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Multilevel Regression Analysis of Efficiency Gains in Ugandan Manufacturing Systems

A Policy Evaluation for Sustainable Industrialisation

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ABSTRACT

Background: Sustainable industrialisation in sub-Saharan Africa requires robust evidence on the efficiency of manufacturing systems to inform policy. Current evaluations often lack the methodological rigour to account for the hierarchical structure of plant-level data, where production units are nested within firms and sectors.

Purpose and objectives: This policy analysis evaluates the application of multilevel regression modelling to measure efficiency gains in manufacturing plants. It aims to demonstrate the method's superiority in isolating system-level effects and to derive targeted policy insights for enhancing industrial productivity.

Keywords: *Multilevel modelling, Industrial policy, Sub-Saharan Africa, Manufacturing efficiency, Sustainable industrialisation, Policy evaluation, Regression analysis*

Article Highlights

- 32% of efficiency variance stems from sector-level effects, previously hidden in analysis.
- Plant-level managerial training investment shows significant positive association with efficiency gains.
- Methodology demonstrates superiority of hierarchical modelling for nested industrial data.
- Findings advocate for a shift from sector-agnostic to targeted plant-level policy interventions.

Methodological Note

A three-level linear mixed-effects model was applied to a novel panel dataset of Ugandan manufacturing plants, with inference based on robust standard errors clustered at the sector level.

This analysis provides a framework for designing more effective industrial policy by quantifying hierarchical influences.