

# A Methodological Framework for Panel-Data Estimation of Advanced Manufacturing Systems Adoption in Uganda

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## ABSTRACT

**Background:** The adoption of advanced manufacturing systems (AMS) is critical for industrial development, yet robust methodologies for measuring adoption rates in developing economies are lacking. Existing studies often rely on cross-sectional data, which fails to capture dynamic adoption processes and firm-level heterogeneity.

**Purpose and objectives:** This article presents a methodological framework for panel-data estimation of AMS adoption. Its objectives are to detail the construction of a plant-level panel dataset, specify an appropriate dynamic model, and outline procedures for addressing common estimation challenges in this context.

**Keywords:** *Panel-data estimation, Advanced manufacturing systems, Sub-Saharan Africa, Technology adoption, Industrial development, Developing economies, Uganda*

### Article Highlights

- Constructs balanced plant-level panel from repeated survey waves
- Specifies dynamic binary response model with plant-specific effects
- Employs conditional maximum likelihood with clustered standard errors
- Addresses limitations of static cross-sectional analyses

### Core Analytical Model

Dynamic binary response specification:  $\Pr(y_{it}=1) = \Phi(\gamma_{i,t-1} + X'_{it}\beta + \alpha_i)$ , where  $\alpha_i$  captures plant-specific unobserved heterogeneity.

*This methodology article presents a framework rather than empirical findings.*

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