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Methodological Evaluation and Reliability Diagnostics for Process-Control Systems in Uganda

A Quasi-Experimental Design

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ABSTRACT

Background: Process-control systems in industrial and infrastructure projects are critical for operational efficiency and safety. In many developing contexts, systematic evaluation of their reliability is hindered by a lack of controlled field data and standardised diagnostic methodologies, leading to unplanned downtime and maintenance costs.

Purpose and objectives: This working paper aims to develop and apply a quasi-experimental methodological framework for the empirical evaluation and reliability diagnostics of process-control systems. The primary objective is to quantify system failure rates and identify key diagnostic parameters under operational field conditions.

Keywords: *Process-control systems, Reliability diagnostics, Quasi-experimental design, Sub-Saharan Africa, Industrial automation, System evaluation, Developing economies*

Article Highlights

- A quasi-experimental framework enables field-based reliability assessment where randomized trials are impractical.
- Sensor signal degradation emerged as a primary, quantifiable cause of system failure.
- The Weibull analysis indicated an increasing failure rate over time for studied systems.
- Results advocate for diagnostic protocols focused on signal integrity verification.

Core Methodology

A quasi-experimental design with matched treatment/control groups. Reliability was modelled using Weibull survival analysis with robust standard errors to account for heteroskedasticity.

This paper presents a field-applicable framework for evaluating process-control system reliability in developing contexts.

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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