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Methodological Evaluation of Transport Maintenance Depot Systems in Senegal: A Randomized Field Trial on System Reliability

Oumar Ngom[1,2], **Ibrahim Sall**[3], **Muhammadou Diop**[4,5], **Seyni Ndiaye**[1,6]

[1] Institut Sénégalais de Recherches Agricoles (ISRA)

[2] Council for the Development of Social Science Research in Africa (CODESRIA), Dakar

[3] Department of Mechanical Engineering, Institut Sénégalais de Recherches Agricoles (ISRA)

[4] Department of Civil Engineering, Council for the Development of Social Science Research in Africa (CODESRIA), Dakar

[5] Department of Electrical Engineering, Université Alioune Diop de Bambey (UADB)

[6] Department of Sustainable Systems, Université Alioune Diop de Bambey (UADB)

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Correspondence: ongom@gmail.com

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Author notes

Oumar Ngom is affiliated with Institut Sénégalais de Recherches Agricoles (ISRA) and focuses on Engineering research in Africa.

Ibrahim Sall is affiliated with Department of Mechanical Engineering, Institut Sénégalais de Recherches Agricoles (ISRA) and focuses on Engineering research in Africa.

Muhammadou Diop is affiliated with Department of Civil Engineering, Council for the Development of Social Science Research in Africa (CODESRIA), Dakar and focuses on Engineering research in Africa.

Seyni Ndiaye is affiliated with Department of Sustainable Systems, Université Alioune Diop de Bambey (UADB) and focuses on Engineering research in Africa.

Abstract

Transport maintenance depots (TMDs) in Senegal are critical for ensuring aircraft reliability and operational readiness. However, their effectiveness varies significantly across different TMD systems. A mixed-method approach combining quantitative data from performance metrics and qualitative interviews with personnel was employed. A random sample of TMDs within Senegalese airspace was selected, and a randomized field trial design was utilised to measure system reliability. Statistical models were used to analyse the data. In this study, we found that while some TMD systems exhibited high system reliability (95% confidence interval), others showed variability in performance metrics such as aircraft downtime reduction by 20% over a six-month period. The findings suggest that consistent training and standardised procedures could enhance the reliability of Senegalese TMDs, leading to improved operational efficiency and reduced maintenance costs. Implementing robust training programmes for maintenance personnel and establishing clear standards for operations can significantly improve the system reliability observed in this study. The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *African geography, randomized trials, maintenance systems, reliability analysis, engineering methodology, statistical methods, quality control*