Reservoir Operation and Multi-Attribute Decision-Making – Web-based Tool

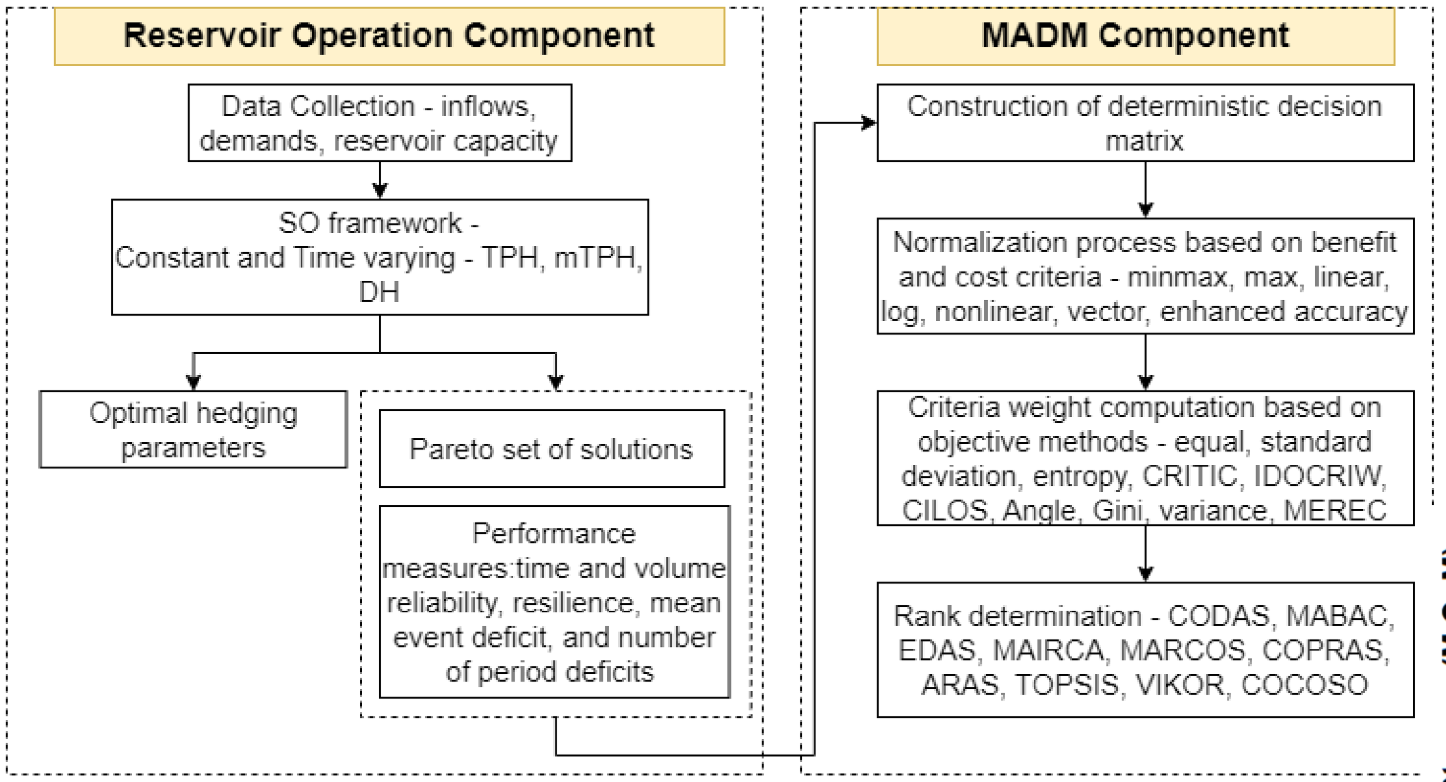
Moola Rajasree and Roshan Srivastav

Department of Civil and Environmental Engineering, Indian Institute of Technology Tirupati, Andhra Pradesh, India

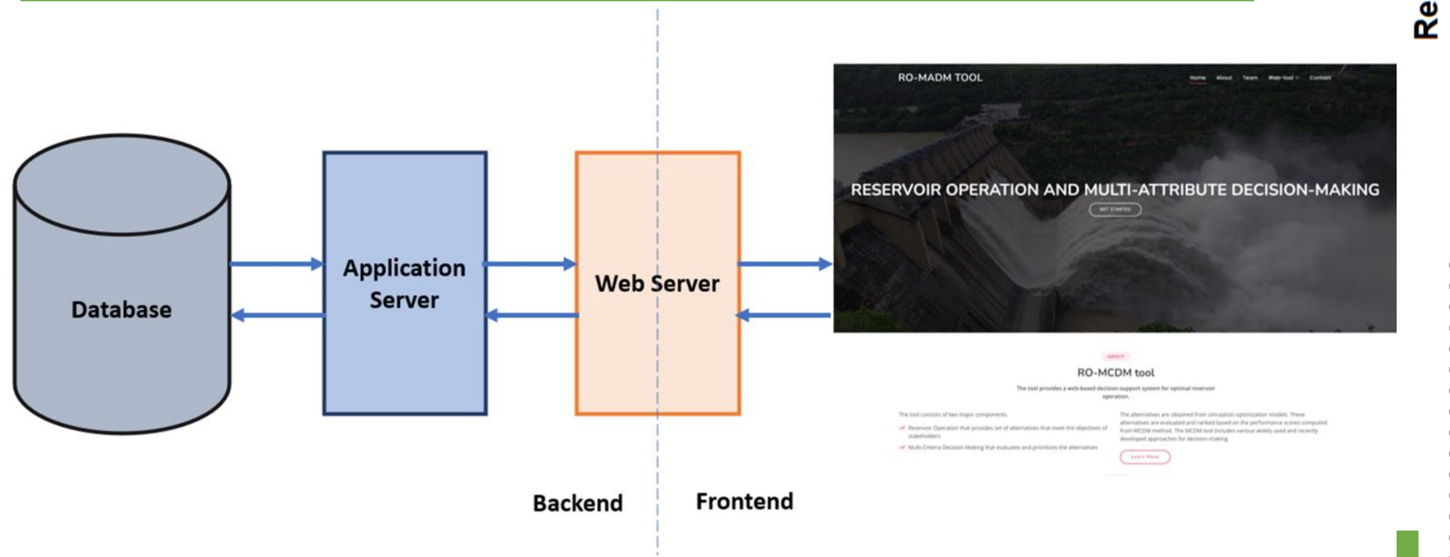
Objective of the study

Design a web-based application for reservoir operation with Multi-Attribute Decision Making (MADM) methods to evaluate and provide rankings for reservoir operation solutions.

Webtool Components



Webtool Framework



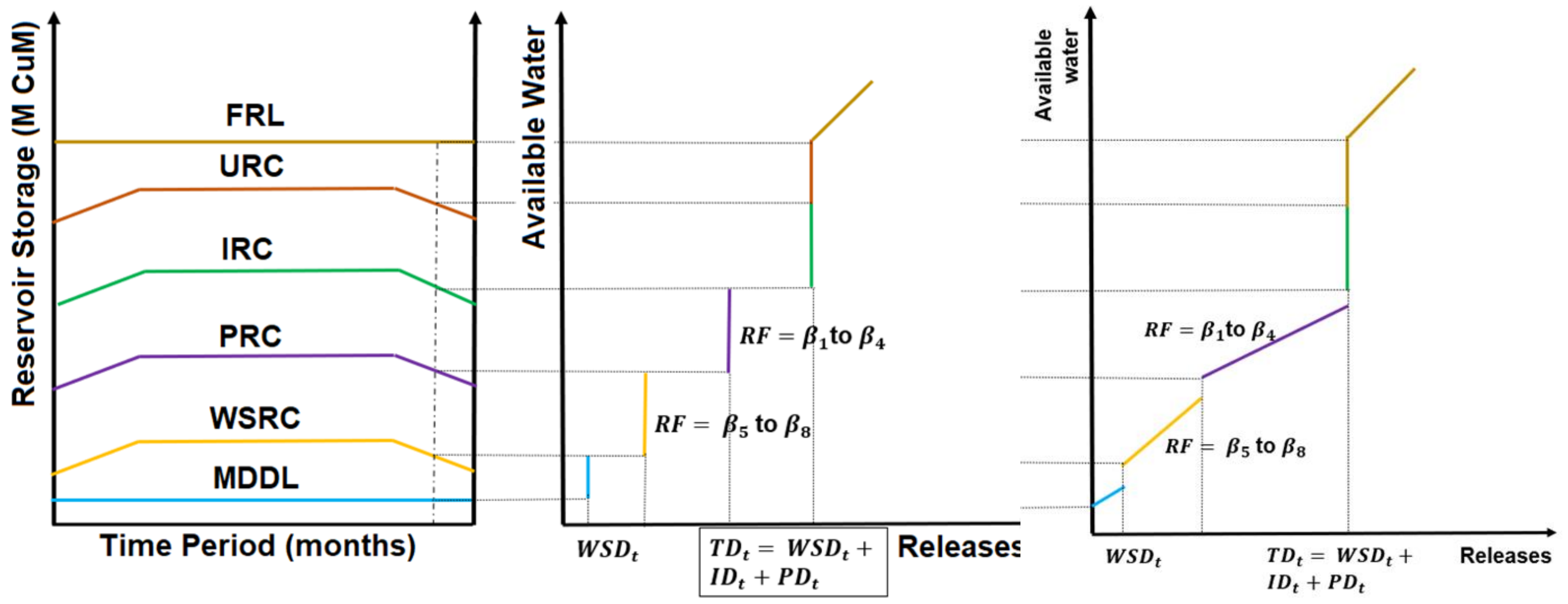
Reservoir Operation - Objectives

$$MSI_{irr} = min\left[\frac{100}{M \times N}\sum_{n=1}^{N}\sum_{m=1}^{M}\left(\frac{(ID_m - IrrR_{n,m})}{(ID_m)}\right)^2\right]$$

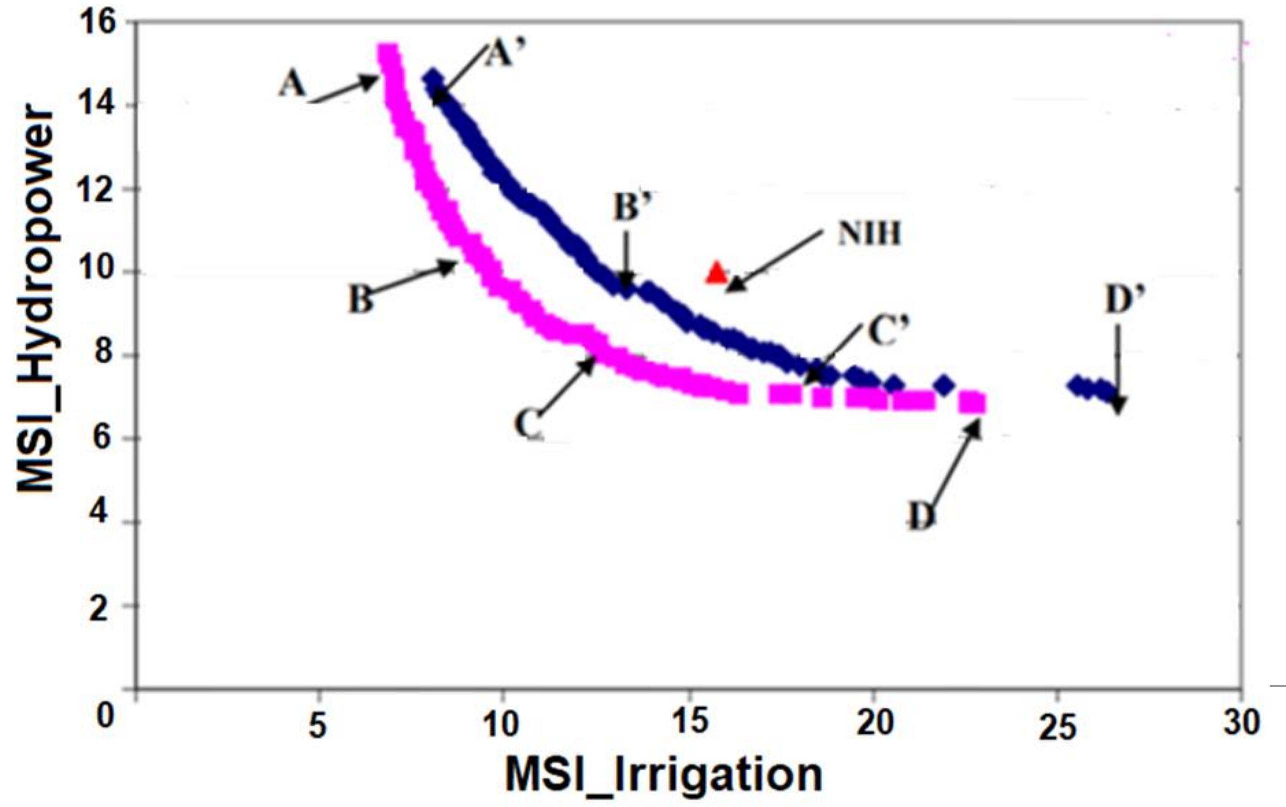
$$MSI_{pow} = min\left[\frac{100}{M \times N}\sum_{n=1}^{N}\sum_{m=1}^{M}\left(\frac{(PD_m - PowR_{n,m})}{(PD_m)}\right)^2\right]$$

Study Area

Hedging Policies – DH, m-TPH



Results – RO Tool



MULTI ATTRIBUTE DECISION MAKING – TOPSIS Procedure

$$wna_{ij} = w_j \times na_{ij}$$

$$is_j = \begin{cases} \min(wna_{ij}) & \forall\, non-beneficial\ attributes \\ \max(wna_{ij}) & \forall\, beneficial\ attributes \end{cases}$$

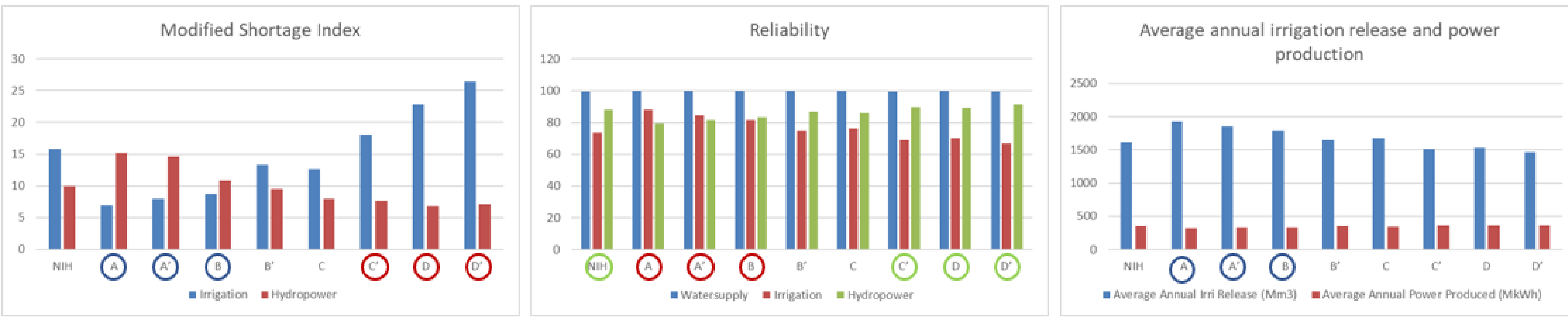
$$ais_j = \begin{cases} \max(wna_{ij}) & \forall\, non-beneficial\ attributes \\ \min(wna_{ij}) & \forall\, beneficial\ attributes \end{cases}$$

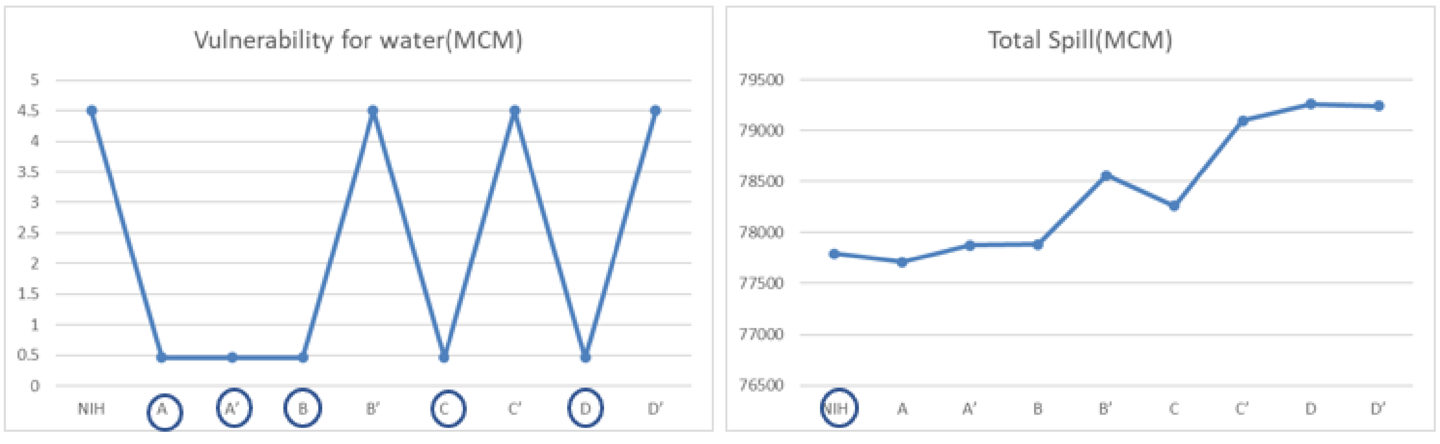
$$dis_{ij} = \sqrt{\Sigma_{i=1}^{m}(is_j - wna_{ij})^2}$$

$$dais_{ij} = \sqrt{\Sigma_{i=1}^{m}(ais_j - wna_{ij})^2}$$

$$rci_i = \frac{dais_{ij}}{dais_{ij} + dis_{ij}}$$

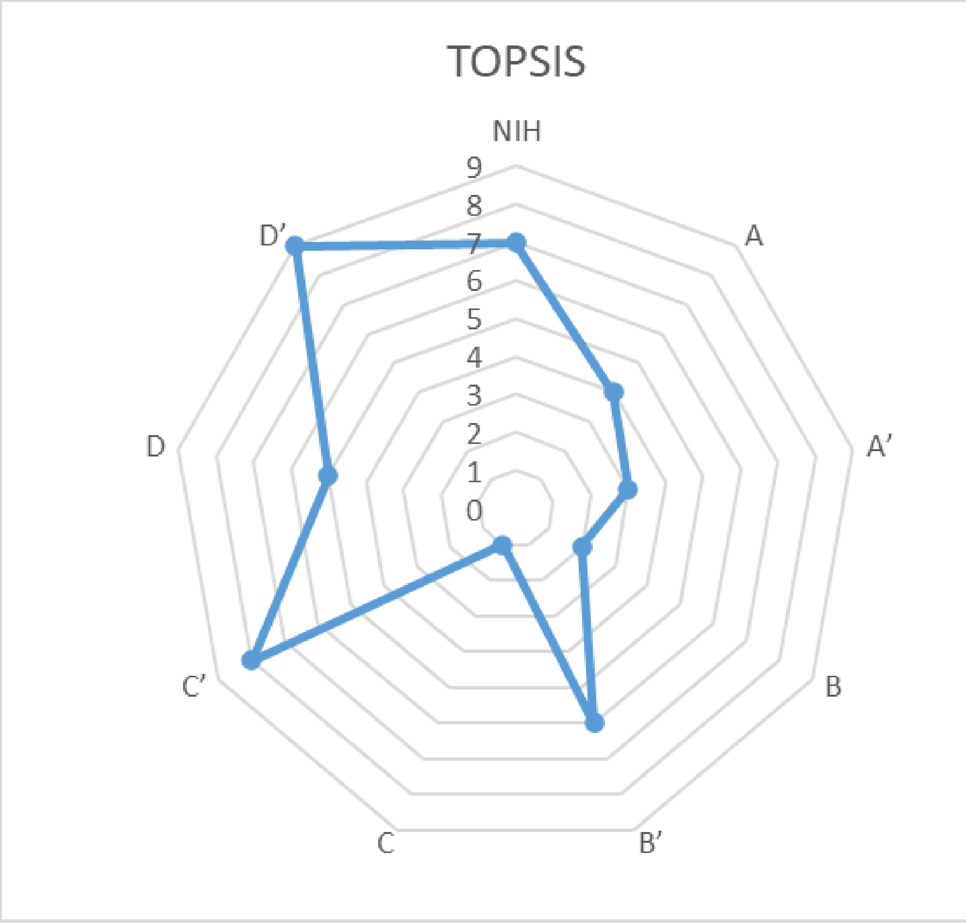
Performance Measures





- The solutions A, A′, B have ***minimum MSI*** for irrigation compared to others
- ***Minimum MSI power*** for solutions NIH, B′, C, C′, D, D′
- All solutions have ***high reliability for WS, average annual power production, irrigation releases***
- All expect solution A has ***high reliability for power***
- All linear solutions and A′ has ***least vulnerability***
- NIH solution has ***least total spills*** compared to other solutions

Results – MADM Tool – Ranking by TOPSIS Method



Applications

Helps the decision-makers/ stakeholders in optimal water allocation

Eases the ranking process for researchers/ practitioners

References

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