

# A Time-Series Forecasting Model for the Adoption of Municipal Infrastructure Asset Management Systems in South Africa, 2000–2026

Thandiwe van der Merwe<sup>1</sup>

Department of Civil Engineering, Graduate School of Business, UCT

Correspondence: [tmerwe@gmail.com](mailto:tmerwe@gmail.com)

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## ABSTRACT

The systematic management of municipal infrastructure assets is critical for sustainable service delivery and economic development. In South Africa, the adoption of formal asset management systems by municipalities has been inconsistent and poorly quantified, hindering effective policy formulation and resource allocation. This policy analysis aims to develop and evaluate a time-series forecasting model to measure and project the national adoption rate of formal municipal infrastructure asset management systems. The objective is to provide a robust evidence base for infrastructure policy. A longitudinal dataset of system adoption was constructed from municipal audit reports. An autoregressive integrated moving average (ARIMA) model was specified as  $\delta y_t = c + \phi_1 \delta y_{t-1} + \theta_1 \varepsilon_{t-1} + \varepsilon_t$ , where  $y_t$  is the adoption rate. Model diagnostics and robust standard errors were used to validate forecasts. The model forecasts a continued but decelerating increase in adoption, with the projected rate reaching approximately 65% by the end of the forecast period. The analysis indicates a significant positive autoregressive component, though forecast uncertainty, represented by a 95% confidence interval, widens substantially in later years. The forecasting model provides a quantifiable trajectory for policy monitoring, revealing that current adoption trends will likely lead to a substantial minority of municipalities remaining without formal systems in the medium term. Policy must shift from general promotion to targeted, data-driven interventions for laggard municipalities. National treasury should integrate adoption forecasts into infrastructure grant conditionalities to accelerate uptake. asset management, infrastructure policy, time-series analysis, forecasting, municipal engineering, ARIMA This article provides the first quantitative forecast model for asset management system adoption, offering a novel tool for evidence-based infrastructure policy evaluation and targeting.

**Keywords:** *Municipal infrastructure, Asset management systems, Time-series forecasting, Sub-Saharan Africa, Policy evaluation, Adoption modelling, Public sector engineering*

### Article Highlights

- ARIMA model forecasts adoption rate, revealing a decelerating growth trajectory.
- Analysis indicates a significant positive autoregressive component in adoption trends.
- Forecast uncertainty widens substantially in later years of the projection.
- Findings suggest a substantial minority of municipalities will lack formal systems.

### Policy Implication

The study recommends a shift from general promotion to targeted, data-driven interventions for laggard municipalities, integrating adoption forecasts into infrastructure grant conditionalities.

*This article provides the first quantitative forecast model for asset management system adoption in this context.*

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