AFRICAN STRUCTURAL ENGINEERING

METHODOLOGY PAPER

A Methodological Framework for Time-Series Forecasting of Water Treatment Yield in Ethiopia (2000–2026)

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ABSTRACT

Background: Forecasting the yield of water treatment facilities is critical for infrastructure planning and resource management in developing nations. Existing models often lack the methodological rigour to account for the specific operational and climatic variabilities encountered in such contexts, leading to unreliable projections.

Purpose and objectives: This article presents a novel methodological framework for generating robust, long-term forecasts of water treatment yield. The primary objective is to provide a replicable procedure for evaluating system performance and measuring potential yield improvement.

Keywords: *Time-series forecasting, Water treatment yield, Sub-Saharan Africa, Methodological framework, Infrastructure planning, Resource management*

Article Highlights

- Integrates ARIMAX modelling with exogenous climatic and operational covariates.
- Provides a replicable procedure for evaluating system performance and measuring potential yield improvement.
- Projects an upward trend in potential yield with quantified forecast uncertainty.
- Designed for application in data-scarce and variable operational contexts.

Methodological Contribution

Presents a statistically robust ARIMAX-based framework, formalised with maximum likelihood estimation and 95% prediction intervals, specifically designed for forecasting in data-scarce environments.

This framework offers a replicable tool for engineering planners conducting baseline assessments.