



Time-Series Forecasting Model for Yield Improvement in South African Process-Control Systems: A Methodological Evaluation

Zanele Ngwenya^{1,2}, Siyavhuza Mthethwa^{2,3}, Naledi Khumalo^{4,5}, Makhathini Gqozi^{2,6}

¹ University of Venda

² University of Limpopo

³ South African Institute for Medical Research (SAIMR)

⁴ Department of Sustainable Systems, University of Limpopo

⁵ Department of Civil Engineering, South African Institute for Medical Research (SAIMR)

⁶ Department of Mechanical Engineering, University of Pretoria

Published: 25 September 2010 | **Received:** 30 July 2010 | **Accepted:** 05 September 2010

Correspondence: zngwenya@outlook.com

DOI: [10.5281/zenodo.18913442](https://doi.org/10.5281/zenodo.18913442)

Author notes

Zanele Ngwenya is affiliated with University of Venda and focuses on Engineering research in Africa.

Siyavhuza Mthethwa is affiliated with University of Limpopo and focuses on Engineering research in Africa.

Naledi Khumalo is affiliated with Department of Sustainable Systems, University of Limpopo and focuses on Engineering research in Africa.

Makhathini Gqozi is affiliated with Department of Mechanical Engineering, University of Pretoria and focuses on Engineering research in Africa.

Abstract

Process-control systems in South Africa are employed to optimise yield in agricultural settings. However, their effectiveness varies widely and lacks a standardised method for forecasting yield improvements. We developed a novel time-series forecasting model to predict yield outcomes. The methodology involved collecting historical data from multiple agricultural sites across South Africa, applying advanced statistical techniques such as ARIMA (AutoRegressive Integrated Moving Average) for analysis. Our findings indicate that the ARIMA model significantly improved forecast accuracy by reducing prediction errors by an average of 15% compared to existing methods. This precision is crucial for resource allocation and policy formulation in agricultural sectors. The robustness of our time-series forecasting model validates its utility in enhancing yield improvement predictions, offering a methodological framework that can be replicated across diverse agricultural settings in South Africa. Aimed at policymakers, we recommend the adoption of this forecasting tool to inform strategic decisions regarding investment and resource allocation for maximum efficiency in agricultural processes. The maintenance outcome was modelled as $Y_t = \beta_0 + \beta_1 X_t + u_t + v \epsilon_t$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Sub-Saharan, econometrics, ARIMA, machine learning, forecasting, intervention analysis, stochastic processes*

ABSTRACT-ONLY PUBLICATION

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

✉ **REQUEST FULL PAPER**

Email: info@parj.africa

Request your copy of the full paper today!

SUBMIT YOUR RESEARCH

Are you a researcher in Africa? We welcome your submissions!

Join our community of African scholars and share your groundbreaking work.

Submit at: app.parj.africa



Scan to visit app.parj.africa

Open Access Scholarship from PARJ

Empowering African Research | Advancing Global Knowledge