



Methodological Evaluation of Industrial Machinery Fleets Systems in South Africa: Randomized Field Trial for Measuring System Reliability

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Abstract

Industrial machinery fleets in South Africa are critical for maintaining productivity across various sectors such as manufacturing and mining. However, the reliability of these systems is often compromised by operational inefficiencies and maintenance issues. A randomized controlled trial was conducted involving two sets of industrial machinery fleets, one serving as the control group with traditional maintenance procedures, and the other using advanced data analytics for predictive maintenance. Data on operational uptime, maintenance costs, and fault incidences were collected over a period of six months. The analysis revealed that the fleet employing predictive maintenance showed a significant improvement in average daily operational uptime by 15% compared to the control group (90% vs. 78%, $p < 0.05$). There was also a notable reduction in maintenance costs associated with unplanned downtime. The findings suggest that incorporating predictive analytics into industrial machinery fleet management can lead to substantial improvements in system reliability and cost savings, providing valuable insights for policy makers and practitioners. Policy recommendations include the integration of real-time data monitoring systems and investment in training for maintenance personnel on advanced predictive maintenance techniques. Industrial Machinery Fleets, Reliability Analysis, Predictive Maintenance, Randomized Controlled Trial

Keywords: *African, reliability engineering, randomized controlled trial, predictive maintenance, asset management, industrial ecology, performance measurement*

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