Methodological Evaluation of Process-Control Systems in Kenya: A Randomized Field Trial for System Reliability Assessment

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Abstract

Recent technological advancements have led to a proliferation of process-control systems in Kenya's manufacturing sector. These systems are crucial for maintaining product quality and operational efficiency. However, there is limited empirical evidence on their reliability under varying conditions. The research employs a mixed-methods approach combining quantitative data analysis with qualitative interviews. A total of 50 randomly selected industrial units were included in the study, representing various sectors such as food processing, pharmaceuticals, and textiles. Process-control systems' performance was monitored for one year using standardised metrics. A notable finding is that system reliability varied significantly by sector (e.g., food processing had a higher failure rate than pharmaceuticals). Specifically, the mean system downtime across all sites was found to be 2.5% with a standard deviation of 1.2%, indicating moderate variability in performance. The study provides insights into the reliability and stability of process-control systems in diverse industrial settings within Kenya. Based on findings, recommendations for system upgrades and maintenance schedules are proposed to enhance overall efficiency and reduce downtime. Process-Control Systems, Reliability Assessment, Industrial Sector, Mixed-Methods Approach The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Kenyan, Geographic Information Systems, Control Theory, Randomized Controlled Trials, Data Analytics, Simulation Models, Quality Metrics*

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