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Methodological Evaluation of Municipal Water Systems in Tanzania: A Randomized Field Trial on Efficiency Gains

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Abstract

Municipal water systems in Tanzania face challenges related to efficiency and sustainability, impacting both service delivery and community well-being. A stratified random sampling approach was employed to select representative communities for intervention. Water flow rates were monitored using automated sensors and data loggers over a six-month period. Statistical analysis included linear regression models with robust standard errors to assess the impact of interventions on water efficiency. The randomized trial revealed an average increase in water flow rate by 15% when equipped with automated monitoring devices, suggesting potential for improved service delivery and cost savings. This study provides a rigorous framework for assessing municipal water system performance using modern data collection techniques and statistical methods. Communities should consider implementing automated monitoring systems to optimise their water distribution networks and improve overall efficiency. The empirical specification follows $Y = \beta_{0+\beta}^{\rightarrow} p\, X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Tanzania, GIS, SWOT analysis, stratified sampling, econometrics, water footprint, sustainability indicators*

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