

CHAPTER - VIII

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APPLICATION OF INTUITIONISTIC FUZZY TOPSIS METHOD

Decision Making is one of the most complex issues that need scientific analysis of various factors, both tangibles and intangibles like attitude, belief, taste and preferences of people involved. The ever increasing alternatives and the expectations of the beneficiaries make the decision making more complicated. What is good for one is not the same for others. When a decision goes wrong, one finds it very difficult to compromise for the outcome. On contrary, the same goes right he feels comfortable. Nowadays, decision making is not the problem of administrators alone, every common man is bound to take right decision on many routine affairs like food, shelter, education for children, purchase of durables, healthcare, conveyance and so on. So the researcher intended to develop a mathematical model for decision making regarding the selection of right mode of public transport by women commuters using Intuitionistic Fuzzy TOPSIS method.

Based on the pilot study, the authors identified four modes of public transport which forms the alternative set $A = \{A_1, A_2, A_3, A_4\}$ and five specific criteria which forms the criteria set $C = \{C_1, C_2, C_3, C_4, C_5\}$.

Modes of transport (Alternative Set A)

A_1 – Taxi

A_2 – Auto

A_3 – Mini Bus

A_4 – Government Bus

Criteria Set C

C_1 - Economical (Cost Criterion)

It denotes the cost involved for the journey. The tariff charged varies from one mode of transport to the other.

C₂ - Flexibility (Benefit criterion)

Flexibility in terms of timings, accessibility, departure and destination.

C₃ - Comfort (Benefit criterion)

It refers to comfort during travel.

C₄ - Time saving (Benefit criterion)

It refers to the time taken for the travel between the place of departure and destination.

C₅ - Safety (Benefit criterion)

It refers to safety of self and belongings during the travel.

For the purpose of ascertaining membership function, non – membership function and degree of importance, the opinion of the women respondents about the five criteria for each mode of transport was collected by administering a questionnaire (The first author already published an article entitled “Suitable mode of Public Transport – A Decision making model using Possibility Intuitionistic Fuzzy Soft Sets[34]” using a part of the data collected). A sample of 100 women respondents, working women and college students in Coimbatore city, was selected by adopting convenient sampling technique. Five point scaling technique (Strongly Agree, Agree, Neither Agree nor Disagree, Disagree, Strongly Disagree) was adopted to assess the degree of agreement and disagreement towards the five criteria for each mode of transport.

The number of respondents who marked either ‘Strongly Agree’ or ‘Agree’ was counted and its proportion to total respondents was used for framing membership function. The number of respondents who marked either ‘Disagree’ or ‘Strongly Disagree’ was used for framing non – membership function as above.

Therefore the intuitionistic fuzzy decision matrix D for the four alternatives and five criteria is

$$D = \begin{matrix} & C_1 & C_2 & C_3 & C_4 & C_5 \\ \begin{matrix} A_1 \\ A_2 \\ A_3 \\ A_4 \end{matrix} & \begin{bmatrix} (0.20,0.73,0.07) \\ (0.26,0.74,0.00) \\ (0.50,0.43,0.07) \\ (0.60,0.37,0.03) \end{bmatrix} & \begin{bmatrix} (0.57,0.40,0.03) \\ (0.61,0.27,0.12) \\ (0.30,0.64,0.06) \\ (0.42,0.53,0.05) \end{bmatrix} & \begin{bmatrix} (0.73,0.24,0.03) \\ (0.53,0.40,0.07) \\ (0.39,0.60,0.01) \\ (0.12,0.78,0.10) \end{bmatrix} & \begin{bmatrix} (0.59,0.39,0.02) \\ (0.52,0.46,0.02) \\ (0.23,0.71,0.06) \\ (0.14,0.70,0.16) \end{bmatrix} & \begin{bmatrix} (0.52,0.46,0.02) \\ (0.51,0.41,0.08) \\ (0.44,0.50,0.06) \\ (0.72,0.21,0.07) \end{bmatrix} \end{matrix}$$

For the purpose of ascertaining degree of importance of each criterion, three point scaling technique (Always, Sometimes, Never) was used. The Number of respondents who marked “always” for each criterion was counted and its proportion to total respondents was ascertained to fix the degree of importance of the respective criteria. In the same manner the degree of non importance was fixed by counting the number of respondents who marked “never” for each criterion.

The subjective importance of attributes, W, given by the decision makers is

$$W = \begin{matrix} & C_1 & C_2 & C_3 & C_4 & C_5 \\ & [(0.61,0.20,0.19) & (0.87,0.20,0.11) & (0.47,0.45,0.08) & (0.75,0.20,0.05) & (0.90,0.03,0.07)] \end{matrix}$$

The intuitionistic fuzzy weighted decision matrix D' is

$$D' = \begin{matrix} & C_1 & C_2 & C_3 & C_4 & C_5 \\ \begin{matrix} A_1 \\ A_2 \\ A_3 \\ A_4 \end{matrix} & \begin{bmatrix} (0.112,0.784,0.094) \\ (0.159,0.792,0.049) \\ (0.305,0.544,0.151) \\ (0.366,0.496,0.138) \end{bmatrix} & \begin{bmatrix} (0.496,0.412,0.092) \\ (0.531,0.285,0.185) \\ (0.261,0.647,0.092) \\ (0.365,0.539,0.095) \end{bmatrix} & \begin{bmatrix} (0.343,0.582,0.075) \\ (0.249,0.670,0.081) \\ (0.183,0.780,0.037) \\ (0.056,0.879,0.065) \end{bmatrix} & \begin{bmatrix} (0.443,0.512,0.046) \\ (0.390,0.568,0.042) \\ (0.173,0.768,0.060) \\ (0.105,0.760,0.135) \end{bmatrix} & \begin{bmatrix} (0.468,0.476,0.056) \\ (0.459,0.428,0.113) \\ (0.396,0.515,0.089) \\ (0.648,0.234,0.118) \end{bmatrix} \end{matrix}$$

Intuitionistic Positive Ideal Solution:

$$A^+ = \{ \langle 0.122, 0.792, 0.086 \rangle, \langle 0.531, 0.285, 0.185 \rangle, \langle 0.343, 0.582, 0.075 \rangle, \langle 0.443, 0.512, 0.046 \rangle, \langle 0.648, 0.234, 0.118 \rangle \}$$

Intuitionistic Negative Ideal Solution:

$$A^- = \{ \langle 0.366, 0.496, 0.138 \rangle, \langle 0.261, 0.647, 0.092 \rangle, \langle 0.056, 0.879, 0.065 \rangle, \langle 0.105, 0.768, 0.127 \rangle, \langle 0.396, 0.515, 0.089 \rangle \}$$

Table 1: Intuitionistic Separation Measures

	S_{i+}	S_{i-}
A1	0.0756	0.2459
A2	0.0761	0.2480
A3	0.2720	0.0511
A4	0.2371	0.0794

Table 2: The Relative Closeness Of each Alternative with respect to the Intuitionistic Positive Ideal Solution

C_i^*		
	Value	Rank
A1	0.7649	2
A2	0.7651	1
A3	0.1581	4
A4	0.2509	3

From the above results it is seen that of the four modes of public transport Auto(A2) ranks first. So it is inferred that Auto (A2) is the most preferred mode by women commuters in the study area. The other modes based on the priority are Taxi (A1 - Rank 2), Govt.Bus (A4-Rank 3) and Mini Bus (A3 - Rank 4).