



Methodological Evaluation of Municipal Water Systems in Rwanda: A Randomized Field Trial for System Reliability Assessment

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Abstract

This study examines the methodological challenges in evaluating municipal water systems in Rwanda, focusing on reliability assessment through a randomized field trial. A randomized field trial was conducted across five municipalities. A binomial distribution model will be used to estimate the proportion of reliable water supply, with a confidence interval set at 95% to account for sampling variability. This study highlights the importance of rigorous methodological approaches in assessing municipal water system reliability. The use of a randomized field trial provides a more accurate reflection of real-world conditions compared to traditional survey methods. Future research should consider implementing similar trials in other Rwandan municipalities and exploring additional factors that influence water supply reliability, such as infrastructure age and maintenance frequency. The empirical specification follows $Y = \beta_{0+\beta} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Sub-Saharan, African, SpatialStatistics, RandomizedControlledTrial, WaterDistribution, SystemsAnalysis, NetworkTheory, GeographicInformationSystems*

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