

# A Quasi-Experimental Evaluation of Industrial Machinery Fleet System Adoption in Rwanda

*A Methodological Case Study*

Samuel Habimana<sup>1,2</sup> | Jean de Dieu Uwimana<sup>3,4</sup>  
Valentine Mukamana<sup>5,6</sup>

Department of Civil Engineering, Rwanda Environment Management Authority (REMA) • University of Rwanda • African Leadership University (ALU), Kigali • Rwanda Environment Management Authority (REMA) • Department of Civil Engineering, University of Rwanda • Department of Mechanical Engineering, African Leadership University (ALU), Kigali

Correspondence: [shabimana@hotmail.com](mailto:shabimana@hotmail.com)

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## ABSTRACT

**Background:** The adoption of advanced industrial machinery fleet management systems (FMS) in developing economies is a critical engineering challenge, yet rigorous methodological frameworks for evaluating their uptake are scarce. This creates a significant evidence gap for policymakers and industry stakeholders.

**Purpose and objectives:** This case study presents and applies a quasi-experimental design to methodologically evaluate the adoption rate of a new GPS-enabled FMS within the Rwandan construction and mining sectors. The primary objective is to demonstrate a robust evaluation framework suitable for resource-constrained settings.

**Keywords:** *Quasi-experimental design, Fleet management systems, Technology adoption, Sub-Saharan Africa, Industrial machinery, Developing economies, Methodological evaluation*

### Article Highlights

- Difference-in-differences design applied to 84 firms in Rwanda's construction and mining sectors.
- Intervention increased the composite adoption index by a statistically significant 18 percentage points.
- Thematic analysis revealed technical skills shortages as the predominant barrier over financial constraints.
- Provides a transferable methodological blueprint for engineering technology evaluation in resource-constrained settings.

### Core Statistical Model

The primary analysis used a difference-in-differences model:  $Y_{it} = \beta_0 + \beta_1 \text{Treat}_i + \beta_2 \text{Post}_t + \delta(\text{Treat}_i \times \text{Post}_t) + \varepsilon_{it}$ , where  $\delta$  is the DiD estimator. Inference was based on cluster-robust standard errors.

*This study demonstrates a rigorous framework for evaluating technology adoption where randomized trials are not feasible.*

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