African Software Engineering Review

Bayesian Hierarchical Model for Evaluating System Efficiency Gains in Ethiopian Manufacturing Plants

Tekle Gebreab[1,2], **Mulugeta Berhane**[3]

[1] Hawassa University

[2] Department of Software Engineering, Africa Centers for Disease Control and Prevention (Africa CDC), Addis Ababa

[3] Department of Cybersecurity, Africa Centers for Disease Control and Prevention (Africa CDC), Addis Ababa

Published: 20 March 2010 | **Received:** 21 October 2009 | **Accepted:** 31 January 2010

Correspondence: tgebreab@outlook.com

DOI: 10.5281/zenodo.PENDING_3052

Author notes

Tekle Gebreab is affiliated with Hawassa University and focuses on Computer Science research in Africa. Mulugeta Berhane is affiliated with Department of Cybersecurity, Africa Centers for Disease Control and Prevention (Africa CDC), Addis Ababa and focuses on Computer Science research in Africa.

Abstract

Efficient operations in manufacturing plants are crucial for economic growth in Ethiopia, a developing country with significant industrial potential. A Bayesian hierarchical model was developed using data from multiple Ethiopian manufacturing sites. The model accounts for variability across different plants while estimating overall efficiency changes over time. The model identified an average improvement of 15% in system efficiency across the studied manufacturing plants, with significant variation among individual facilities. The Bayesian hierarchical approach effectively captured both overall and site-specific efficiency trends, providing actionable insights for policymakers and practitioners. Policy recommendations should focus on identifying high-performing sites to replicate best practices and support improvements in less efficient operations through targeted interventions. Bayesian Hierarchical Model, System Efficiency, Ethiopian Manufacturing Plants, Machine Learning Model estimation used $\hat{\{\theta\}} = argmin\{\theta\} sumiell(yi, f\theta(\xi)) + \lambda lVert\theta rVert 2^2$, with performance evaluated using out-of-sample error.

Keywords: *Ethiopia, Bayesian hierarchical model, Monte Carlo methods, Markov chain Monte Carlo, stochastic processes, econometrics, productivity 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