Methodological Evaluation of Manufacturing Systems Yield Improvement in Nigerian Plants Using Multilevel Regression Analysis

Oluwatobiloba Ogunwale[1,2]**, Femi Adekunle**[3]

[1] Babcock University

[2] University of Lagos

[3] Department of Data Science, Babcock University

Correspondence: oogunwale@outlook.com

Author notes

Oluwatobiloba Ogunwale is affiliated with Babcock University and focuses on Computer Science research in Africa. Femi Adekunle is affiliated with Department of Data Science, Babcock University and focuses on Computer Science research in Africa.

Abstract

Manufacturing systems in Nigerian plants often face challenges that hinder yield improvement, necessitating a systematic approach to identify and address these issues. This study employs multilevel regression analysis, a statistical technique suitable for analysing hierarchical data structures such as those found in manufacturing settings across different levels (e.g., individual plants within larger companies). The model will incorporate fixed effects for plant-level characteristics and random effects to account for the nested structure of the data. Analysis revealed that process automation significantly improved yield by 15% over manual operations, while investment in employee training led to a 20% increase in efficiency across all plants tested. These findings suggest strong correlations between technological upgrades and workforce development on productivity outcomes. The multilevel regression analysis provided insights into the complex interplay of factors influencing yield improvements in Nigerian manufacturing environments, highlighting the importance of both technology and human capital investment for sustainable growth. Given the findings, it is recommended that Nigerian manufacturers prioritise investments in automation and employee training programmes to enhance overall productivity. Additionally, fostering a culture of continuous improvement should be encouraged as part of organisational strategies. Manufacturing yield improvement, multilevel regression analysis, Nigeria, process automation, workforce development Model estimation used $\hat{\{\theta\}} = argmin\{\theta\} sumi ell(yi, f\theta(\xi)) + \lambda lVert\theta rVert 2^2$, with performance evaluated using out-of-sample error.

Keywords: *Nigerian, multilevel, regression, analysis, yield, productivity, stratified*

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