

# A Quasi-Experimental Evaluation of Risk Reduction Methodologies in Nigerian Manufacturing Systems

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## ABSTRACT

**Background:** Manufacturing systems in Nigeria face significant operational risks, yet there is a paucity of rigorous, field-based evaluations comparing the efficacy of different risk reduction methodologies within this context.

**Purpose and objectives:** This study aimed to conduct a quasi-experimental comparison of two prominent risk reduction methodologies—Failure Mode and Effects Analysis (FMEA) and a tailored Hazard and Operability Study (HAZOP) variant—to determine their relative effectiveness in mitigating identified risks.

**Keywords:** *Quasi-experimental design, Risk reduction methodologies, Nigerian manufacturing systems, Operational risk, Sub-Saharan Africa, Comparative engineering analysis*

### Article Highlights

- Tailored HAZOP variant outperformed conventional FMEA in risk reduction.
- Quasi-experimental design provides robust field-based comparison evidence.
- Structured guideword protocols better uncover procedural hazards.
- Findings offer concrete basis for methodological selection in Sub-Saharan contexts.

### Core Analytical Approach

Difference-in-differences model estimated treatment effects from pre- and post-intervention risk scores across four manufacturing plants, with robust standard errors clustered at plant level.

*This study provides empirical evidence for selecting risk reduction methodologies in manufacturing contexts.*

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