

# **Decomposing Palm Oil Production Growth in Indonesia: A Provincial Panel Analysis of Land Expansion, Yield-Based Total Factor Productivity, and Technical Efficiency (2007–2023)**

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## **ABSTRACT**

This study examines the drivers of palm oil production growth in Indonesia by decomposing the relative contributions of land expansion and productivity improvements across provinces during 2007–2023. Utilizing a provincial-level panel dataset, this study investigates whether output growth has been predominantly driven by extensive cultivation area expansion or intensive productivity and efficiency gains. The empirical framework integrates four complementary approaches: growth decomposition to disentangle land and productivity contributions, yield-based Total Factor Productivity (TFP) measurement, fixed-effects panel regressions to control for unobserved provincial heterogeneity, and Stochastic Frontier Analysis (SFA) to estimate technical efficiency scores and production frontiers. The findings reveal that land expansion has been the primary driver of production growth, particularly during periods of rapid area development, while productivity improvements have played a secondary yet significant role. Substantial spatial heterogeneity emerges, with established producing provinces in Sumatra demonstrating higher technical efficiency relative to expanding frontier regions. The SFA results indicate considerable efficiency gaps across provinces, suggesting that substantial output gains remain achievable through improved management practices, optimal plantation age structures, and enhanced input utilization without requiring additional land conversion. These findings carry important policy implications for Indonesia's palm oil sector. The development strategy should pivot toward productivity enhancement and efficiency-based intensification to sustain long-term growth while mitigating environmental pressures from continued deforestation. This study contributes to the literature on agricultural productivity decomposition and provides empirical evidence for designing sustainable intensification policies in tropical commodity sectors.

**Keywords:** Palm oil; productivity decomposition; Total Factor Productivity; Stochastic Frontier Analysis; technical efficiency; Indonesia