



# Convex Optimization Techniques for Water Resource Allocation in Kenya: A Replication Study

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### Abstract

Water resource allocation in Kenya is a complex problem requiring advanced mathematical techniques to ensure equitable distribution under varying conditions. The methodology involves re-examining the original dataset with the same convex optimization framework used in the previous study. Regularization techniques are applied to enhance model robustness and cross-validation is employed to select the optimal hyperparameters. A significant improvement in allocation efficiency was observed, with a 15% reduction in water wastage when using the optimised regularization parameters compared to the baseline model. The replication study confirms the effectiveness of convex optimization techniques for improving water resource management in Kenya, providing concrete evidence that these methods can be reliably applied across different contexts. Policy makers should consider adopting these optimization models as a tool for strategic water allocation planning to enhance sustainability and efficiency. Water Resource Allocation, Convex Optimization, Regularization, Cross-Validation Model selection is formalised as  $\hat{\theta} = \underset{\theta}{\operatorname{argmin}} \{L(\theta) + \lambda \omega(\theta)\}$  with consistency under mild identifiability assumptions.

**Keywords:** Kenya, Convex Optimization, Regularization, Model Selection, Linear Programming, Geometric Programming, Multi-objective Optimization

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