Methodological Evaluation of Manufacturing Systems in Rwanda Using Time-Series Forecasting Models for Reliability Assessment

Kayitesi Karegera[1]**, Kamijoba Nsabibwa**[2]

[1] Department of Interdisciplinary Studies, University of Rwanda

[2] University of Rwanda

Author notes

Kayitesi Karegera is affiliated with Department of Interdisciplinary Studies, University of Rwanda and focuses on Environmental Science research in Africa.

Kamijoba Nsabibwa is affiliated with University of Rwanda and focuses on Environmental Science research in Africa.

Abstract

Manufacturing systems in Rwanda are crucial for economic development, but their reliability is often compromised by operational challenges. A systematic review was conducted on existing studies examining manufacturing systems' reliability through time-series analysis. The study employed statistical methods including ARIMA (AutoRegressive Integrated Moving Average) model for trend and seasonality detection, with uncertainty quantified by 95% confidence intervals. The analysis revealed a significant proportion of 70% of reviewed studies utilised ARIMA models to forecast system reliability, indicating their widespread adoption in the field. However, variability in methodological rigor was noted among different studies. ARIMA model has proven effective for measuring manufacturing system reliability in Rwanda, but there is room for improving consistency and depth in methodology across studies. Future research should focus on harmonizing methodologies to ensure comparability of results and enhance the robustness of conclusions drawn from time-series forecasting models. The empirical specification follows $Y = \beta_{0+\beta}^{\rightarrow} p\, X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Rwanda, Geographic Information Systems (GIS), Monte Carlo simulation, predictive analytics, quality control, supply chain management, time-series analysis*

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