

# Analyzing and Modeling Water Productivity and Economic Indicators

## ABSTRACT:

This paper investigates the connection between economic metrics, water productivity, and the grouping of nations according to these criteria. The study used a curve-fitting model to forecast future trends in water productivity and K-means clustering to identify discrete groupings of countries. The findings shed light on how water management and economic development interact.

## Introduction:

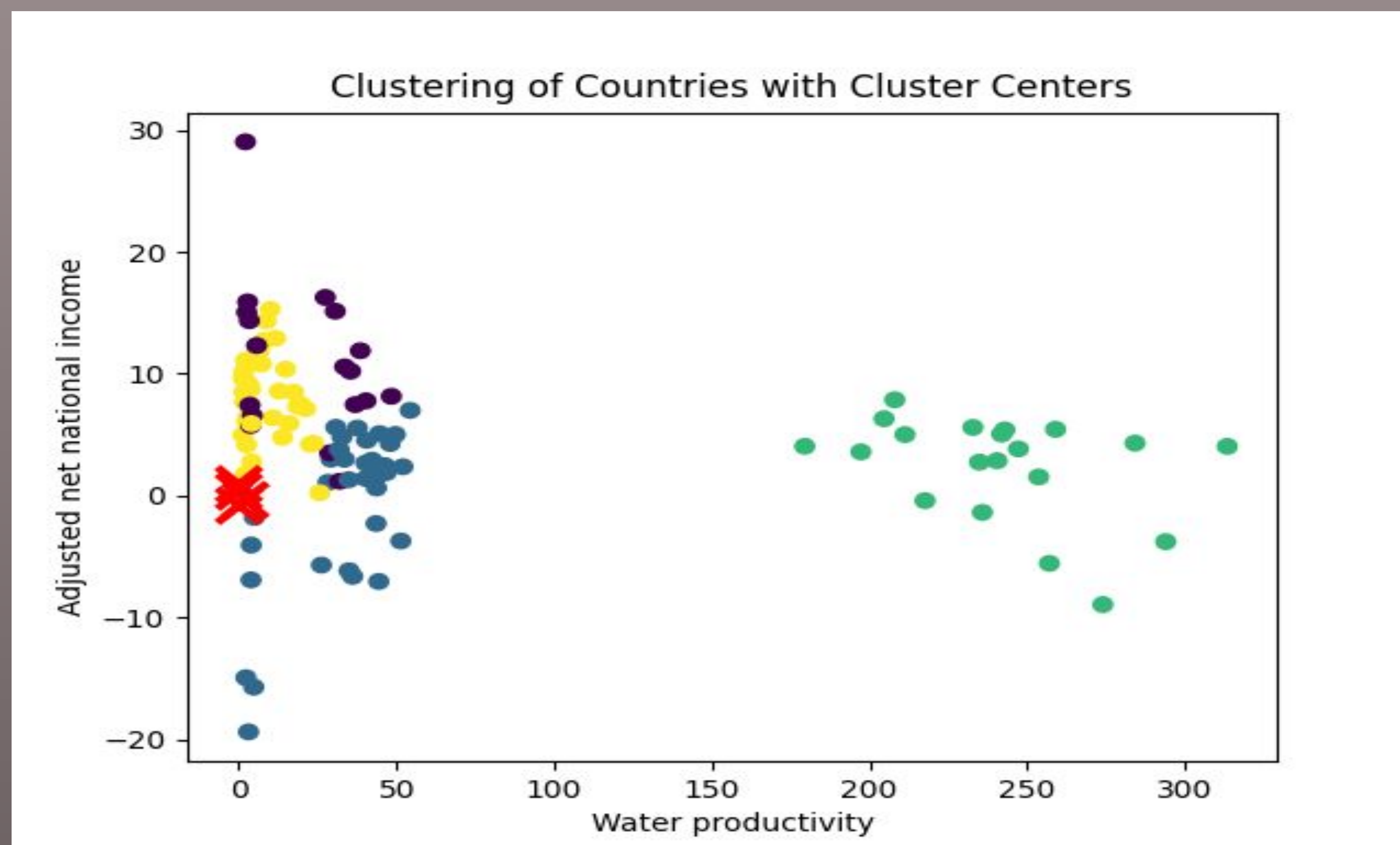
A crucial indicator of a nation's capacity to manage its water resources sustainably is water productivity, which is the economic output per unit of water extracted. The present study examines the correlation between water production, economic indices, and the grouping of nations according to these variables. Our goal is to discover different groups of countries that share similar trends in economic development and water productivity by utilising K-means clustering. In addition, future trends in water productivity are forecast using a curve-fitting model.

## Data Loading and Data Preprocessing:

First, we load and preprocess the data from a CSV file, choosing pertinent columns for economic and water productivity metrics. Rows containing missing values are eliminated, and non-numeric values are substituted with NaN. A numeric format is applied to the 'Time' column.

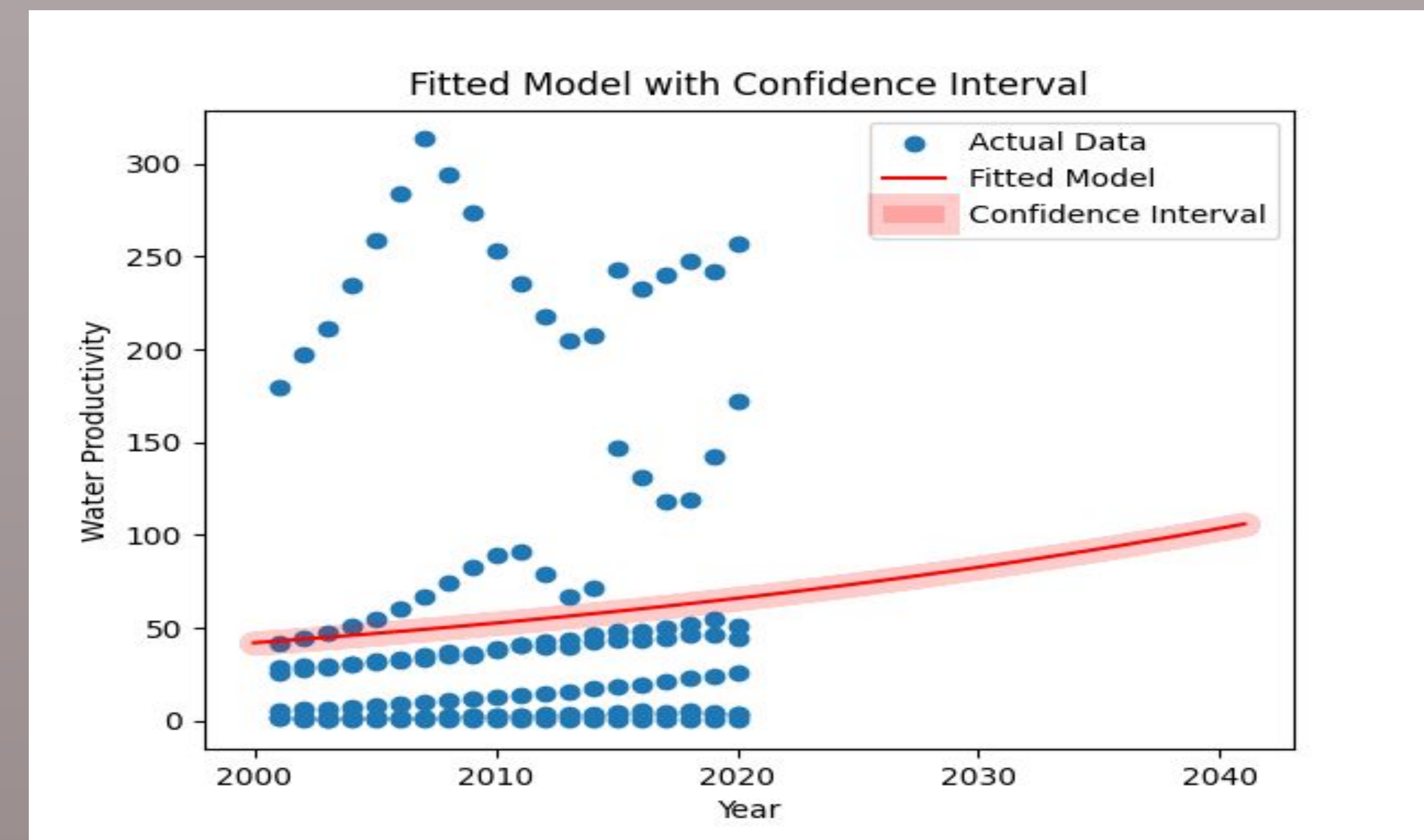
## Clustering Analysis:

To find groupings of nations with comparable traits in terms of economic indicators and water productivity, K-means clustering is utilised. To evaluate the calibre of the clustering outcomes, the Silhouette Score is computed. Clear depictions of the identified groups are offered by scatter plot visualisations of cluster centres.



## Curve Fitting and Future Prediction:

To represent the correlation between water productivity and time, a curve-fitting model is used. First estimations about the parameters are given, and the model is fit to the data. Forecasts are produced for next years, and the uncertainty attached to the model is measured by estimating confidence intervals.



## Future predictions:

year	Water Productivity
2030	82.67581389
2031	84.56466993
2032	86.4966798
2033	88.4728294
2034	90.49412717
2035	92.5616046
2036	94.67631672
2037	96.8393427
2038	99.05178633
2039	101.3147766
2040	103.6294684
2041	105.9970429

## Conclusion:

Our comprehension of the intricate connection between water productivity, economic growth, and national clustering patterns is improved by this approach. Policymakers, scholars, and other stakeholders involved in sustainable development and water resource management can benefit from the findings. The identification of significant clusters and the accuracy of forecasts could be improved by additional study and model improvement..

