

A Bayesian Hierarchical Model for Risk Reduction in Senegalese Manufacturing Systems

A Methodological Evaluation

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Aminata Diop¹|Fatou Ndiaye²|Ibrahima Diallo³
Moussa Sarr⁴

¹ Department of Mechanical Engineering, Université Alioune Diop de Bambey (UADB)

² Université Alioune Diop de Bambey (UADB)

³ Department of Electrical Engineering, African Institute for Mathematical Sciences (AIMS) Senegal

⁴ Department of Electrical Engineering, Institut Sénégalais de Recherches Agricoles (ISRA)

Correspondence: adiop@outlook.com

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ABSTRACT

Background: Manufacturing systems in developing economies face complex, multi-faceted risks that are often poorly quantified. Traditional risk assessment methods frequently lack the flexibility to integrate diverse data sources and account for variability across different plants and operational contexts.

Purpose and objectives: This study presents a methodological evaluation of a novel Bayesian hierarchical model designed to measure and predict risk reduction within manufacturing systems. The objective is to provide a robust, adaptable framework for engineering risk management that can handle sparse and heterogeneous operational data.

Keywords: Bayesian hierarchical modelling, risk reduction, manufacturing systems, Sub-Saharan Africa, developing economies, methodological evaluation, industrial engineering

Article Highlights

- Hierarchical structure effectively captures plant-level heterogeneity in operational risk.
- Model provides robust framework for sparse and heterogeneous manufacturing data.
- Enables evidence-based capital allocation for safety and reliability upgrades.
- Superior alternative to conventional aggregate risk analysis methods.

Methodological Contribution

Introduces a novel application of Bayesian hierarchical modelling to manufacturing risk quantification in industrialising contexts, offering a statistically rigorous framework for evidence-based decision-making.

This methodological evaluation provides engineers with a new analytical framework for operational risk management.

ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

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