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Methodological Evaluation of Manufacturing Plant Systems in Rwanda: A Randomized Field Trial for Efficiency Gains,

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Abstract

This study addresses a current research gap in Engineering concerning Methodological evaluation of manufacturing plants systems in Rwanda: randomized field trial for measuring efficiency gains in Rwanda. 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 Rwanda: randomized field trial for measuring efficiency gains, Rwanda, Africa, Engineering, case study 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: *Rwanda, Geographic Information Systems (GIS), Lean Manufacturing, Six Sigma, Total Quality Management (TQM), Benchmarking, Process Mapping*

ABSTRACT-ONLY PUBLICATION

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