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Bayesian Hierarchical Model for Assessing System Reliability in Nigerian Process-Control Systems: A Methodological Evaluation

Chinedu Chikezio[1,2], **Okechukwu Ologajiaku**[2,3], **Enoch Etimoka**[2,4], **Emeka Ekweghie**[2,5]

[1] Department of Mechanical Engineering, Nnamdi Azikiwe University, Awka

[2] Usmanu Danfodiyo University, Sokoto

[3] Ahmadu Bello University, Zaria

[4] Department of Electrical Engineering, Ahmadu Bello University, Zaria

[5] Department of Sustainable Systems, Nnamdi Azikiwe University, Awka

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Correspondence: cchikezio@aol.com

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Author notes

Chinedu Chikezio is affiliated with Department of Mechanical Engineering, Nnamdi Azikiwe University, Awka and focuses on Engineering research in Africa.

Okechukwu Ologajiaku is affiliated with Ahmadu Bello University, Zaria and focuses on Engineering research in Africa.

Enoch Etimoka is affiliated with Department of Electrical Engineering, Ahmadu Bello University, Zaria and focuses on Engineering research in Africa.

Emeka Ekweghie is affiliated with Usmanu Danfodiyo University, Sokoto and focuses on Engineering research in Africa.

Abstract

This study aims to evaluate the reliability of process-control systems in Nigerian industries by applying a Bayesian hierarchical model approach. A Bayesian hierarchical model will be employed to analyse and predict the reliability of process-control systems in Nigerian industries. The methodology incorporates statistical modelling with uncertainty quantification techniques. The analysis revealed that the proportion of systems operating under optimal conditions was approximately 75% across different sectors, indicating a moderate level of system reliability. The findings suggest that improvements can be made to enhance system reliability in Nigerian process-control systems by addressing identified inefficiencies and vulnerabilities. Recommendations include the implementation of regular maintenance schedules and upgrading software protocols to improve overall system performance and safety. The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Nigeria, Bayesian Hierarchical Model, Reliability Analysis, Hierarchical Modelling, Probability Theory, Monte Carlo Simulation, System Dynamics*

ABSTRACT-ONLY PUBLICATION

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

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