



Methodological Evaluation of Manufacturing Systems Reliability in Nigerian Plants Using Panel Data Analysis

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Gabriel Okezie is affiliated with Department of Electrical Engineering, University of Calabar and focuses on Engineering research in Africa.

Abstract

This study addresses a current research gap in Engineering concerning Methodological evaluation of manufacturing plants systems in Nigeria: panel-data estimation for measuring system reliability in Nigeria. The objective is to formulate a rigorous model, state verifiable assumptions, and derive results with direct analytical or practical implications. A structured analytical approach was used, integrating formal modelling with domain evidence. The results establish bounded error under perturbation, a convergent estimation process under stated assumptions, and a stable link between the proposed metric and observed outcomes. The findings provide a reproducible analytical basis for subsequent theoretical and applied extensions. Stakeholders should prioritise inclusive, locally grounded strategies and improve data transparency. Methodological evaluation of manufacturing plants systems in Nigeria: panel-data estimation for measuring system reliability, Nigeria, Africa, Engineering, case study This work contributes a formal specification, transparent assumptions, and mathematically interpretable claims. The maintenance outcome was modelled as $Y_{it} = \beta_0 + \beta_1 X_{it} + u_i + \epsilon_{it}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Nigerian, manufacturing, reliability, econometrics, panel, stochastic frontier, systems analysis*

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