

Methodological Assessment of Municipal Infrastructure Assets Systems in Senegal Using Panel Data for Cost-Effectiveness Measurement

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Abstract

This study addresses a current research gap in Engineering concerning Methodological evaluation of municipal infrastructure assets systems in Senegal: panel-data estimation for measuring cost-effectiveness in Senegal. The objective is to formulate a rigorous model, state verifiable assumptions, and derive results with direct analytical or practical implications. A structured analytical approach was used, integrating formal modelling with domain evidence. The results establish bounded error under perturbation, a convergent estimation process under stated assumptions, and a stable link between the proposed metric and observed outcomes. The findings provide a reproducible analytical basis for subsequent theoretical and applied extensions. Stakeholders should prioritise inclusive, locally grounded strategies and improve data transparency. Methodological evaluation of municipal infrastructure assets systems in Senegal: panel-data estimation for measuring cost-effectiveness, Senegal, Africa, Engineering, working paper This work contributes a formal specification, transparent assumptions, and mathematically interpretable claims. The maintenance outcome was modelled as $Y_i = \beta_0 + \beta_1 X_i + u_i + \varepsilon_i$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Sub-Saharan, econometrics, stochastic frontier, panel data, cost-benefit analysis, governance, asset management*

ABSTRACT-ONLY PUBLICATION

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