Abstract

Groundwater is a valuable asset in both urban and rural areas, where the demand for alternate water sources is increasing—a vital resource for agriculture, industry, and domestic. Assessment of this resource becomes paramount globally and especially in areas where fresh water demand is rising despite falling within a multi-faceted geologic environment—rendering its sustainable management a pressing concern. To address this issue, an Integrated Determination of Objective CRIteria weights–Combined Compromise Solution (IDOCRIW-CoCoSo) was developed by integrating five groundwater potential influencing factors sourced from remote sensing and geophysical datasets. This will increase the prospect of finding productive aquifers and maximize the choice of drilling sites. The results were contrasted with two other hybrid objective modelling approaches, including CRiteria Importance Through Intercriteria Correlation–Combined Compromise Solution (CRITIC-CoCoSo), and Mean Weighted (MW) - CoCoSo. The groundwater potential map produced, classified into five classes, showed that 6% (113 km²), 26% (486 km²), 32% (603 km²), 26% (473 km²), and 10% (192 km²) fall into very low, low, medium, medium high, and high potentiality, respectively. The obtained results were confirmed using the receiver operating characteristic (ROC) curve and sensitivity analysis. According to the area under the ROC curve, the IDOCRIW-CoCoSo had a success rate of 83%, compared to MW- CoCoSo with an area under the curve (AUC) of 75% and CRITIC-CoCoSo (69%). The findings demonstrate IDOCRIW-CoCoSo's higher accuracy in predicting groundwater potential zones. For the sustained development and management of water-scarce areas, this study offers scientific perspective into the sustainability, distribution and governance of groundwater assets.

Keywords: Groundwater; Objective MCDM algorithms; Sustainability; IDOCRIW-CoCoSo; AUC-ROC