



A Scoping Review of Methodological Frameworks for Time-Series Forecasting in Municipal Water Risk Reduction

Diagnostics for South African Systems (2021–2026)

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ABSTRACT

Background: Municipal water systems are critical for agricultural resilience, yet face escalating pressures from climate variability and demand growth. Effective risk reduction hinges on robust forecasting methodologies, but a synthesis of applicable frameworks for local contexts is lacking.

Purpose and objectives: This scoping review aims to identify, map, and evaluate methodological frameworks for time-series forecasting applied to municipal water risk reduction, with a diagnostic focus on applications relevant to the agricultural sector.

Methodology: The review followed a structured, five-stage scoping framework. Peer-reviewed literature and technical reports were systematically identified from major scholarly databases. Included records were charted and analysed thematically to synthesise methodological approaches, model diagnostics, and implementation contexts.

Keywords: *time-series forecasting, water risk reduction, methodological frameworks, municipal water systems, Southern Africa*

Article Highlights

- SARIMA models with climate variables dominate current forecasting approaches
- Model performance highly sensitive to input data quality
- Prediction intervals widen substantially under non-stationary drought conditions
- Critical gap exists in frameworks tailored for data-sparse agricultural contexts

Diagnostic Insight

The review identifies seasonal autoregressive integrated moving average (SARIMA) models integrated with exogenous climate variables as the dominant methodological approach, with performance heavily dependent on data quality.

This scoping review synthesizes methodological frameworks for time-series forecasting in municipal water risk reduction.

ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

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