Evaluating Process-Control System Efficiency in Ghana

A Difference-in-Differences Analysis of Operational Gains

Kwame Agyeman-Bonsu[1] **Ama Serwaa Mensah**[1,2]

University of Professional Studies, Accra (UPSA) | *Accra Technical University*

Correspondence: kagyemanbonsu@aol.com

ABSTRACT

Background: Process-control systems are critical for optimising industrial operations, yet rigorous empirical evaluations of their efficiency gains in developing economies are scarce. This study addresses a gap in the literature concerning the quantitative assessment of such technological interventions within the structural engineering and manufacturing sectors.

Purpose and objectives: This case study aims to quantify the operational efficiency improvements attributable to the implementation of a modern process-control system in a Ghanaian industrial setting. Its primary objective is to demonstrate the application of a quasi-experimental econometric technique to isolate the causal effect of the technological upgrade.

Methodology: A difference-in-differences (DiD) model was employed, comparing performance metrics from a treatment plant that installed the new system against a control plant that did not. The core model is specified as

$$Y_{it} = \beta_0 + \beta_1 \text{Treat}_i + \beta_2 \text{Post}_t + \delta (\text{Treat}_i \times \text{Post}_t) + \varepsilon_{it},$$

where δ captures the causal effect. Inference is based on robust standard errors clustered at the plant level.

Keywords: *Process-control systems, Operational efficiency, Difference-in-differences, Sub-Saharan Africa, Industrial automation, Developing economies, Ghana*

Article Highlights

• Causal efficiency gain demonstrated via quasi-experimental DiD model.

• 17.5% reduction in process cycle time with 95% CI [12.1%, 22.9%].

• Robust evidence for process-control upgrades in industrial settings.

• Methodology offers credible evaluation framework for engineering interventions.

Methodological Note

The core DiD model $Y_{it} = \beta_0 + \beta_1 \text{Treat}_i + \beta_2 \text{Post}_t + \delta (\text{Treat}_i \times \text{Post}_t) + \epsilon_{it}$ isolates the causal effect δ of the technological intervention.

This study provides a rigorous econometric evaluation of an engineering intervention in a developing economy context.

📄 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

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

Scan to visit app.parj.africa

Open Access Scholarship from PARJ

Empowering African Research | Advancing Global Knowledge