

# A Bayesian Hierarchical Model for Yield Improvement in Senegal's Industrial Machinery Fleets

*A Policy Analysis for Sustainable Productivity*

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## ABSTRACT

**Background:** Industrial machinery fleets in many developing economies, including those in West Africa, operate below optimal yield, constraining productivity and sustainable industrial growth. Current policy evaluations often lack robust, data-driven methods to quantify performance improvements and account for heterogeneous operational conditions across sectors.

**Purpose and objectives:** This policy analysis aims to develop and evaluate a novel Bayesian hierarchical model to measure yield improvement within the country's industrial machinery sector. The objective is to provide a methodological framework for evidence-based policy targeting sustainable productivity gains.

**Keywords:** *Bayesian hierarchical modelling, yield improvement, industrial machinery fleets, Sub-Saharan Africa, sustainable productivity, policy analysis, developing economies*

### Article Highlights

- Policy targeting maintenance protocols shows stronger yield association than operator training.
- Model quantifies impact while accounting for inherent sectoral variability across fleets.
- Provides a statistically rigorous framework for evidence-based industrial policy.
- Recommends investment in centralised data systems for ongoing policy monitoring.

### Methodological Contribution

A Bayesian hierarchical model with fleet-level random effects and shared covariates, using MCMC sampling for inference on policy impacts.

*This analysis offers a data-driven framework for sustainable industrial policy in developing economies.*

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