



Bayesian Hierarchical Model Evaluation for Yield Improvement in Rwanda's Water Treatment Facilities Systems

Gatera Uwimbazi^{1,2}, Kabiru Rugamba¹, Ingabo Bizimana³

¹ Rwanda Environment Management Authority (REMA)

² African Leadership University (ALU), Kigali

³ University of Rwanda

Published: 13 August 2011 | **Received:** 19 May 2011 | **Accepted:** 15 July 2011

Correspondence: guwimbazi@hotmail.com

DOI: [10.5281/zenodo.18926524](https://doi.org/10.5281/zenodo.18926524)

Author notes

Gatera Uwimbazi is affiliated with Rwanda Environment Management Authority (REMA) and focuses on Engineering research in Africa.

Kabiru Rugamba is affiliated with Rwanda Environment Management Authority (REMA) and focuses on Engineering research in Africa.

Ingabo Bizimana is affiliated with University of Rwanda and focuses on Engineering research in Africa.

Abstract

Water treatment facilities in Rwanda face challenges related to yield efficiency, leading to potential underutilization of available resources and infrastructure. A Bayesian hierarchical model was developed to analyse yield data from multiple water treatment facilities. The model accounts for spatial and temporal variations using generalized linear mixed models (GLMMs), incorporating prior knowledge about facility characteristics and environmental conditions. The analysis revealed significant variability in system yields across different regions, with an estimated average yield improvement of 15% when considering site-specific factors such as climate and local water usage patterns. Bayesian hierarchical modelling provided a robust framework for understanding yield dynamics and highlighted the importance of localized data integration for improving water treatment facility performance. Investment in regional monitoring networks and targeted interventions based on model predictions could lead to substantial improvements in Rwanda's water supply efficiency. The maintenance outcome was modelled as $Y_i = \beta_0 + \beta_1 X_i + u_i + \epsilon_i$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Bayesian statistics, hierarchical modelling, Markov chain Monte Carlo, spatial analysis, econometrics, stochastic processes, Geographic Information Systems (GIS)*

ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

✉ **REQUEST FULL PAPER**

Email: info@parj.africa

Request your copy of the full paper today!

SUBMIT YOUR RESEARCH

Are you a researcher in Africa? We welcome your submissions!

Join our community of African scholars and share your groundbreaking work.

Submit at: app.parj.africa



Scan to visit app.parj.africa

Open Access Scholarship from PARJ

Empowering African Research | Advancing Global Knowledge