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A General View of TOPSIS Method Involving Multi-Attribute Decision Making Problems

P. K. Parida

Abstract**:** ***The TOPSIS method, commonly known as the technique for order performance by similarity to ideal solutions, is one of the most popular approaches used in the multi-attribute decision making (MADM). In this method has some advantages are simplicity, rationality, comprehensibility, good computational efficiency and ability to measure the relative performance for each alternative in a simple mathematical form. In the last four decades world is getting warmer. It is whether the cause of human activity or natural variability. The thermometer reading all round the world have risen steadily since the beginning of the industrial revolution. According to the ongoing temperature analysis conducted by scientist at NASA's Goddard Institute for Space Studies (GISS), the average global temperature on the Earth has increased about 0.80 Celsius since 1880. So, applying this method to determines the best solution from a set of alternatives with certain attributes. The best alternative is chosen based on its Euclidean distance from the ideal solution. The aim of this paper to systematizes the knowledge within the scope of techniques of decision taking with the use of the TOPSIS method. Simple numerical examples that reference real situations show practical applications of different aspects of this method.***

Keywords**:** ***Euclidian distance, Interval numbers, MADM, Temperature, TOPSIS.***

I. INTRODUCTION

Multi-attribute decision making (MADM) and Multi-criteria decision making (MCDM) are the renowned branches of decision making. These branches deals with the development of computational and mathematical tools for the evaluation of given alternatives with respect to the identified criteria [1]. Alternatives are different choices of actions present for the decision maker, which are prioritized and ranked. Many MADM approaches have been developed for the ranking of alternatives such as the analytic hierarchy process (AHP), weighted sum model (WSM), simple additive weighting (SAW), linear programming technique for multidimensional analysis of preference (LINMAP), multi-objective optimization on the basis of ratio analysis (MOORA), ELimination Et Choix Traduisant la REalite (ELECTRE) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) [2, 3]. MADM have been widely used to select a finite number of alternatives generally characterized by multiple conflicting criteria.

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***** Correspondence Author
P. K. Parida*, Department of Mathematics, C.V. Raman College of Engineering, Bhubaneswar, India. Email: prashanta_math@yahoo.co.i n

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Several MADM approaches have been devised to resolve a large variety of problems involving real world. To an economic consideration, there are several criteria needed to be taken into account the temperatures in different cities in the World.

In the last four decades world is getting warmer. It is whether the cause of human activity or natural variability. The thermometer reading all round the world have risen steadily since the beginning of the industrial revolution. According to the ongoing temperature analysis conducted by scientist at NASA's Goddard Institute for Space Studies (GISS), the average global temperature on the Earth has increased about 0.80 Celsius since 1880. Since 1975 two-third of the warming has occurred at the rate of roughly 0.15-0.200C per decade. The global temperature record represents an average over the entire surface of the planet.

According to that base we recorded the temperature in the Bhubaneswar city in the year 2018. In this city temperature rising every year. In this paper we presented the warmth temperature in the city and crisp temperature of the city by account of the decision making processes. An extensive list of available software for these different MADM approaches is provided on the official web-page of international society on multiple criteria decision making [4]. Among the developed approaches, TOPSIS is utilized in the diverse fields of research. TOPSIS chooses the best alternative based on the shortest and farthest Euclidean distances from the positive ideal solution and negative ideal solution, respectively [5], [6]. The algorithm of TOPSIS method is summarized using pseudo-code format in Algorithm. TOPSIS was developed by Hwang and Yoon in 1981, and has been used in various MADM problems such as supply chain logistics, marketing management, environmental management or chemical engineering [7], [8]. TOPSIS is preferred over other approaches because of (i) its suitability for large number of attributes and alternatives; (ii) requirement of limited subjective inputs; (iii) its logical and programmable behavior; and (iv) comparative consistency in the alternative ranking [9].

For environmental aspects and level of comfort we consider these multiple criteria such as maximum and minimum temperature evaluations in multi-criteria decision making problems. The Technique TOPSIS was utilized to the selection of technology alternatives in conceptual and preliminary aircraft design [10]. However, TOPSIS has the limitations that it assumes that each criterion's utility is monotonic and is rather sensitive to the weighting factors. A multi-criteria interactive decision-making advisor for the selection of the most appropriate decision making method was developed [11].

TOPSIS is used to assess the performance of alternatives through the similarity with the IS given by Hwang and Yoon [12]. According to the technique of Hwang and Yoon [12], the most suitable alternative is one which is nearest to the PIS and at maximum apart from the NIS [13]-[15] . The PIS makes the benefit criteria maximum while minimizing the cost criteria. The NIS on the other hand enhances the cost criteria to a maximum level while minimizing the benefit criteria.

The principal objective of the multi-attribute decision making (MADM) field is to introduce methodology as well as tools for solving problems and consequently to support decision-makers (DM) to make better decisions. In MADM problems, the overall performance of the alternatives is evaluated with respect to several and conflicting criteria, and the objectives are combined based on the DM's preferences [12]. Decision criteria and weighting factors are main input data in the DM process. It is observed that there are always uncertainties existing in the decision criteria due to incomplete information. The weighting factors are often highly subjective, considering the fact that they are elicited based on the decision making experience or intuition [16], [17]. Therefore, uncertainty assessment for the decision criteria and the weighting factors should be prudently performed. Also find the distances of PIS and NIS from the respective alternatives by applying the TOPSIS methodology [18]. Moreover, here define a closeness coefficient to determine the ranking order of the alternative. The classical version of the method, as proposed by Hwang and Yoon [13], was chosen as the focus of this paper based on the literature review conducted by de Farias Aires and Ferreira [26] and also because, to our knowledge, only four papers were published on RRP in the TOPSIS method: (i) García-Cascales and Lamata [27] proposed modifications to the normalization procedure and the introduction of fictitious alternatives; (ii) Senouci, Mushtaq, Hoceini, and Mellouk [29] analyzed the effect of four normalization procedures on RRP; (iii) Mufazzal and Muzakkir [28] proposed the incorporation of two new measures called the Weighted Proximity Index and the Overall Proximity Value to minimize the RRP; and (iv) Cables, Lamata, and Verdegay [30] propose a new concept for an ideal solution called the Reference Ideal Method. These papers have presented interesting ideas and solutions, they have presented some limitations, such as: (i) they consider only the addition and removal of alternatives in order to evaluate cases of temperature. Therefore, they do not include an analysis on the important property of transitivity; (ii) they typically use case studies. This approach hinders the generalization of results; (iii) they have limited applications. For example, García-Cascales and Lamata [32] consider that all criteria must have the same range of values; (iv) some of the proposals do not solve the problem, for example, those by Senouci et al. [31] and Mufazzal and Muzakkir [28]; and (v) they include modifications to the method that may make them difficult for DMs to use Cables et al. [30].

Here compare attributes to identify the significance of each of them in the selection of options. Finally, after identifying the weights of attributes in decision making, the selection is made by considering how much benefit an option offers over another option. In the following section II, we discuss briefly on fundamental terminologies involving TOPSIS methodology, and an algorithm associated with it. Section III contain the some parameter of the evaluation of Euclidean and weighted distance values of eight alternatives, the average linguistic performance of the two months of temperature, the linguistic weights for seven criteria, Section IV contains the application and result discussion and Section V contains conclusion of research work with future scope.

II. LITERATURE SURVEY

A. Interval Numbers

We provide some basic definitions to work with interval numbers. We start with two definitions: interval number and Euclidean distance.

Definition 1. The objects $a=[a^L,\ a^U]$ where $a^L \le a^U$, defined on the real line is called interval number. The values a^L and a^U stand for the lower and upper bounds of a respectively. The center and the width of an interval number $a=[a^L,\ a^U]$ are given by $m(a)=\dfrac{a^L+a^U}{2}$ and $w(a)=\left(a^U-a^L\right)$ respectively.

Definition 2. Let $a=[a^L,\ a^U]$ and $b=[b^L,\ b^U]$ be two interval numbers. The Euclidean distance between a and b is given by

$$d(a,b)=\sqrt{\frac{1}{2}\left[\left(a^L-b^L\right)^2+\left(a^U-b^U\right)^2\right]}$$

Definition 3. Let $a=[a^L,\ a^U]$ and $b=[b^L,\ b^U]$ be two interval numbers. The degree of preference of a and b is given by

$$P(a>b)=\frac{\max\{0, a^U-b^L\}-\max\{0, a^L-b^U\}}{a^U-a^L+b^U-b^L}$$

Definition 4. Let $a=[a^L,\ a^U]$ and $b=[b^L,\ b^U]$ be two interval numbers. We say that a is superior to b, denoted by $a>b$, if $P(a>b)>P(b>a)$. If $P(a>b)=P(b>a)$, then we say that a is in different to b, denoted by $a=b$.

For the generalization of TOPSIS, we use the definition 3 only through the definition 4. Due to this fact, Lourenzutti and Krohling presented the following corollary to simplify the methods.

Corollary 1 Let $a=[a^L,\ a^U]$ and $b=[b^L,\ b^U]$ be two interval numbers, then $a>b$ if and only if $m(a)>m(b)$.

By corollary 1 we can determine which interval is preferable in the sense of definition 4 simply comparing the center of intervals. The last definition about interval numbers provides a way to normalize interval data.

Definition 5. Let $s_{ij}=[s_{ij}^L, s_{ij}^U]$ be an interval numbers used to evaluate the i th alternative with respect to j th criterion. The normalization of the interval number is given according to the following expressions

$$r_{ij}^{L}=\frac{s_{ij}^{L}}{\max_i s_{ij}^{U}},\quad i=1,\Lambda\ ,m$$

$$r_{ij}^{U}=\frac{s_{ij}^{U}}{\max_i s_{ij}^{U}},\quad i=1,\Lambda\ ,m$$

B. TOPSIS Method

The TOPSIS method is one of the most widely used multi-criteria decision analysis methods, see for example Behzadian et al. [27] and Ferreira, Borenstein, Righi, and de Almeida Filho [26]. This TOPSIS method was first developed by Hwang and Yoon in [13] and extended by Yoon [11]. In this method, the best alternative is the one nearest to the positive ideal solution (PIS) and farthest from the negative ideal solution (NIS). PIS is a hypothetical alternative that maximizes the benefit criteria and simultaneously minimizes the cost criteria. The alternative which has the least Euclidean distance from PIS while being farthest from NIS is the best one of all (Mufazzal & Muzakkir, [28]). With the above hypotheses, calculations involving eigenvector, square rooting and summations are used for obtaining a relative closeness value of the criteria tested. TOPSIS ranks these values of relative closeness of the whole system by assigning the highest value of the relative closeness to the best attributes in the system. By various linguistic rating applied to represent the performances under certain alternative criteria [21]-[25]. For calculation of TOPSIS values, we have to go through the following Algorithm.

The TOPSIS method is one of the most widely used multi-criteria decision analysis methods, see for example Behzadian et al. [27] and Ferreira, Borenstein, Righi, and de Almeida Filho [29]. It was proposed by Hwang and Yoon [15] and extended by Yoon [11]. In this method, the best alternative is the one nearest to the positive ideal solution (PIS) and farthest from the negative ideal solution (NIS). PIS is a hypothetical alternative that maximizes the benefit criteria (BC) and simultaneously minimizes the cost criteria (CC). On the contrary, NIS maximizes the cost criteria (CC) and simultaneously minimizes the benefit criteria (BC). The alternative which has the least Euclidean distance from PIS while being farthest from NIS is the best one of all (Mufazzal & Muzakkir, [28]).

Algorithm

The foundations of the TOPSIS method were presented in the work of Hwang, Yoon, 1981. The basis of the analysis is the decision matrix Q_{mn} including ratings of considered alternatives $i=1,2,\Lambda\ ,m$ in the context of the accepted criteria $j=1,2,\Lambda\ ,n$

$$Q_{mn}=\begin{bmatrix} q_{11} & q_{12} & \Lambda & q_{1\sigma} & \Lambda & q_{1n} \\ q_{21} & q_{22} & \Lambda & q_{2\sigma} & \Lambda & q_{2n} \\ M & M & M & M & M & M \\ q_{\omega 1} & q_{\omega 2} & \Lambda & q_{\omega\sigma} & \Lambda & q_{\omega n} \\ M & M & M & M & M & M \\ q_{m1} & q_{m2} & \Lambda & q_{m\sigma} & \Lambda & q_{mn} \end{bmatrix}$$

On the basis of which there have been calculated normalized rating of particular alternatives:

$$n_{\omega\sigma}=\frac{q_{\omega\sigma}}{\sqrt{\sum_{\omega=1}^{m} q_{\omega\sigma}^{2}}}$$

In the phase of normalized rating it is possible to use the formulas Ishizaka, Nemery, 2013:

For the benefits criterion $n_{\omega\sigma}=\frac{q_{\omega\sigma}}{q_{\max}}$

For the cost criterion $n_{\omega\sigma}=\frac{q_{\min}}{q_{\omega\sigma}}$

Normalization causes all the criteria to have the character of a benefits criterion. Corrected rating (with the use of weights of the assigned criteria) are calculated as:

$$u_{\omega\sigma}=w_{\sigma}\times n_{\omega\sigma}$$

Then, there is an identification of the ideal solution conducted U^{+} and negative ideal solution U^{-} with the use of corrected assessments. The ideal solution is defined as:

$$U^{+}=\{u_1^{+},u_2^{+},\Lambda\ ,u_n^{+}\}$$

Where

$$u_{\sigma}^{+}=\left(\left(\max_{\omega} u_{\omega\sigma}\ |\sigma\in C_{benefits},\min_{\omega} u_{\omega\sigma}\ |\sigma\in C_{costs}\right)\right)$$

$\omega=1,2,\Lambda\ ,m$,

whereas the negative ideal solution is defined as:

$$U^{-}=\{u_1^{-},u_2^{-},\Lambda\ ,u_n^{-}\}$$

where

$$u_{\sigma}^{-}=\left(\left(\min_{\omega} u_{\omega\sigma}\ |\sigma\in C_{benefits},\max_{\omega} u_{\omega\sigma}\ |\sigma\in C_{costs}\right)\right)$$

$\omega=1,2,\Lambda\ ,m$.

In the above equations u_{σ}^{+} and u_{σ}^{-} are values defining ideal and negative ideal solutions in the context of criterion σ.

After indication of the ideal and negative ideal solution there are the distances calculated d_{σ}^{+} and d_{σ}^{-} between them and consecutive alternatives:

$$d_{\omega}^{+}=\sqrt{\sum_{\sigma=1}^{n}\left(u_{\omega\sigma}-u_{\sigma}^{+}\right)^2}$$

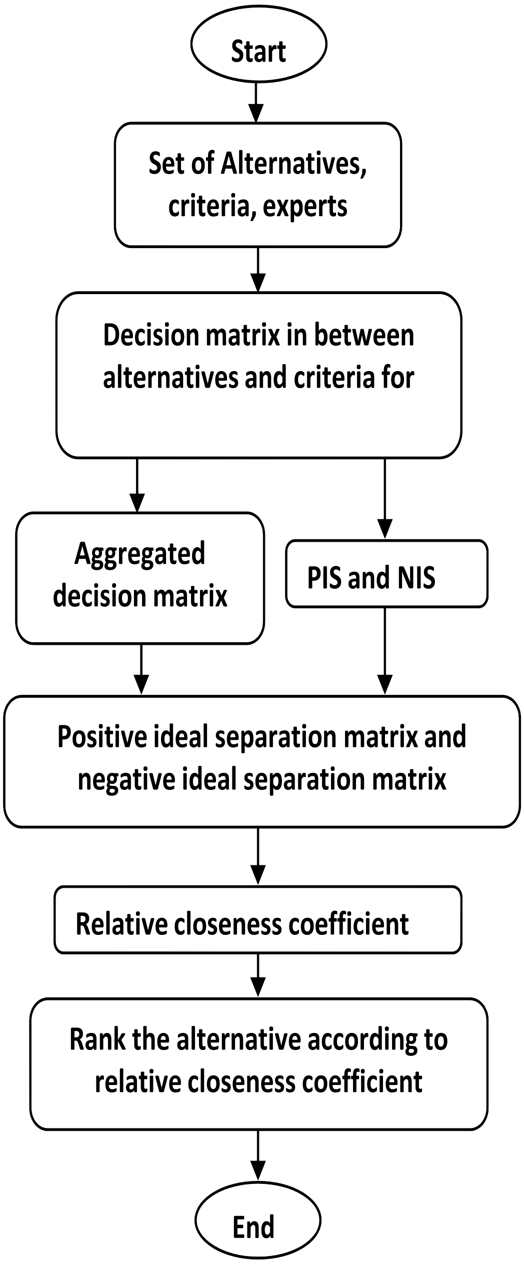
$$d_\omega^- = \sqrt{\sum_{\sigma=1}^{n}\left(v_{\omega\sigma} - v_\sigma^-\right)^2}$$

On the basis of d_ω^+ and d_ω^- there is a ranking the coefficient of the particular alternatives indicated:

$$\Delta_\omega = \frac{d_\omega^-}{d_\omega^- + d_\omega^+}$$

The procedure ends with the establishment of the alternatives ranking in the decreasing order of the Δ_ω value rating.

C. Flow Chart



III. EVALUATION FRAMEWORK

In the MCDM problem, a number of alternatives can determine and compared to using the different criteria. The aim of MCDM problem is to provide support to the decision-maker in the process of making the choice between alternatives. The ranking order of a set of alternatives according to their closeness coefficients and best alternative is found from the set of alternatives.

In Table-1 we define weighted distance (WD), negative weighted distance (NWD), positive weighted distance (PWD), euclidean distance (ED), negative euclidean distance (NED) and positive euclidean distance (PED) for each and every alternative.

Table-I: The euclidean and weight distance values

Alt.	WD	NWD	PWD	ED	NED	PED
JAN	u_1	u_1^-	u_1^+	d_1	d_1^-	d_1^+
FEB	u_2	u_2^-	u_2^+	d_2	d_2^-	d_2^+
MAR	u_3	u_3^-	u_3^+	d_3	d_3^-	d_3^+
$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$
DEC	u_{12}	u_{12}^-	u_{12}^+	d_{12}	d_{12}^-	d_{12}^+

IV. SIMULATION RESULTS

In this section, we work out a numerical example to illustrate the TOPSIS method for decision making problem with crisp data. Assume that twelve months recorded temperature January (JAN), February (FEB), March (MAR), April (APL), May (MAY), June (JUN), July (JLY), August (AUG), September (SEP), October (OCT), November (NOV), December (DEC) are evaluated by crisp environment for operation performance against twenty eight days criteria like, date1, date2, date3, ... , date28 for every month of the year 2018. Suppose that we have twenty eight criteria date1, date2, date3, ... , date28 are identified and twelve alternatives January (JAN), February (FEB), March (MAR), April (APL), May (MAY), June (JUN), July (JLY), August (AUG), September (SEP), October (OCT), November (NOV), December (DEC) are identified as the evaluation criteria for these alternatives. TOPSIS method is proposed for evaluating the temperature of the year 2018 in the Odisha capital city Bhubaneswar, considering the different criteria and weights of the criteria. The proposed method is applied to solve this problem. Here two different problems are solved: One is to construct the maximum temperature of the city in the year 2018. Other one is to construct the minimum temperature of the city in the year 2018. Also both the temperature combining and solving by TOPSIS method and get the ranking order of the temperature performance of the city in the year 2018.

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Table-II: The decision matrix and weights of twelve alternatives

Alt\Cri	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18	D19	D20	D21	D22	D23	D24	D25	D26	D27	D28
JAN	25	28	28	27	27	28	27	27	27	28	29	30	29	28	29	29	29	29	29	29	30	30	30	31	29	30	28	30
FEB	32	33	33	33	34	35	35	34	33	32	29	32	32	33	32	32	33	34	33	34	36	36	37	37	38	38	37	37
MAR	37	38	40	39	39	35	36	35	36	39	37	36	39	38	38	31	37	38	36	40	38	36	39	37	36	38	38	38
APL	36	32	35	35	33	35	36	34	36	34	36	36	37	38	40	41	41	38	38	37	39	39	39	38	40	38	37	37
MAY	32	35	36	35	37	36	35	37	37	38	38	38	36	33	34	35	35	36	35	36	35	36	30	34	35	36	37	36
JUN	37	37	37	36	38	36	39	35	33	35	35	30	35	37	40	40	42	42	42	40	36	33	31	34	31	29	26	29
JLY	33	34	33	34	32	35	29	34	34	34	31	31	33	32	31	27	32	32	33	30	28	27	33	33	34	31	33	33
AUG	30	32	34	35	34	28	27	33	33	34	32	33	34	30	31	32	33	34	34	30	32	33	34	33	30	27	30	31
SEP	31	30	33	31	28	27	32	32	34	34	34	34	35	35	34	31	34	35	34	27	30	31	32	34	34	33	33	34
OCT	35	36	36	36	36	35	35	35	33	26	28	28	29	33	33	33	33	33	35	35	34	34	34	34	34	33	32	35
NOV	32	33	32	35	34	34	34	32	31	32	31	30	32	31	34	35	34	34	33	32	33	31	30	31	31	31	30	31
DEC	29	31	30	30	30	29	30	29	29	29	30	31	30	30	27	25	22	19	25	27	28	27	28	28	28	28	28	24
Wight	0.036	0.0357	0.036	0.036	0.0357	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036

Table-III: The normalized decision matrix

Alt\Cri	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18	D19	D20	D21	D22	D23	D24	D25	D26	D27	D28
JAN	0.2214	0.2422	0.2373	0.2294	0.2313	0.2455	0.2353	0.2348	0.2354	0.2441	0.2563	0.2661	0.2495	0.2426	0.2476	0.2545	0.2454	0.2455	0.2451	0.2508	0.259	0.2629	0.2603	0.2649	0.2498	0.2633	0.2475	0.2612
FEB	0.2834	0.2855	0.2797	0.2804	0.2913	0.3068	0.305	0.2957	0.2877	0.2789	0.2563	0.2838	0.2753	0.286	0.2732	0.2808	0.2792	0.2878	0.2789	0.2941	0.3108	0.3155	0.3211	0.3162	0.3273	0.3335	0.3271	0.3222
MAR	0.3277	0.3287	0.3391	0.3314	0.3341	0.3068	0.3137	0.3044	0.3138	0.3399	0.327	0.3193	0.3355	0.3293	0.3245	0.272	0.3131	0.3217	0.3043	0.3459	0.328	0.3155	0.3384	0.3162	0.3101	0.3335	0.3359	0.3309
APL	0.3189	0.2768	0.2967	0.2974	0.2827	0.3068	0.3137	0.2957	0.3138	0.2963	0.3182	0.3193	0.3183	0.3293	0.3415	0.3598	0.3469	0.3217	0.3212	0.32	0.3367	0.3418	0.3384	0.3248	0.3445	0.3335	0.3271	0.3222
MAY	0.2834	0.3028	0.3052	0.2974	0.317	0.3156	0.305	0.3218	0.3225	0.3312	0.3358	0.337	0.3097	0.286	0.2903	0.3071	0.2962	0.3047	0.2958	0.3114	0.3021	0.3155	0.2603	0.2906	0.3015	0.316	0.3271	0.3135
JUN	0.3277	0.3201	0.3136	0.3059	0.3256	0.3156	0.3399	0.3044	0.2877	0.3051	0.3093	0.2661	0.3011	0.3206	0.3415	0.351	0.3554	0.3555	0.355	0.3459	0.3108	0.2892	0.269	0.2906	0.267	0.2545	0.2298	0.2525
JLY	0.2923	0.2941	0.2797	0.2889	0.2742	0.3068	0.2527	0.2957	0.2964	0.2963	0.274	0.275	0.2839	0.2773	0.2647	0.2369	0.2708	0.2709	0.2789	0.2595	0.2417	0.2366	0.2864	0.282	0.2928	0.2721	0.2917	0.2874
AUG	0.2657	0.2768	0.2882	0.2974	0.2913	0.2455	0.2353	0.287	0.2877	0.2963	0.2828	0.2927	0.2925	0.26	0.2647	0.2808	0.2792	0.2878	0.2874	0.2595	0.2762	0.2892	0.295	0.282	0.2584	0.237	0.2652	0.27
SEP	0.2746	0.2595	0.2797	0.2634	0.2399	0.2367	0.2789	0.2783	0.2964	0.2963	0.3005	0.3016	0.3011	0.3033	0.2903	0.272	0.2877	0.2963	0.2874	0.2335	0.259	0.2716	0.2777	0.2906	0.2928	0.2896	0.2917	0.2961
OCT	0.31	0.3114	0.3052	0.3059	0.3084	0.3068	0.305	0.3044	0.2877	0.2266	0.2475	0.2484	0.2495	0.286	0.2818	0.2896	0.2792	0.2793	0.2958	0.3027	0.2935	0.2979	0.295	0.2906	0.2928	0.2896	0.2829	0.3048
NOV	0.2834	0.2855	0.2713	0.2974	0.2913	0.2981	0.2963	0.2783	0.2702	0.2789	0.274	0.2661	0.2753	0.2686	0.2903	0.3071	0.2877	0.2878	0.2789	0.2768	0.2849	0.2716	0.2603	0.2649	0.267	0.2721	0.2652	0.27
DEC	0.2569	0.2682	0.2543	0.2549	0.257	0.2542	0.2614	0.2522	0.2528	0.2528	0.2651	0.275	0.2581	0.26	0.2305	0.2194	0.1862	0.1608	0.2113	0.2335	0.2417	0.2366	0.243	0.2393	0.2412	0.2457	0.2475	0.209

Table-IV: The weighted normalized decision matrix

Alt\Cri	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18	D19	D20	D21	D22	D23	D24	D25	D26	D27	D28
JAN	0.0079	0.0086	0.0085	0.0082	0.0083	0.0088	0.0084	0.0084	0.0084	0.0087	0.0092	0.0095	0.0089	0.0087	0.0088	0.0091	0.0088	0.0088	0.0088	0.009	0.0092	0.0094	0.0093	0.0095	0.0089	0.0094	0.0088	0.0093
FEB	0.0101	0.0102	0.01	0.01	0.0104	0.011	0.0109	0.0106	0.0103	0.01	0.0092	0.0101	0.0098	0.0102	0.0098	0.01	0.01	0.0103	0.01	0.0105	0.0111	0.0113	0.0115	0.0113	0.0117	0.0119	0.0117	0.0115
MAR	0.0117	0.0117	0.0121	0.0118	0.0119	0.011	0.0112	0.0109	0.0112	0.0121	0.0117	0.0114	0.012	0.0118	0.0116	0.0097	0.0112	0.0115	0.0109	0.0124	0.0117	0.0113	0.0121	0.0113	0.0111	0.0119	0.012	0.0118
APL	0.0114	0.0099	0.0106	0.0106	0.0101	0.011	0.0112	0.0106	0.0112	0.0106	0.0114	0.0114	0.0114	0.0118	0.0122	0.0128	0.0124	0.0115	0.0115	0.0114	0.012	0.0122	0.0121	0.0116	0.0123	0.0119	0.0117	0.0115
MAY	0.0101	0.0108	0.0109	0.0106	0.0113	0.0113	0.0109	0.0115	0.0115	0.0118	0.012	0.012	0.0111	0.0102	0.0104	0.011	0.0106	0.0109	0.0106	0.0111	0.0108	0.0113	0.0093	0.0104	0.0108	0.0113	0.0117	0.0112
JUN	0.0117	0.0114	0.0112	0.0109	0.0116	0.0113	0.0121	0.0109	0.0103	0.0109	0.011	0.0095	0.0107	0.0114	0.0122	0.0125	0.0127	0.0127	0.0127	0.0124	0.0111	0.0103	0.0096	0.0104	0.0095	0.0091	0.0082	0.009
JLY	0.0104	0.0105	0.01	0.0103	0.0098	0.011	0.009	0.0106	0.0106	0.0106	0.0098	0.0098	0.0101	0.0099	0.0094	0.0085	0.0097	0.0097	0.01	0.0093	0.0086	0.0084	0.0102	0.0101	0.0105	0.0097	0.0104	0.0103
AUG	0.0095	0.0099	0.0103	0.0106	0.0104	0.0088	0.0084	0.0102	0.0103	0.0106	0.0101	0.0104	0.0104	0.0093	0.0094	0.01	0.01	0.0103	0.0103	0.0093	0.0099	0.0103	0.0105	0.0101	0.0092	0.0085	0.0095	0.0096
SEP	0.0098	0.0093	0.01	0.0094	0.0086	0.0085	0.01	0.0099	0.0106	0.0106	0.0107	0.0108	0.0107	0.0108	0.0104	0.0097	0.0103	0.0106	0.0103	0.0083	0.0092	0.0097	0.0099	0.0104	0.0105	0.0103	0.0104	0.0106
OCT	0.0111	0.0111	0.0109	0.0109	0.011	0.011	0.0109	0.0109	0.0103	0.0081	0.0088	0.0089	0.0089	0.0102	0.0101	0.0103	0.01	0.01	0.0106	0.0108	0.0105	0.0106	0.0105	0.0104	0.0105	0.0103	0.0101	0.0109
NOV	0.0101	0.0102	0.0097	0.0106	0.0104	0.0106	0.0106	0.0099	0.0096	0.01	0.0098	0.0095	0.0098	0.0096	0.0104	0.011	0.0103	0.0103	0.01	0.0099	0.0102	0.0097	0.0093	0.0095	0.0095	0.0097	0.0095	0.0096
DEC	0.0092	0.0096	0.0091	0.0091	0.0092	0.0091	0.0093	0.009	0.009	0.009	0.0095	0.0098	0.0092	0.0093	0.0082	0.0078	0.0066	0.0057	0.0075	0.0083	0.0086	0.0084	0.0087	0.0085	0.0086	0.0088	0.0088	0.0075

Table-V: The ideal solution of weighted normalized decision matrix

Alt\Cri	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18	D19	D20	D21	D22	D23	D24	D25	D26	D27	D28
JAN	0.0038	0.0031	0.0036	0.0036	0.0037	0.0025	0.0037	0.0031	0.0031	0.0034	0.0028	0.0025	0.0031	0.0031	0.0034	0.0038	0.0039	0.0039	0.0039	0.0034	0.0028	0.0028	0.0028	0.0021	0.0034	0.0025	0.0032	0.0025
FEB	0.0016	0.0015	0.0021	0.0018	0.0015	0.0003	0.0012	0.0009	0.0012	0.0022	0.0028	0.0019	0.0021	0.0015	0.0024	0.0028	0.0027	0.0024	0.0027	0.0019	0.0009	0.0009	0.0006	0.0003	0.0006	0	0.0003	0.0003
MAR	0	0	0	0	0	0.0003	0.0009	0.0006	0.0003	0	0.0003	0.0006	0	0	0.0006	0.0031	0.0015	0.0012	0.0018	0	0.0003	0.0009	0	0.0003	0.0012	0	0	0
APL	0.0003	0.0019	0.0015	0.0012	0.0018	0.0003	0.0009	0.0009	0.0003	0.0016	0.0006	0.0006	0.0006	0	0	0	0.0003	0.0012	0.0012	0.0009	0	0	0	0	0	0	0.0003	0.0003
MAY	0.0016	0.0009	0.0012	0.0012	0.0006	0	0.0012	0	0	0.0003	0	0	0.0009	0.0015	0.0018	0.0019	0.0021	0.0018	0.0021	0.0012	0.0012	0.0009	0.0028	0.0012	0.0015	0.0006	0.0003	0.0006
JUN	0	0.0003	0.0009	0.0009	0.0003	0	0	0.0006	0.0012	0.0012	0.0009	0.0025	0.0012	0.0003	0	0.0003	0	0	0	0	0.0009	0.0019	0.0025	0.0012	0.0028	0.0028	0.0038	0.0028
JLY	0.0013	0.0012	0.0021	0.0015	0.0021	0.0003	0.0031	0.0009	0.0009	0.0016	0.0022	0.0022	0.0018	0.0019	0.0027	0.0044	0.003	0.003	0.0027	0.0031	0.0034	0.0038	0.0019	0.0015	0.0018	0.0022	0.0016	0.0016
AUG	0.0022	0.0019	0.0018	0.0012	0.0015	0.0025	0.0037	0.0012	0.0012	0.0016	0.0019	0.0016	0.0015	0.0025	0.0027	0.0028	0.0027	0.0024	0.0024	0.0031	0.0022	0.0019	0.0015	0.0015	0.0031	0.0034	0.0025	0.0022
SEP	0.0019	0.0025	0.0021	0.0024	0.0034	0.0028	0.0022	0.0016	0.0009	0.0016	0.0013	0.0013	0.0012	0.0009	0.0018	0.0031	0.0024	0.0021	0.0024	0.004	0.0028	0.0025	0.0022	0.0012	0.0018	0.0016	0.0016	0.0012
OCT	0.0006	0.0006	0.0012	0.0009	0.0009	0.0003	0.0012	0.0006	0.0012	0.004	0.0032	0.0032	0.0031	0.0015	0.0021	0.0025	0.0027	0.0027	0.0021	0.0015	0.0015	0.0016	0.0015	0.0012	0.0018	0.0016	0.0019	0.0009
NOV	0.0016	0.0015	0.0024	0.0012	0.0015	0.0006	0.0016	0.0016	0.0019	0.0022	0.0022	0.0025	0.0021	0.0022	0.0018	0.0019	0.0024	0.0024	0.0027	0.0025	0.0018	0.0025	0.0028	0.0021	0.0028	0.0022	0.0025	0.0022
DEC	0.0025	0.0022	0.003	0.0027	0.0028	0.0022	0.0028	0.0025	0.0025	0.0031	0.0025	0.0022	0.0028	0.0025	0.004	0.005	0.006	0.007	0.0051	0.004	0.0034	0.0038	0.0034	0.0031	0.0037	0.0031	0.0032	0.0044

Table-VI: The worst solution of weighted normalized decision matrix

Alt\Cri	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18	D19	D20	D21	D22	D23	D24	D25	D26	D27	D28
JAN	0	0	0	0	0	0.0003	0	0	0	0.0006	0.0003	0.0006	0	0	0.0006	0.0013	0.0021	0.003	0.0012	0.0006	0.0006	0.0009	0.0006	0.0009	0.0003	0.0009	0.0006	0.0019
FEB	0.0022	0.0015	0.0015	0.0018	0.0021	0.0025	0.0025	0.0022	0.0019	0.0019	0.0003	0.0013	0.0009	0.0015	0.0015	0.0022	0.0033	0.0045	0.0024	0.0022	0.0025	0.0028	0.0028	0.0027	0.0031	0.0034	0.0035	0.004
MAR	0.0038	0.0031	0.0036	0.0036	0.0037	0.0025	0.0028	0.0025	0.0028	0.004	0.0028	0.0025	0.0031	0.0031	0.0034	0.0019	0.0045	0.0057	0.0033	0.004	0.0031	0.0028	0.0034	0.0027	0.0025	0.0034	0.0038	0.0044
APL	0.0035	0.0012	0.0021	0.0024	0.0018	0.0025	0.0028	0.0022	0.0028	0.0025	0.0025	0.0025	0.0025	0.0031	0.004	0.005	0.0057	0.0057	0.0039	0.0031	0.0034	0.0038	0.0034	0.0031	0.0037	0.0034	0.0035	0.004
MAY	0.0022	0.0022	0.0024	0.0024	0.0031	0.0028	0.0025	0.0031	0.0031	0.0037	0.0032	0.0032	0.0021	0.0015	0.0021	0.0031	0.0039	0.0051	0.003	0.0028	0.0022	0.0028	0.0006	0.0018	0.0022	0.0028	0.0035	0.0037
JUN	0.0038	0.0028	0.0027	0.0027	0.0034	0.0028	0.0037	0.0025	0.0019	0.0028	0.0022	0.0006	0.0018	0.0028	0.004	0.0047	0.006	0.007	0.0051	0.004	0.0025	0.0019	0.0009	0.0018	0.0009	0.0006	0	0.0016
JLY	0.0025	0.0019	0.0015	0.0021	0.0015	0.0025	0.0006	0.0022	0.0022	0.0025	0.0009	0.0009	0.0012	0.0012	0.0012	0.0006	0.003	0.0039	0.0024	0.0009	0	0	0.0015	0.0015	0.0018	0.0013	0.0022	0.0028
AUG	0.0016	0.0012	0.0018	0.0024	0.0021	0.0003	0	0.0019	0.0019	0.0025	0.0013	0.0016	0.0015	0.0006	0.0012	0.0022	0.0033	0.0045	0.0027	0.0009	0.0012	0.0019	0.0019	0.0015	0.0006	0	0.0013	0.0022
SEP	0.0019	0.0006	0.0015	0.0012	0.0003	0	0.0016	0.0016	0.0022	0.0025	0.0019	0.0019	0.0018	0.0022	0.0021	0.0019	0.0036	0.0048	0.0027	0	0.0006	0.0013	0.0012	0.0018	0.0018	0.0019	0.0022	0.0031
OCT	0.0032	0.0025	0.0024	0.0027	0.0028	0.0025	0.0025	0.0025	0.0019	0	0	0	0	0.0015	0.0018	0.0025	0.0033	0.0042	0.003	0.0025	0.0018	0.0022	0.0019	0.0018	0.0018	0.0019	0.0019	0.0034
NOV	0.0022	0.0015	0.0012	0.0024	0.0021	0.0022	0.0022	0.0016	0.0012	0.0019	0.0009	0.0006	0.0009	0.0009	0.0021	0.0031	0.0036	0.0045	0.0024	0.0015	0.0015	0.0013	0.0006	0.0009	0.0009	0.0013	0.0013	0.0022
DEC	0.0013	0.0009	0.0006	0.0009	0.0009	0.0006	0.0009	0.0006	0.0006	0.0009	0.0006	0.0009	0.0003	0.0006	0	0	0	0	0	0	0	0	0	0	0	0.0003	0.0006	0

Table-VII: Closeness coefficients

I.S.\Alt.	JAN	FEB	MAR	APL	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
d_{ω}^{+}	0.0171	0.0091	0.0047	0.0045	0.0069	0.008	0.0123	0.012	0.0114	0.0104	0.0112	0.019
d_{ω}^{-}	0.0051	0.0132	0.018	0.0179	0.0153	0.0169	0.0101	0.0101	0.0109	0.0123	0.0105	0.0031

Table-VIII: Ranking order

Alt.	JAN	FEB	MAR	APL	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
Δ_{ω}^{+}	0.2284	0.5917	0.7945	0.7991	0.6899	0.6789	0.4503	0.4554	0.4884	0.544	0.4821	0.1405
Rank	11	5	2	1	3	4	10	9	7	6	8	12

Table-IX: The decision matrix and weights of twelve alternatives

Alt\Cri	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18	D19	D20	D21	D22	D23	D24	D25	D26	D27	D28
JAN	17	14	12	12	10	11	13	12	11	11	11	12	15	13	11	13	13	12	12	11	12	13	14	14	17	13	16	14
FEB	13	12	14	13	15	15	16	21	19	19	19	15	15	17	16	17	16	17	18	19	17	16	18	18	16	18	21	21
MAR	20	22	22	22	22	21	21	20	20	21	22	23	23	20	21	24	22	21	23	22	22	25	25	24	24	25	26	24
APL	21	21	23	21	19	25	23	22	24	22	24	25	22	26	24	26	27	25	26	28	27	28	26	23	25	27	27	25
MAY	21	25	23	25	27	28	28	28	28	25	27	26	21	22	22	23	21	27	25	23	22	28	23	25	28	28	28	28
JUN	28	27	25	26	28	27	27	27	26	28	27	27	25	26	28	27	27	27	26	25	24	23	26	27	26	23	24	24
JLY	24	25	25	28	27	27	25	25	26	27	27	26	26	25	25	26	25	26	27	26	25	25	25	26	27	25	26	26
AUG	25	25	25	26	25	24	24	26	26	25	26	26	26	25	26	26	25	27	25	26	26	26	26	25	26	25	25	26
SEP	24	25	24	26	25	24	24	24	25	26	25	25	25	26	25	24	24	25	25	24	24	24	24	25	25	24	25	26
OCT	26	25	25	25	25	25	24	24	23	23	22	23	21	22	22	22	21	22	22	23	23	21	22	23	21	17	19	19
NOV	21	23	22	22	22	22	24	22	22	21	21	18	18	18	19	18	17	18	20	20	19	20	18	15	14	14	14	17
DEC	18	16	16	15	16	18	16	17	15	14	15	17	17	18	18	20	16	17	16	14	13	14	11	10	11	12	13	13
Weight	0.0357	0.0357	0.0357	0.0357	0.0357	0.0357	0.0357	0.0357	0.0357	0.0357	0.0357	0.0357	0.0357	0.0357	0.0357	0.0357	0.0357	0.0357	0.0357	0.0357	0.0357	0.0357	0.0357	0.0357	0.0357	0.0357	0.0357	0.0357

Table-X: The normalized decision matrix

Alt\Cri	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18	D19	D20	D21	D22	D23	D24	D25	D26	D27	D28
JAN	0.2243	0.1822	0.159	0.1548	0.1288	0.1393	0.1665	0.1523	0.1405	0.1419	0.1399	0.1543	0.2012	0.1714	0.14498	0.1664	0.1734	0.1538	0.1537	0.1425	0.1598	0.167	0.1833	0.1845	0.2196	0.1735	0.2046	0.1801
FEB	0.1716	0.1562	0.1855	0.1677	0.1932	0.1899	0.205	0.2665	0.2426	0.245	0.2417	0.1929	0.2012	0.2242	0.21087	0.2176	0.2134	0.2179	0.2306	0.2462	0.2263	0.2055	0.2357	0.2372	0.2067	0.2402	0.2686	0.2701
MAR	0.2639	0.2863	0.2914	0.2838	0.2834	0.2659	0.269	0.2538	0.2554	0.2708	0.2799	0.2958	0.3085	0.2637	0.27677	0.3072	0.2935	0.2692	0.2947	0.285	0.2929	0.3211	0.3274	0.3163	0.31	0.3336	0.3325	0.3087
APL	0.2771	0.2733	0.3047	0.2709	0.2447	0.3165	0.2947	0.2792	0.3065	0.2837	0.3053	0.3215	0.295	0.3428	0.31631	0.3328	0.3602	0.3205	0.3331	0.3628	0.3595	0.3597	0.3405	0.3031	0.3229	0.3603	0.3453	0.3215
MAY	0.2771	0.3254	0.3047	0.3225	0.3478	0.3545	0.3587	0.3554	0.3575	0.3224	0.3435	0.3344	0.2816	0.2901	0.28995	0.2944	0.2801	0.3462	0.3203	0.298	0.2929	0.3597	0.3012	0.3294	0.3617	0.3737	0.3581	0.3601
JUN	0.3695	0.3514	0.3312	0.3354	0.3607	0.3418	0.3459	0.3427	0.332	0.3611	0.3435	0.3472	0.3353	0.3428	0.36903	0.3456	0.3602	0.3462	0.3331	0.3239	0.3195	0.2954	0.3405	0.3558	0.3358	0.3069	0.3069	0.3087
JLY	0.3167	0.3254	0.3312	0.3612	0.3478	0.3418	0.3203	0.3173	0.332	0.3482	0.3435	0.3344	0.3487	0.3296	0.32949	0.3328	0.3335	0.3333	0.3459	0.3369	0.3328	0.3211	0.3274	0.3426	0.3487	0.3336	0.3325	0.3344
AUG	0.3299	0.3254	0.3312	0.3354	0.322	0.3038	0.3075	0.33	0.332	0.3224	0.3307	0.3344	0.3487	0.3296	0.34267	0.3328	0.3335	0.3462	0.3203	0.3369	0.3461	0.334	0.3405	0.3294	0.3358	0.3336	0.3197	0.3344
SEP	0.3167	0.3254	0.3179	0.3354	0.322	0.3038	0.3075	0.3046	0.3192	0.3353	0.318	0.3215	0.3353	0.3428	0.32949	0.3072	0.3201	0.3205	0.3203	0.311	0.3195	0.3083	0.3143	0.3294	0.3229	0.3203	0.3197	0.3344
OCT	0.3431	0.3254	0.3312	0.3225	0.322	0.3165	0.3075	0.3046	0.2937	0.2966	0.2799	0.2958	0.2816	0.2901	0.28995	0.2816	0.2801	0.2821	0.2818	0.298	0.3062	0.2697	0.2881	0.3031	0.2712	0.2269	0.243	0.2444
NOV	0.2771	0.2993	0.2914	0.2838	0.2834	0.2785	0.3075	0.2792	0.2809	0.2708	0.2671	0.2315	0.2414	0.2373	0.25041	0.2304	0.2268	0.2308	0.2562	0.2591	0.253	0.2569	0.2357	0.1977	0.1808	0.1868	0.179	0.2187
DEC	0.2375	0.2082	0.212	0.1935	0.2061	0.2279	0.205	0.2158	0.1915	0.1806	0.1908	0.2186	0.228	0.2373	0.23723	0.256	0.2134	0.2179	0.205	0.1814	0.1731	0.1798	0.144	0.1318	0.1421	0.1601	0.1663	0.1672

Table-XI: The weighted normalized decision matrix

Alt\Cri	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14
JAN	0.008	0.0065	0.0057	0.0055	0.0046	0.005	0.0059	0.0054	0.005	0.0051	0.005	0.0055	0.0072	0.0061
FEB	0.0061	0.0056	0.0066	0.006	0.0069	0.0068	0.0073	0.0095	0.0087	0.0087	0.0086	0.0069	0.0072	0.008
MAR	0.0094	0.0102	0.0104	0.0101	0.0101	0.0095	0.0096	0.0091	0.0091	0.0097	0.01	0.0106	0.011	0.0094
APL	0.0099	0.0098	0.0109	0.0097	0.0087	0.0113	0.0105	0.01	0.0109	0.0101	0.0109	0.0115	0.0105	0.0122
MAY	0.0099	0.0116	0.0109	0.0115	0.0124	0.0127	0.0128	0.0127	0.0128	0.0115	0.0123	0.0119	0.0101	0.0104
JUN	0.0132	0.0125	0.0118	0.012	0.0129	0.0122	0.0123	0.0122	0.0119	0.0129	0.0123	0.0124	0.012	0.0122
JLY	0.0113	0.0116	0.0118	0.0129	0.0124	0.0122	0.0114	0.0113	0.0119	0.0124	0.0123	0.0119	0.0124	0.0118
AUG	0.0118	0.0116	0.0118	0.012	0.0115	0.0108	0.011	0.0118	0.0119	0.0115	0.0118	0.0119	0.0124	0.0118
SEP	0.0113	0.0116	0.0114	0.012	0.0115	0.0108	0.011	0.0109	0.0114	0.012	0.0114	0.0115	0.012	0.0122
OCT	0.0122	0.0116	0.0118	0.0115	0.0115	0.0113	0.011	0.0109	0.0105	0.0106	0.01	0.0106	0.0101	0.0104
NOV	0.0099	0.0107	0.0104	0.0101	0.0101	0.0099	0.011	0.01	0.01	0.0097	0.0095	0.0083	0.0086	0.0085
DEC	0.0085	0.0074	0.0076	0.0069	0.0074	0.0081	0.0073	0.0077	0.0068	0.0064	0.0068	0.0078	0.0081	0.0085

Alt\Cri	D15	D16	D17	D18	D19	D20	D21	D22	D23	D24	D25	D26	D27	D28
JAN	0.00518	0.0059	0.0062	0.0055	0.0055	0.0051	0.0057	0.006	0.0065	0.0066	0.0078	0.0062	0.0073	0.0064
FEB	0.00753	0.0078	0.0076	0.0078	0.0082	0.0088	0.0081	0.0073	0.0084	0.0085	0.0074	0.0086	0.0096	0.0096
MAR	0.00988	0.011	0.0105	0.0096	0.0105	0.0102	0.0105	0.0115	0.0117	0.0113	0.0111	0.0119	0.0119	0.011
APL	0.01129	0.0119	0.0129	0.0114	0.0119	0.013	0.0128	0.0128	0.0122	0.0108	0.0115	0.0129	0.0123	0.0115
MAY	0.01035	0.0105	0.01	0.0124	0.0114	0.0106	0.0105	0.0128	0.0108	0.0118	0.0129	0.0133	0.0128	0.0129
JUN	0.01317	0.0123	0.0129	0.0124	0.0119	0.0116	0.0114	0.0105	0.0122	0.0127	0.012	0.011	0.011	0.011
JLY	0.01176	0.0119	0.0119	0.0119	0.0123	0.012	0.0119	0.0115	0.0117	0.0122	0.0125	0.0119	0.0119	0.0119
AUG	0.01223	0.0119	0.0119	0.0124	0.0114	0.012	0.0124	0.0119	0.0122	0.0118	0.012	0.0119	0.0114	0.0119
SEP	0.01176	0.011	0.0114	0.0114	0.0114	0.0111	0.0114	0.011	0.0112	0.0118	0.0115	0.0114	0.0114	0.0119
OCT	0.01035	0.0101	0.01	0.0101	0.0101	0.0106	0.0109	0.0096	0.0103	0.0108	0.0097	0.0081	0.0087	0.0087
NOV	0.00894	0.0082	0.0081	0.0082	0.0091	0.0093	0.009	0.0092	0.0084	0.0071	0.0065	0.0067	0.0064	0.0078
DEC	0.00847	0.0091	0.0076	0.0078	0.0073	0.0065	0.0062	0.0064	0.0051	0.0047	0.0051	0.0057	0.0059	0.006

Table-XII: The ideal solution of weighted normalized decision matrix

Alt\Cri	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14
JAN	0.0052	0.006	0.0061	0.0074	0.0083	0.0077	0.0069	0.0072	0.0077	0.0078	0.0073	0.0069	0.0053	0.0061
FEB	0.0071	0.007	0.0052	0.0069	0.006	0.0059	0.0055	0.0032	0.0041	0.0041	0.0036	0.0055	0.0053	0.0042
MAR	0.0038	0.0023	0.0014	0.0028	0.0028	0.0032	0.0032	0.0036	0.0036	0.0032	0.0023	0.0018	0.0014	0.0028
APL	0.0033	0.0028	0.0009	0.0032	0.0041	0.0014	0.0023	0.0027	0.0018	0.0028	0.0014	0.0009	0.0019	0
MAY	0.0033	0.0009	0.0009	0.0014	0.0005	0	0	0	0	0.0014	0	0.0005	0.0024	0.0019
JUN	0	0	0	0.0009	0	0.0005	0.0005	0.0005	0.0009	0	0	0	0.0005	0
JLY	0.0019	0.0009	0	0	0.0005	0.0005	0.0014	0.0014	0.0009	0.0005	0	0.0005	0	0.0005
AUG	0.0014	0.0009	0	0.0009	0.0014	0.0018	0.0018	0.0009	0.0009	0.0014	0.0005	0.0005	0	0.0005
SEP	0.0019	0.0009	0.0005	0.0009	0.0014	0.0018	0.0018	0.0018	0.0014	0.0009	0.0009	0.0009	0.0005	0
OCT	0.0009	0.0009	0	0.0014	0.0014	0.0014	0.0018	0.0018	0.0023	0.0023	0.0023	0.0018	0.0024	0.0019
NOV	0.0033	0.0019	0.0014	0.0028	0.0028	0.0027	0.0018	0.0027	0.0027	0.0032	0.0027	0.0041	0.0038	0.0038
DEC	0.0047	0.0051	0.0043	0.006	0.0055	0.0045	0.0055	0.005	0.0059	0.0064	0.0054	0.0046	0.0043	0.0038

Alt\Cri	D15	D16	D17	D18	D19	D20	D21	D22	D23	D24	D25	D26	D27	D28
JAN	0.008	0.0064	0.0067	0.0069	0.0069	0.0079	0.0071	0.0069	0.0056	0.0061	0.0051	0.0071	0.0055	0.0064
FEB	0.00565	0.0046	0.0052	0.0046	0.0041	0.0042	0.0048	0.0055	0.0037	0.0042	0.0055	0.0048	0.0032	0.0032
MAR	0.00329	0.0014	0.0024	0.0027	0.0018	0.0028	0.0024	0.0014	0.0005	0.0014	0.0018	0.0014	0.0009	0.0018
APL	0.00188	0.0005	0	0.0009	0.0005	0	0	0	0	0.0019	0.0014	0.0005	0.0005	0.0014
MAY	0.00282	0.0018	0.0029	0	0.0009	0.0023	0.0024	0	0.0014	0.0009	0	0	0	0
JUN	0	0	0	0	0.0005	0.0014	0.0014	0.0023	0	0	0.0009	0.0024	0.0018	0.0018
JLY	0.00141	0.0005	0.001	0.0005	0	0.0009	0.001	0.0014	0.0005	0.0005	0.0005	0.0014	0.0009	0.0009
AUG	0.00094	0.0005	0.001	0	0.0009	0.0009	0.0005	0.0009	0	0.0009	0.0009	0.0014	0.0014	0.0009
SEP	0.00141	0.0014	0.0014	0.0009	0.0009	0.0019	0.0014	0.0018	0.0009	0.0009	0.0014	0.0019	0.0014	0.0009
OCT	0.00282	0.0023	0.0029	0.0023	0.0023	0.0023	0.0019	0.0032	0.0019	0.0019	0.0032	0.0052	0.0041	0.0041
NOV	0.00423	0.0041	0.0048	0.0041	0.0032	0.0037	0.0038	0.0037	0.0037	0.0056	0.0065	0.0067	0.0064	0.0051
DEC	0.00471	0.0032	0.0052	0.0046	0.005	0.0065	0.0067	0.0064	0.007	0.008	0.0078	0.0076	0.0068	0.0069

Table-XIII: The worst solution of weighted normalized decision matrix

Alt\Cri	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14
JAN	0.0019	0.0009	0	0	0	0	0	0	0	0	0	0	0	0
FEB	0	0	0.0009	0.0005	0.0023	0.0018	0.0014	0.0041	0.0036	0.0037	0.0036	0.0014	0	0.0019
MAR	0.0033	0.0046	0.0047	0.0046	0.0055	0.0045	0.0037	0.0036	0.0041	0.0046	0.005	0.005	0.0038	0.0033
APL	0.0038	0.0042	0.0052	0.0041	0.0041	0.0063	0.0046	0.0045	0.0059	0.0051	0.0059	0.006	0.0034	0.0061
MAY	0.0038	0.006	0.0052	0.006	0.0078	0.0077	0.0069	0.0072	0.0077	0.0064	0.0073	0.0064	0.0029	0.0042
JUN	0.0071	0.007	0.0061	0.0064	0.0083	0.0072	0.0064	0.0068	0.0068	0.0078	0.0073	0.0069	0.0048	0.0061
JLY	0.0052	0.006	0.0061	0.0074	0.0078	0.0072	0.0055	0.0059	0.0068	0.0074	0.0073	0.0064	0.0053	0.0056
AUG	0.0057	0.006	0.0061	0.0064	0.0069	0.0059	0.005	0.0063	0.0068	0.0064	0.0068	0.0064	0.0053	0.0056
SEP	0.0052	0.006	0.0057	0.0064	0.0069	0.0059	0.005	0.0054	0.0064	0.0069	0.0064	0.006	0.0048	0.0061
OCT	0.0061	0.006	0.0061	0.006	0.0069	0.0063	0.005	0.0054	0.0055	0.0055	0.005	0.005	0.0029	0.0042
NOV	0.0038	0.0051	0.0047	0.0046	0.0055	0.005	0.005	0.0045	0.005	0.0046	0.0045	0.0028	0.0014	0.0024
DEC	0.0024	0.0019	0.0019	0.0014	0.0028	0.0032	0.0014	0.0023	0.0018	0.0014	0.0018	0.0023	0.001	0.0024

Alt\Cri	D15	D16	D17	D18	D19	D20	D21	D22	D23	D24	D25	D26	D27	D28
JAN	0	0	0	0	0	0	0	0	0.0014	0.0019	0.0028	0.0005	0.0014	0.0005
FEB	0.00235	0.0018	0.0014	0.0023	0.0027	0.0037	0.0024	0.0014	0.0033	0.0038	0.0023	0.0029	0.0037	0.0037
MAR	0.00471	0.005	0.0043	0.0041	0.005	0.0051	0.0048	0.0055	0.0065	0.0066	0.006	0.0062	0.0059	0.0051
APL	0.00612	0.0059	0.0067	0.006	0.0064	0.0079	0.0071	0.0069	0.007	0.0061	0.0065	0.0071	0.0064	0.0055
MAY	0.00518	0.0046	0.0038	0.0069	0.0059	0.0056	0.0048	0.0069	0.0056	0.0071	0.0078	0.0076	0.0068	0.0069
JUN	0.008	0.0064	0.0067	0.0069	0.0064	0.0065	0.0057	0.0046	0.007	0.008	0.0069	0.0052	0.005	0.0051
JLY	0.00659	0.0059	0.0057	0.0064	0.0069	0.0069	0.0062	0.0055	0.0065	0.0075	0.0074	0.0062	0.0059	0.006
AUG	0.00706	0.0059	0.0057	0.0069	0.0059	0.0069	0.0067	0.006	0.007	0.0071	0.0069	0.0062	0.0055	0.006
SEP	0.00659	0.005	0.0052	0.006	0.0059	0.006	0.0057	0.005	0.0061	0.0071	0.0065	0.0057	0.0055	0.006
OCT	0.00518	0.0041	0.0038	0.0046	0.0046	0.0056	0.0052	0.0037	0.0051	0.0061	0.0046	0.0024	0.0027	0.0028
NOV	0.00376	0.0023	0.0019	0.0027	0.0037	0.0042	0.0033	0.0032	0.0033	0.0024	0.0014	0.001	0.0005	0.0018
DEC	0.00329	0.0032	0.0014	0.0023	0.0018	0.0014	0.0005	0.0005	0	0	0	0	0	0

Table-XIV: Closeness coefficients

I.S.\Alt.	JAN	FEB	MAR	APL	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
d_{ω}^{+}	0.0359	0.0265	0.013	0.0096	0.0078	0.005	0.0046	0.0053	0.007	0.0131	0.0211	0.0305
d_{ω}^{-}	0.0045	0.0136	0.026	0.031	0.0331	0.035	0.0342	0.0333	0.0314	0.0265	0.0193	0.0097

Table-XV: Ranking order

I.S.\Alt.	JAN	FEB	MAR	APL	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
Δ_{ω}^{-}	0.1105	0.3386	0.6666	0.764	0.81	0.8747	0.8808	0.8636	0.8188	0.6691	0.4776	0.2408
Rank	12	10	8	6	5	2	1	3	4	7	9	11

Table-XVI. General ranking order of maximum and minimum temperature

I.S.\Alt.	JAN	FEB	MAR	APL	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
Δ_{ω}	0.326	0.364	0.4562	0.4888	0.54	0.563	0.6617	0.6547	0.6264	0.5516	0.4976	0.6315
Rank	12	11	10	9	7	5	1	2	4	6	8	3

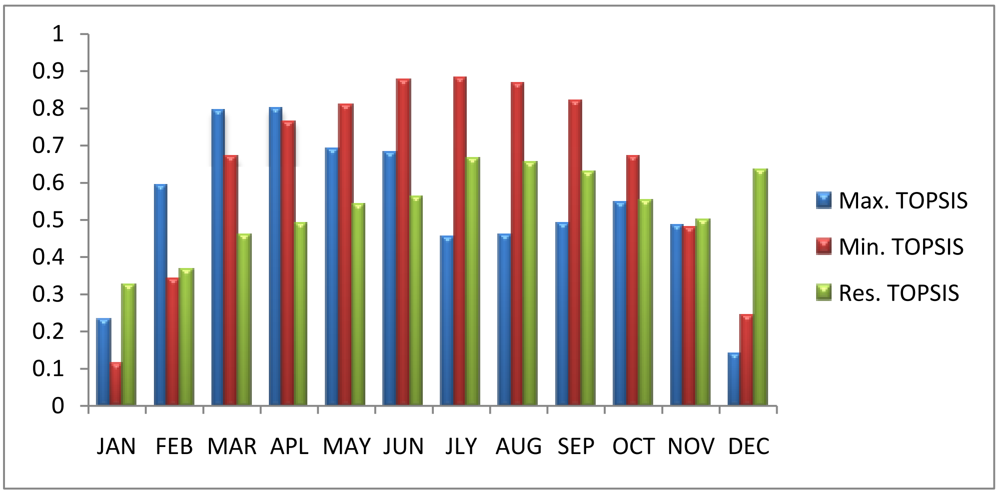

Fig. 1. Resulted Graph of ranking the alternatives with respect to relative closeness using Histo-graph

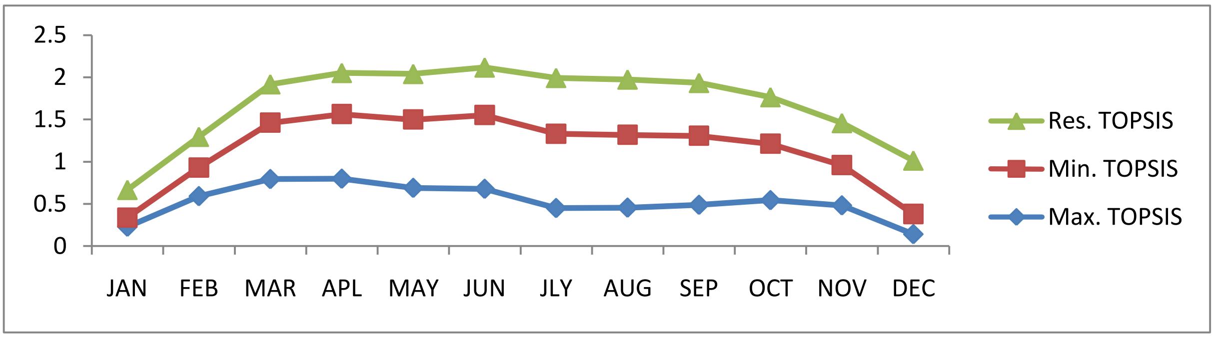

Fig. 2. Ranking the alternatives with respect to relative closeness with stacked graphical line

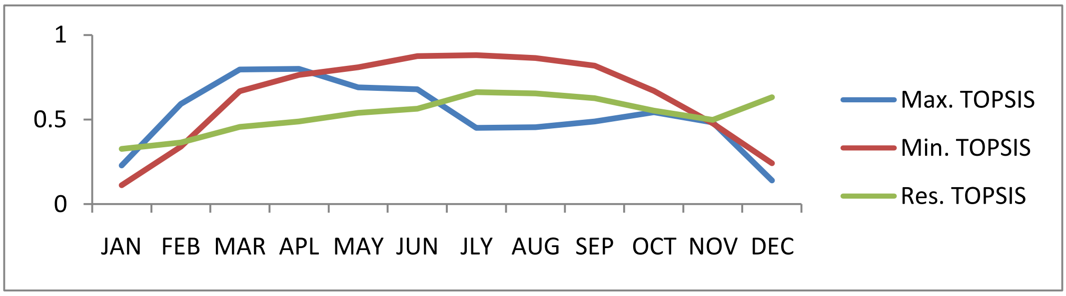

Fig. 3. Ranking the alternatives with respect to relative closeness with xy-scatter graphical line

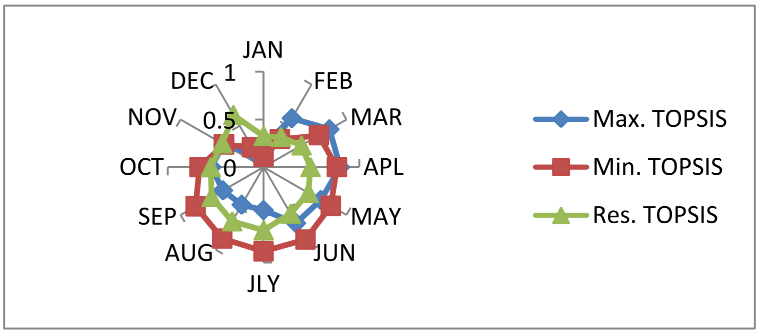

Fig. 4. Ranking the alternatives with respect to relative closeness with radar graphical line

These data, the vector of corresponding weight of each criteria, the normalized decision matrix, weighted normalized decision matrix, ideal solution, worst solution are given in Table 2, Table 3, Table 4, Table 5, Table 8, Table 9, Table 10, Table 11, Table 12, respectively. The closeness coefficients which are defined to determine the ranking order of all alternatives by calculating the distance to both the positive ideal solution and negative ideal solution are given in Table 6 and Table 13, respectively.

According to the closeness coefficient, ranking the order preference, order of these alternatives is also given in Table 7 and Table 14. Table 15 shows the results obtained for the above by using the proposed approach and Figure 1 shows the best temperature represented by histograph, Figure 2 shows the best temperature represented by stacked graphical line, Figure 3 shows the best temperature represented by xy-scatter graphical line, Figure 4 shows the best temperature represented by radar graphical line using different criteria and finite number of alternatives. So the ranking order of twelve months of the year 2018, best temperature or warmth of the month is selected is as follows.

$$JLY > AUG > DEC > SEP > JUN > OCT > MAY > NOV > APL > MAR > FEB > JAN$$

The best solution in the given alternatives, the selected month temperature is JLY.

V. CONCLUSION

MADM has found wide applications in the solution of real world decision making problems. The solution of the most MADM problems includes both quantitative and qualitative criteria using erroneous data and human awareness. The input data, Flow chart and algorithm of TOPSIS approach are discussed. In this paper, we purpose a methodology to provide a simple approach to find the best alternative months based on temperature and help of decision makers to select the best one of among the month.

There is enormous scope of research on TOPSIS in various directions. Several opportunities can be created involving the distance from the positive and negative solutions and relative closeness to the ideal solution. The several techniques have been introduced with the TOPSIS and many other new techniques involving TOPSIS not yet been explored.

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AUTHOR PROFILE

P. K. Parida pursed Bachelor of Science from Utkal University, India in 1998 and Master of Science from F.M. University in year 2000. Also, he was completed Master of Philosophy from Sambalpur University in year 2004 and Ph.D. from Sambalpur University in the 2010, India. He is currently working as Assistant Professor in Department of Mathematics, C V Raman College of Engineering, Bhubaneswar, India since 2011. He is a life member of OMS since 2010. He has published more than 20 research papers in reputed national & international journals including Thomson Reuters (SCI & Web of Science). His main research work focuses on Fuzzy Mathematics, Soft Computing, Cosmology and Managment based education. He has 12 years of teaching experience and 9 years of Research Experience.