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Methodological Evaluation and Time-Series Forecasting for Manufacturing Yield Improvement in Ghana (2000–2026)

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ABSTRACT

Persistent inefficiencies in manufacturing output constrain industrial development in many emerging economies. A systematic, data-driven approach to yield forecasting is required to inform capital investment and process optimisation decisions within the sector. This report aims to methodologically evaluate production systems and develop a robust forecasting model to predict manufacturing yield trends, thereby providing a quantitative tool for performance improvement. A time-series analysis was conducted on aggregated national manufacturing output data. The core forecasting model employed is an ARIMA(1,1,1) process defined by $Yt = \mu + phi1\,Y\{t-1\} + theta1\,\varepsilon\{t-1\} + epsilont$, where parameters were estimated using maximum likelihood. Model diagnostics included checks for residual autocorrelation and stationarity. The model forecasts a moderate but sustained upward trajectory in aggregate manufacturing yield, with a projected increase of approximately 18% over the forecast horizon. Forecast uncertainty, represented by the 95% prediction interval, widens notably in later periods, indicating reduced confidence in long-term point estimates. The implemented time-series model provides a viable, evidence-based tool for anticipating yield trends, highlighting both potential gains and increasing uncertainty in longer-term projections. Manufacturing firms should integrate similar forecasting methodologies into their operational planning. Subsequent research should disaggregate the analysis by sub-sector to identify specific drivers of yield improvement. manufacturing yield, time-series forecasting, ARIMA modelling, industrial efficiency, production systems This work provides a novel application of a classical time-series methodology to a longitudinal national manufacturing dataset, demonstrating its utility for strategic planning within an industrialising context.

Keywords: *Manufacturing yield improvement, Time-series forecasting, Sub-Saharan Africa, Industrial systems evaluation, Data-driven methodology, Production efficiency*

Article Highlights

- Applies ARIMA(1,1,1) modelling to national manufacturing data for yield forecasting.
- Projects an 18% aggregate yield increase but notes growing long-term uncertainty.
- Provides a quantitative, evidence-based tool for industrial planning in Ghana.
- Highlights the need for sub-sector analysis to identify specific improvement drivers.

Forecast Insight

Model diagnostics confirm a viable forecasting tool, yet the widening 95% prediction interval underscores the challenge of long-term precision in evolving industrial systems.

This analysis offers a methodological framework applicable to other industrialising contexts.