



Methodological Evaluation of Manufacturing Systems Reliability in South Africa Using Panel Data Analysis

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Published: 01 November 2006 | **Received:** 30 May 2006 | **Accepted:** 06 September 2006

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DOI: [10.5281/zenodo.18829017](https://doi.org/10.5281/zenodo.18829017)

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Abstract

Manufacturing systems in South Africa are critical for economic growth but often face reliability challenges. A mixed-method approach incorporating econometric techniques such as fixed effects models was employed to analyse panel data. The study identified a positive correlation between investment in maintenance and system uptime ($r = 0.65$, $p < 0.01$). Panel data analysis revealed significant improvements in manufacturing systems reliability with strategic investments. Strategic investments should focus on preventive maintenance to enhance system reliability. Manufacturing Systems; Panel Data Analysis; System Reliability; South Africa Engineering

Keywords: *Panel data analysis, Fixed effects model, Econometrics, Manufacturing reliability, South Africa, Time-series analysis, Geographic information systems*

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