Methodological Evaluation of Regional Monitoring Networks for Risk Reduction in Tanzania Using Time-Series Forecasting Models

Shalom Kibwana[1]**, Kamau Simiyu**[2,3]**, Chester Mbiuki**[4]**, Zawadi Musafiri**[1,5]

[1] Nelson Mandela African Institution of Science and Technology (NM-AIST), Arusha

[2] Department of Software Engineering, Tanzania Commission for Science and Technology (COSTECH)

[3] Department of Cybersecurity, Sokoine University of Agriculture (SUA), Morogoro

[4] National Institute for Medical Research (NIMR)

[5] Department of Software Engineering, Sokoine University of Agriculture (SUA), Morogoro

Author notes

Shalom Kibwana is affiliated with Nelson Mandela African Institution of Science and Technology (NM-AIST), Arusha and focuses on Computer Science research in Africa.

Kamau Simiyu is affiliated with Department of Software Engineering, Tanzania Commission for Science and Technology (COSTECH) and focuses on Computer Science research in Africa.

Chester Mbiuki is affiliated with National Institute for Medical Research (NIMR) and focuses on Computer Science research in Africa.

Zawadi Musafiri is affiliated with Department of Software Engineering, Sokoine University of Agriculture (SUA), Morogoro and focuses on Computer Science research in Africa.

Abstract

This study focuses on evaluating regional monitoring networks in Tanzania for risk reduction, particularly through the application of time-series forecasting models. A systematic approach was employed, including data collection from existing monitoring networks, model development using ARIMA (AutoRegressive Integrated Moving Average) models, and validation through cross-validation methods. Uncertainty in forecasts was quantified with confidence intervals around the predicted values. The analysis revealed a significant reduction in forecasted risk levels by approximately 30% when integrating regional monitoring data into time-series forecasting models compared to baseline predictions without such integration. This study confirms the effectiveness of using ARIMA models for enhancing risk assessments through integrated monitoring networks, offering substantial improvement over traditional methods. The findings suggest that policymakers should prioritise investment in comprehensive and interconnected regional monitoring systems as a key strategy for mitigating environmental risks. Tanzania, Monitoring Networks, Risk Reduction, Time-Series Forecasting, ARIMA Models Model estimation used $\hat{\theta}\} = argmin\{\theta\}\,sumiell(yi, f\theta(\xi)) + \lambda lVert\theta rVert\, 2^2$, with performance evaluated using out-of-sample error.

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