Bayesian Hierarchical Model Evaluation of Municipal Infrastructure Asset Systems in Ethiopia: A Comparative Study

Hailu Abate[1], Yilfin Girma[1,2], Negusse Molla[3,4], Fikru Gebreab[1]

[1] Ethiopian Institute of Agricultural Research (EIAR)

[2] Bahir Dar University

[3] Department of Sustainable Systems, Bahir Dar University

[4] Department of Civil Engineering, Haramaya University

Author notes

Hailu Abate is affiliated with Ethiopian Institute of Agricultural Research (EIAR) and focuses on Engineering research in Africa.

Yilfin Girma is affiliated with Bahir Dar University and focuses on Engineering research in Africa.

Negusse Molla is affiliated with Department of Sustainable Systems, Bahir Dar University and focuses on Engineering research in Africa.

Fikru Gebreab is affiliated with Ethiopian Institute of Agricultural Research (EIAR) and focuses on Engineering research in Africa.

Abstract

The study examines municipal infrastructure asset systems in Ethiopia, focusing on their reliability under varying conditions. A novel Bayesian hierarchical model is employed to assess system reliability. This approach allows for the integration of different types of data, including historical performance metrics and predictive models. The analysis revealed significant variability in asset performance across different regions within Ethiopia, indicating the need for targeted interventions. This study provides a robust framework for assessing municipal infrastructure reliability that integrates both empirical data and expert knowledge. Policy makers should consider implementing regional-specific strategies to enhance infrastructure resilience based on this model's findings. Bayesian hierarchical models, municipal infrastructure, asset systems, Ethiopia, system reliability The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Ethiopia, Hierarchical Modelling, Bayesian Statistics, Reliability Analysis, Asset Management, Methodology, Quantitative Methods*

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