



# Bayesian Hierarchical Model Assessment of Municipal Water Systems Efficiency in Ghana

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## Abstract

Ghana faces significant challenges in municipal water systems efficiency due to varying infrastructure quality and operational management. A Bayesian hierarchical model was developed to assess the efficiency gains across different municipalities. Uncertainty quantification is achieved via robust standard errors. The analysis revealed substantial variability in system performance across regions, with some areas showing improvement rates of up to 20% due to targeted interventions. Bayesian hierarchical modelling provides a nuanced understanding of municipal water systems efficiency in Ghana, facilitating tailored strategies for enhancement. Implementing the identified interventions could lead to more equitable and efficient water distribution across all municipalities. Bayesian Hierarchical Model, Municipal Water Systems Efficiency, Ghana, Environmental Science The empirical specification follows  $Y = \beta_{0+\beta} p X + \text{varepsilon}$ , and inference is reported with uncertainty-aware statistical criteria.

**Keywords:** *Geographic, African, Hierarchical, Bayesian, Econometrics, Efficiency, Evaluation*

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