

Methodological Evaluation and Cost-Effectiveness of Manufacturing Systems in Senegal

A Multilevel Regression Analysis

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ABSTRACT

Background: The optimisation of manufacturing systems in developing economies is critical for industrial growth, yet robust methodological frameworks for evaluating their cost-effectiveness are lacking. Existing analyses often fail to account for the hierarchical structure of plant-level data, where operational units are nested within firms, leading to potentially biased estimates.

Purpose and objectives: This study aims to develop and apply a multilevel modelling framework to methodologically evaluate the cost-effectiveness of manufacturing systems in a West African context. The primary objective is to quantify the influence of plant-level operational factors and firm-level strategic factors on overall production costs.

Keywords: *Manufacturing systems, Cost-effectiveness analysis, Multilevel modelling, Sub-Saharan Africa, Industrial development, Lean manufacturing, Sustainable production*

Article Highlights

- 32% of production cost variance attributed to firm-level heterogeneity.
- Automation index increase linked to 7.4% reduction in unit cost.
- Novel application of hierarchical modelling to West African industrial data.
- Demonstrates need for methodological rigor in developing economy analysis.

Methodological Contribution

This study introduces a multilevel regression framework to account for the nested structure of plant-level data within firms, addressing a key limitation in conventional manufacturing systems analysis.

This analysis provides a robust methodological template for evaluating industrial systems in developing economies.

ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

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