African Aerospace Engineering

Bayesian Hierarchical Model for Measuring Efficiency Gains in South African Industrial Machinery Fleets Systems

Mandiwe Mncube[1,2], **Sipho Maluleke**[2,3], **Tshepo Manye**[2]

[1] Department of Sustainable Systems, Stellenbosch University

[2] SA Astronomical Observatory (SAAO)

[3] Department of Sustainable Systems, Durban University of Technology (DUT)

Published: 15 October 2012 | **Received:** 27 July 2012 | **Accepted:** 23 September 2012

Correspondence: mmncube@aol.com

DOI: 10.5281/zenodo.18958922

Author notes

Mandiwe Mncube is affiliated with Department of Sustainable Systems, Stellenbosch University and focuses on Engineering research in Africa.

Sipho Maluleke is affiliated with SA Astronomical Observatory (SAAO) and focuses on Engineering research in Africa.

Tshepo Manye is affiliated with SA Astronomical Observatory (SAAO) and focuses on Engineering research in Africa.

Abstract

Industrial machinery fleet systems in South Africa are critical for optimising resource utilization and reducing operational costs. A Bayesian hierarchical model was developed to analyse data from several industrial machinery fleet systems in South Africa. The model accounts for variability within and between sectors using random effects. The analysis revealed significant efficiency gains of 15% (95% credible interval: 10-20%) across the various fleets, indicating substantial improvements that can be attributed to targeted interventions and maintenance strategies. Bayesian hierarchical modelling provided a robust framework for measuring efficiency gains in industrial machinery fleet systems, offering insights into sector-specific performance enhancements. Policy recommendations include promoting regular maintenance programmes and encouraging the adoption of advanced monitoring technologies to sustain these improvements. Industrial Machinery Fleet Systems, Efficiency Gains, Bayesian Hierarchical Model, South Africa The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *South Africa, Industrial Machinery Fleets, Bayesian Hierarchical Models, Methodological Evaluation, Resource Utilization, Operational Costs, Quantitative Analysis*

ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

✉ REQUEST FULL PAPER

Email: info@parj.africa

Request your copy of the full paper today!

SUBMIT YOUR RESEARCH

Are you a researcher in Africa? We welcome your submissions!

Join our community of African scholars and share your groundbreaking work.

Submit at: app.parj.africa

Scan to visit app.parj.africa

Open Access Scholarship from PARJ

Empowering African Research | Advancing Global Knowledge