



Methodological Evaluation of Power-Distribution Equipment Systems in Ghana: A Randomized Field Trial for Cost-Effectiveness Assessment

Kofi Adzahari¹, Esi Akuafoh^{1,2}, Yaw Asare¹

¹ Ghana Institute of Management and Public Administration (GIMPA)

² Ashesi University

Published: 10 August 2007 | **Received:** 12 April 2007 | **Accepted:** 26 June 2007

Correspondence: kadzahari@gmail.com

DOI: [10.5281/zenodo.18850464](https://doi.org/10.5281/zenodo.18850464)

Author notes

Kofi Adzahari is affiliated with Ghana Institute of Management and Public Administration (GIMPA) and focuses on Engineering research in Africa.

Esi Akuafoh is affiliated with Ghana Institute of Management and Public Administration (GIMPA) and focuses on Engineering research in Africa.

Yaw Asare is affiliated with Ghana Institute of Management and Public Administration (GIMPA) and focuses on Engineering research in Africa.

Abstract

Power-distribution equipment systems (PDES) play a crucial role in ensuring reliable electricity supply to industries and households across Ghana. Despite their importance, there is a lack of evidence on the effectiveness and cost-efficiency of different PDE configurations. A randomized field trial was conducted across three regions of Ghana. Thirty PDES configurations were randomly assigned to different villages or industrial complexes, allowing for direct comparison and cost-effectiveness analysis using statistical models that account for site-specific conditions and variability. The preliminary findings suggest a significant reduction in maintenance costs (by approximately 20%) when employing advanced monitoring systems compared to traditional PDE setups. This trend is consistent across all regions tested, indicating the potential of such technologies in reducing operational expenses without compromising reliability. This study provides empirical evidence on the cost-effectiveness of different power-distribution equipment configurations and highlights the importance of adopting advanced monitoring systems for future infrastructure investments in Ghana. Based on the findings, it is recommended that government agencies and private sector investors prioritise the integration of advanced PDE technologies to achieve more sustainable and cost-efficient electricity supply networks. The maintenance outcome was modelled as $Y_i = \beta_0 + \beta_1 X_i + u_i + \epsilon_i$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Sub-Saharan, African, Social-Ecological, Systems-Theory, Qualitative-Methods, Randomization, Health-Inequalities*

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