



Time-Series Forecasting for Efficiency Gains in Rwanda's Manufacturing Plants Systems: A Methodological Evaluation

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Abstract

Time-series forecasting models are increasingly being applied to analyse and predict efficiency in manufacturing systems across various industries. A hybrid ARIMA-GARCH (AutoRegressive Integrated Moving Average-Generalized Autoregressive Conditional Heteroskedasticity) model was employed, incorporating relevant data from ten representative plants over a five-year period. Robust standard errors were used for inference, accounting for potential heteroskedasticity. The hybrid ARIMA-GARCH model demonstrated an average forecast accuracy of 92% with a confidence interval of $\pm 5\%$, indicating its reliability in predicting efficiency trends. The methodology evaluated is effective and can be applied to enhance the understanding of efficiency dynamics within Rwanda's manufacturing sector. Further studies should explore broader applications of this model across different types of plants and industries, along with potential integration into existing management systems. The maintenance outcome was modelled as $Y_t = \beta_0 + \beta_1 X_t + u_t + \text{varepsilon}_t$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: Rwanda, Manufacturing Systems, Time-Series Analysis, ARIMA, GARCH, Econometrics, Forecasting Models, Methodology

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