



Methodological Evaluation of Manufacturing Plant Systems in Tanzania: Randomized Field Trial for System Reliability Assessment

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Published: 05 July 2001 | **Received:** 27 January 2001 | **Accepted:** 11 May 2001

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DOI: [10.5281/zenodo.18728442](https://doi.org/10.5281/zenodo.18728442)

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Abstract

Manufacturing plants in Tanzania face challenges related to system reliability, which can affect productivity and environmental impact. A randomized field trial was conducted across four randomly selected Tanzanian manufacturing sites. Data were collected on system performance metrics using an ordinal logistic regression model to analyse the impact of operational variables on system reliability. In one site, a 25% reduction in downtime was observed compared to baseline conditions (95% confidence interval for reduction: -10% to -35%). The randomized field trial demonstrated that systematic improvements can significantly enhance manufacturing plant system reliability. Manufacturers should implement the identified improvements and continue monitoring system performance through regular audits. The empirical specification follows $Y = \beta_{0+\beta}^{\rightarrow} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: Tanzania, Geographic Information Systems (GIS), Monte Carlo simulation, System dynamics, Lean manufacturing, Sustainability metrics, Quality control methodologies

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