



Time-Series Forecasting Model for Cost-Efficient Municipal Infrastructure Asset Management in South Africa

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Abstract

This case study focuses on municipal infrastructure asset management in South Africa, aiming to improve cost-effectiveness through advanced forecasting models. A time-series forecasting model was developed and applied to historical data from South African municipalities. Machine learning techniques were used to predict future costs based on current and past performance indicators. The model demonstrated a significant reduction in predicted maintenance costs by up to 15% over the next five years, with trends indicating consistent seasonal variations in infrastructure usage. The findings suggest that time-series forecasting can be an effective tool for municipal asset management, potentially saving substantial resources and improving financial planning. Municipalities should adopt this model to forecast costs more accurately and allocate budgets accordingly. Further research is recommended to validate these predictions across different regions. Infrastructure Management, Cost Forecasting, Time-Series Analysis, South Africa The maintenance outcome was modelled as $Y_t = \beta_0 + \beta_1 X_t + u_t + \epsilon_t$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *South Africa, Geographic Information Systems (GIS), Asset Management, Time-Series Analysis, Forecasting Models, Econometrics, Cost-Benefit Analysis*

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