A Randomised Field Trial Methodology for Yield Optimisation in Senegalese Manufacturing Systems

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ABSTRACT

Background: Manufacturing systems in developing economies face unique challenges in process optimisation, with a paucity of robust, context-specific methodologies for evaluating yield improvements. Existing approaches often rely on retrospective data or theoretical models not validated in real-world, resource-constrained settings.

Purpose and objectives: This article presents a novel methodological framework for designing and implementing randomised field trials (RFTs) to causally identify yield-optimising interventions in active manufacturing plants. The objective is to provide a rigorous, step-by-step protocol for engineers to generate high-quality evidence on process efficacy.

Keywords: *Randomised controlled trial, Yield optimisation, Manufacturing systems, Sub-Saharan Africa, Process improvement, Field experiment, Industrial engineering*

Article Highlights

- Presents a novel clustered, stepped-wedge design for randomised field trials in active plants.
- Methodology enables causal identification of yield-optimising technical interventions.
- Framework is specifically developed for the constraints of Sub-Saharan African manufacturing.
- Pilot application confirmed feasibility, with power analysis indicating robust effect detection.

Core Analytical Model

The analysis uses a generalised linear mixed model with cluster-robust standard errors to account for plant- and unit-level random effects, formally expressed as: $\logit(P(Y_{ijt}=1)) = \beta_0 + \beta_1 T_{ijt} + u_i + v_j + \epsilon_{ijt}$.

This is a methodology paper; it presents a framework for future trials rather than empirical results.

📄 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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