Methodological Evaluation of Manufacturing Plant Systems in Kenya Using Multilevel Regression Analysis for Efficiency Gains Analysis

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Abstract

This study addresses a current research gap in Engineering concerning Methodological evaluation of manufacturing plants systems in Kenya: multilevel regression analysis for measuring efficiency gains in Kenya. The objective is to formulate a rigorous model, state verifiable assumptions, and derive results with direct analytical or practical implications. A mixed-methods design was used, combining survey and interview data collected over the study period. 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 Kenya: multilevel regression analysis for measuring efficiency gains, Kenya, Africa, Engineering, original research This work contributes a formal specification, transparent assumptions, and mathematically interpretable claims. The maintenance outcome was modelled as $Y\{\}=beta\,0+beta\,1\,X\{\}+ui+varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Kenya, Multilevel Regression, Manufacturing Systems, Methodology, Efficiency Analysis, Hierarchical Modelling, Econometrics*

ABSTRACT-ONLY PUBLICATION

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