Maintenance Performance Measurement Using Fuzzy Logic and Analytical Hierarchy Process (AHP)

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Abstract

Maintenance is critical to organizational success and sustainability. Poor maintenance may lead to low productivity and a lack of competitiveness. Maintenance performance measures should be aligned with organizational goals. The study objective is to determine the overall maintenance performance using some maintenance metrics aligned with organizational goals. The Fuzzy Logic Method (FLM) was combined with the Analytical Hierarchical Process (AHP) to evaluate organizational maintenance performance. To demonstrate the utility of the approach. A production enterprise was selected. The FLM was used to quantify the elementary indicators, allowing for the resolution of challenges related to a shortage of time, funds, and expertise. The AHP was used to weight each indicator to determine relative significance based on stakeholder ranking. Six strategic factors were considered: technical, financial, internal process, support, human resource, and health safety and environment. These combined (FLM and AHP) yielded an overall maintenance performance of 0.79, indicating that 79% of strategic objectives were met. The technical, financial, and internal process features contributed 70% of the overall maintenance performance. Therefore, these should be the focal points for any continuous improvement programs.
The two-stage model aids in the identification and prioritization of the most important indicators for evaluating organizational maintenance performance.

Keywords
Overall Maintenance Performance, Fuzzy Logic, Analytical Hierarchical Process, Sustainability, Strategic Objectives.

Biographies
Olalekan Emmanuel Omoniyi is a graduate of the Department of Industrial and Production Engineering, University of Ibadan. As a student. He served in various roles as the Financial Secretary, Head of Sports Committee, Member of the Annual Industrial Engineering Students Association Conference Committee. He is currently an Ambassador for Cowrywise, a Fintech company that helps Nigerians to save and invest money regularly, a former campus Ambassador for Barter by Flutterwave, a lifestyle payment solution used to send and receive money to and from Africa for free. His research interests span across Manufacturing Systems Engineering, Ergonomics, and Engineering Management. He is currently a User Interface/User Experience Designer with a focus on developing useful, useable, and desirable web applications.

Ayodeji Emmanuel Oluleye is a Professor of Industrial Engineering at the University of Ibadan (UI). He earned B.Sc. (Hons.) in Agricultural Engineering from the University of Ibadan, Nigeria, a Master's degree in Agricultural Machinery Engineering, from Cranfield Institute of Technology, England, and a Ph.D. in Industrial Engineering, University of Ibadan. He has served as a three-time Dean of the Faculty of Technology, University of Ibadan, Director Management Information Systems, and Chairman Information and Communication Committee, UI. He is a member of the Nigerian Society of Engineers, Fellow Nigerian Institute of Industrial Engineers, Fellow Nigerian Institution of Production Engineers. He is a registered engineer by the Council for the Regulation of Engineering, Nigeria (COREN). He serves as a member of the Technical Advisory Group (TAG) of Tertiary Education Trust Fund, Nigeria (TETFUND). He has over 80 publications in refereed Conference Proceedings and reputable Journals. His research interests include production and operations management, engineering economy, supply chain management, and productivity systems.