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USING MCDM TECHNIQUE-TOPSIS FOR SELECTING SMALL PASSENGER CAR

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Abstract— This paper is about using multiple criteria decision making technique in finding best suitable car for Indian Middle class family. A literature review on TOPSIS is also performed in the paper. In this paper some major parameters are considered by customer while purchasing a small passenger car for day to day life.

1.0 INTRODUCTION

Customer faces so much confusion and problem while purchasing small passenger car for day to day life. During decision making for a purchase of car, customer has to decide from which company they should purchase the car. Customer has to select a car depending upon face value of company, product cost, product maintenance cost, product resale value etc. its common within a family that different member has different opinion about selecting car. During selection rank the car parameters like their Cost, Company, service cost and Fuel Consumption per Kilometer. During ranking set process is followed through a questionnaire method. In this list of parameters are selected and ranking was done on parameter which are important while selecting car for 20 middle class family of average member 4. And then weightage was taken by different family member for top four selected parameters. Various Multi-Criteria Decision Making(MCDM) techniques are available for example analytic hierarchy process, fuzzy set theory, DEA, goal programming, ELECTRE, PROMETHEE and TOPSIS.

2.0 LITERATURE REVIEW

Jadidi, et al. [1] This paper is examining about TOPSIS and fuzzy mode for provider choice issue has been talked about. The Main target of applying TOPSIS and fluffy incorporates lessening net dismissed thing limit the all out expense and backwards all out benefit of buying. The fundamental

target is to ascertain ideal request amounts among chosen provider. Jitendra et al. [2] apply the TOPSIS technique for choice of refrigerant. Contextual investigation is done on refrigeration framework. Coefficient of execution of cooler rely on numerous parameter and refrigerant is one of them. TOPSIS is applied on four refrigerant with four criteria and best refrigerant is chosen. Krohling and Pacheco [3] examined about the TOPSIS and its utilization for positioning developmental calculations. Right now comprises of calculations and criteria are principle parameters .TOPSIS is utilized to think about the exhibition among the algorithmic in term of standard deviation and mean worth. Vega et al. [4] examined about the TOPSIS strategy and comes out with new system TOPSIS-M.TOPSIS take a shot at Euclidean standard, where it is assumed that all property are free of one another. In really life this isn't in every case genuine a few characteristics are reliant of one another where TOPSIS-M ought to be utilized. Yabinhi et al. [5] look at the three changed multi-criteria dynamic strategy for settling on choice about conveyed vitality framework .Decision creators need to choose best DES for five criteria speculation cost, essential vitality use, working expense and CO2 discharge. Right now accomplished from TOPSIS and COPRAS are achievable and pertinent. Velasquez and Hester [6] talked about the different multi-criteria dynamic techniques. As dozen of strategies have been created and this paper fundamentally examine about the writing audit of all regular multi-criteria dynamic system. It talk about the quality and shortcoming of every strategy. Opricov and Tzeng [7] look at the two changed procedures of multi criteria dynamic VIKOR and TOPSIS. In TOPSI strategy vector standardization is utilized though in VIKOR straight standardization is utilized. TOPSIS decide an answer which is closest to perfect arrangement, yet it doesn't concentrate on the general significance of these separation while VIKOS does. A correlation investigation of both technique is finished by demonstrating their likeness and contrasts.

2.1 TOPSIS

Top request inclination by similitude to perfect arrangement is one of the strategies for multi-criteria dynamic system. Right now perfect arrangement and negative perfect arrangement are resolved. After that substitute which is closest to positive perfect arrangement and most distant to the negative perfect arrangement is discover and chosen as best exchange. Principle preferred position of TOPSIS system over all other accessible procedure is the effortlessness to utilize and number of step will stay same paying little mind to number of characteristic accessible. TOPSIS discovered its application in different assembling framework, venture the board framework, inventory network the executives framework, building, plan and different other framework too. Premise thought or key of TOPSIS is that best arrangements ought to have most limited good ways from positive perfect arrangement and most distant from against perfect arrangement. TOPSIS method essentially comprise of seven key advance which the examined as:

Step 1. Development of decision matrix and offering weightage to every measure.

Step 2. Calculate the normalized decision matrix. The performance of all the attributes or criteria needs to be normalized. Difference normalization method can be used for this purpose.
(a) The ideal normalization is to be done by dividing all criteria by highest valve in each column if criteria has to be maximized and vice versa if it has to be minimized.
(b) The distributive normalization is the step of normalization all criteria of the column is divided by square root of the sum of each squared element.
IDEAL NORMALIZATION:

$$Zai=xai/va+ \quad \text{for } a=1$$
$$\text{Where} \quad ua+= \max.(xai)$$
$$Zai=xai/va- \quad \text{for } a=1$$
$$\text{Where} \quad ua- = \min.(xai)$$

Step 3. Weighted normalized decision matrix is calculated in this step. In third step weightage value is multiplied with each column of normalized value i to produce weighted normalized matrix.

Step 4. In this step ideal best and ideal worst solution are calculated. It is the process of selecting maximum or minimum value the weighted column, like for cost we prefer lower so lover value will be Ideal best solution and for Fuel economy we need more than higher value will be ideal best, and vice versa for ideal worst solution

X+= [K1+… Kj+… Kn+]
X-= [K1_… Kj-… Kn--]
[X+ = Denote ideal best solution]
[X--=Denote ideal worst solution]

Step 5. Calculate the separation of each alternative from positive and negative ideal solution.

$$X+= \sqrt{\sum} (Ki+-Zai)2$$
$$X- = \sqrt{\sum} (Ki--Zai)2$$

Step 6. In this step relative closeness to positive ideal solution is determine.

$$C= \quad X- / X++ X-$$

Step 7. Rank the alternative and choosing best solution of the matrix.

3. CASE STUDY

An car manufacturing industry wants to launch a car on the basis of their preferences based on some parameters selected by customer itself. For this industry has selected 20 middle class family having annual salary Rs 6 lakh to 10 lakh and they are planning to purchase a car. While survey four independent parameters highlighted are product cost, Boot Space, fuel economy and Maximum Power Generated by engine.
The company has decided to manufacture a car of maximum price 7 lakhs. So they have short listed 4 major selling cars in India under 5 lakhs. By this industry designer will get better idea while designing of new product.

While selecting cars for cover of different overview all cars are taken from different manufacturer.

Finally four cars selected are as mentioned Maruti Suzuki Alto 800 (Petrol), Hundai Santro (Petrol), Renault Kwid (Petrol) and Tata Tiago (Petrol). All cars are petrol fueled and lowest price of model is selected.

According to survey done by industry different weightage given like 0.1 weightage is given to Boot Space in Litres, o.2 to Power generated by vehicle in Break Hourse Power (Bhp), o.3 is given to Fuel Economy in Kilometer per Litre offuel consumed (Km/L) and 0.4 weightage is given to Cost of the vehicle in Rupees in lakhs.

The following parameter of vehicle is given in Table 1.1.

Table 1.1

	Cost in Lakhs	Boot Space in Litres	Fuel Economy in Km/L	Power Generated in Bhp
WEIGHT	0.4	0.1	0.3	0.2
1.Maruti Suzuki Alto 800 (Petrol)	2.95	177	22	40.3
2.Hundai Santro (Petrol)	4.57	235	20	58
3.Renault Kwid (Petrol)	2.92	279	23	67
4.Tata Tiago (Petrol)	4.6	242	23	84.48

For normalization of values two different methods are available. One method is known as distributive normalization. Second method is known as ideal normalization method. We have used the distributive normalization in this paper. In this method of normalization each criteria column is divided by square root of the sum of each squared element as shown in the table 1.2.

Table 1.2 Distributive normalization

	Cost in Lakhs	Boot Space in Litres	Fuel Economy in Km/L	Power Generated in Bhp
WEIGHT	0.4	0.1	0.3	0.2
1.Maruti Suzuki Alto 800 (Petrol)	0.383	0.375	0.499	0.313
2.Hundai Santro (Petrol)	0.594	0.498	0.454	0.450
3.Renault Kwid (Petrol)	0.379	0.591	0.522	0.520

4.Tata Tiago (Petrol)	0.597	0.513	0.522	0.655

After calculating the distributive normalized values in table 1.2 we will find out weighted normalized scores. In this step weightage value is multiplied with each column normalized value to produce weighted normalized matrix as shown in table 1.3.

Table 1.3 Weighted normalized scores

	Cost in Lakhs	Boot Space in Litres	Fuel Economy in Km/L	Power Generated in Bhp
1.Maruti Suzuki Alto 800 (Petrol)	0.153	0.037	0.150	0.063
2.Hundai Santro (Petrol)	0.237	0.050	0.136	0.090
3.Renault Kwid (Petrol)	0.152	0.059	0.157	0.104
4.Tata Tiago (Petrol)	0.239	0.051	0.157	0.131

In the next we will select the Ideal Best and Ideal worst value of parameters as Cost minimum value will be Ideal best and Maximum value will be Ideal Worst. Similarly for Boot space, Fuel economy and Power generated higher value will be Ideal Best and vise versa. In this step positive ideal best and negative ideal worst are calculated as shown in the table 1.4 by using ideal normalization.

Table 1.4 Ideal Best and Ideal Worst Value

	Cost in Lakhs	Boot Space in Litres	Fuel Economy in Km/L	Power Generated in Bhp
X+	0.152	0.059	0.157	0.131
X-_	0.239	0.037	0.136	0.063

After this the separation of each alternative from Ideal best and ideal worst solution is calculated along this step relative closeness to ideal best solution is determine. Then according to relative closeness ‘C’ rank will be decided as shown in the figure 1.5.

Table 1.5 Closeness calculation

	1.Maruti Suzuki Alto 800 (Petrol)	2.Hundai Santro (Petrol)	3.Renault Kwid (Petrol)	4.Tata Tiago (Petrol)
Sa+	0.072	0.098	0.027	0.088
Sa_	0.186	0.247	0.197	0.272
C	0.721	0.717	0.879	0.756
Rank	3	4	1	2

4. CONCLUSION

By this ranking through MCDM based on TOPSIS following results are concluded. Out of the 4 car selected the best suited car will Renault Kwid(Petrol) followed by Tata Tiago (Petrol) and then Maruti Suzuki Alto 800 (Petrol). The worst case is of selecting Hundai Santro (Petrol) on the basis of these parameters selected and weightage given to different parameters. This Results can vary in accordance to different set of people if they have different weightage criteria and different aspects of parameters required in the vehicle.

5. References

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