

A Bayesian Hierarchical Model for Yield Improvement Diagnostics in Ghanaian Manufacturing Systems

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ABSTRACT

Background: Persistent yield inefficiencies in manufacturing systems represent a critical barrier to industrial productivity and economic development. Current diagnostic methods often lack the statistical rigour to disentangle plant-level effects from systemic process variations, particularly in contexts with heterogeneous operational data.

Purpose and objectives: This working paper develops and evaluates a novel Bayesian hierarchical model specifically designed for yield improvement diagnostics. The objective is to provide a robust methodological framework for quantifying and attributing yield gains within complex, multi-plant manufacturing environments.

Keywords: *Bayesian hierarchical modelling, yield improvement, manufacturing diagnostics, Sub-Saharan Africa, industrial productivity, process optimisation*

Article Highlights

- Proposes a novel Bayesian hierarchical model for manufacturing yield diagnostics.
- Quantifies uncertainty via posterior credible intervals for key process parameters.
- Isolates plant-level effects from systemic process variations in heterogeneous data.
- Provides a statistically principled framework for performance attribution.

Methodological Contribution

Introduces a Beta-distribution Bayesian hierarchical model with plant-level random effects, estimated via Hamiltonian Monte Carlo, specifically designed for yield diagnostics in multi-plant manufacturing systems.

This paper presents a new methodological framework for industrial diagnostics.

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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