MULTI-CRITERIA EVALUATION OF TOURIST SATISFACTION

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Abstract: *In this paper, two new formulas for calculation of tourist satisfaction based on multi- criteria model with one dominant criterion are given. This is a continuation of the work and the results obtained in Pavlović et al., 2018. A comparative analysis was done through examples.*
Keywords: *Tourist satisfaction, multi-criteria evaluation, weight coefficients, criteria for evaluation, dominant criterion.*

INTRODUCTION

In Pavlović et al., 2018 two formulas for evaluation the tourist satisfaction are introduced. These formulas are based on criteria $\boldsymbol{C_1, C_2, \ldots, C_n}$ for measuring (calculating) deviations (i.e. satisfaction, dissatisfaction), where $\boldsymbol{W_1, W_2, \ldots, W_n}$ are relative weight of these criteria and

$$\sum_{i=1}^{n} \boldsymbol{W_i} = \mathbf{1}.$$

If we assume that tourist expectations are defined by each of the criteria represented by the number $\boldsymbol{O_1, O_2, \ldots, O_n}$, where $\mathbf{0} \leq \boldsymbol{O_i} \leq \mathbf{1}$, then $\boldsymbol{O_i} = \mathbf{0}$ indicates that we do not expect anything for criterion $\boldsymbol{C_i}$, where $\boldsymbol{O_i} = \mathbf{1}$ means that we have maximal expectation according to criterion $\boldsymbol{C_i}$. Values between 0 and 1 represent estimates of satisfaction expectations $\boldsymbol{O_i}$ according to criterion $\boldsymbol{C_i}$.

After the service has been completed, tourist expresses the level of satisfaction (or dissatisfaction) with the received services according to each criteria $\boldsymbol{C_1, C_2, \ldots, C_n}$ with value $\boldsymbol{D_i}$, where $\boldsymbol{i} = \mathbf{1}, \ldots \boldsymbol{n}$ and $\mathbf{0} \leq \boldsymbol{D_i} \leq \mathbf{1}$. In

this case, $\boldsymbol{D_i = 0}$ means that, by criterion $\boldsymbol{C_i}$, the tourist was completely dissatisfied (nothing was obtained) and $\boldsymbol{D_i = 1}$ means that the received service fulfilled the maximum expectations of the tourist, by criterion $\boldsymbol{C_i}$. Values $\boldsymbol{D_i}$ between 0 and 1 represent evaluations of tourist satisfaction according to criterion $\boldsymbol{C_i}$.

For calculating satisfaction (dissatisfaction) in Pavlović et al., 2018 was used formula

$$\boldsymbol{E\_1 = W\_1\,(D\_1 - O\_1\,) + W\_2\,(D\_2 - O\_2\,) + \ldots + W\_n\,(D\_n - O\_n\,)}, \text{"(1)"}$$

where clearly holds

$$\boldsymbol{-1 \le E_1 \le +1}.$$

In this paper, we give a new formula for evaluation of tourist satisfaction:

$$\boldsymbol{\overline{E}_1 = \sum_{i=1}^{n} W_i (D_i - v(D_i, O_i) \cdot O_i)}, \text{"(2)"}$$

where

$$\boldsymbol{v(D_i, O_i) = \begin{cases} 0, & \text{for} \quad O_i \le D_i, \\ 1, & \text{for} \quad O_i > D_i. \end{cases}} \quad (3)$$

Considering that the values $\boldsymbol{D_i}$ i $\boldsymbol{O_i}$ are between 0 and 1, and that $\sum_{i=1}^{n} \boldsymbol{W_i = 1}$, we can infer the following:

Proposition 1. Value of $\boldsymbol{\overline{E}_1}$ is greater than or equal to the value of $\boldsymbol{E_1}$.

For the same reason, it is clear that

$$\boldsymbol{-1 \le E_1 \le \overline{E}_1 \le 1}.$$

We believe that the evaluation $\boldsymbol{\overline{E}_1}$ is better than evaluation $\boldsymbol{E_1}$, because evaluation $\boldsymbol{E_1}$ registers only the difference between the expected and the obtained, while the evaluation $\boldsymbol{\overline{E}_1}$ insists only on the obtained and

evaluates satisfaction only if it is greater than or equal to the expected. This can be shown in the following example.

Example 1. Let the expected values of tourists satisfaction be $O_i = 1$, while realized values are $D_i = 1$, for $i = 1, \dots, n$. We have that

$$\boldsymbol{E_1 = W_1(1-1)+\dots+W_n(1-1) = 0.}$$

On the other hand,

$$\boldsymbol{\bar{E}_1 = W_1+\dots+W_n = 1.}$$

Formula (2) in Pavlović, 2018

$$\boldsymbol{E_2 = W_1(D_1 - O_1) + D_1\big(W_2(D_2 - O_2)+\dots+W_n(D_n - O_n)\big)}\text{"(4)"}$$

is used for evaluation the tourist satisfaction assuming that there is a dominant criterion for consideration. Criterion $\boldsymbol{C_1}$ (for example) is dominant in the sense that if it is fulfilled or if it is not sufficiently fulfilled, we are certainly dissatisfied, i.e. we are certainly completely rejecting the possibility of compensation with other criteria, no matter how much they have been fulfilled.

Instead of formula (2), we will first introduce formula

$$E_2' = \begin{cases} W_1 \cdot (D_1 - O_1) + D_1 \cdot \sum_{i=2}^{n} W_i \cdot (D_i - O_i), & \text{for } \sum_{i=2}^{n} W_i \cdot (D_i - O_i) \geq 0, \\ \sum_{i=1}^{n} W \cdot_i (D_i - O_i), & \text{for } \sum_{i=2}^{n} W_i \cdot (D_i - O_i) < 0. \end{cases} \text{"(5)"}$$

It is not difficult to see that, for
$\boldsymbol{W_2(D_2 - O_2)+\dots+W_n(D_n - O_n) < 0}$,
we have
$\boldsymbol{E_2' = E_1}$ and $\boldsymbol{-1 \leq E_2' \leq 1.}$

Now, we introduce the new formula $\boldsymbol{\bar{E}_2}$, analogue of the formula $\boldsymbol{\bar{E}_1}$ in the form

$$\overline{E}_2' = \begin{cases} W_1 \cdot \left(D_1 - v\left(D_1, O_1\right) \cdot O_1\right) + D_1 \cdot \sum_{i=2}^{n} W_i \cdot \left(D_i - v\left(D_i, O_i\right) \cdot O_i\right), \\ \qquad\qquad \text{for } \sum_{i=2}^{n} W_i \cdot \left(D_i - v\left(D_i, O_i\right) \cdot O_i\right) \geq 0, \\ \sum_{i=1}^{n} W_i \cdot \left(D_i - v\left(D_i, O_i\right) \cdot O_i\right), \quad \text{for } \sum_{i=2}^{n} W_i \cdot \left(D_i - v\left(D_i, O_i\right) \cdot O_i\right) < 0. \end{cases} \quad \text{"(6)"}$$

It is easy to show that $-\mathbf{1} \leq \overline{\boldsymbol{E}}_{\boldsymbol{2}}{}' \leq \mathbf{1}$.

In the following example we can see that the formula (5) is better than the formula (4) for observing effects of the dominant criterion.

Example 2. Suppose that $\boldsymbol{D_1 = 0,1}$, $\boldsymbol{D_2 = \cdots = D_n = 0}$ and $\boldsymbol{O_1 = 0}$, $\boldsymbol{O_2 = \cdots = O_n = 1}$. Then we have

$$\boldsymbol{E_2 = W_1 \cdot 0,1 + 0,1 \cdot (-W_2 - \ldots - W_n)} = 0{,}2 \cdot \boldsymbol{W_1} - 0{,}1,$$

while
$$\boldsymbol{E_2{}' = W_1 \cdot 0,1 + (-W_2 - \ldots - W_n)} = 1{,}1 \cdot \boldsymbol{W_1} - 1.$$

Example 3. Let us consider five alternatives with weighted coefficients

$$W_1 = W_2 = W_3 = W_4 = W_5 = 0{,}2\,.$$

Let tourist expectations of satisfaction are given by

$$O_1 = O_2 = O_3 = O_4 = O_5 = 0{,}8\,.$$

Suppose that the first criterion is dominant for evaluation and let the level of satisfaction (or dissatisfaction) with the received services according to the criteria are given in the following way

a) $D_1 = D_2 = D_3 = D_4 = D_5 = 0{,}5\,,$

b) $D_1 = 0\,, \quad D_2 = D_3 = D_4 = D_5 = 0{,}5\,.$

If we use formula (4) for evaluation the tourist satisfaction assuming that there is a dominant criterion for consideration , then we obtain:

a) $E_2 = -0{,}18$,

b) $E_2 = -0{,}16$,

so, we can conclude that although the value of the dominant criterion decreased, there was still an increase in the overall score.

On the other hand, if we use formula (5), we obtain:

a) $E_2^{'} = -0{,}3$,

b) $E_2^{'} = -0{,}4$,

and we can see that the decreasing of the dominant criterion leads to the reduction of the final value as expected.

Example 4. Let consider four criteria with weights

$W_1 = 0{,}4$, $W_2 = 0{,}3$, $W_3 = 0{,}2$ and $W_4 = 0{,}1$.

Further, let we have

$O_1 = 0{,}8$, $O_2 = 0{,}9$, $O_3 = 0{,}9$ and $O_4 = 0{,}6$,

$D_1 = 0{,}9$, $D_2 = 0{,}9$, $D_3 = 1$ and $D_4 = 0{,}5$.

Then we have

$E_1 = 0{,}05$, $E_2^{'} = -0{,}049$, $\overline{E}_1 = 0{,}82$ and $\overline{E}_2^{'} = 0{,}774$.

Clearly, the greatest tourist satisfaction is given by $\overline{E}_1$ but it can be considered that $\overline{E}_2^{'}$ gives the most realistic picture.

CONCLUSION

Formulas $\overline{E}_1$ and $\overline{E}_2^{'}$ give a more realistic assessment of tourist satisfaction because they are more based on the obtained satisfaction (what was obtained), and less on the expected satisfaction (what we expect to be satisfactory). This property makes overall marks $\overline{E}_1$ and $\overline{E}_2^{'}$ better than overall marks E_1 and $E_2^{'}$.

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