



Methodological Evaluation of Regional Monitoring Networks in South Africa Using Time-Series Forecasting Models for Cost-Effectiveness Assessment

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Abstract

Regional monitoring networks in South Africa aim to enhance cost-effectiveness through data-driven decision-making. However, their effectiveness varies widely and lacks a standardised method for evaluation. A scoping review approach was employed to systematically identify and analyse existing literature on regional monitoring networks in South Africa. Time-series forecasting models were used to assess cost-effectiveness across various regions. Our analysis indicates that time-series forecasting can effectively measure the cost-effectiveness of these networks, with some regions showing significant reductions in operational costs by over 20%. The use of time-series forecasting models provides a robust method for evaluating regional monitoring networks' impact on cost-efficiency. This approach offers valuable insights for policymakers and practitioners seeking to optimise public sector operations. Policymakers should consider implementing standardised methods for monitoring network evaluation, such as the one proposed in this review, to ensure consistent and reliable data-driven decisions across different regions. Model estimation used $\hat{\theta} = \underset{\theta}{\operatorname{argmin}} \sum_{i=1}^n (y_i - f(\theta; \xi_i))^2 + \lambda \|\theta\|_1$, with performance evaluated using out-of-sample error.

Keywords: *Sub-Saharan, econometrics, time-series, spatial analysis, model validation, regionalization, cost-benefit*

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