

AFRICAN STRUCTURAL ENGINEERING

ISSN: XXXX-XXXX | Peer-Reviewed | Open Access

# A Randomised Field Trial Methodology for Efficiency Diagnostics in Nigerian Industrial Machinery Fleets

DOI: [10.5281/zenodo.18968515](https://doi.org/10.5281/zenodo.18968515) | Received: 17 August 2012 | Accepted: 15 December 2012 | Published: 14 January 2013

Chinweike Okonkwo<sup>1</sup>|Amina Suleiman-Bello<sup>2,3</sup>

<sup>1</sup> Department of Civil Engineering, Ahmadu Bello University, Zaria

<sup>2</sup> Nnamdi Azikiwe University, Awka

<sup>3</sup> Department of Mechanical Engineering, Ahmadu Bello University, Zaria

Correspondence: [cokonkwo@gmail.com](mailto:cokonkwo@gmail.com)

DOI: [10.5281/zenodo.18968515](https://doi.org/10.5281/zenodo.18968515)

Received: 17 August 2012 | Accepted: 15 December 2012

## ABSTRACT

**Background:** Industrial machinery fleets in Nigeria are critical to economic output, yet systematic methodologies for diagnosing and quantifying efficiency gains in their operational systems are lacking. Current evaluations often rely on retrospective, non-experimental analyses, which are susceptible to confounding and bias.

**Purpose and objectives:** This article presents a novel methodological framework for conducting randomised field trials (RFTs) to robustly measure efficiency improvements within industrial machinery systems. The objective is to provide a structured protocol for the design, implementation, and analysis of such trials in an active industrial setting.

**Keywords:** *Randomised controlled trial, Efficiency diagnostics, Industrial machinery fleets, Sub-Saharan Africa, Field trial methodology, Maintenance optimisation*

### Article Highlights

- Proposes a cluster-randomised, stepped-wedge design for active industrial settings.
- Statistical model detects  $\geq 12\%$  MTBF improvement with 80% power in pilot simulation.
- Overcomes confounding and bias limitations of retrospective, non-experimental analyses.
- Provides structured protocol for design, implementation, and analysis of field trials.

### Core Statistical Model

Linear mixed model with cluster-robust inference:  $Y_{ijt} = \mu + \beta T_{ijt} + \theta_i + \gamma_t + \varepsilon_{ijt}$ , where  $T_{ijt}$  is the treatment indicator,  $\theta_i$  and  $\gamma_t$  are random cluster and fixed time effects.

*This is a methodology paper presenting a novel experimental framework, not empirical results from a completed trial.*

## **ABSTRACT-ONLY PUBLICATION**

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

## **REQUEST FULL PAPER**

 **Email:** [info@parj.africa](mailto:info@parj.africa)

Request your copy of the full paper today!

## **SUBMIT YOUR RESEARCH**

**Are you a researcher in Africa? We  
welcome your submissions!**

Join our community of African scholars and share  
your groundbreaking work.

 **Submit at:** [app.parj.africa](http://app.parj.africa)



Scan to visit [app.parj.africa](http://app.parj.africa)

### **Open Access Scholarship from PARJ**

Empowering African Research | Advancing Global  
Knowledge