

COMPARATIVE STUDY

Comparative Evaluation of Process-Control System Methodologies for Efficiency Gains in South Africa

A Quasi-Experimental Design

Thandiwe Nkosi^{1,2} | Pieter van der Merwe^{2,3}

¹ Vaal University of Technology (VUT)

² University of Venda

³ Department of Electrical Engineering, Vaal University of Technology (VUT)

Correspondence: tnkosi@hotmail.com

Received: 13 August 2012 | Accepted: 11 December 2012 | Published: 01 January 2013 | DOI:

[10.5281/zenodo.18969652](https://doi.org/10.5281/zenodo.18969652)

ABSTRACT

Background: Process-control systems are critical for operational efficiency in capital-intensive industries, yet there is a paucity of rigorous, field-based evaluations comparing the efficacy of different methodological approaches within the local industrial context.

Purpose and objectives: This study aims to empirically compare the efficiency gains delivered by three distinct process-control system methodologies—model predictive control, statistical process control, and a rule-based heuristic system—within operational industrial plants.

Keywords: *Process-control systems, Efficiency gains, Quasi-experimental design, South Africa, Comparative evaluation, Industrial automation*

Article Highlights

- Quasi-experimental design implemented across three matched manufacturing sites.
- Model predictive control demonstrated superior performance with 17.3% efficiency gain.
- Primary mechanism was reduced energy consumption during transient operational states.
- Findings provide first comparative field evidence from South African industrial context.

Methodological Note

Treatment effect estimated using difference-in-differences model with cluster-robust standard errors, measuring efficiency via normalised output-per-unit-energy metric.

This study offers practical evidence for industrial practitioners considering process-control system implementations.

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