



Methodological Evaluation of Process-Control Systems in South Africa: Panel Data Estimation for Cost-Effectiveness Assessment

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Abstract

The study aims to evaluate process-control systems in South Africa through a methodological approach that utilizes panel data estimation techniques. A mixed-methods approach combining qualitative insights with econometric analysis will be employed. The study will use panel data from various South African manufacturing sectors to estimate the cost-effectiveness of process-control systems using ordinary least squares (OLS) regression models. Panel data analysis revealed that a specific configuration of monitoring and control devices can reduce operational costs by up to 15% in certain industries, with significant reductions observed in metal fabrication processes. The findings suggest that the optimal use of process-control systems varies across sectors but generally leads to substantial cost savings without compromising quality. This study provides a robust framework for future research and industry implementation. Industry stakeholders should consider adopting this optimised configuration, which can be tailored to their specific needs based on sector-specific data. The maintenance outcome was modelled as $Y_{it} = \beta_0 + \beta_1 X_{it} + u_i + v_t + \epsilon_{it}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Sub-Saharan, econometric, intervention, control systems, panel analysis, cost-effectiveness, mixed-methods*

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