IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

DECISION MAKING PROBLEM IN BIPOLAR INTUITIONISTIC FUZZY ENVIRONMENT

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Abstract: The paper focuses on furnishing the entropy measure of bipolar intuituionistic fuzzy sets.We further utilise the constructed entropy measure to technique for the order of preference by similarity to positive ideal solution(TOPSIS) method which is a widely used method in solving the real time decision making problems. Bipolar intuitionistic fuzzy technique for the order of preference by the similarity to the positive ideal solution (BIFTOPSIS) is put forward as an effective multicriteria decision making problem approach with group decision making to evaluate different job alternatives according to the students preferences.The choice of the most undertaken job by the students during the COVID-19 pandemic lockdown involving different criteria is a difficult and complex task.In such complex situations, (BIF-TOPSIS) method can be used to completely eliminate uncertainity and to order the most undertaken job by students in a better way.

***Index Terms* - Bipolar intuitionistic fuzzy set(BIFS),BIF-TOPSIS method,BIF-entropy measure,BIF-euclidean distance.**

I. INTRODUCTION

Real world decision making problems comprises lot of uncertain and inadequate data.Such type of uncertainities were solved by using fuzzy logic which was introduced by Zadeh[19] in the year 1965.Intuitionistic fuzzy sets(IFS) was expounded by Attanasov[1], who tackled with indecisive information in a better means as compared with fuzzy sets and they have best resilience,sharpness and closeness to the structure when conflicted with the earlier remaining fuzzy models.A voluminous range of individual decision making is positioned on bipolar irrational reasoning on a positive side and negative side,for instance association and disassociation,construction and destruction,compatibility and incompatibility.Yin and Yang are the two edges of non-identical judgement exactly seeded in Chinese medicine.Yin is the anti-side of the structure while Yang is the associated side of the structure.The interpretation of bipolar fuzzy sets was instituted by Zhang[21,22] , Zhang& Zhang[20] in the space $\{\forall(x,y)|(x,y) \in [-1,0] \times [0,1]\}$. Bipolar fuzzy sets were phased by Lee[12] are actually an dilation of fuzzy sets whose membership range is [-1,1].Despite the fact that bipolar sets and intuitionistic fuzzy sets examine homogeneous properties of each other,they are fundamentally distinct sets[13,14]. Ezhilmaran & Sankar[9] in the year 2015,discussed on the morphism of bipolar intuitionistic fuzzy graphs and developed its related properties.

The central formulation of TOPSIS spans the distance between each preferences and standard solution.Hwang and Yoon's[10] came up with heterogeneous aspect of decision making technique and utilizations.These methods are cited on crisp observations and cannot compromise with wide data.During 2000,fuzzy description of TOPSIS form was projected in Chen's[4] findings.In view of that diverse TOPSIS-premised methods are put forward and operated with several multicriteria decision management issues.Chu[7]established fuzzy TOPSIS process over group decision for facility location selection setback. Boron et al[2] envisioned an intuitionistic fuzzy set rooted TOPSIS approach.Chen & Tsao[6] propounded IVFS(interval valued fuzzy set) derived from TOPSIS method.Joshi & Kumar[11] drafted intuitionistic fuzzy entropy,distance measure-centered TOPSIS method in multicriteria judgement making problems. Chen et al[5], Ye [18] divulged the intuitionistic fuzzy MADM problems with indefinite attribute weights employing intuitionistic fuzzy entropy measure. In this paper we present an application on the jobs undertaken by the student community in the midst of lockdown during this pandemic situation using BIF-TOPSIS method. Manfeng Liu and Haiping Ren[15] in the year 2014,developed a new entropy measure in intuitionistic fuzzy set and use it in solving MCDM problems.

Wang Yinghui and Li Wenlu[17] in the year 2015 came up with another real life problem which they solved using intuitionistic fuzzy TOPSIS method were the weights were calculated using an intuitionistic fuzzy entropy index.

II.PRELIMINARIES

Definition 2.1[9]

Let X be a non empty set. A bipolar intuitionistic fuzzy set B = $\{(x,\mu^P(x),\mu^N(x), \nu^P(x),\nu^N(x))|\ x \in X\}$ where $\mu^P : X \to [0,1]$, $\mu^N : X \to [-1,0]$,$\gamma^P : X \to [0,1]$, $\gamma^N : X \to [-1,0]$ are the mappings such that $0 \leq \mu^P(x) + \nu^P(x) \leq 1$ and $-1 \leq \mu^N(x) + \nu^N(x) \leq 0$.

Definition 2.2[8]

Entropy of a fuzzy set describes the fuzziness degree of a fuzzy set.De Luca and Termini introduced the axioms to describe the fuzzinesss of a fuzzy set.

Let E be a set to point mapping E: $F(2^x) \to [0,1]$.Hence E is a fuzzy set defined on fuzzy sets.E is an entropy measure if it satisfies the four De Luca and Termini axioms:

- E(A)=0$\Leftrightarrow$A$\in 2^x$ (a is non fuzzy)
- E(A)=1 $\Leftrightarrow \mu_A(x_i) = 0.5\ \forall\ x_i \in X$.
- $E(A) \leq E(B)$,if A is less fuzzy than B, ie.,$\mu_A(x) \leq \mu_B(x), when\ \mu_B(x) \leq 0.5$ or $\mu_A(x) \geq \mu_B(x), when\ \mu_B(x) \geq 0.5$.
- E(A)=$E(A^c)$

Definition 2.3

Burillo and Bustince [3], Szmidt and Kacprzyk[16] studied the entropy of intuitionistic fuzzy sets from different aspects from different angles respectively.

A map $E: IFS(X) \to [0,1]$ is called intuitionistic fuzzy entropy if it satisfies the following properties

- E(A)=0$\Leftrightarrow$A is a crisp set.
- E(A)=1 $\Leftrightarrow \mu_A(x_i) = \nu_A(x_i)\ \forall\ x_i \in X$.
- E(A)=$E(A^c)$
- $E(A) \leq E(B)$,if A is less fuzzy than B, ie.,$\mu_A(x) \leq \mu_B(x), \nu_A(x) \geq \nu_B(x)$ for $\mu_B(x) \leq \nu_B(x)$ or $\mu_A(x) \geq \mu_B(x), \nu_A(x) \leq \nu_B(x)$ for $\mu_B(x) \geq \nu_B(x)$.

III.MADM PROBLEM WITH UNKNOWN ATTRIBUTE WEIGHTS INFORMATION

Definition 3.1

A map E: BIFS(X) $\to$ [0,1] is called the bipolar intuitionistic fuzzy entropy (BIF-entropy),if it satisfies the following conditions:

- **Sharpness**: $E(A) = 0 \Leftrightarrow A$ is a crisp set.
- **Maximality**:$E(A) = 1 \Leftrightarrow \mu_A^P(x_i) = \nu_A^P(x_i)\ and\ \mu_A^N(x_i) = \nu_A^N(x_i)\ \forall\ x_i \in X$.
- **Symmetry**:E(A)=$E(A^c)$.
- **Resolution**: $E(A) \leq E(B)$,if A is less fuzzy than B, ie.,$\mu_A^P(x) \leq \mu_B^P(x), \nu_A^P(x) \geq \nu_B^P(x)$ for $\mu_B^P(x) \leq \nu_B^P(x)$ and $\mu_A^N(x) \geq \mu_B^N(x), \nu_A^N(x) \leq \nu_B^N(x)$ for $\mu_B^N(x) \geq \nu_B^N(x)$ or $\mu_A^P(x) \geq \mu_B^P(x), \nu_A^P(x) \leq \nu_B^P(x)$ for $\mu_B^P(x) \geq \nu_B^P(x)$ and $\mu_A^N(x) \leq \mu_B^N(x), \nu_A^N(x) \geq \nu_B^N(x)$ for $\mu_B^N(x) \leq \nu_B^N(x)$

Definition 3.2

Let A be a BIFS then the entropy of A is denoted by E(A) and is defined as follows:

$$E(A) = 1 - \sum_i [|\mu_A^P(x_i) - \nu_A^P(x_i)| + |\mu_A^N(x_i) - \nu_A^N(x_i)|]$$

- **Sharpness**: $E(A) = 0 \Leftrightarrow A$ is a crisp set.
- **Maximality**:$E(A) = 1 \Leftrightarrow \mu_A^P(x_i) = \nu_A^P(x_i) = 0.5\ and\ \mu_A^N(x_i) = \nu_A^N(x_i) = -0.5$
- **Symmetry:**
  E(A)= $1 - \sum_i[|\mu_A^P(x_i) - \nu_A^P(x_i)| + |\mu_A^N(x_i) - \nu_A^N(x_i)|]$
  $E(A^c)$= $1 - \sum_i[|(1 - \mu_A^P(x_i)) - (1 - \nu_A^P(x_i))| + |(-1 - \mu_A^N(x_i)) — (1 - \nu_A^N(x_i))|]$
  =$1 - \sum_i[|-(\mu_A^P(x_i) - \nu_A^P(x_i))| + |-(\mu_A^N(x_i) - \nu_A^N(x_i))|]$
  =$1 - \sum_i[|\mu_A^P(x_i) - \nu_A^P(x_i)| + |\mu_A^N(x_i) - \nu_A^N(x_i)|]$ = E(A)
  Therefore E(A)=$E(A^c)$.
- **Resolution:**
  Let $A = \{< a, 0.2, -0.2, 0.5, -0.8 >, < b, 0.2, -0.2, 0.5, -0.6 >\}\ and\ B = \{< a, 0.3, -0.3, 0.4,\ -0.4 >, < 0.3, -0.4, 0.3, -0.5 >\}$ be two bipolar intuitionistic fuzzy sets then E(A)=-0.6
  and $E(B) = 0.7$.
  Hence we have $E(A) \leq E(B)$.

Defintion 3.3

When the attribute weights are completely unknown, we can use the proposed BIF entropy to determine the attribute weights:

$w_i = \frac{1 - E(F_i)}{m - \sum_{i=1}^m E(F_i)}$ where $E(F_i)$ is the bipolar intuitionistic fuzzy entropy and is given by

$E(F_i) = 1 - \sum_{j=1}^k\left[\left|\mu_A^P(x_{ij}) - \nu_A^P(x_{ij})\right| + \left|\mu_A^N(x_{ij}) - \nu_A^N(x_{ij})\right|\right]$ for $i = 1,2, \dots, m$ and $j = 1,2, \dots, k$.

Defintion 3.4

The following are the four distance measures in bipolar intuitionistic fuzzy environment

BIF-Hamming distance:

$$\frac{\sum_{i=1}^{k}[|\mu_A^P(x_i)-\mu_B^P(x_i)|+|\mu_A^N(x_i)-\mu_B^N(x_i)|+|\nu_A^P(x_i)-\nu_B^P(x_i)|+|\nu_A^N(x_i)-\nu_B^N(x_i)|]}{4}$$

BIF-Normalised Hamming Distance:

$$\frac{\sum_{i=1}^{k}[|\mu_A^P(x_i)-\mu_B^P(x_i)|+|\mu_A^N(x_i)-\mu_B^N(x_i)|+|\nu_A^P(x_i)-\nu_B^P(x_i)|+|\nu_A^N(x_i)-\nu_B^N(x_i)|]}{4k}$$

BIF-Euclidean distance:

$$\sqrt{\frac{1}{4}\sum_{j=1}^{k}\left[\left((\mu_A^P(x_i)-\mu_B^P(x_i)\right)^2+\left((\mu_A^N(x_i)-\mu_B^N(x_i)\right)^2+\left(\nu_A^P(x_i)-\nu_B^P(x_i)\right)^2+\left(\nu_A^N(x_i)-\nu_B^N(x_i)\right)^2\right]}$$

BIF-Normalised Euclidean distance:

$$\sqrt{\frac{1}{4k}\sum_{j=1}^{k}\left[\left((\mu_A^P(x_i)-\mu_B^P(x_i)\right)^2+\left((\mu_A^N(x_i)-\mu_B^N(x_i)\right)^2+\left(\nu_A^P(x_i)-\nu_B^P(x_i)\right)^2+\left(\nu_A^N(x_i)-\nu_B^N(x_i)\right)^2\right]}$$

IV.BIPOLAR INTUITIONISTIC FUZZY TOPSIS METHOD

The BIF-TOPSIS method is proferred as follows:Let P=$\{P_1,P_2,P_3,\dots,P_m\}$ be a set of m favourable alternatives under each of k-attributes,T=$\{T_1,T_2,T_3,\dots,T_k\}$.Presume that the decisor is bound to accessing the set of alternatives under each attribute.The attributes are chosen based on the study of the decisor.The value of individual alternative with consideration to each criteria is a BIFV and the weights given to them are fuzzy values.

The path of the BIF-TOPSIS technique are as follows:

Step 1:Individual alternative is estimated in regard to k-criteria.The value of individual alternative over individual criteria is put forward in the form of BIFS and it can be revealed in the decision matrix as follows:

$$X=[x_{ij}]_{m\times k}=\begin{bmatrix} x_{11} & x_{12} & x_{13} & \cdots & x_{1k} \\ x_{21} & x_{22} & x_{23} & \cdots & x_{2k} \\ x_{31} & x_{32} & x_{33} & \cdots & x_{3k} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ x_{m1} & x_{m2} & x_{m3} & \cdots & x_{mk} \end{bmatrix}$$

Each entry $x_{ij}=<\mu_{ij}^P,\mu_{ij}^N,\nu_{ij}^P,\nu_{ij}^N>$ where, μ_{ij}^P represents the positive membership degree, μ_{ij}^N represents the negative membership degree, ν_{ij}^P represents the positive non membership degree and ν_{ij}^N represents the negative non-membership degree respectively such that, $\mu_{ij}^P,\nu_{ij}^P\in[0,1]$ and $\mu_{ij}^N,\nu_{ij}^N\in[-1,0]$ and $0\le\mu_{ij}^P+\nu_{ij}^P-\mu_{ij}^N-\nu_{ij}^N\le 2$.

Step 2:In this method the weights are calculated using bipolar intuitionistic fuzzy entropy measure using the formula

$$w_i=\frac{1-E(F_i)}{n-\sum_{i=1}^{n}E(F_i)}$$

where $E(F_i)=1-\sum_{j=1}^{k}[|\mu_A^P(x_i)-\nu_A^P(x_i)|+|\mu_A^N(x_i)-\nu_A^N(x_i)|]$ for $i=1,2,\dots,m$ and $j=1,2,\dots,k$.

Weights which are thus calculated satisfy the restriction of normality, is $W=[w_1,w_{2,}\dots,w_k]^T$, $\sum_{j=1}^{k}w_j=1$ where w_j is the weight of the j^{th} criteria.

Step 3:The accumulated bipolar intuitionistic fuzzy weighted decision matrix is determined by finding the product between the weighted vector and the decision matrix

$$X\otimes W=[q_{ij}]_{m\times k}=\begin{bmatrix} q_{11} & q_{12} & q_{13} & \cdots & q_{1k} \\ q_{21} & q_{22} & q_{23} & \cdots & q_{2k} \\ q_{31} & q_{32} & q_{33} & \cdots & q_{3k} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ q_{m1} & q_{m2} & q_{m3} & \cdots & q_{mk} \end{bmatrix}$$

Where each entry $q_{ij} = (m_{ij}, n_{ij}, o_{ij}, p_{ij})$ is calculated as $m_{ij} = w_j\mu^P_{ij}, n_{ij} = w_j\mu^N_{ij}, o_{ij} = w_j\nu^P_{ij}, p_{ij} = w_j\nu^N_{ij}$ for $i = 1,2,\dots,m$ And $j = 1,2,\dots,k$.

Step 4: BIF-PIS , BIF-NIS are computed by the formulas

$\mathrm{BIF-PIS}=\{(\mu_1^{P^+},\mu_1^{N^+},\nu_1^{P^+},\nu_1^{N^+}),(\mu_2^{P^+},\mu_2^{N^+},\nu_2^{P^+},\nu_2^{N^+}),\dots,(\mu_k^{P^+},\mu_k^{N^+},\nu_k^{P^+},\nu_k^{N^+})\}$
$\mathrm{BIF-NIS}=\{(\mu_1^{P^-},\mu_1^{N^-},\nu_1^{P^-},\nu_1^{N^-}),(\mu_2^{P^-},\mu_2^{N^-},\nu_2^{P^-},\nu_2^{N^-}),\dots,(\mu_k^{P^-},\mu_k^{N^-},\nu_k^{P^-},\nu_k^{N^-})\}$

where

$\mu_j^{P^+}=max_i\{m_{ij}\}$ $\mu_j^{N^-}=min_i\{m_{ij}\}$
$\mu_j^{N^+}=max_i\{n_{ij}\}$ $\mu_j^{N^-}=min_i\{n_{ij}\}$
$\nu_j^{P^+}=max_i\{o_{ij}\}$ $\nu_j^{P^-}=min_i\{o_{ij}\}$
$\nu_j^{N^+}=max_i\{p_{ij}\}$ $\nu_j^{N^-}=min_i\{p_{ij}\}$

Step 5: The BIF euclidean diatance of individual alternative P_i $(i = 1,2,3,\dots,m)$ from the BIF-PIS ,BIF-NIS are measured using the formula given below

$$U(P_i,\mathrm{BIF-PIS})=\sqrt{\frac{1}{4}\sum_{j=1}^{k}\left[(m_{ij}-\mu_j^{P^+})^2+(n_{ij}-\mu_j^{N^+})^2+(o_{ij}-\nu_j^{P^+})^2+(p_{ij}-\nu_j^{N^+})^2\right]}$$

$$U(P_i,\mathrm{BIF-NIS})=\sqrt{\frac{1}{4}\sum_{j=1}^{k}\left[(m_{ij}-\mu_j^{P^-})^2+(n_{ij}-\mu_j^{N^-})^2+(o_{ij}-\nu_j^{P^-})^2+(p_{ij}-\nu_j^{N^-})^2\right]}$$

Step 6: The relative nearness degree to BIF-PIS is given a picture of $\sigma(P_i)$ and is calculated using the formula

$$\sigma(P_i)=\frac{U(P_i,\mathrm{BIF-NIS})}{U(P_i,\mathrm{BIF-PIS})+U(P_i,\mathrm{BIF-NIS})}$$

Step 7:The alternatives are arranged in ascending order and the alternative with the greatest comparitive measure is the best alternative.

V.**CASE STUDY**

The **COVID-19 epidemic**, in addition to is also known as the **coronavirus epidemic**, gives rise to extreme respiratory syndrome coronavirus 2 (SARS-CoV-2). The outburst was initially examined in Wuhan, China, during December 2019. The WHO announced the outburst a community health crisis on world-wide concern on 30th January 2020 as well as a pandemic on 11th March. The COVID-19 expands initially by means of sprinkles of salaiva or release from the nose when the diseased person coughs or sneezes.

In India,its government proclaimed the first case of coronavirus disease on 30th ,Jan 2020 from the state of Kerala,where a college student from China voyaged back to her state in India.The governing body in India during 22nd March 2020, under Prime Minister Narendra Modi systemized a countrywide lockdown for 21 days, controlling the mobility of the entire population of India as a self protective measure against the COVID-19 epidemic across India. After the completion of the first lockdown stage drew closer, state governments,different consulting groups mentioned to prolong the lockdown period.Lockdown limited people from moving out of their homes.

The whole lot means of activities including rail,air and road was banned,but permissions for mobility of fundamental goods, fire, police, emergency facilities. Educational eatablishments, industrial organisations were halted.Services rendered by banks,food shops, petrol bunks,basic necessities and its associated mass productions were unrestricted. The epidemic has triggered worldwide societal and financial disorderliness.It resulted to the deferment or abandonment of cultural,political,sporting and religious activities,expansive supply insufficiencies,intensified by fearfulness buying of things and limited the release of greenhouse gases and pollutants.All the educational instituitions have been sealed on a countrywide or statewide grounds in nearly 172 countries, disturbing relatively 98.5% of the worldwide student community.

In this paper the study focuses on how the students community utilised their valuable time amidst COVID-19 lockdown in making a profitable income. After initial data was filtered,the jobs were categorised into four sectors namely P_1 =Art and craft,P_2=online jobs,P_3 = tutoring and P_4 = other jobs based on the decision makers inputs for various questions fixing to four criteria namely T_1 = time,T_2 =money, T_3 =job satisfaction and T_4 = personality development.We apply the above proposed BIF-TOPSIS method to conclude which job has favoured the student community in earning income during the lockdown period.

Step 1:

The BIF decision matrix is specified in table 1,where the individual item x_{ij} in the matrix characterises the scale of positive membership,scale of negative membership, scale of positive non-membership and scale of negative non membership for the different types of jobs $P_{i,} i = 1,2,3,4$ for the alternatives T_j,j=1,2,3,4

$$\mathbf{X}=\begin{bmatrix} \{0.2916,-0.375,0.1666,-0.1666\} & \{0.2777,-0.3333,0.2777,-0.1111\} & \{0.4444,-0.4444,0.0555,-0.0555\} & \{0.5555,-0.1944,0.0555,-0.1944\} \\ \{0.3437,-0.2187,0.2187,-0.2187\} & \{0.4166,-0.2916,0.2083,-0.0833\} & \{0.25,-0.5,0.0833,-0.1666\} & \{0.4375,-0.2916,0.0625,-0.2083\} \\ \{0.2083,-0.4166,0.2083,-0.1666\} & \{0.1111,-0.4444,0.2222,-0.2222\} & \{0.2222,-0.3333,0.1111,-0.3333\} & \{0.4166,-0.2777,0.0555,-0.25\} \\ \{0.4333,-0.225,0.2166,-0.1\} & \{0.1555,-0.6222,0.1555,-0.0666\} & \{0.4,-0.3777,0.1111,-0.0888\} & \{0.4777,-0.3555,0.0666,-0.1\} \end{bmatrix}$$

Step 2:

Weights are calculated using the BIFE measure as given below:

w_1 =0.22,w_2=0.24,w_3=0.27 and w_4=0.27 where $\sum_{j=1}^{4} w_j$=1.

Step 3:

The BIF weighted decision matrix is found by multiplying the weights with the BIF decision matrix.

X⊗W=

$$\begin{bmatrix} \{0.0641,-0.0825,0.0366,-0.0366\} & \{0.0666,-0.0799,0.0666,-0.0266\} & \{0.1199,-0.1199,0.0149,-0.0149\} & \{0.1499,-0.0524,0.0149,-0.0524\} \\ \{0.0756,-0.0481,0.0481,-0.0481\} & \{0.0999,-0.0699,0.0499,-0.0199\} & \{0.0675,-0.135,0.0224,-0.0449\} & \{0.1181,-0.0787,0.0168,-0.0562\} \\ \{0.0458,-0.0916,00458,-0.0366\} & \{0.0266,-0.1066,0.0533,-0.0533\} & \{0.0599,-0.0899,0.0299,-0.0899\} & \{0.1124,-0.0749,0.0149,-0.0675\} \\ \{0.0953,-0.055,0.0476,-0.022\} & \{0.0373,-0.1493,0.0373,-0.0159\} & \{0.108,-0.1019,0.0299,-0.0239\} & \{0.1289,-0.0959,0.0179,-0.027\} \end{bmatrix}$$

Step 4:

The BIF-PIS and BIF-NIS are given by

$$\mathrm{BIF-PIS} = \{< 0.0953, -0.0481, 0.0481, -0.022 >, < 0.0999, -0.0699, 0.0666, -0.0159 >, \\ < 0.1199, -0.0899, 0.0299, -0.0149 >, < 0.1499, -0.0524, 0.0179, -0.027 >\}$$

$$\text{BIF-NIS}=\{< 0.0458, -0.0916, 0.0366, -0.0481 >, < 0.0266, -0.1493, 0.0373, -0.0533 >, \\ < 0.0599, -0.1199, 0.0149, -0.0899 >, < 0.1181, -0.0959, 0.0149, -0.0675 >\}$$

Step 5:

The BIF Euclidean distance measure of each job from BIF-PIS and BIF-NIS is given by

$\mathrm{U}(\mathrm{P}_1, \mathrm{BIFPIS})$=0.0374, $\mathrm{U}(\mathrm{P}_1, \mathrm{BIFNIS})$=0.0722,
$\mathrm{U}(\mathrm{P}_2, \mathrm{BIFPIS})$=0.0491, $\mathrm{U}(\mathrm{P}_2, \mathrm{BIFNIS})$=0.0682,
$\mathrm{U}(\mathrm{P}_3, \mathrm{BIFPIS})$=0.0800, $\mathrm{U}(\mathrm{P}_3, \mathrm{BIFNIS})$=0.0376,
$\mathrm{U}(\mathrm{P}_4, \mathrm{BIFPIS})$=0.0587, $\mathrm{U}(\mathrm{P}_4, \mathrm{BIFNIS})$=0.0614.

Step 6:

The relative nearness degree to BIPIS is given by

$\sigma(\mathrm{P}_1)$=0.6587, $\sigma(\mathrm{P}_2)$=0.5814, $\sigma(\mathrm{P}_3)$=0.3197, $\sigma(\mathrm{P}_4)$=0.5112

Step 7:

Arranging the jobs in ascending order conceding to the comparative nearness or likeness to PIS,we acquire

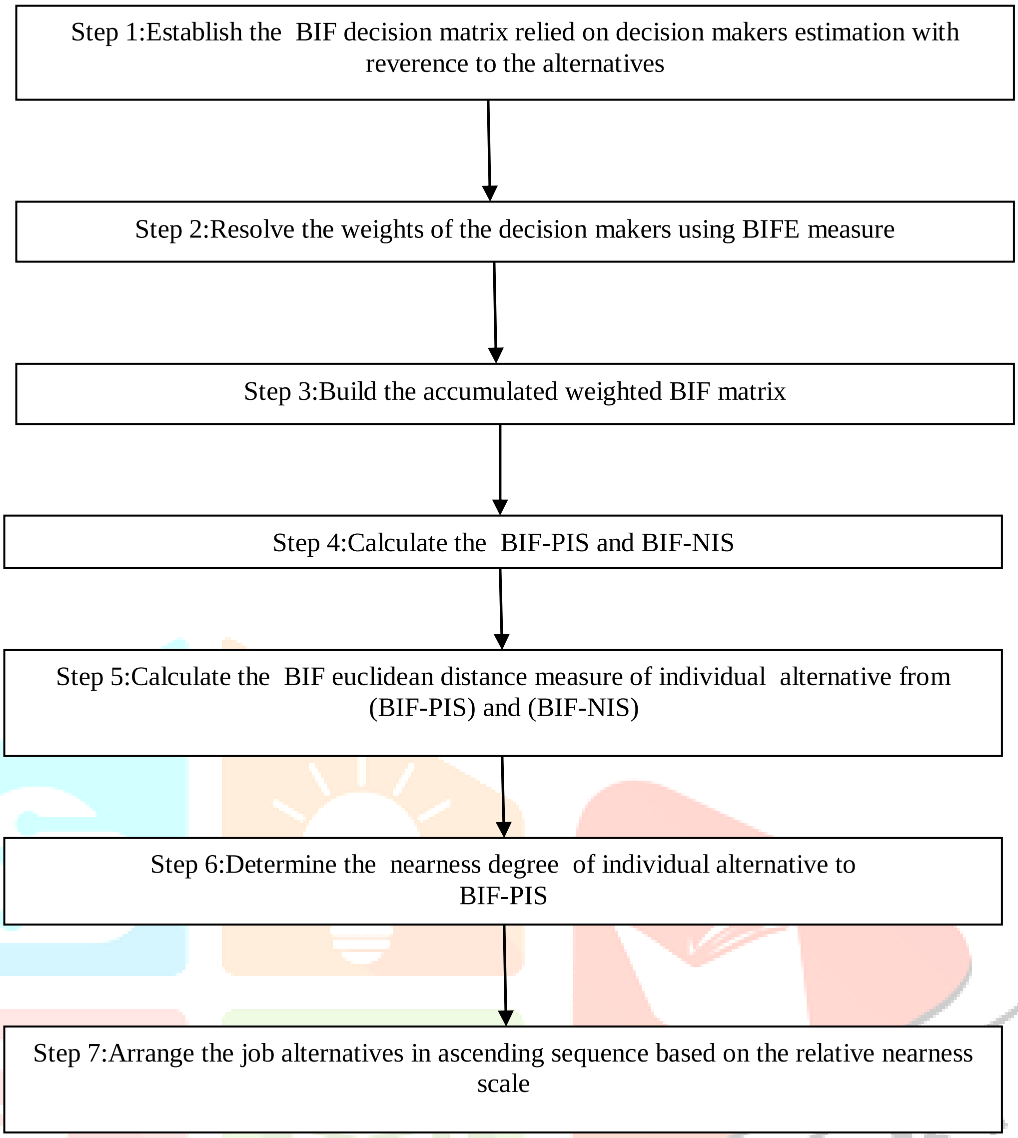
$$\mathrm{P}_3 < \mathrm{P}_4 < \mathrm{P}_2 < \mathrm{P}_1$$

Therefore out of all the above jobs,we conclude that the arts and craft related job has fetched a valuable income to the students community during the lockdown on account of COVID-19.

VI.CONCLUSION

The article employs the bipolar intuitionistic fuzzy set TOPSIS method to conclude on the most undertook job by the students amidst COVID-19 lockdown. Through this case study, the BIF-TOPSIS method examines the students work experience based on time, money, job satisfaction and personality development in a more comprehensive and effective way. Therefore it is an effective tool which helps in building a career graph in the middle of COVID-19 pandemic lockdown .Over the discussed evaluation,BIF-TOPSIS procedure is fruitful to process the presentation of individual persons resources more extensively which consider the ability and performance on the whole. The bipolar intuitiontic fuzzy TOPSIS method evaluates the conclusions reasonably unbiased and even handed and greater closeness.The basis procedure is straightforward and uncomplicated to execute and easy to implement. The method suggests a latest version for the difficult numerous decision making issues in real monetary management. It is better to be appreciable in many identical sectors.

SCHEMATIC DIAGRAM OF BIF-TOPSIS METHOD



VI.ACKNOWLEDGEMENTS

I would like to thank my guide Rev.Sr.Dr.M.Helen who motivated and helped me in each stage of the construction of the paper.

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