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A Comparative Multilevel Regression Analysis of Manufacturing Systems for Yield Optimisation in Ghanaian Plants

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ABSTRACT

Background: Manufacturing systems in developing economies face unique challenges in yield optimisation, yet comparative analyses of their efficacy using advanced statistical techniques are scarce. This gap limits evidence-based decision-making for plant managers and policymakers.

Purpose and objectives: This study aims to methodologically evaluate and compare the effectiveness of three prevalent manufacturing systems—Total Productive Maintenance (TPM), Lean Manufacturing, and computerised maintenance management systems (CMMS)—in optimising production yield within an industrial context.

Keywords: *Manufacturing systems, Yield optimisation, Multilevel regression analysis, Ghanaian industry, Sub-Saharan Africa, Comparative study, Process improvement*

Article Highlights

- TPM implementation shows a positive yield association (coefficient: 0.15, 95% CI: 0.09, 0.21).
- Effects of Lean Manufacturing and CMMS were not statistically significant in this context.
- Multilevel regression isolates system effects from confounding plant-level variables.
- Findings provide an evidence-based framework for managerial and policy decisions.

Methodological Note

The core analysis employs a three-level hierarchical linear model to account for nested data structure (batches within plants), using robust standard errors for inference.

This analysis offers a robust, comparative evaluation of manufacturing systems for yield improvement in a developing economy context.