Quasi-Experimental Evaluation of Process-Control Systems in Tanzanian Infrastructure Maintenance Projects

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Abstract

Infrastructure maintenance in Tanzania often faces challenges related to efficiency and quality control. A quasi-experimental approach was employed, utilising pre-post intervention data from multiple Tanzanian infrastructure maintenance projects. Random assignment of project sites to control and treatment groups was not feasible due to the nature of ongoing maintenance work. Data showed that process-control systems in the treatment group reduced average maintenance delays by 15% ($p < 0.05$) compared to a 7% reduction in the control group, indicating significant system reliability improvements. Despite methodological constraints, results suggest substantial benefits from implementing process-control systems for enhancing infrastructure maintenance efficiency and quality. Further randomized controlled trials should be conducted with larger sample sizes to validate these findings and explore potential cost savings. The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Tanzania, Geographic Information Systems (GIS), Quality Control, Reliability Engineering, System Dynamics, Case Studies, Quasi-Experimental Design*