

A Multilevel Regression Analysis of Manufacturing Systems Adoption in Ugandan Plants

A Methodological Case Study, 2000–2024

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Moses Kato¹

¹ Gulu University

Correspondence: mkato@hotmail.com

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ABSTRACT

Background: The adoption of advanced manufacturing systems in developing economies is a critical engineering challenge, yet robust methodological frameworks for analysing plant-level adoption drivers are scarce. Existing studies often fail to account for the hierarchical structure of industrial data, where plants are nested within sectors and regions.

Purpose and objectives: This case study presents and evaluates a multilevel regression methodology to analyse the determinants of manufacturing systems adoption. It aims to demonstrate the application of this technique using Ugandan plant data and to assess its superiority over conventional single-level models for capturing contextual influences.

Keywords: *Manufacturing systems adoption, Multilevel regression analysis, Sub-Saharan Africa, Plant-level analysis, Developing economies, Engineering case study, Methodological framework*

Article Highlights

- Multilevel regression showed 15%+ better model fit than conventional single-level analysis.
- Sector-level infrastructure was a stronger predictor than individual plant capital expenditure.
- Plant size had a positive but diminishing marginal effect on adoption likelihood.
- Methodology effectively disentangles plant-specific and sectoral influences.

Methodological Contribution

Presents and evaluates a two-level random intercept model for analysing hierarchical industrial data in a developing economy context.

This case study provides a methodological framework for engineering adoption research in similar industrial settings.



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