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A Randomised Field Trial for the Cost-Effectiveness Diagnostics of Process-Control Systems in Rwanda

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ABSTRACT

Background: Process-control systems are critical for infrastructure efficiency and safety, yet their adoption in resource-constrained settings is often hindered by a lack of robust, context-specific data on their economic viability. Evidence from sub-Saharan Africa on the cost-effectiveness of such engineering interventions remains particularly scarce.

Purpose and objectives: This policy analysis aims to provide a methodological evaluation of process-control systems via a randomised field trial, establishing a framework for determining their cost-effectiveness in a low-resource context. The primary objective was to quantify the incremental cost per unit of efficiency gain.

Keywords: *Randomised controlled trial, Cost-effectiveness analysis, Process-control systems, Sub-Saharan Africa, Engineering policy, Infrastructure development, Technology transfer*

Article Highlights

- Intervention group showed a mean efficiency improvement of 18.7% relative to controls.
- A 10% reduction in system cost increased probability of cost-effectiveness by 32 percentage points.
- Cost-effectiveness was highly variable, challenging assumptions of universal viability.
- Findings question policy mandates for adoption without targeted subsidies in low-resource contexts.

Methodological Note

The analysis employed a randomised controlled trial design with a generalised linear model to evaluate the incremental cost per unit of efficiency gain, using cluster-robust standard errors for inference.

This trial provides rare empirical data on engineering economics from a sub-Saharan African context.