

AFRICAN CIVIL ENGINEERING JOURNAL

ISSN: XXXX-XXXX | Peer-Reviewed | Open Access

Bayesian Hierarchical Modelling of Municipal Infrastructure Asset Adoption Rates in Senegal

A Methodological Evaluation Dataset (2000–2026)

DOI: [10.5281/zenodo.18967418](https://doi.org/10.5281/zenodo.18967418) | Received: 20 December 2000 | Accepted: 27 February 2001 |
Published: 23 April 2001

Mamadou Ndiaye¹|Aïssatou Diagne^{1,2}

¹ Institut Pasteur de Dakar

² African Institute for Mathematical Sciences (AIMS) Senegal

Correspondence: mndiaye@yahoo.com

DOI: [10.5281/zenodo.18967418](https://doi.org/10.5281/zenodo.18967418)

Received: 20 December 2000 | Accepted: 27 February 2001

ABSTRACT

Background: Municipal infrastructure asset management in developing nations often relies on aggregated national statistics, which obscure sub-national variation and hinder localised planning. A methodological gap exists for robust, probabilistic models that can estimate adoption rates of diverse infrastructure systems at the municipal level while accounting for spatial and temporal heterogeneity.

Purpose and objectives: This Data Descriptor presents a structured dataset and methodological framework for evaluating municipal infrastructure adoption. The primary objective is to provide a reproducible, Bayesian hierarchical modelling approach to estimate and project adoption rates for water, sanitation, and transport assets, enabling uncertainty quantification for engineering decision-making.

Keywords: Bayesian hierarchical modelling, municipal infrastructure, asset management, Sub-Saharan Africa, adoption rates, developing nations, methodological evaluation

Article Highlights

- Bayesian hierarchical logistic growth model estimates municipal-level adoption rates.
- Dataset integrates national surveys, municipal records, and engineering project inventories.
- Method quantifies uncertainty in projections, with credible intervals widening over time.
- Framework captures significant spatial clustering in infrastructure adoption trajectories.

Core Statistical Model

$\text{logit}(p_{\{ijt\}}) = \alpha_j + \beta_{\{1i\}} X_{\{ijt\}} + \varepsilon_{\{ijt\}}$, where $\alpha_j \sim \text{Normal}(\mu_\alpha, \sigma_\alpha)$ are municipality-level random effects.

This Data Descriptor presents a reproducible methodological framework and dataset.

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