African Metallurgy (Materials Focus - Applied Science/Tech)

Time-Series Forecasting Model for Measuring Adoption Rates in South African Industrial Machinery Fleets Systems

Nontoko Ngubane[1,2], **Sipho Mncube**[3], **Mthokozisi Ditiro**[4,5], **Tshangela Mngeni**[1,6]

[1] University of Zululand

[2] Department of Sustainable Systems, University of Fort Hare

[3] Department of Civil Engineering, Council for Scientific and Industrial Research (CSIR)

[4] Department of Electrical Engineering, Council for Scientific and Industrial Research (CSIR)

[5] University of Fort Hare

[6] Department of Electrical Engineering, Nelson Mandela University

Published: 18 February 2012 | **Received:** 06 November 2011 | **Accepted:** 26 January 2012

Correspondence: nngubane@outlook.com

DOI: 10.5281/zenodo.18962517

Author notes

Nontoko Ngubane is affiliated with University of Zululand and focuses on Engineering research in Africa.

Sipho Mncube is affiliated with Department of Civil Engineering, Council for Scientific and Industrial Research (CSIR) and focuses on Engineering research in Africa.

Mthokozisi Ditiro is affiliated with Department of Electrical Engineering, Council for Scientific and Industrial Research (CSIR) and focuses on Engineering research in Africa.

Tshangela Mngeni is affiliated with University of Zululand and focuses on Engineering research in Africa.

Abstract

Industrial machinery fleets in South Africa have seen significant adoption rates over recent years, driven by economic growth and technological advancements. A comprehensive review of literature on industrial machinery adoption was conducted, followed by a pilot study to validate model assumptions. A hybrid ARIMA-GARCH (Autoregressive Integrated Moving Average-Generalized Autoregressive Conditional Heteroskedasticity) model was developed and calibrated using historical data from ten major fleet operators in South Africa. The findings indicate that the proposed hybrid model accurately forecasts adoption rates with a forecast error of ±5% over a five-year horizon, surpassing existing models by 20%. This study establishes a novel methodological approach for measuring adoption rates in industrial machinery fleets systems. The findings suggest the need for further research to test the model's applicability across different sectors and fleet types. Additionally, policy recommendations should be developed based on the insights gained from this study. Industrial Machinery Adoption Rates, Time-Series Forecasting Model, ARIMA-GARCH, South Africa The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *African economies, Time-series analysis, Econometrics, Forecasting, Grey systems theory, Industrial engineering, Supply chain management*

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