

A Bayesian Hierarchical Model for Evaluating Manufacturing Systems Adoption in Nigeria

A Methodological Framework

Chinwe Okonkwo¹|Adebayo Adeyemi^{2,3}

¹ Department of Sustainable Systems, University of Jos

² Nigerian Institute of Social and Economic Research (NISER)

³ Department of Mechanical Engineering, University of Jos

Correspondence: cokonkwo@gmail.com

Received: 10 June 2020 | Accepted: 14 August 2020 | Published: 12 September 2020 | DOI:

[10.5281/zenodo.18970377](https://doi.org/10.5281/zenodo.18970377)

ABSTRACT

Background: The adoption of advanced manufacturing systems in developing economies is critical for industrial growth, yet robust methodological frameworks for evaluating adoption rates are lacking. Existing approaches often fail to account for the hierarchical structure of plant-level data and inherent uncertainties in self-reported adoption metrics.

Purpose and objectives: This paper proposes a novel Bayesian hierarchical model to provide a rigorous methodological framework for evaluating the adoption of manufacturing systems. The objective is to estimate true adoption rates while quantifying uncertainty and accounting for plant-level heterogeneity.

Keywords: *Bayesian hierarchical modelling, manufacturing systems adoption, Sub-Saharan Africa, industrial development, methodological framework, developing economies, Nigeria*

Article Highlights

- Proposes a novel three-level Bayesian hierarchical model for technology adoption evaluation.
- Demonstrates how measurement error in self-reported data significantly biases adoption estimates.
- Provides uncertainty-aware estimates crucial for evidence-based industrial policy in developing economies.
- Offers a methodological framework adaptable to hierarchical plant-level data structures.

Methodological Contribution

The model separates measurement noise from genuine adoption signals through a probabilistic framework with explicit error accounting.

This framework enables more reliable assessment of technological uptake in data-scarce environments.

ABSTRACT-ONLY PUBLICATION

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