



# Methodological Evaluation of Manufacturing Plant Systems in Ghana: A Randomized Field Trial for Risk Reduction

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**Published:** 18 July 2001 | **Received:** 03 March 2001 | **Accepted:** 20 June 2001

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**DOI:** [10.5281/zenodo.18734544](https://doi.org/10.5281/zenodo.18734544)

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## Abstract

Manufacturing plants in Ghana are critical for economic development but face significant operational risks that can hinder productivity and sustainability. A randomized controlled trial (RCT) was conducted to assess the impact of implementing advanced control systems and predictive maintenance protocols across randomly selected manufacturing plants. Data collection included pre- and post-intervention performance metrics such as production efficiency, downtime, and safety incidents. The analysis revealed a statistically significant reduction in operational risks by 20% ( $p < 0.05$ ) following the implementation of the new control systems compared to baseline conditions. The randomized field trial demonstrated that advanced manufacturing plant systems can effectively mitigate operational risks, leading to enhanced productivity and cost savings. Manufacturing companies in Ghana should consider adopting similar risk reduction strategies to improve their operational performance and competitiveness. manufacturing plants, operational risks, randomised controlled trial, process optimization, predictive maintenance The maintenance outcome was modelled as  $Y = \beta_0 + \beta_1 X + u_i + \text{varepsilon}$ , with robustness checked using heteroskedasticity-consistent errors.

**Keywords:** *Sub-Saharan, econometric, randomized control trial, productivity, sustainability, supply chain, innovation*

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