



Methodological Assessment of Manufacturing Systems Efficiency in Ethiopian Plants Using Multilevel Regression Analysis

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Abstract

The focus of this study is on assessing the efficiency of manufacturing systems in Ethiopian plants within the agricultural sector. The methodology involves collecting data from multiple levels within Ethiopian agricultural plants, including both firm-level and industry-level variables. Multilevel regression analysis is employed to account for the hierarchical structure of the data, ensuring that inter-plant variations are appropriately addressed. A key finding indicates that investment in automation equipment leads to a 15% increase in production efficiency across Ethiopian plants, with a confidence interval of ± 3 percentage points. The multilevel regression analysis reveals significant gains in efficiency through targeted investments and operational improvements, providing actionable insights for policymakers and industry leaders. Recommendations include prioritising the adoption of automation technologies and fostering collaboration among agricultural plants to share best practices and resources effectively. The empirical specification follows $Y = \beta_{0+\beta}^{-1} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *African agriculture, multilevel regression, productivity analysis, efficiency measurement, input-output models, stochastic frontier analysis, econometrics*

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