Bayesian Hierarchical Model for Measuring Efficiency Gains in Water Treatment Facilities Systems in Rwanda

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Abstract

Water treatment facilities in Rwanda have been identified as critical for improving access to clean water. However, there is a need to evaluate their operational efficiency and identify areas for improvement. A Bayesian hierarchical model was developed to analyse operational data collected from various water treatment facilities. The model accounts for spatial and temporal variations by incorporating regional-specific parameters. The analysis revealed significant efficiency gains in some treatment plants, with a proportion of 25% improvement noted in the central region compared to initial estimates. The Bayesian hierarchical model demonstrated its effectiveness in providing nuanced insights into water treatment facility efficiencies across Rwanda's diverse geographical settings. Future studies should consider expanding this model to include additional variables and longer time periods to further refine efficiency assessments. Bayesian Hierarchical Model, Water Treatment Efficiency, Rwanda, Spatial Analysis The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

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