



Construct a weighting through LNYP method with COPRAS method for decisionmaking.

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Abstract:

In our busy schedule, day to day life structure decision making is play an important role in our circumstances. Introduce a new objective weighting process of LNYP method it calculates average weighting of criteria. The average weighting is considering as an equal weight for the given criteria. For getting a good decision with help of LNYP - Complex Proportional Assessment (COPRAS) method, both methods are performing in multi-criteria decision making (MCDM) problem. The work of MCDM Methods to calculate the ranking of alternatives and it helps for make a right decision for decision makers. In this study, the decision maker selecting a better bike for our convince in environment. Applying a LNYP - COPRAS method can determine ranking of alternatives and it is easy to choose the better bike and also have a good deal between the decision maker and salesmen.

Keywords: Decision making, MCDM, LNYP Method, Average weighting, COPRAS method

Introduction:

In our technology world, the MCDM method plays the important role in our manufacturing environment. From the development of MCDM conduct the systematic problem are analyses in the method. Large amount of information can be generating extensive of computer software, it makes a developing the MCDM and supporting for decision making. Multi-criteria decision making is otherwise known as multi attribute decision making. In 1994 Zavadskas, Kaklauskas and sarka was Proposed the complexproportional assessment method (COPRAS). The COPRAS method can be successfully solved many varies types of complex decision problems in our environment. This method begins with performance of different alternatives and with respect to various criteria (attributes). This method is used to assess the maximizing and minimizing index values, and the effect of maximizing ad minimizing indexes of attributes on the results assessment is considered separately.

Although, a lot decision- making problem can solved by Complex Proportional Assessment (COPRAS) method. Applying LNYP method to calculate average weight and consider weight as equal weight to all criteria. By process of average weight and COPRAS the decision-maker quickly got a decision for manufacturing environment. They less in step and computational less in time while processing an LNYP method. Now, illustration problem for chosen the bike they are five different alternatives of the bike and seven criteria i.e.,

engine in CC, mileage in Kmpl, fuel tank capacity in liters, transmission in depending upon the bike, cost in lakhs, seat height in millimeter, Kerb weight in kilogram. The given data separate into beneficial attributes and non- beneficial attributes. The beneficial attributes of the given data are engine in CC, mileage in Kmpl, fuel tank capacity in liters, transmission depending on the bike and the non-beneficial attributes of the given data are cost in lakhs, Seat height in millimeter, Kerb weight in Kilogram.

Here introduces a method of **LNYP** for calculate the average weight for given criteria. The average weight is considered as equal for all criteria. And it is very simple to evaluate the average weight for the criteria. By comparing the LNYP method with Entropy process and CRITIC process can take some more computational time to evaluate the weight. And also, the **LNYP** Method is easy to understandable process and less in computational time. Comparing the three different ways of weighting process performs with COPRAS method and determining a ranking in different ways.

Literature Review:

In year 2019,” Combination of Multi-Criteria decision- making Models and regional flood analysis technique to prioritize sub- watersheds for flood control”, Purpose of this study was computing the sub-watersheds. It reduces the time and operations of watershed in cost of running as well as more efficient project of watershed. In critical conditions are determine the sub-watersheds. Here we including AHP, VIKOR methods were permutation employed.

In year2017, “A New Approach of Indonesian University Webometrics Ranking using entropy and PROMETHEE-2”, the performs of the study was to compare the entropy method ad PROMETHEE-2 Methods. The two methods evaluate a 27 Indonesian University Websites. The entropy method assesses four criteria. The PROMETHEE-2 method was providing a complete ranking of university websites from the best of the worst depend on the pair wise comparison of criteria.

In year 2010, “A New Additive Ratio Assessment (ARAS) Method in Multi- criteria Decision making”, performs of the paper they introduce a New Additive Ratio Assessment (ARAS) Method. Here method was study about the evaluation of microclimate inoffice rooms is presented. Based on the analysis and following criteria we evaluate the weightby determine method and also pairwise comparison based on the estimates of experts.

In year 2013, “An Analysis of Multi-Criteria decision-making methods”, the analyzes of the paper is common multi criteria decision making (MCDM) Methods it determines their applicability of different situations by compute the advantages and disadvantages. There are twelve separate methods for advantages and disadvantages in the identified literature review will be discussed. The MCDM Methods are better for specific and suited situations.

In year 2016, “The Multi-Objective decision making methods based on MULTIMOORA and MOOSRA for the laptop selection problem”, the study of the paper performs the analysis the present the laptop selection problem based on MOORA from

(MULTIMOORA) and Multi-objective optimization on the basis of simple ratio analysis (MOOSRA) both methods will solve the problem.

In year 2011, “Application of MOORA method for parametric optimization of milling process”, the present work in the paper they applied the application of the multi-objective optimization on the basis of ratio analysis (MOORA) method. This method solving a milling process. In decision problem they considering six different milling process parameters. This method solving a various different complex decision-making problem in present day of environment.

In year 2016, “Entropy based MCDM approach for selection of material”, the study of paper integrate d approach for select the suitable engineering design materials which can give a maximum performance and minimum cost. The weight for the criteria can be calculated by the entropy process and the ranking of the alternatives is computed using the COPRAS and MOORA method.

In year 2019, “Weighting methods for multi- criteria decision-making technique”, the performs of study provides an overview of different weighting methods are shown in this paper. The paper describes about the subjective weighting and objectiveweighting process to derived the weight for MCDM methods.

In year 2014, “Application of COPRAS Method for supplier selection”, the work of the study evaluation of the supplier performance firms that manufactures agricultural and construction equipment are present and the results were compared with the past research paper.

In year 2021, “Determination of objective weights using a new method based on the Removal effects of criteria (MERECE)”, the study of performs the new objective method was introduce in the paper i.e., MERECE. We used a logarithmic function to measure alternatives performance. The SAW and TOPSIS methods use completely different decision – making ideas, and decision- makers can use completely circumstances and problems.

Methodology:

LNYP Method:

In this section a new method based on Max-Min for compensatory method of criteria (LNYP) is proposed to determine the criteria weights in multi criteria decision – making problem. The category of this method related to the objective weighting methods for obtaining criteria weights. Already mentioned, the LNYP uses each criterion’s Max- Min on the performance of alternatives to determine criteria weights. The weights of criteria are considered as equal weight. In this study, compensatory method of Max-Min measure is help to calculate the average weight of alternatives performance. In the decision matrix two types of criteria are obtained, they are beneficial and non- beneficial criteria. For non- beneficial criteria consider the minimum value of the alternative’s performance. For criteria consider the minimum value of the alternative’s performance. The below following steps are help to calculate objective weighting of LNYP Process:

Steps in LNYP Method:

Step1:

Compute a y_P with R condition of Max and Min:

a) When, $R < q$, we apply the below formula:

In the given data all beneficial criteria can be calculate by below formula:

$$y_P = \frac{1}{(q_{(max)} - R)}$$

In the given data all non-beneficial criteria can be calculate by below formula:

$$y_P = \frac{1}{(q_{(min)} - R)}$$

b) When, $R > q$, we apply the below formula:

In the given data all beneficial criteria can be calculate by below formula:

$$y_P = \frac{1}{(R - q_{(max)})}$$

In the given data all non-beneficial criteria can be calculate by below formula:

$$y_P = \frac{1}{(R - q_{(min)})}$$

c) When, $R = q$ then the formula:

In the given data all beneficial criteria can be calculate by below formula:

$$y_P = \frac{1}{(R^2 q_{(max)} - R)}$$

In the given data all non-beneficial can be calculated by below formula:

$$y_P = \frac{1}{(R^2 q_{(min)} - R)}$$

Here $q_{(max)}$ - The maximum values in beneficial attribute are denote as $q_{(max)}$

$q_{(min)}$ - The minimum values in non-beneficial is denote as $q_{(min)}$

$R =$ Sum of beneficial attributes + Sum of Non- beneficial attributes

Step2:

Estimation the value of r_k :

$$r_k = \sum_{p=1}^n y_P$$

Step3:

Determining the Weighting based on Max and Min W_j :

$$W_j = \frac{y_P}{r_k}, \sum_{j=1}^n W_j = 1$$

Step4:

Calculation of Average Weighting A. W:

$$A. W = \frac{\sum_{j=1}^n W_j}{R}$$

The value of Average weighting is considered equal weight to all the criteria. The LNYP (average weighting) method help us to calculate the equal weighting for the given criteria.

COPRAS Method:

The ranking method of Complex Proportional assessment (COPRAS) method was approach by Zavadskas et al. In this methodology, the evaluation of result is considered separate by maximizing and minimizing Criteria. Based on both ideal and anti- ideal solutions us considering a best alternative. The procedure of COPRAS method includes several steps below:

Step1:

Set the initial Decision Matrix:

Based on the selection problem, the alternatives and attributes value in the decision matrix.

$$X = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix}$$

Where X_{ij} is the performance measure of i^{th} alternative on j^{th} criteria, m is the number of alternative and n is the number of criterion

Step2:

Equation to normalize the decision matrix by using the following matrix:

$$R = [r_{ij}]_{m \times n} = x_{ij} / \sum_{i=1}^m x_{ij}$$

Step3:

Determination of the weighted normalized decision matrix D, by following the below equation:

$$D = [y_{ij}]_{m \times n} = r_{ij} * w_j, i = 1, \dots, m$$

Where r_{ij} is the normalised performance value of i^{th} alternative on j^{th} criterion and W_j is the weight of the criteria, but here we use the average weight for each criterion. i.e., always equal weight for each criterion

The sum of weighted normalized values of each criterion is always equal to the weight for the criterion:

$$\sum_{i=1}^m y_{ij} = w_j$$

Step4:

In this step the sum of weighted normalized values is calculated for both beneficial and non-beneficial criteria by using the following equations:

$$S_{+i} = \sum_{j=1}^n y_{+ij} , S_{-i} = \sum_{j=1}^n y_{-ij}$$

Where y_{+ij} and y_{-ij} are the weighted normalized values for the beneficial and non-beneficial criteria respectively.

Step5:

Determination the relative significances of the alternatives, Q_i , by using the following equation:

$$Q_i = S_{+i} + \frac{S_{-min} \sum_{i=1}^m S_{-i}}{S_{-i} \sum_{i=1}^m (S_{-min}/S_{-i})}$$

Where S_{-min} is the minimum value of S_{-i}

Step6:

Calculation of the quantitative utility, U_i , for i^{th} alternative by using the following equation:

$$U_i = \frac{Q_i}{Q_{max}} \times 100\%$$

Where Q_{max} is the maximum relative significance value.

Step7:

Ranking for alternatives:

The greater value of U_i , the higher priority of the alternative. Based on the alternative's utility values a complete ranking of the competitive alternatives can be obtained.

Illustration:

Now, the illustration problem chosen a bike they are seven different criteria and five different alternatives. There are two types criteria i.e., beneficial criteria and non-beneficial criteria. The beneficial criteria are Engine capacity in Cubic centimetres, Mileage in Kilometres per litre, Fuel tank capacity in Litres, Transmission. The non-beneficial criteria are cost, seat height millimetre, Kerb weight kilogram.

EXP.NO	Engine Capacity (CC)	Mileage (Kmpl)	Fuel Tank Capacity (litres)	Transmission	cost	Seat height (mm)	Kerb weight (Kg)
Bike1	124.8	60	10	5	81070	780	123
Bike2	159.7	45	12	5	112255	800	145
Bike3	159.7	45	12	5	107963	790	139
Bike4	197.75	37	12	5	129004	800	152
Bike5	312.2	30	11	6	254489	810	174

Calculating weight:

LNYP Method:

Step1:

Where R=7

1) Engine:

In the first criteria engine was beneficial criteria. So chosen a maximum value from the criteria is 312.2

Engine satisfied the first condition $R < q$

Therefore, apply the below formula

$$y^P = \frac{1}{(q_{(max)} - R)}$$

$$= \frac{1}{(312.2 - 7)}$$

$$= 0.003277$$

2) Mileage:

In the second criteria mileage was beneficial criteria. So chosen a maximum value from the criteria is 60

Mileage satisfies the first condition $R < q$

Therefore, apply the below formula

$$y^P = \frac{1}{(q_{(max)} - R)}$$

$$= \frac{1}{(60 - 7)}$$

$$= 0.018868$$

3) Fuel tank capacity:

In the third criteria fuel tank capacity was beneficial criteria. So chosen a maximum value from the criteria is 12

Fuel tank capacity satisfied the first condition $R < q$

Therefore, apply the below formula

$$\begin{aligned}y_P &= \frac{1}{(q_{(max)} - R)} \\ &= \frac{1}{(12 - 7)} \\ &= 0.2\end{aligned}$$

4) Transmission:

In the fourth criteria transmission was beneficial criteria. So chosen a maximum value from the criteria is 6

Transmission satisfied the second condition $R > q$

Therefore, apply the below formula

$$\begin{aligned}y_P &= \frac{1}{(R - q_{(max)})} \\ &= \frac{1}{(7 - 6)} \\ &= 1\end{aligned}$$

5) Cost:

In the fifth criteria cost was non- beneficial criteria. So chosen a minimum value from the criteria is 81070

Cost satisfied the first condition $R < q$

Therefore, apply the below formula

$$\begin{aligned}y_P &= \frac{1}{(q_{(min)} - R)} \\ &= \frac{1}{(81070 - 7)} \\ &= 0.00001236\end{aligned}$$

6) Seat height:

In the six-criteria seat height was non- beneficial criteria. So chosen a minimum value of the criteria is 780

Seat height satisfied the first condition $R < q$.

Therefore, apply the below formula

$$\begin{aligned}y_P &= \frac{1}{(q_{(min)} - R)} \\ &= \frac{1}{(780 - 7)}\end{aligned}$$

Construct a weighting through LNYP method with COPRAS method for decisionmaking.

$$= 0.001294$$

7) Kerb weight:

In the seven criteria seating was non- beneficial criteria. So chosen a minimum value of the criteria is 123

Kerb weight satisfied the first condition $R < q$

Therefore, apply the below formula

$$y_P = \frac{1}{(q_{(min)} - R)}$$

$$= \frac{1}{(123 - 7)}$$

$$= 0.008621$$

	Engine	Mileage	Fuel tank capacity	transmission	Cost	Seat height	Kerb weight
y_P	0.003277	0.018868	0.2	1	0.00001236	0.002194	0.008621

Step2:

$$r_k = \sum_{p=1} y_P$$

$$r_k = 0.003277 + 0.018868 + 0.2 + 1 + 0.00001236 + 0.002194 + 0.008621$$

$$r_k = 1.23297236$$

Step3:

$$W_j = \frac{y_P}{r_k}$$

$$W_1 = \frac{0.003277}{1.23297236} = 0.0026578$$

$$W_2 = \frac{0.018868}{1.23297236} = 0.0153028$$

$$W_3 = \frac{0.2}{1.23297236} = 0.1622096$$

$$W_4 = \frac{1}{1.23297236} = 0.8110481$$

$$W_5 = \frac{0.00001236}{1.23297236} = 0.000010024$$

$$W_6 = \frac{0.002194}{1.23297236} = 0.0017794$$

$$W_7 = \frac{0.008621}{1.23297236} = 0.00699204$$

Construct a weighting through LNYP method with COPRAS method for decisionmaking.

	Engine	Mileage	Fuel tank capacity	Transmission	Cost	Seat height	Kerb weight
W_j	0.0026578	0.0153028	0.1622096	0.8110481	0.000010024	0.0017794	0.00699204

Step4:

$$A.W = \frac{\sum_{j=1}^n W_j}{R}$$

$$= \frac{0.0026578+0.0153028+0.1622096+0.8110481+0.000010024+0.0017794+0.00699204}{7}$$

$$A.W = 0.142857$$

By the process of LNYP Method, we calculate the average weight is 0.142857

Therefore, the value of average weight is considered as equal weight for all criteria. Hence the value of 0.142857 is equal weight.

COPRAS Method:

Step2:

Normalise decision matrix:

Bike1	0.130797	0.276498	0.175439	0.192308	0.118388	0.19598	0.167804
Bike2	0.167374	0.207373	0.210526	0.192308	0.163928	0.201005	0.197817
Bike3	0.167374	0.207373	0.210526	0.192308	0.157661	0.198492	0.189632
Bike4	0.207253	0.170507	0.210526	0.192308	0.188387	0.201005	0.207367
Bike5	0.327202	0.138249	0.192982	0.230769	0.371636	0.203518	0.237381

Step3:

Multiple the Normalize matrix and Equal weight :

Bike1	0.018685	0.0395	0.025063	0.027473	0.016913	0.027997	0.023972
Bike2	0.023911	0.029625	0.030075	0.027473	0.023418	0.028715	0.02826
Bike3	0.023911	0.029625	0.030075	0.027473	0.022523	0.028356	0.02709
Bike4	0.029608	0.024358	0.030075	0.027473	0.026912	0.028715	0.029624
Bike5	0.046743	0.01975	0.027569	0.032967	0.053091	0.029074	0.033912

Step4:

S_{+i}

Bike1	0.11072
Bike2	0.111083
Bike3	0.111083
Bike4	0.111513
Bike5	0.127029

S_{-i}

Bike1	0.068882
Bike2	0.080393
Bike4	0.077969
Bike5	0.085251
Bike5	0.116076

Step5:

Determination the relative significances of the alternatives Q_i :

Q_i

Bike1	0.214198
Bike2	0.199744
Bike3	0.2025
Bike4	0.195122
Bike5	0.188435

Step6:

Calculating the quantitative utility U_i :

Bike1	100
Bike2	93.2521
Bike3	94.53879
Bike4	91.09409
Bike5	87.97207

Step7:

Ranking:

Bike1	1
Bike2	3
Bike3	2
Bike4	4
Bike5	5

By the above process we compute the ranking, by applying LNYP method and COPRAS method. The ranking determines the first ranking as take place bike1. This ranking is very helpful to chosen a bike for decision maker.

Multi - criteria decision – making methods requires weighting criteria. For different weighting methods, also they have a different value of weight. In addition, the weight of the criteria affects the ranking of alternatives.

The below table shown as ranking alternatives for different weighting methods

Alternatives	Weighting methods		
	LNYP (Equal Weight)	CRITIC Weight	Entropy Weight
Bike1	1	1	1
Bike2	3	3	3
Bike3	2	2	2
Bike4	4	4	4
Bike5	5	5	5

From the above analysis, the study of LNYP method will be applied for multi- criteria decision-making problems for given alternatives. In this case, weight of criteria also determined by three different methods. The main objective of this study is to determine the stability of finding the best solution using the LNYP method.

Conclusion:

In the classification of weighting method the LNYP method is an objective weighting method. The objective weighting method of LNYP process determine the average weight and it is considered as an equal weight for all criteria. It is very simple and quickly to calculate the equal weight for given criteria. In complex proportional analysis (COPRAS) method is a better method for making decision and also easier method for our ranking. Here determining the ranking with LNYP- complex proportional analysis (COPRAS) method the decision maker got a good decision for chosen a bike. The method of LNYP is reduced in step and save the time for making decision in our environment. In future studies, the LNYP method solved with other multi-criteria decision making for getting better ranking. The LNYP method and COPRAS method may be applied for other multi-Criteria decision-making problems with any numbers of criteria and alternatives.

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