

ORIGINAL RESEARCH

Quasi-Experimental Evaluation of System Reliability in Rwandan Manufacturing Plants

A Methodological Framework

Niyonkuru Uwimana¹

¹ African Leadership University (ALU), Kigali

Correspondence: nuwimana@gmail.com

Received: 16 June 2012 | Accepted: 16 July 2012 | Published: 25 August 2012 | DOI: [10.5281/zenodo.18968560](https://doi.org/10.5281/zenodo.18968560)

ABSTRACT

Background: The reliability of manufacturing systems is critical for industrial productivity and economic development. In many developing economies, however, rigorous, data-driven frameworks for assessing system reliability are lacking, leading to reactive maintenance and unplanned downtime.

Purpose and objectives: This study aimed to develop and apply a novel quasi-experimental methodological framework to evaluate the operational reliability of electromechanical systems within manufacturing plants. The primary objective was to quantify reliability metrics and identify key factors influencing system failure.

Keywords: *Manufacturing systems, System reliability, Quasi-experimental design, Sub-Saharan Africa, Industrial engineering, Maintenance engineering, Developing economies*

Article Highlights

- Novel application of quasi-experimental design with survival analysis for reliability assessment.
- MTBF increased by ~32% in intervention groups using structured predictive maintenance.
- Weibull analysis ($\beta=1.85$) indicates wear-out failure characteristics in electromechanical systems.
- Provides a practical methodological framework for resource-constrained industrial settings.

Methodological Insight

Reliability was modelled using Weibull survival analysis: $R(t)=\exp[-(t/\eta)^\beta]$, with inference based on robust standard errors accounting for plant-level clustering.

This study offers a transferable framework for evidence-based maintenance policy in developing industrial 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.

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