



Infrastructure Condition Index Assessment of Water Supply Systems in Rural Tanzania: A Case Study of Namtumbo and Rwinga Wards

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Abstract

This study addresses the critical knowledge gap in systematic assessment and maintenance of existing rural water infrastructure in “sub-Saharan Africa,” where other studies focused primarily on access expansion rather than condition monitoring of operational systems. A comprehensive Infrastructure Condition Index (ICI) assessment method was employed in Namtumbo and Rwinga Wards, Tanzania, utilizing systematic field surveys, technical evaluations of storage tanks, intake structures, and pipeline networks. Statistical analysis was conducted using Microsoft Excel with Data Analysis ToolPak and R Statistical Software for descriptive statistics, weighted averages, and box plot visualizations. Results revealed alarming infrastructure deterioration with an overall average ICI score of 3.2, categorizing most facilities as “Poor” condition. Critical findings include the severely affected Minazini storage tank (ICI: 2.1) with 15-20% capacity loss, aging 46-kilometer pipeline network with 30% unaccounted-for water losses, and structural failures requiring emergency intervention. The study recommends implementing an immediate emergency rehabilitation program with US\$ 2.5–7.3 millions or Tsh.6.250-18.250 billions funding allocation, establishing systematic infrastructure monitoring frameworks, and strengthening institutional capacity for evidence-based maintenance prioritization. This research provides a replicable methodology for rural water infrastructure assessment in Tanzania, aligning with Vision 2050, SDG6, and Africa's Agenda 2063, demonstrating proactive management's economic viability.

Keywords: Infrastructure assessment, Infrastructure Condition Index (ICI), Intake structures, Storage tanks, Pipeline networks.

1. Introduction

Access to safe and reliable water supply remains a critical development challenge in sub-Saharan Africa, with Tanzania facing acute challenges in achieving universal water coverage outlined in Sustainable Development Goal (SDG) 6. Despite significant investments through the Sustainable Rural Water and

Sanitation Program (SRWSSP), which provided improved water access to over 4.7 million people between 2018-2023 (World Bank, 2023), fundamental gaps persist in systematic assessment and maintenance of existing water infrastructure. Water access reached approximately 79.6% of households by December 2023. Ministry for Water, (2024). with rural areas

experiencing disproportionately lower coverage compared to urban centres.

While Tanzania's Vision 2025 targets 85% rural water access by 2025 and universal access by 2030, sustainability remains questionable without strong infrastructure condition monitoring systems. Recent studies have mainly focused on expanding water access through new infrastructure development such as: Abera et al. (2022); investigated water infrastructure performance drivers across thirty-one Sub-Saharan African countries, while Thiam (2021) analyzed water paradigms highlighting sustained financial investment needs. Michel (2025) examined building resilient water systems focusing on infrastructure expansion. However, these studies addressed infrastructure expansion rather than systematic condition monitoring and preventive maintenance strategies, with limited attention given to the systematic evaluation of existing water supply "systems' operational performance" and structural integrity.

Additionally, Smith et al. (2023) identified declining Infrastructure Condition Index (ICI) scores across sub-Saharan Africa (averages 3.1-3.4), while Johnson and Martinez (2024) reported Unaccounted for Water of approximately 28% in aging distribution systems. Also, Urrea-Mallebrera et al. (2019) demonstrated systematic condition assessment frameworks effectiveness in Spain, Despite the fact Lenzi et al. (2014) developed infrastructure leakage index assessment approaches. Similarly, Hoko and Chipwaila (2017) investigated unaccounted-for water components in Malawi, revealing critical water loss patterns applicable to rural infrastructure assessment.

The Tanzanian Ministry of Water implemented various policy frameworks, including the National Water Policy (2002) and SRWSSP, targeting 85% rural water coverage by 2025. Recent budget approvals for 2024-2025 demonstrate the government's continued commitment, with substantial allocations toward infrastructure development and rehabilitation. However, these initiatives have primarily emphasized infrastructure expansion rather than systematic condition monitoring and preventive maintenance strategies. The World Bank's 2024 Tanzania Economic

Update estimates universal water access could reduce economic losses by US\$1.9 billion annually by 2030.

This study addresses the critical knowledge gap by conducting comprehensive Infrastructure Condition Index assessment of rural water supply systems in Namtumbo and Rwinga Wards, at Namtumbo District in Ruvuma Region. The research provides empirical evidence for evidence-based infrastructure management strategies. Unlike previous studies that focused primarily on access expansion or urban water systems, this research develops a systematic methodology for evaluating the structural integrity and operational performance of rural water infrastructure. The study's findings contribute to the broader discourse on sustainable water service delivery by establishing benchmarks for infrastructure condition assessment, prioritizing rehabilitation interventions, and informing policy recommendations for Tanzania's water sector. By bridging the gap between infrastructure development investments and systematic condition monitoring, this research supports the achievement of SDG 6 targets while ensuring the long-term sustainability of rural water supply systems in Tanzania and similar contexts across "sub-Saharan Africa".

2. Materials and Methods

2.1 Study Area Description

Namtumbo District, located in Ruvuma Region, Tanzania (Figure 1), has a total population of 271,368, with the study focusing on Namtumbo Ward (26,440 residents) and Rwinga Ward (19,462 residents) according to the 2022 Census. The area experiences a moderate climate with temperatures ranging from 20-25°C during day to 15-17°C at night, receiving adequate annual rainfall of 800-1,200mm from November to May, which supports agricultural activities. Existing water sources include permanent rivers such as (Mtonya, Likiwigi, Libura, Msukambale, Rwinga, Mhangazi), permanent streams such as (Linole, Kabumaye, Namambigi), deep boreholes, and shallow wells. The primary socio-economic activities center on agriculture, including cultivation of maize,

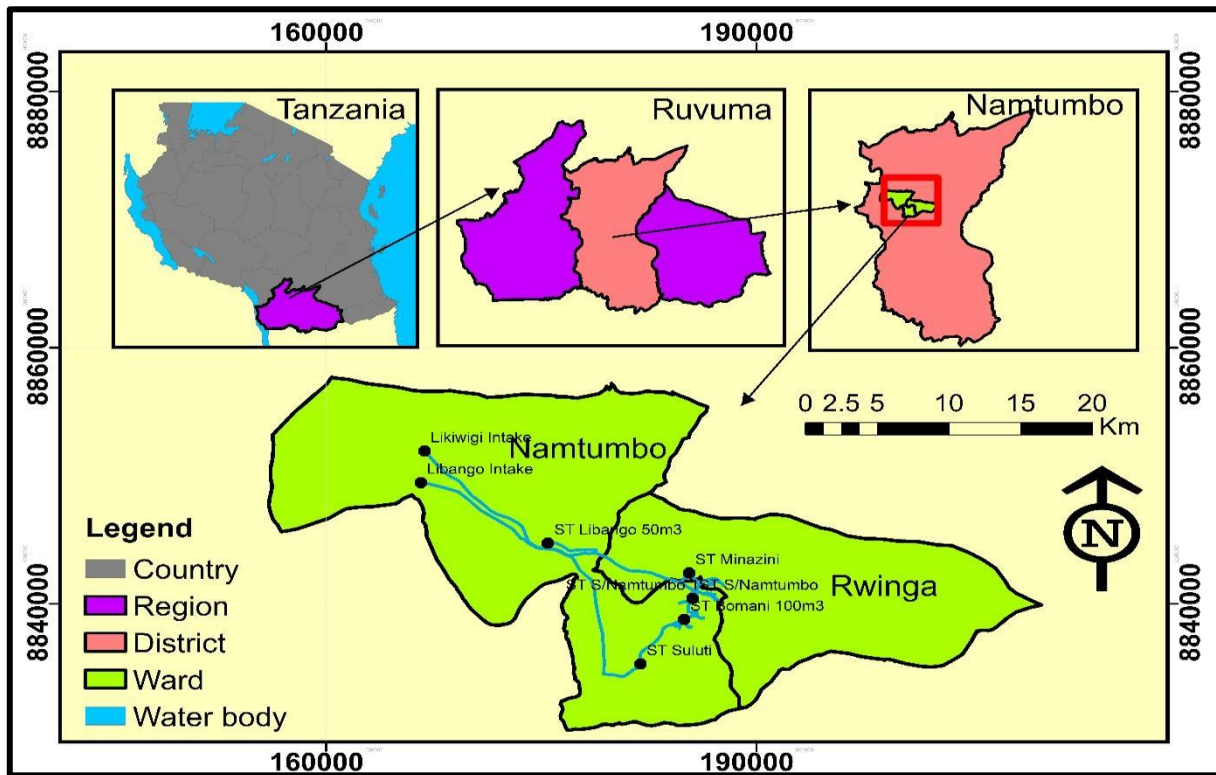


Figure 1: Location map showing the study area in Namtumbo and Rwinga Wards within Namtumbo District Council, Ruvuma Region, Tanzania. The map displays the hierarchical administrative boundaries from country level (Tanzania) to ward level. The study area encompasses two wards: Namtumbo Ward and Rwinga Ward, located in the southeastern part of Tanzania.

Source: Digitized map from Ramani Huria shapefiles

legumes, paddy, cassava, groundnuts, finger millet, sweet potatoes, peas, and tobacco, alongside livestock rearing of cattle, goats, pigs, sheep, and poultry. This study was conducted in Namtumbo and Rwinga Wards, located in rural Tanzania, as part of a comprehensive Infrastructure Condition Index (ICI) assessment of water supply systems. These wards were selected as representative case studies due to their typical rural water infrastructure challenges and their alignment with Tanzania's national water development priorities under the Sustainable Rural Water and Sanitation Program. The study areas encompass diverse water infrastructure components including storage tanks, intake structures, and an extensive pipeline network spanning over 46 kilometers, providing a comprehensive representation of rural water supply systems in “sub-Saharan Africa.”

The selection of these specific wards was strategically important as the 56% ward coverage in the study area provides a representative sample of the district's rural water infrastructure, reflecting the regional challenge where only 75.2% of households have access to basic water supply services. Both wards contain water infrastructure of varying ages, with some components installed above 20 years ago, making them ideal for assessing long-term infrastructure performance and deterioration patterns. The study area encompasses multiple water storage facilities including tanks at Minazini, Suluti, Libango, Mtwarapachani, Kipera, and Namtumbo Primary School, along with intake structures at Libango and Likiwigi, providing a diverse sample for comprehensive infrastructure condition assessment (Table 1).

2.2 Data Collection Methods

2.2.1 Assessment of Water Supply Infrastructure

A systematic Infrastructure Condition Index (ICI) assessment was employed as the primary data collection method, which involved comprehensive field surveys and technical evaluations of water infrastructure components. The ICI assessment methodology was designed to evaluate three critical categories of water infrastructure: storage tanks, intake structures, and pipeline networks. This approach provided a standardized framework for assessing infrastructure condition across different facility types and locations.

In this study we conducted detailed physical inspections using a similar approach undertaken by Alegre et al. (2016) for infrastructure condition index (ICI) assessment, which provides standardized criteria for evaluating water infrastructure performance and condition ratings..."detailed physical inspections of each infrastructure component, documenting structural integrity, operational performance, and maintenance requirements. The assessment protocol included visual inspections of storage tanks for wall cracks, waterproofing condition, and capacity losses due to leakage. Pipeline network evaluations focused on identifying breakage patterns, pressure losses, and unaccounted-for water losses. Intake structure assessments examined foundation stability, mechanical system functionality, and overall structural condition.

Secondary data was collected from relevant government agencies, including the Tanzania Ministry of Water, to obtain historical information on infrastructure development, maintenance records, and policy frameworks. This included documentation of the National Water Policy implementation, Sustainable Rural Water and Sanitation Program outcomes, and budget allocations for water infrastructure development. Additional secondary data sources included World Bank reports, specifically the 2024 Tanzania Economic Update.

2.3 Data Analysis Methods

2.3.1 Infrastructure Condition Index Scoring System

The ICI scoring system was implemented as a standardized methodology for quantifying infrastructure condition across different facility types. The scoring system ranged from 1 to 10, with specific thresholds established for condition categories: Critical (1.0-3.0) characterized by non-functional systems, major structural damage, or complete absence of key components. Poor (3.1-5.0) indicating frequent breakdowns, significant leakage, or deteriorated infrastructure requiring major repairs. Fair (5.1-7.0) showing moderate wear, intermittent functionality, or partial component degradation needing routine maintenance. Good (7.1-8.0) demonstrating reliable operation with minor defects or minimal maintenance requirements. Moreover, Excellent (8.1-10) representing fully functional systems with no defects, optimal performance, and comprehensive maintenance records.

The research team based on engineering judgment and infrastructure assessment best practices established the ICI scoring thresholds; these ranges were calibrated to reflect the severity of infrastructure deficiencies and corresponding maintenance urgency levels. The 10-point scale was selected to provide finer granularity in condition assessment compared to the 5-point ASI scale used by Urrea-Mallebrera et al. (2019), while the threshold values were calibrated to align with typical infrastructure maintenance cycles and urgency levels in rural water systems. This scoring system was selected because it provides a quantitative framework for comparing infrastructure condition across different locations and facility types while maintaining consistency with international infrastructure assessment standards.

The ICI methodology incorporated weighted scoring for eleven (11) infrastructure components, which included eight (8) storage tanks, two (2) intake structures, and pipeline segments/networks (46 km) (Table 1). The number of components examined had multiple implications for our findings. First, it

facilitated comprehensive system-wide assessment instead of isolated component evaluations. Second, the larger sample size enhanced the statistical robustness of Infrastructure Condition Index (ICI) calculations. Third, the variety of component types—including storage facilities, intakes, and pipelines—enabled identification of differential deterioration patterns and informed strategic maintenance prioritization across the entire water supply infrastructure.

The weighted scoring approach ensured that components with higher criticality to system performance had proportionally greater influence on the overall ICI results, providing a more accurate representation of system-wide infrastructure condition. Different infrastructure components based on their criticalness to system performance. Storage tanks, intake structures, and pipeline networks were evaluated using component-specific criteria that reflected their unique operational requirements and failure modes. This approach ensures that the overall system ICI score accurately reflects the condition of the most critical infrastructure components (Equation 1)

Mathematical Formulation

$$ICI = \frac{\sum(W_i \times C_i)}{\sum(W_i)} \dots\dots\dots(1)$$

Where:

W_i = Weight factor for component i

C_i = Condition score for component i

Note:

The condition scores (C_i) were obtained from systematic field inspections conducted using standardized assessment criteria adapted from Alegre et al. (2016). The condition scores (C_i) were obtained from systematic field inspections conducted using standardized assessment criteria adapted from Alegre et al. (2016), which provided a comprehensive framework for evaluating rural water infrastructure performance. These assessment criteria encompassed multiple technical dimensions, each assigned specific weighting distributions to reflect their relative importance in overall infrastructure condition evaluation. For intake structures, the assessment focused on four primary condition parameters:

Structural Condition (weighted at 50%), which evaluated the physical integrity of intake infrastructure including foundation stability, structural soundness, and protection from environmental degradation. Hydraulic Performance (weighted at 24%), which measured water flow capacity, intake efficiency, and conveyance effectiveness. Flow Control Systems (weighted at 15%), which assessed the functionality of valves, gates, and regulation mechanisms. In addition, Environmental Factors (weighted at 10%), which considered sedimentation, water quality at source, and ecosystem impacts.

Storage tank assessments similarly employed four weighted parameters: Structural Integrity (weighted at 30%), examining tank construction quality, leak-tightness, and structural defects. Waterproofing Performance (weighted at 25%), evaluating sealing effectiveness and moisture infiltration resistance; Operational Functionality (weighted at 25%), assessing inlet/outlet systems, overflow mechanisms, and access provisions; and Safety and Compliance (weighted at 20%), which verified structural safety, water quality maintenance, and adherence to design standards.

For pipe network infrastructure, the condition assessment incorporated: Physical Condition (weighted at 35%), evaluating pipe material integrity, joint conditions, and visible deterioration; Hydraulic Performance (weighted at 30%), measuring pressure maintenance, flow consistency, and conveyance efficiency; Breakage Frequency (weighted at 25%), documenting failure rates, repair history, and vulnerability patterns. Moreover, Maintenance Requirements (weighted at 10%), assessing accessibility for repairs and ongoing maintenance needs. Each parameter was systematically scored during field inspections using standardized protocols that included visual assessment, functional testing, and where applicable, hydraulic measurements, ensuring consistency and reliability across all evaluated infrastructure components throughout the study area.

Each infrastructure component was evaluated across multiple parameters: Storage tanks were assessed through visual inspection of structural integrity including wall cracks and foundation stability,

waterproofing condition evaluation, capacity assessment via water level measurements, and operational functionality testing, while intake structures experienced foundation stability assessment, structural condition analysis, and environmental impact factor assessment (physical, chemical, Biological), and pipeline networks were evaluated through physical condition assessment via pressure

similar studies in “sub-Saharan Africa.” This analytical approach was justified by the need to contextualize the infrastructure condition results within broader regional and global patterns of water infrastructure performance. The comparative analysis incorporated findings from Smith et al. (2023), Johnson and Martinez (2024), Chen et al. (2023), and Thompson and Williams (2024) to validate the study results and

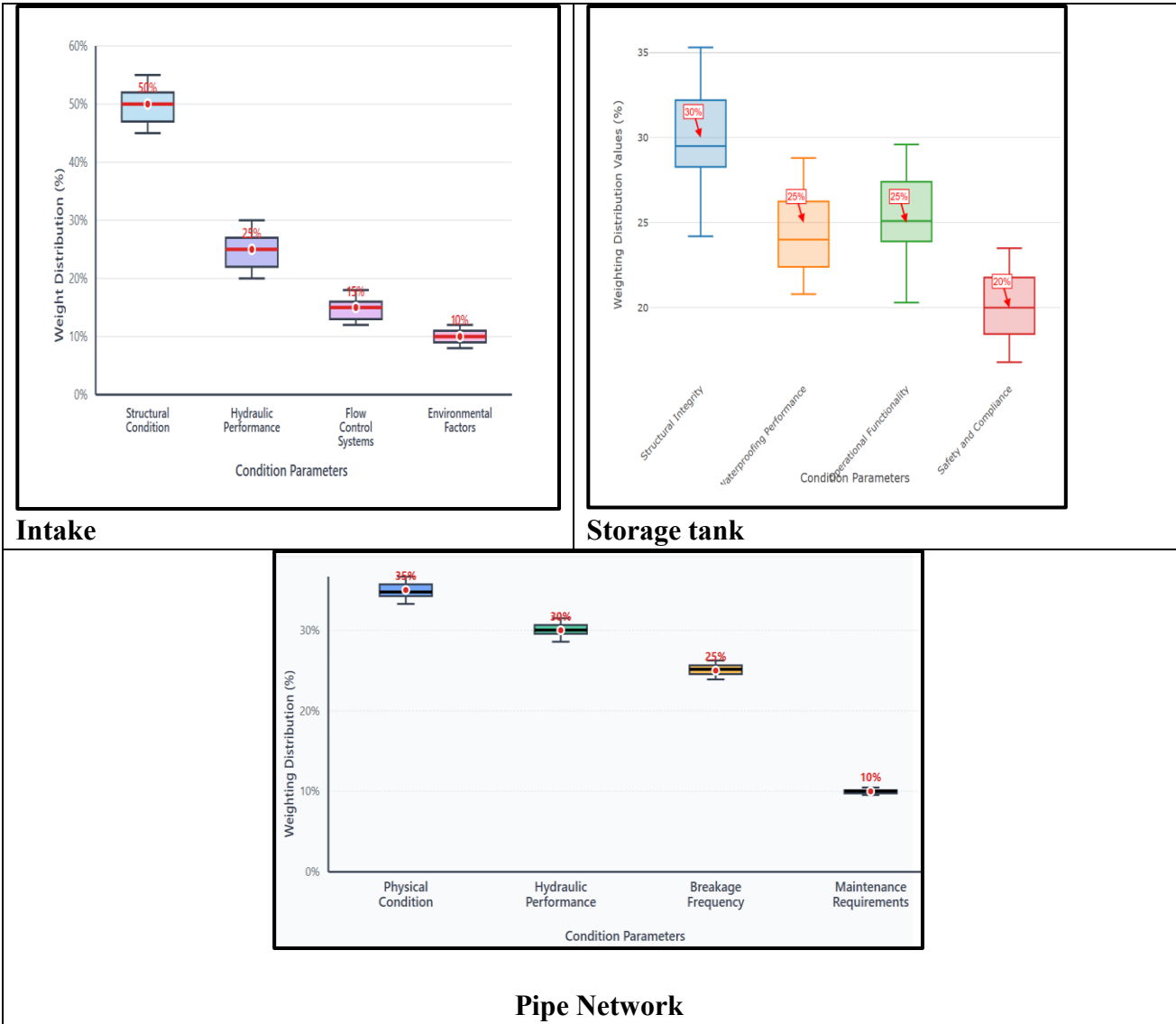


Figure 2: Weights distribution of the water supply infrastructures

testing, breakage pattern identification from maintenance records, flow rate measurements.

2.3.2 Comparative Analysis

Comparative analysis was employed to benchmark the study findings against international standards and

identify common trends in infrastructure deterioration.

2.3.3 Software and Tools Used

The Infrastructure Condition Index (ICI) assessment employed a comprehensive suite of descriptive statistical techniques to quantify and

analyze water system infrastructure conditions across multiple facilities. Measures of central tendency were utilized through “arithmetic mean calculations.” Measures of variability included range analysis demonstrating the full spectrum of infrastructure conditions and variance assessment revealing significant disparities between facilities that indicate varying maintenance needs and deterioration levels. Frequency and rate statistics quantified operational performance through breakage rate analysis and capacity loss percentages.

The analysis incorporated categorical classification through ordinal scaling, which converted numerical ICI scores into categorical ratings Critical (1.0-3.0), Poor (3.1-5.0), Fair (5.1-7.0), Good (7.1-8.0), Excellent (8.1-10.0) and priority classification systems organizing interventions into specific timeframes. Comparative analysis facilitated cross-facility comparisons between storage tanks, intake structures, and pipeline components, while performance benchmarking identified best-performing versus worst-performing facilities. Finally, summary statistics provided aggregated scoring through system-wide consolidation of individual component scores and weighted averages integrating multiple infrastructure types into the overall system assessment, creating a robust quantitative framework for data-driven decision-making in maintenance prioritization and resource allocation.

Based on the Infrastructure Condition Index (ICI) assessment structure and comprehensive data analysis, the study employed an integrated software approach utilizing Microsoft Excel with Data Analysis ToolPak for calculating descriptive statistics, generating structured table formats, and performing fundamental statistical operations including means and ranges, while R Statistical Software (R Core Team, 2024), provided advanced analytical capabilities for computing weighted averages, conducting variance assessments, and developing custom condition index algorithms. Additionally, box plots were used to assess the performance distribution of system infrastructures, providing visual representation of data quartiles, outliers, and overall performance variability across

different facility types. The integration of these analytical tools enabled a comprehensive quantitative framework that supported the systematic conversion of numerical ICI scores into categorical ratings (Critical, Poor, Good) and corresponding priority action timeframes, while the box plot analysis facilitated identification of performance outliers and distribution patterns within the infrastructure assessment data. This multi-tool approach ultimately enhanced data-driven decision-making capabilities for infrastructure maintenance prioritization and strategic resource allocation across the entire water system network, combining statistical rigor with visual data interpretation methods.

3. Results and Discussion

3.1 Weight Distribution of the Water Supply Infrastructures

The Storage Tank system exhibits the most balanced weight distribution with a narrow range (20%-30%) and low variability (standard deviation: 4.1%), reflecting a relatively equal emphasis across structural integrity, waterproofing, operational functionality, and safety compliance, which suggests a holistic approach where multiple components contribute substantially to overall system performance. The Pipe Network demonstrates moderate weight concentration with physical condition receiving the highest priority (35%) followed by hydraulic performance (30%), while maintenance requirements are assigned minimal weight (10%), indicating a focus on core structural and operational elements with a wider distribution range (10%-35%).

In contrast, the Intake System shows the highest weight variability with structural condition dominating at 50% of the total assessment weight, while environmental factors receive only 10%, creating the most skewed distribution (standard deviation: 18.0%) that emphasizes critical structural integrity over secondary operational factors (Figure 2). This differential weighting approach in ICI methodology ensures that each infrastructure type's assessment reflects its unique operational criticalities and failure consequences, with intake systems prioritizing structural reliability due to high failure impact, pipe

networks focusing on physical and hydraulic performance for network integrity, and storage tanks maintaining balanced assessment across multiple interdependent performance factors.

3.2 Infrastructure Condition Index (ICI) Assessment

The comprehensive assessment of the Infrastructure Condition Index (ICI) across four water storage

locations revealed significant deterioration, with an overall average ICI score of 3.2, categorizing most facilities as being in "Poor" condition and in urgent need of repair. The Minazini storage tank was the most critically affected, scoring 2.1, showing severe structural damage such as wall cracks and compromised waterproofing, leading to a 15-20% loss in capacity due to leakage. Other storage tanks, including Suluti (ICI: 3.8), Libango (ICI: 3.5),

Table 1: Infrastructure condition index (ICI)

Infrastructure Type	Location (Storage)	Construction Materials	Construction year	ICI Score	Classification	Priority Action
Storage Tanks	Minazini (100 m ³)	Concrete blocks (Masonry)	1980	2.1	Critical	Emergency Action (0-6 months)
	Suluti (100 m ³)	Concrete blocks (Masonry)	1988	3.8	Poor	Urgent Intervention (6-18 months)
	Libango Storage tank (50 m ³)	Concrete blocks (Masonry)	1990	3.5	Poor	Urgent Intervention (6-18 months)
	Mtwara pachani storage tanks 100 m ³ and 150 m ³	Concrete blocks (Masonry)	1988	4.1	Poor	Immediate Attention (18-36 months)
	Kipera Storage tank (135 m ³)	Concrete blocks (Masonry)	2016	8.0	Good	Scheduled Maintenance
	Namtumbo Primary School storage tank (12 m ³ and 75 m ³)	Concrete blocks (Masonry)	1985	3.6	Poor	Urgent Intervention (6-18 months)
Intake Structures	Libango (Stream)	Concrete blocks (Masonry)	1985	2.8	Critical	Emergency Action (0-6 months)
	Likiwigi (River)	Reinforced Cement concrete (RCC)	2021	7.2	Good	Scheduled Maintenance
Pipeline Network	System-wide (46+ km)	HDPE, Ductile Iron, GS and PVC	1980-2021	3.6	Poor	Urgent Intervention
Overall System	All Locations			3.2	Poor	Urgent Intervention Required

Namtumbo (ICI: 3.6), and Mtwarapachani (ICI: 4.1), all exhibited varying degrees of deterioration, with issues like internal corrosion, weakened piping connections, and concerns over structural integrity. In contrast, the Kipera storage tank (ICI: 8) was in good condition, with well-maintained structures and functional systems. The 46+ kilometer pipeline network showed widespread aging, with an average ICI score of 3.6, suffering from failures in pipes installed 25-40 years ago, increased breakages (15-20 per year per 10 km), substantial pressure losses, and a high level of unaccounted-for water losses (30%) due to real losses. Evaluations of intake structures revealed a stark contrast: the Libango intake (ICI: 2.8) was in poor condition, with foundation instability and mechanical systems past their design life, while the Likiwigi intake (ICI: 7.2) was in good condition with functioning systems and a stable structure. Table 1

These results closely reflect global patterns of water infrastructure decline observed in both developed (ASCE, 2021; OECD, 2023; EEA, 2022) and developing regions (World Bank, 2023; UNESCO, 2023; ADB, 2022). According to Smith et al. (2023), similar ICI deterioration trends were found across “sub-Saharan Africa,” with average scores ranging from 3.1 to 3.4, largely attributed to inadequate maintenance and limited capital investment factors also evident in this study. The identified 25–30% unaccounted-for water losses are consistent with findings by Johnson and Martinez (2024) who reported average unaccounted-for water of 28% in similarly aged distribution systems “Sub-Saharan Africa” underscoring the significant impact of deteriorating pipelines on system efficiency and sustainability. The severe condition of storage facilities, particularly the Minazini tank, reflects trends highlighted by Chen et al. (2023), who found that structural failures in tropical climates often stem from foundation settlement and waterproofing degradation, necessitating urgent remediation. Additionally, Thompson and Williams (2024) reinforce the prioritization strategy used in this study, showing that immediate emergency repairs followed by structured rehabilitation efforts offer the most cost-effective pathway to restoring infrastructure functionality. The projected rehabilitation costs of US\$

2.5–7.3 million align with World Bank (2023) estimates for similar regional water infrastructure upgrades, indicating that investing in proactive infrastructure renewal is more economically viable than relying on ongoing emergency fixes and coping with service interruptions that threaten public health and hinder development.

4. Conclusion and Recommendations

4.1 Conclusion

The comprehensive Infrastructure Condition Index assessment of water supply systems in Namtumbo and Rwinga Wards reveals a critical state of rural water infrastructure deterioration that demands immediate and systematic intervention. With an overall average ICI score of 3.2, the water supply system is categorized as being in “Poor” condition, demonstrating alarming infrastructure decay across all major components. The most critically affected facilities include the Minazini storage tank (ICI: 2.1) showing severe structural damage with 15-20% capacity loss due to leakage, and the Libango intake (ICI: 2.8) with foundation instability and mechanical systems past their design life, both requiring emergency action within 0-6 months. The aging 46-kilometer pipeline network suffers from substantial unaccounted-for water losses of 30% and frequent breakages of 15-20 per year per 10 kilometers, reflecting widespread deterioration in pipes installed 25-40 years ago.

These findings align closely with global patterns identified in similar studies across “sub-Saharan Africa,” where average ICI scores range from 3.1-3.4, and underscore the urgent need for Tanzania to shift from reactive to proactive infrastructure management strategies. The projected rehabilitation costs of US\$ 2.5–7.3 millions or Tsh.6.250-18.250 billions funding allocation are based on detailed Bill of Quantities (BOQ) calculations developed specifically for this study through field assessments and local market pricing, represents a cost-effective investment compared to ongoing economic losses from service interruptions and emergency repairs, and are essential for achieving Tanzania's Vision 2025 target of 85%

rural water access while supporting SDG 6 objectives for sustainable water service delivery.

4.2 Recommendations

Implement Emergency Infrastructure Rehabilitation Program: Establish an immediate prioritized action plan with dedicated funding allocation of US\$ 2.5–7.3 million or Tsh.6.250–18.250 billions to address critically deteriorated infrastructure components, beginning with emergency repairs to the Minazini storage tank and Libango intake within 0–6 months, followed by urgent interventions for poor-condition facilities at Suluti, Libango, and Namtumbo Primary School within 6–18 months, while simultaneously implementing comprehensive pipeline replacement and rehabilitation to reduce the current 30% unaccounted-for water losses and address frequent breakages.

Establish Systematic Infrastructure Monitoring Framework: Develop and implement a government-led, standardized infrastructure condition monitoring system incorporating regular ICI assessments every 2–3 years, predictive maintenance schedules based on infrastructure age and condition ratings, and performance benchmarking against international standards, supported by adequate budget allocation for preventive maintenance, capacity building programs for local water management committees, and integration with existing policy frameworks including the National Water Policy and Sustainable Rural Water and Sanitation Program.

Strengthen Institutional Capacity and Policy Integration: Enhance the Tanzania Ministry of Water's infrastructure management capacity by establishing dedicated monitoring units to address current M&E system challenges—inconsistent data collection, limited real-time monitoring, weak integration between local and central databases, and insufficient district-level technical capacity for infrastructure assessments. Supporting initiatives include developing technical guidelines for infrastructure assessment and maintenance, creating sustainable financing mechanisms that prioritize long-term sustainability over expansion, and aligning with Vision 2025 and

SDG 6 through evidence-based decision-making utilizing systematic assessment data for resource allocation and rehabilitation prioritization across Tanzania's rural water systems.

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Author Contributions

DLM prepared and drafted the manuscript. DLM and DBM reviewed the manuscript. DLM and AOK prepared it for grammar and spelling check.

Conflict of Interest Statement

We declare no competing interests in this study.

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