Methodological Evaluation and Time-Series Forecasting of Water Treatment Systems Adoption in Ethiopia (2000–2026)

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ABSTRACT

Background: The expansion of water treatment infrastructure is critical for public health and development. In Ethiopia, significant investment has been made, yet a robust methodological framework for evaluating system performance and forecasting future adoption is lacking, hindering strategic planning.

Purpose and objectives: This study aims to develop and validate a methodological framework for evaluating water treatment systems and to construct a time-series forecasting model for national adoption rates, providing a tool for evidence-based infrastructure planning.

Keywords: *Water treatment infrastructure, Sub-Saharan Africa, Time-series analysis, Adoption forecasting, Methodological evaluation, Sustainable development goals*

Article Highlights

• Methodological evaluation reveals systemic gaps in operational monitoring protocols.
• ARIMA modelling provides statistically sound basis for predicting adoption trends.
• Forecast uncertainty widens notably in later projection stages.
• Integrated framework combines system evaluation with statistical forecasting.

Forecasting Model Specification

ARIMA(1,1,1) model: $\Delta y_t = \phi_1 \Delta y_{t-1} + \theta_1 \epsilon_{t-1} + \epsilon_t$, with parameters estimated via maximum likelihood.

This study presents the first integrated evaluation and forecasting framework for Ethiopian water treatment infrastructure.

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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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