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A Quasi-Experimental Framework for Cost-Effectiveness Diagnostics in South African Manufacturing Systems

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ABSTRACT

Background: Evaluating the cost-effectiveness of interventions in complex manufacturing systems presents significant methodological challenges, particularly in resource-constrained industrial settings. Existing frameworks often lack the rigour to isolate causal effects from confounding operational variables, leading to unreliable diagnostics for capital investment and process re-engineering decisions.

Purpose and objectives: This article presents a novel quasi-experimental framework designed to diagnose cost-effectiveness in manufacturing systems. The primary objective is to provide a structured methodology for engineering practitioners to robustly measure the impact of technical interventions on production costs and output, controlling for external market and supply chain fluctuations.

Keywords: *Quasi-experimental design, Cost-effectiveness analysis, Manufacturing systems, Industrial diagnostics, Sub-Saharan Africa, Resource-constrained optimisation, Process evaluation*

Article Highlights

- A structured quasi-experimental methodology for manufacturing cost diagnostics.
- Difference-in-differences design isolates causal effects from confounding variables.
- Provides robust measurement of technical intervention impact on production costs.
- Designed for application in resource-constrained industrial settings.

Methodological Core

The econometric model employs unit and time fixed effects with cluster-robust standard errors, controlling for external market and supply chain fluctuations in cost-effectiveness analysis.

This framework offers engineering practitioners a structured approach to evaluate process interventions.



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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