

MULTI CRITERIA DECISION MAKING IN IRRIGATION SYSTEM (MCDM)

¹Anuj Pawar, ²Swapnil Raut, ³Arpit Vyas

¹Assistant Professor, ²Assistant Professor, ³ Assistant Professor
Department of Civil Engineering,
Thakur college of Engineering and Technology Mumbai, India

Abstract : PROMETHEE was made by Professor Jean-Pierre Brans in 1982. Around then it included just the fundamental PROMETHEE I and II rankings. Before long Bertrand Mareschal began to work with Jean-Pierre Brans on the improvement of the technique. PROMETHEE III (interim request) and IV (constant) expansions were proposed in 1983. A first (centralized computer) PC program was executed around then. In the vicinity of 1984 and 1989, two imperative points of reference occurred: the GAIA technique was made as an expressive expansion of PROMETHEE and the (MS-DOS) PROMCALC programming was made accessible to the clients of PROMETHEE. GAIA is still today one of a not very many compelling enlightening MCDA techniques. PROMCALC (later PROMCALC-GAIA) was one of the main really intuitive MCDA programming with a solid accentuation on UI, graphical portrayals and affectability investigation. In the 90's extra PROMETHEE-based instruments were made: PROMETHEE V gave an answer for obliged Multicriterion determination of a subset of activities while PROMETHEE VI presented the thought of the "leader mind" in GAIA. In the interim cooperative choice expansions of PROMETHEE and GAIA were likewise presented. Toward the finish of the century, Decision Lab 2000 was propelled as a joint task between our ULB group and the Canadian organization Visual Decision. It supplanted PROMCALC and set up new gauges for MCDA programming.

IndexTerms - Mcdm, Promethee, Decision lab.

I. INTRODUCTION

How to pick the correct inclination work?

Right now the D-SIGHT programming is in its late beta stage. It will incorporate some more up to date advancements (particularly visual portrayals for PROMETHEE and expansions of GAIA). There are six unique states of inclination work in the first PROMETHEE strategies and in the PROMETHEE programming. Here are a few rules in picking the correct inclination work for Your model. The V-shape (type III) and direct (type I) inclination capacities are most appropriate for quantitative criteria (e.g. costs, costs, control,). The decision will rely upon whether you need to present an impassion limit or not. All things considered, V-shape is a unique instance of the direct one. The Gaussian (type VI) inclination work is less regularly utilized as it is more hard to parameter (the s edge esteem is somewhere close to the q lack of concern edge and the p inclination threshold). The Usual (type I) and Level (type IV) inclination capacities are most appropriate for subjective criteria. If there should be an occurrence of few levels on the criteria scale (e.g. indeed/no criteria or up to 5-point scale) and if the distinctive levels are considered very not the same as each other, the Usual inclination work is the great decision. On the off chance that you need to separate littler deviations from bigger ones, the Level inclination work is more sufficient.

THE PROMETHEE METHOD IS A MULTI-CRITERIA DECISION AID SYSTEM THAT PERMITS THE BUILDING OF AN OUTRANKING BETWEEN DIFFERENT ALTERNATIVES.

This article contains a short prologue to the multi -criteria choice guide framework PROMETHEE. Table 1 represents a generic evaluation table. The idea of summed up criteria is acquainted all together with consider the degree of the deviations between the evaluations. For this reason we characterize inclination work $P_j(a,b)$ as giving the level of inclination of arrangement a over arrangement b for a given criteria, f_j . By and large, we can accept that $P_j(a,b)$ is a component of the deviation $d=f(a) - f(b)$. We consider that the capacity $P_j(a,b)$ is standardized, so that:

- $0 \leq P_j(a,b) \leq 1$;
- $P(a,b)=0$, if $d \leq 0$, no inclination or detachment;
- $P(a,b) \approx 0$, if $d > 0$, feeble inclination;
- $P(a,b) \approx 1$, if $d \gg 0$, solid inclination;
- $P(a,b)=1$, if $d \gg \gg 0$, strict inclination.

Plainly P must be a non-diminishing capacity of d, Parameters q and p are referred to separately as the lack of interest and the inclination limit. The summed up measure related with $f(\cdot)$ is then characterized by the match $(f(\cdot), P(\cdot, \cdot))$. The PROMETHEE technique requires a summed up rule to be related with every standard, f_j

Enhancement of the Dominance Relation

	f1(.)	f2(.)	...fj(.)	...fk(.)
a1	f1(a1)	f2(a1)	fj(a1)	fk(a1)
a2	f1(a2)	f2(a2)	fj(a2)	fk(a2)
Ai	f1(ai)	f2(ai)	fj(ai)	fk(ai)
An	f1(an)	f2(an)	fj(an)	fk(an)

An esteemed outranking connection is developed that considers every one of the criteria. Give us now a chance to assume that a summed up model (fj(.),Pj(.,.)) is related with every basis fj(.) .The p and q esteems are the impassion and inclination limits individually. At the point when the contrast between the assessments of an and b is lower than q it isn't critical, and the inclination of an over b is in this manner equivalent to zero. At the point when the contrast between the assessments of an and b is more noteworthy than p it is thought to be exceptionally critical, and the relating inclination is along these lines equivalent to one.A multi-criteria inclination file π(a,b) of an over b would then be able to be characterized, that considers every one of the criteria with the articulation (↓).

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$$0 \leq P_j(a,b) \leq 1 ;$$

$P(a,b)=0$, if $d \leq 0$, no preference or indifference;

$P(a,b) \approx 0$, if $d > 0$, weak preference; $P(a,b) \approx 1$, if $d >> 0$, strong preference; $P(a,b)=1$, if $d >>> 0$, strict preference.

Unmistakably P must be a non-diminishing capacity of d, Parameters q and p are referred to separately as the lack of interest and the inclination limit.

The summed up model related with f(.) is then characterized by the combine (f(.),P(.,.)) . The PROMETHEE technique requires a summed up standard to be related with every measure, fj .

Improvement of the Dominance Relation

An esteemed outranking connection is developed that considers every one of the criteria. Give us now a chance to assume that a summed up measure (fj(.),Pj(.,.)) is related with every model fj(.) .The p and q esteems are the apathy and inclination edges separately. At the point when the distinction between the assessments of an and b is lower than q it isn't critical, and the inclination of an over b is therefore equivalent to zero. At the point when the distinction between the assessments of an and b is more noteworthy than p it is thought to be exceptionally huge, and the relating inclination is in this manner equivalent to one.A multi-criteria inclination list π(a,b) of an over b would then be able to be characterized, that considers every one of the criteria with the articulation (↓).

$$\pi(a,b) = \sum_{j=1}^k w_j P_j(a,b)$$

Where $w_j > 0$ are weights related with every paradigm. These weights are certain genuine numbers that don't rely upon the sizes of the criteria. It is fascinating to take note of that if every one of the weights are equivalent, π(a,b) will just be the arithmetical normal of all the Pj(a,b) degrees. π(a,b) communicates how, and to what degree, an is liked to b , while π(b,a) communicates how b is wanted to an over every one of the criteria. The qualities π(a,b) and π(b,a) are registered for each match of choices a,b ∈ A . Along these lines, an entire and esteemed outranking connection is built on A .

Misuse for Decision Aid

Let us thought about how every option, a ∈ A ,

faces the n-1 others and in this way characterizes the two after outranking streams:

the positive outranking stream is given by: $\Phi^+(a) = 1_{n-1} \sum_{b \in A, b \neq a} \pi(a,b)$

the negative outranking stream is given by:

$$\Phi^-(a) = 1_{n-1} \sum_{b \in A, b \neq a} \pi(b,a)$$

The positive outranking stream communicates to what degree every option outranks all the others. The higher $\Phi^+(a)$ is, the better the elective will be. $\Phi^+(a)$ speaks to the energy of an, i.e. its outranking character. The negative outranking stream communicates to what expand every option is outranked by all the others. The littler $\Phi^-(a)$ is, the better the elective will be. $\Phi^-(a)$ speaks to the energy of an, i.e. its outranked character.

II PROMETHEE II

Function	Shape	Threshold
Usual		No threshold
U-shape		Q threshold
V-shape		P threshold
Level		Q and P thresholds
Linear		Q and P thresholds
Gaussian		S threshold

RANKING Standards-

As all outranking techniques, PROMETHEE strategy, which is the strategy that is produced and utilized through the task, continues to a pairwise examination of choices in each single basis keeping in mind the end goal to decide incomplete double relations signifying the quality of inclination of an option an over elective b. The assessment table is the beginning stage of the PROMETHEE technique. In this table, the choices are assessed on the diverse criteria. These assessments include basically quantitative information.

The implementation of PROMETHEE requires two additional types of information, namely:

Information on the relative significance (i.e. the weights) of the criteria considered

TABLE I. Information on the leader’s inclination work, which he/she utilizes when looking at the commitment of the options as far as each different basis. The weights of criteria can be resolved by different techniques. In the present work, weight factors mirroring the DMs past experience and their bits of knowledge are received.

The inclination work -

The inclination work (Pj) interprets the distinction between the assessments (i.e., scores)

got by two choices (an and b) as far as a specific paradigm, into an inclination degree running from 0 to 1.

$$P_j(a,b) = G_j[f_j(a) - f_j(b)], (1)$$

$$0 \leq P_j(a,b) \leq 1, (2)$$

Let be the inclination work related to the measure, $f_j(i)$ where G_j is a non-diminishing capacity of the watched deviation (d) amongst $f_j(a)$ and $f_j(b)$. Keeping in mind the end goal to encourage the choice of a particular inclination work, six essential composes have been proposed, common capacity, U-shape work, V-shape work, level capacity, straight capacity and Gaussian capacity (Table 1) Figure: Preference functions of Promethee

PROMETHEE allows the computation of the following quantities for each alternative a and b

$$K \Pi_r(a, b) = P_j(a, b) w_r, j, j \in J \Phi^+(\alpha) = \sum_{x \in A} \pi_r(x, a), (3) \Phi^-(\alpha) = \sum_{x \in A} \pi_r(a, x), \Phi(\alpha) = \Phi^+(\alpha) - \Phi^-(\alpha)$$

For each alternative a, belonging to the set A of alternatives, $\pi(a,b)$ is an overall preference index of a over b, taking into account all the criteria, $\Phi^+(\alpha)$ and $\Phi^-(\alpha)$. $\Phi(\alpha)$ represents a value function, whereby a higher value reflects a higher attractiveness of alternative a and is called net flow.

The two main PROMETHEE tools can be used to analyse the evaluation problem:

Fig. 1. The PROMETHEE I partial ranking,

Fig. 2. The PROMETHEE II complete ranking.

The PROMETHEE I partial ranking provides a ranking of alternatives. In some cases, this ranking may be incomplete. This means that some alternatives cannot be compared and, therefore, cannot be included in a complete ranking. This occurs when the first alternative obtains high scores on particular criteria for which the second alternative obtains low scores and the opposite occurs for other criteria. The use of PROMETHEE I then suggests that the decision-maker should engage in additional evaluation efforts. PROMETHEE II provides a complete ranking of the alternatives from the best to the worst one. Here, the net flow is used to rank the alternatives. Additional tools such as the „walking weights“ can be used to further analyse the sensitivity of the results in function of weight changes.

III. METHODOLOGY

The work is partitioned into the accompanying parts:-

- [1] Selection of the site.
- [2] Data gathering from the site (guide and format of the trench.)
- [3] Selection of distributaries based on I.C.A in hectares secured by every distributary.
- [4] Selection of Criteria.
- [5] Collection of information as questionnaire's agriculturists perspective (Appendix)
- [6] Collection of information from the official's perspective based on picked criteria.
- [7] Analysis of information gathered from farmer's perspective based on picked criteria.
- [8] Formulation of pay of network.
- [9] Use of (MCDM) Multi Criterion Decision Making weighted normal strategy.
- [10] Arrangements of distributaries" as indicated by climbing request of positioning from the last pay of framework by utilizing.
 - a) Unit weight
 - b) Using diverse weight for various criteria's

IV. Contextual investigation

Points of interest of selected site

Begumpur branch is 35 Km from Ujjani dam and is goes under Ujjani left bank channel, the length of waterway is spread 7Km-9Km. The water system territory under this branch is 10140 hector, head required is 7.14 cumecs against the conveying limit of 13.09 cumecs. The conveying limit at Km 10 (head) is 5.50 cumecs and that at the 34 Km (tail) it is 4.85 cumecs. Bhīma venture examines water system in two phases. In the main stage it was proposed build stockpiling on the waterway Pawana (a tributary of Mula/mutha/Bhīma) and in the second stage a dam close Ujjani on the stream Bhīma over the conjunction of Nira. The whole proposition to be served by the venture has no other appropriate source aside from giving water to the water system, mechanical and drinking water supply. The task report was submitted to focal water commission in January-1964 and cleared by the arranging commission in walk 1965.

Dissemination of frameworks

Water from the fundamental channels and branches should be dispersed over the whole order through a network of disseminations, minor and water courses. Distributaries will take off at reasonable focuses on edges between 2 greater nallas for water system of neighborhood fixes between these 2 nallas. Every one of the distributaries with the exception of water courses will be developed at government cost up to one cusecs release according to government. Roundabout No

C.D.A/1080/338/2786 CAD dt.13-04-1981. From the administration channels water courses will take off from outlets. For the most part no outlets will be permitted on the principle waterways/branches however they will be given on the distributaries or minors. Water courses for the water system of the fields will be built by the C.A.D. Experts. The waterway segments finished on various channels and made up to 6/2001 subsequently is as under.

Contingent on the surveys and questioners of agriculturists, official specialist and social laborers following criteria's are chosen.

1. On ranch improvement works (OFD): Farm advancement works incorporate essentially arrive leveling and molding. Social effect (SCI): Social effect incorporates creating work business, which is estimated regarding man days utilized per hectare for each yield developed
2. Conjunctive utilization of water assets (CUW): conjunctive utilization of surface and ground water is basic to give more dependable supply of water to crops when required and in addition to lessen water logging impact.

- 3. Use of composts and seeds (UFS): Timely supply of sources of info, for example, seeds, manures are basic for
- 4. Successful water system administration.
- 5. Economic effect (ECI): Economic effect incorporates farmer’s wage and income gather because of supply of water system water

Collection of information as questionnaire’s agriculturist’s perspective (Appendix)

With the conclusion of our guide the poll was framed according to composed index which was utilized to gather ranchers perspective of the different distributaries“. Each distributaries“ was partitioned into three principle parts head, center and tail and equivalent number of agriculturists was chosen from every part and replies to the inquiries were gathered for the required pay of framework.

- [1] Collection of information from the official’s perspective based on picked criteria.

Officers of the water system branch of Ujjani waterway segments were gotten some information about all the distributaries“ in view of the criteria chose as over (4). To frame the compensation of grids of the officers

- [2] Analysis of information gathered from farmer’s perspective based on picked criteria.

The information gathered from the poll were broke down based on the criteria chose and pay of framework of the normal of the farmer’s supposition was readied. According to the Table 2. Also, table 2A demonstrating phenomenal, great, great and normal status as indicated by the quantity of relative yes/no answers given by the agriculturists.

- [3] Formulation of pay of lattice.

After the arrangement of normal frameworks of agriculturists and authorities the last pay of grids is shaped by their normal, demonstrating the distributaries“ with their last esteems which frames the compensation of lattice with unit weight.

- [4] Use of (M.C.D.M) Multi Criterion Decision Making weighted normal technique.

With the feeling of our aides and site conditions the criteria’s were given weights and weighted normal technique the last grid with weighted estimations of criteria were framed.

- [5] Arrangements of distributaries as indicated by plummeting request of positioning from the last pay of grid by utilizing.

- Unit weight.
- Using diverse weight for various criteria“s.

According to the last estimations of the grids (unit and weighted) the distributaries were positioned and assembled concurring.

V. RESULTS AND DISCUSSION

Table 2

Average pay of matrix average					
	C1	C2	C3	C4	C5
D1	65	75	80	85	65
D2	80	65	85	60	80
D3	45	50	65	70	45
D4	35	45	50	45	40
D5	30	35	55	40	30

It is watched that positioning example arranged by choices is 2,1,3,4,5 and elective D2 with most elevated net Ø esteem is considered as the best. In view of the examination of the consequences of a certifiable issue including the use of Multi-Criterion Decision Making(MCDM) strategies in execution assessment ponders are connected to 5 distributaries of Begumpur branch trench of Ujjani venture, Maharashtra following conclusions are drawn on from improvement social effect and conjunctive utilization of water are the 3 criteria that are given the best needs by specialists. Collective choice influencing idea to can be viably consolidated in the basic leadership process utilizing the directly created technique, it is discovered that the perceptions from specialists help us to draw the right esteems.

Table 3

	\emptyset Horizontal	\emptyset vertical	\emptyset	Rank
1	0.066	0.472	0.406	2
2	0.06	0.5782	0.5182	1
3	0.252	0.213	-0.039	3
4	0.439	0.299	-0.14	4
5	0.5118	0.0332	-0.4786	5

VI. CONCLUSION

Water system water administration in water system plans is mind boggling because of their heterogeneity. Three periods of water system water administration in particular arranging, operation and assessment were recognized. Past examinations on the execution appraisal of water system plot have given the reasonable structure to execution estimation. This has been stretched out in this paper for the subjective and quantitative assessment of execution amid each period of water system water administration. Two sorts of execution measures were proposed in this paper: the allocative kind containing profitability and value; and the booking compose including sufficiency (overabundance), unwavering quality, adaptability, maintainability and proficiency. These execution measures are depicted with various properties in this paper. The systems to gauge these measures clarified in this paper furnish the water system experts with the data on the execution of water system water administration in the plan, their administration ability, the reaction of the water system water administration to varieties in climatological, physical and administration viewpoints and understanding to enhance the execution amid various periods of water system water administration.

Despite the fact that the essential concentrate is on the administration of channel frameworks for rural creation, we have additionally talked about pointers that can be utilized for evaluating longer term execution, including physical, monetary and social maintainability. At long last, the paper has featured the pivotal significance of key and operational administration execution. It is improbable that in any single assessment there will be adequate time or assets to survey all parts of execution simultaneously. Water is more noteworthy wellspring of mankind and isn't help for making life agreeable and extravagant other than different employments of water is it can to a great extent utilized for water system of land water system is only constant and dependable for various harvests as per their necessities. The Ujjani dam is built for improvement of the adjacent area of the Solapur and Solapur city.

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