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Methodological Evaluation and Time-Series Forecasting Model for Manufacturing Systems Adoption in Tanzania (2000–2026)

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ABSTRACT

The adoption of advanced manufacturing systems in developing economies is a critical driver of industrialisation, yet there is a paucity of robust, quantitative methodologies to forecast adoption rates and evaluate systemic integration. This gap hinders evidence-based policy and investment planning in the engineering sector. This data descriptor presents a novel methodological framework for evaluating manufacturing systems and a corresponding time-series forecasting model designed to measure and predict adoption rates. The objective is to provide a replicable analytical tool for engineers and policymakers. The methodology integrates a system readiness assessment with an autoregressive integrated moving average (ARIMA) model, specified as $\varphi(B)(1 - B)^d y_t = \theta(B)\epsilon_t$, where y_t is the adoption rate. Model parameters were estimated using maximum likelihood, and forecasts were generated with 95% confidence intervals to quantify uncertainty. The application of the framework indicates a positive, non-linear trajectory for systems adoption, with the forecast suggesting a potential increase in the adoption rate of computer-aided technologies to approximately 34% by the end of the forecast horizon. The model's robustness was confirmed through sensitivity analysis. The developed framework provides a statistically rigorous and practically applicable tool for forecasting technological adoption in manufacturing, filling a significant methodological gap in the engineering literature for emerging industrial contexts. It is recommended that future research applies this model to sub-sectoral analyses and that policymakers utilise such forecasts for targeted infrastructure and skills development programmes. manufacturing systems, technological adoption, time-series forecasting, ARIMA modelling, industrial policy, engineering management This paper introduces a novel hybrid methodological framework that uniquely combines a structured system evaluation with a statistical

forecasting model, specifically tailored for assessing manufacturing technology uptake in industrialising economies.

Keywords: *Manufacturing systems, Time-series forecasting, Adoption modelling, Industrialisation, Sub-Saharan Africa, Methodological evaluation, Developing economies*

Article Highlights

- Presents a novel hybrid framework combining system readiness assessment with ARIMA forecasting.
- Model forecasts a potential 34% adoption rate for key technologies by the end of 2026.
- Provides a replicable, statistically rigorous tool for engineers and policymakers in industrialising contexts.
- Fills a significant methodological gap in forecasting technological adoption for emerging economies.

Methodological Contribution

Integrates a structured system evaluation with a specified ARIMA model $(\varphi(B)(1-B)^d)y_t = \theta(B)\varepsilon_t$ to forecast adoption rates with quantified uncertainty.

This framework offers a practical tool for evidence-based industrial planning.

ABSTRACT-ONLY PUBLICATION

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

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