Bayesian Hierarchical Model for Yield Improvement in Process-Control Systems: A South African Perspective

Tshepiso Thaba[1]**, Sipho Motshekga**[2]**, Nkosana Ngubane**[1,3]**, Mampho Mothibedi**[4]

[1] University of Venda

[2] Department of Electrical Engineering, Agricultural Research Council (ARC)

[3] Department of Civil Engineering, Cape Peninsula University of Technology (CPUT)

[4] Agricultural Research Council (ARC)

Author notes

Tshepiso Thaba is affiliated with University of Venda and focuses on Engineering research in Africa.
Sipho Motshekga is affiliated with Department of Electrical Engineering, Agricultural Research Council (ARC) and focuses on Engineering research in Africa.
Nkosana Ngubane is affiliated with Department of Civil Engineering, Cape Peninsula University of Technology (CPUT) and focuses on Engineering research in Africa.
Mampho Mothibedi is affiliated with Agricultural Research Council (ARC) and focuses on Engineering research in Africa.

Abstract

Process-control systems are critical for optimising yield in manufacturing processes across various industries. In South Africa, these systems can enhance efficiency and reduce waste. A BHM was employed to analyse data from multiple sites, accounting for variability across different conditions and processes. The model incorporates uncertainty quantification through robust standard errors. The analysis revealed that incorporating site-specific parameters significantly improved the accuracy of yield predictions compared to a generic approach. The BHM demonstrated its effectiveness in enhancing yield measurement precision, offering insights for process-control system optimization in South Africa. Adoption of the BHM should be encouraged as it provides more nuanced and site-specific yield measurements, aiding in decision-making processes. process control, Bayesian hierarchical model, yield improvement, manufacturing systems, South Africa The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *African geography, Bayesian hierarchical models, Process control systems, Yield optimization, Statistical methods, Quality assurance, Manufacturing process improvements*

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