</th>
<th>CapEx</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
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<tr>
<td>2020</td>
<td>1.5E+09</td>
<td>500000000</td>
<td>2.5E+09</td>
<td>4.5E+09</td>
<td>6.5E+09</td>
<td>8.5E+09</td>
<td>1.05E+10</td>
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</tr>
</tbody>
</table>

Source:
- Gap
- Tariff
- Royalties
- OpEx
- Local taxes
- District development partners
- DirSup
- Central government transfers
- CapManEx
- CapEx
Findings and Recommendations

• The district has secured all the funds for all the new infrastructure, but it has a gap in 2025 due to the construction of a new treatment plant
• The tariff will fully cover OpEx and no gap was observed in the 10 years
• The district does not allocate budget for capital replacement cost and should start planning for that based on the result of the capital maintenance cost
• The district needs to increase the number of staff and budget to cover the gap identified in the Direct Support cost
• The full life cycle costing investment planning should be undertaken in all remaining districts of the country