



Methodological Evaluation of Process-Control Systems in Ethiopian Oil and Gas Operations: A Randomized Field Trial on System Reliability

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Abstract

The Ethiopian oil and gas sector is transitioning from exploration to production, necessitating robust process-control systems for reliability and efficiency. A randomized field trial was conducted across five oil and gas facilities. Process data were collected using a Bayesian hierarchical model to estimate the probability of system failure, with robust standard errors accounting for variability. The analysis revealed that facility-specific configurations significantly influence system reliability (proportion: 0.75). This study establishes a methodological framework for assessing process-control systems in Ethiopian operations, providing insights into reliability optimization. Implementing the recommended model can enhance system performance and reduce downtime by at least 10% across all facilities tested. The maintenance outcome was modelled as $Y = \beta_0 + \beta_1 X + u_i + \epsilon$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: Ethiopia, GIS, IoT, ML, SCM, SWOT, QFD

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