THE METHODS FOR FINDING ELIGIBLE EMPLOYEES BASED ON SPECIFICATION

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DECEMBER 2021

APPROVAL

Our research entitled "**The Methods for Finding Eligible Employees Based on Specification**", submitted by *Saidul Islam Rajib* and *Kafiatun Jannat Momi* to Daffodil International University's Department of Computer Science and Engineering, has been acknowledged as adequate for the partial fulfillment of the criteria for the degree of B.Sc. in Computer Science and Engineering, and has been approved in terms of style and content on *06-01-2022*.

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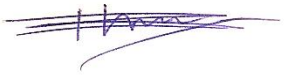

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DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Ms. Israt Jahan, Lecturer, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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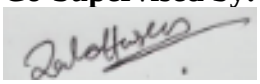

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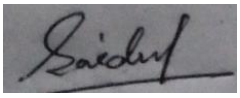

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ACKNOWLEDGEMENT

First and foremost, we convey our heartfelt gratitude to almighty God for His divine grace, which has enabled us to successfully complete our final year thesis.

We are quite grateful to **Ms. Israt Jahan**, **Lecturer**, and express our deep gratitude to Daffodil International University, Dhaka, Department of CSE Deep knowledge and a strong desire to learn. This project will be carried out by our supervisor in the field of "HR Automation." Her never-ending patience, academic advice, ongoing encouragement, active and regular oversight, and constructive criticism Reading numerous lesser manuscripts and correcting them at all stages has resulted in constructive criticism, useful suggestions, and the reading and correction of many inferior drafts. This project could not have been completed without your help.

we would like to offer our heartfelt gratitude to **Ms. Israt Jahan, Md Zahid Hasan** and **Head Department of CSE**, for his generous assistance in completing our thesis, as well as to other faculty members and students. Daffodil International University's CSE department staff. We'd want to express our gratitude to everyone in our class.

ABSTRACT

Our main aim in this conceptual study is to find out the eligible employees and rank them by looking at their data based on specification for the purpose of promotion in an organization. This paper approaches with many scales of linguistic terms to resolve the problem for both conceptual and practical implications related to model building. In today's fast-paced dynamic business field, the success of each organization gets affected by whom will lead the organization. To get right man on the right position human resource department (HR) needs to go through some process of promotion. Promoting of employees is an important part of HR department. They are responsible for monitoring employees, handling employee's salary and so on. To make their work easy companies are investing HR automation for carrying the right man on the right position. Based on organizational requirements, a promotion it requires more and more work, quality of work, experience, intelligence and effort in a job. Some previous study uses MCDM or AHP to find weights of criteria but the thing is different in this study. Our study uses FAHP method to find weights of criteria based on specifications.

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List of Abbreviations

Short Form	Full Name
AHP	Analytical Hierarchical Process
FAHP	Fuzzy Analytical Process
ELECTRE	Election et Choix Traduisant La Realite
TFN	Triangular Fuzzy Number
MCDM	Multi Criteria Decision Making
TrFN	Trapezoidal Fuzzy Number
Q.P.	Quality of Performance
Exp	Experience
J.S.	Job Satisfaction
E.I.	Employee Innovation
Er.R	Error Rate
A.R.	Absence Rate

CHAPTER 1

INTRODUCTION

1.1: Introduction

Today's fast-paced environment business always demand for success at any circumstances. Therefore, human resource department have to access all sort of data, whether it is related to employee performance, sales, supply chain, manufacturing and so on. To make their task easier companies across the world is investing in HR automation for carrying out the right man on the right place through promotion process with computer based online HR system instead of paper-based HR process. The AHP is a multi-criteria analytical method that uses an additive weighting process, in which several relevant attributes are represented by their relative importance [13].

Employee promotion means the rise of an employee to higher position, increasing the range of salary and the increase of responsibility. Simply, it is upward advancement of an employee in an organization, which commands an increase of position, salary range, responsibility for work and a higher level of job title in an organization. Employee promotion process affects almost all sides of an organization lives and it provides motivations and job satisfaction to all personnel. The selections of job performance of employees are making by the help of ELECTRE method and the parameter required for this work is made by the help of Analytical Hierarchy Process (AHP) method.

1.2: Motivation

We know, Organization's success depends on its employees (who is leading the company). So, if an organization fail to figure out the most intellectual employee whom to promote. Then it will hamper the overall reputation or success for that particular organization. To get the right man on the right position HR department has to go through some manual process that is quite hard and error prone. For these errors, sometimes it happens most intellectual employee get covered under shadow and he/she didn't get promotion. So, in our study we are going to make-

1. Find out most eligible employee among other whom to promote.

2. Find out most weak employee &
3. Benefits for organizations; if an organization are able to place the right man on the right position, then it will make profit for the organization. Oppositely, if an organization failed to place the right man on his position, then it will do exactly opposite.

1.3: Objectives

Employee promotion process requires almost every organization all across the world and it's important choosing the right method to make the task easier. There are many types of systemic method to make right man on the right position. But in our study, we combined just three methods named FAHP, AHP and ELECTRE methods for most eligible employee selections by the help of general acknowledges. We will do certain things like-

1. Figure out the weights of criterion for each column by the help of combined AHP and FAHP methods.
2. After getting the weights of criterion then the next step is to find out the preference of each criterion through ELECTRE method to get the right man on his position.

CHAPTER 2

LITERATURE REVIEW

2.1: Comparing with several papers and methods

AHP has some shortcomings on the process of pairwise comparisons matrix [11]. It uses the unequal scale and inability to control over the uncertainty and also accuracy [2]. The traditional AHP method is also unable to exactly reflect like a human thinking style in capturing the expert's knowledge [3,16]. To overcome these problems several researchers are integrated Fuzzy AHP method. The Fuzzy_AHP method is the combine result of fuzzy set theory and hierarchical analysis to make a single decision based on specification for qualitative evaluation [2] and it is also been used for determining the weights of criterion. Some studies used traditional AHP method or MCDM method to calculate the weight of preference criterions in employee selection process but in our study as we have linguistic term and for that we used Fuzzy AHP (FAHP method) to determines the weight of each criterion based on organizational requirements. For decision making judgement Fuzzy numbers can be represent by the help of Triangular Fuzzy Number (TFN) and Trapezoidal Fuzzy Number (TrFN) but for the simplicity in modeling and also for easy interpretations we used only TFN in our study of eligible employee selection. In our study the scale of TFN is defined by three parameters namely "lower point", "middle point" and "upper point". Some other studies used more point that were converted into the scale of Fuzzy Triangular Number. ELECTRE is famous for its outranking relations among the alternatives. ELECTRE method exploit characteristics of dominance regarding analyzed multiple criterions [12]. ELECTRE method can detect gene mutation simulations in human those who suffering cancer. So, the development of concordance and discordance will be more diverse to get the result [8]. And the development of concordance and discordance will be more diverse to get the result [4].

CHAPTER 3

METHODOLOGY

For promotion process companies has to go with some assessment criteria. Based on organizational specifications, each criterion can be collected from some skillful interest. Our study uses total six criterion but the thing can be different for different organizations; the six criterions are- (1) Work Experience, (2) Performance, (3) Job Satisfaction, (4) Innovations, (5) Absence rate, (6) Error rate. Each of the criteria have two categories, (1) Beneficial and (2) non- Beneficial. The Beneficial criteria refer- the highest number is the best among others and the non-Beneficial refers exact opposite. Here, the Beneficial category has work experience, performance, satisfaction, innovations and the non-beneficial category has absence rate and error rate. The beneficial and non-beneficial indexes will be affected by given formulae below-

$$Non\ Beneficial\ = \frac{Min\ x_{ij}}{x_{ij}} \qquad (1)$$

$$Beneficial\ = \frac{x_{ij}}{Max\ x_{ij}} \qquad (2)$$

3.1: Fuzzy Analytical Hierarchical Process (FAHP)

FAHP stands for Fuzzy Analytical Hierarchical Process. Our study uses Fuzzy AHP instead of AHP method because of AHP has some shortcomings on pair-wise comparison matrix and uncertainties. For examples, AHP method mostly used in crisp decision application; AHP method also creates unbalanced scale of judgements. AHP method's ranking imprecise and subjective judgement based on preferences and selection of the decision maker have great influences on AHP method [1]. To overcomes these kinds of shortcomings, some researchers hardly integrated fuzzy set theory and AHP method to improve uncertainty.

For solving complex problem, Fuzzy Analytical Hierarchy Process (FAHP) is an important tool. Fuzzy set have different degree of membership function of linguistic variables.

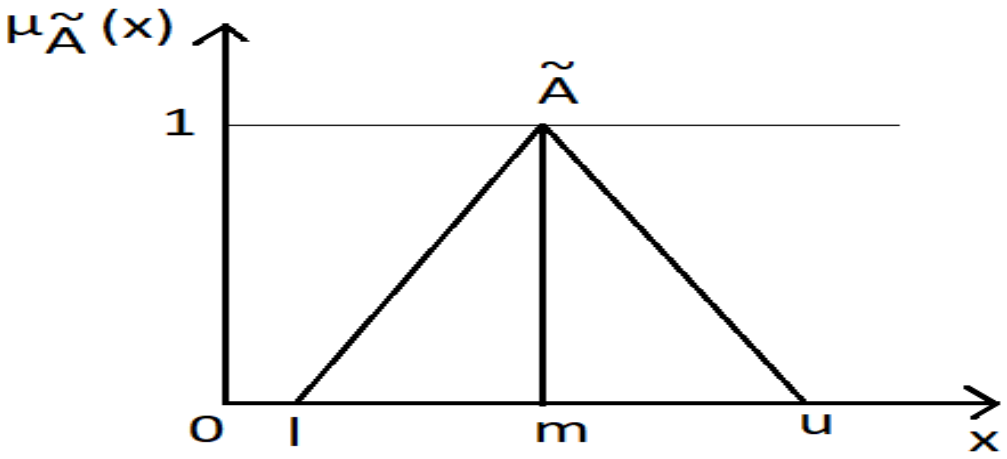

Figure 1: Triangular fuzzy number for membership functions

According to the given figure above (fig 1): l, m, u is lower, middle and upper point of fuzzy number.

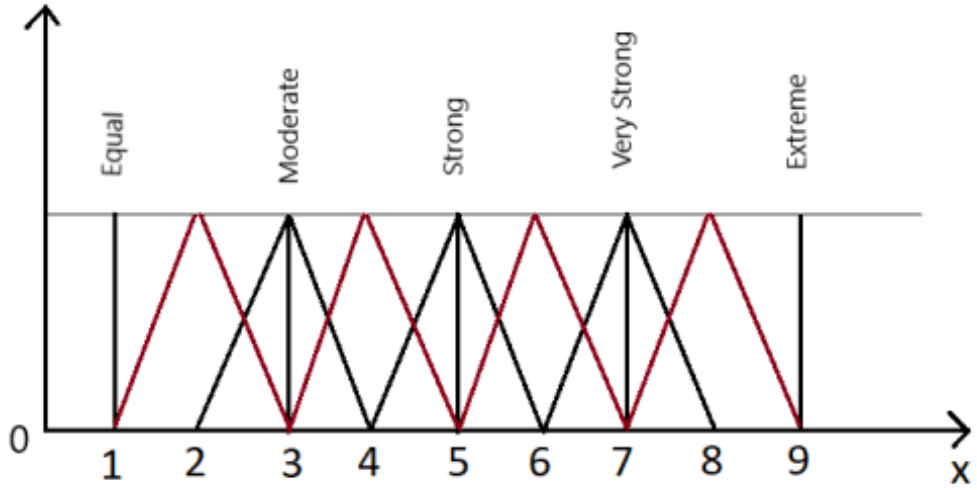

Figure 2: Membership function of linguistic variables

Fuzzy sets have different degrees of element as an extension of the traditional definition of a fuzzy set. The computational method for some basic operation like addition, multiplication is shown below.

Addition of fuzzy number are-

$$\tilde{\mathrm{A}}_1 \oplus \tilde{\mathrm{A}}_2 = (l_1, m_1, u_1) \oplus (l_2, m_2, u_2) \quad (3)$$
$$= (l_1 + l_2, m_1 + m_2, u_1 + u_2)$$

Multiplication of fuzzy numbers are-

$$\tilde{r}_i = \tilde{\mathrm{A}}_1 \otimes \tilde{\mathrm{A}}_2 = (l_1, m_1, u_1) \otimes (l_2, m_2, u_2) \quad (4)$$
$$= (l_1 l_2, m_1 m_2, u_1 u_2);$$
$$\text{where}, l_1, l_2 > 0, m_1, m_2 > 0, u_1, u_2 > 0$$

Calculation of Reciprocal fuzzy number use formula below-

$$\tilde{A}^{-1} = (l_1, m_1, u_1) \quad (5)$$
$$= \left(\frac{1}{u_1}, \frac{1}{m_1}, \frac{1}{l_1}\right)$$
$$Where, l_1, l_2 > 0, m_1, m_2 > 0, u_1, u_2 > 0$$
$$Example: \ \frac{1}{3} = \left(\frac{1}{4}, \frac{1}{3}, \frac{1}{2}\right)$$

$$\widetilde{w_i} = \tilde{r}_i \otimes (\tilde{r_1} \oplus \tilde{r_2} \oplus \ldots \oplus \tilde{r_n})^{-1} \quad (6)$$
$$\text{Where}, \widetilde{w_i} \ is \ fuzzy \ weight$$

3.2: ELECTRE Method

ELECTRE (means Election et Choix Traduisant La Realite) is a part of multi-criteria approach and it was conceived in responses of deficiencies of the existing decision-making problems [6]. ELECTRE method is famous for its outranking relations among the alternatives and exploits characteristics of dominance regarding analyzed multiple criteria [2] and it also able to detect gene mutation simulations in human those who suffering cancer [7]. So, the development of concordance and discordance will be more diverse to get the result [8] and for that, initially, we need to normalized the dataset first (eq: 1) [10] then it arranged onto concordance and discordance interval set

Weighted Normalized Matrix $r_{ij} = \frac{r_{ij}}{\sqrt{\sum_{i=1}^{m} x^2{}_{ij}}}$ (7)

In deciding concordance (C_{ab}) and discordance (D_{ab}) interval sets, it can be used the 2nd

and 3rd equation respectively.

$$Concordance \quad \mathbf{C_{ab}} = \{ \boldsymbol{j} \,|\boldsymbol{x_{aj}} \geq \boldsymbol{x_{bj}} \qquad (8)$$

$$Discordane \quad \mathbf{D_{ab}} = \{\mathrm{j} \,|\, \boldsymbol{x_{aj}} < \boldsymbol{x_{bj}} \qquad (9)$$

$$= \mathrm{J} - \mathbf{C_{ab}}$$

Concordance index matrix indicates the preferences of the assertion “A outrank B” (eq:10).

$$c_{ab} = \sum_{j \epsilon c_{ab}}^{\cdot} w_j \qquad (10)$$

Discordance index matrix of d(a, b), which can also be viewed as preferences of discontents in decision of schemes “a” rather than scheme “b” (eq: 11).

$$\mathrm{d(a,b)} = \frac{max_{j \epsilon D_{ab}} \left| v_{aj} - v_{bj} \right|}{max_{j \epsilon J,\ m,n \epsilon I} \left| v_{mj} \ v_{nj} \right|} \qquad (11)$$

The equation for concordance index matrix uses 4th equation.

$$\bar{c} = \sum_{a=1}^{m} . \sum_{b=1}^{m} c(a,b) \mid m(m-1) \qquad (12)$$

Here, given $\bar{c}$ is the critical value that is determined by the average dominances index. So, the formula for Boolean (E) matrices are given below-

$$e(a,b) = 1 \text{ if } (a,b) \geq \bar{c} \qquad (13)$$
$$e(a,b) = 0 \text{ if } (a,b) < \bar{c}$$

Equation for discordance index matrix uses 5th equation

$$\bar{d} = \frac{\sum_{a=1}^{m} . \sum_{b=1}^{m} d(a,b)}{m(m-1)} \qquad (14)$$

Based on the discordance index matrix mentioned above, the discordance Boolean matrix (F) are uses below formula-

$$f(a,b) = 1 \text{ if } d(a,b) \geq \bar{d} \qquad (15)$$

$$f(a,b) = 0 \text{ if } d(a,b) < \bar{d}$$

Net superior value is defined to determine the employees who is eligible for promotion. The equation to calculate net superior are given below-

$$c_a = \sum_{b=1}^{n} c(a,b) - \sum_{b=1}^{n} c(b,a) \qquad (16)$$

Unlike the net superior value, the net inferior value is determining the employees who is going to be quiet. The equation to calculate the net inferior value is given below-

$$d_a = \sum_{b=1}^{n} d(a,b) - \sum_{b=1}^{n} d(b,a) \qquad (17)$$

The following step of this study is defined to promote some employees based on their performance are shown in fig 4.

3.3: Complete Process for finding eligible employee

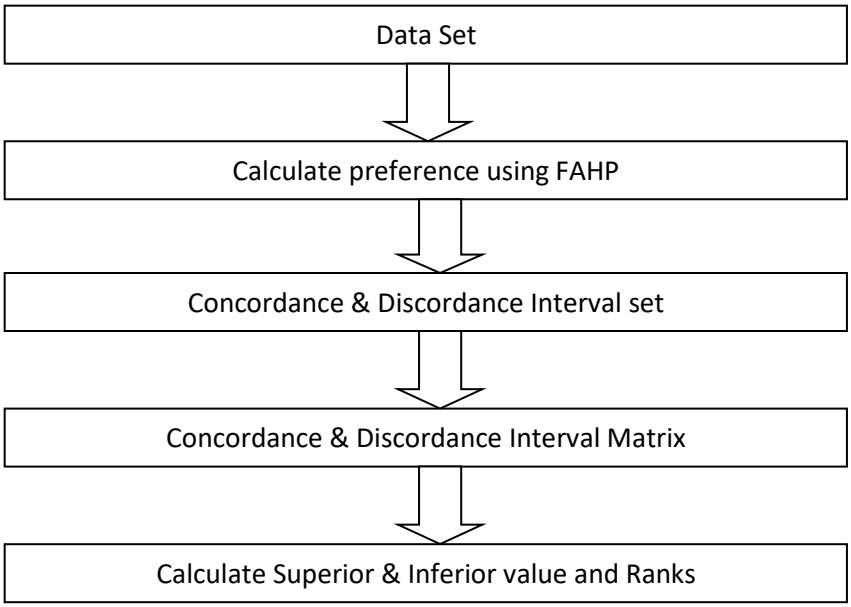

Figure 3: Conceptual model to rank eligible employees

This figure exploits the whole process of our study. The superiority is calculated from the concordance interval matrix and it defines who is going to be promoted. Similarly, the inferiority calculates from discordance interval matrix and it defines the employees who is going to be quiet.

CHAPTER 4

ILLUSTRATIVE EXAMPLE

4.1: Dataset

TABLE 1: EMPLOYEE DATASET

Emp Name	Performance	Satisfaction	Innovation	Absence rate	Experience	Error rate
E1	1	5	0	1	10	0
E2	2	5	0	15	13	0
E3	1	5	0	15	9	0
E4	2	3	4	19	7	0
E5	2	4	0	19	8	0
E6	2	3	0	4	12	0
E7	2	5	6	16	6	0
E8	1	4	5	9	7	0
E9	2	4	0	7	9	0
E10	1	3	0	16	5	3
E11	2	5	0	12	10	0
E12	2	4	0	13	8	0
E13	2	3	0	13	9	3
E14	2	3	0	2	8	0
E15	1	3	0	19	7	0
E16	3	3	0	3	10	0
E17	2	4	3	4	6	1
E18	2	2	6	14	13	1
E19	2	3	0	9	7	1
E20	2	5	0	17	8	1

The above dataset (Table I) is the basic dataset of our study and it has total twenty employees (named E1 to E20). After getting the data, it needs to be normalized the data based on their weights of each criterion. Before that, it has to calculate the preferences of each criterion.

In our study we arranged an interview with some questionnaires to get the relationship among criteria's. For example-

Question: How important is "Quality of Performance" with respect to "Experience"?

Ans: Moderate importance

Then this linguistic variable converted onto crisp numerical value and arranged onto pair-wise comparison matrix (Table 2).

4.2: Preferences using FAHP

TABLE 2: PAIR_WISE COMPARISON MATRIX FOR RELIABILITY INDICATIORS

	Q. P.	Exp.	J.S.	E. I.	Er. R.	A.R.
Q. P.	1	3	4	2	9	3
Exp.	1/3	1	5	6	9	2
J.S.	1/4	1/5	1	7	5	5
E. I.	1/2	1/6	1/7	1	3	2
Er. R.	1/9	1/9	1/5	1/3	1	5
A.R.	1/3	1/2	1/5	1/2	1/5	1

Linguistic term is a variable whose data are in form of word or sentence and they adopt values in term of set [1]. The study uses natural word to compare different employee using five basic linguistic term – "Equal", "Moderate", "Strong", "Very strong", "Extreme". The computational techniques for this research based on fuzzy numbers [1,9] (Table 2 and Table 3).

Each of this membership functions (named "Scale of Fuzzy Numbers") are normally defined by three parameter- (1) lower point, (2) middle point and (3) upper point- for a symmetrical triangular fuzzy number (fig: 1) in the range over which a function is defined.

Linguistic	Fuzzy Number	Scale of Fuzzy Number
Equal	1	(1, 1, 1)
Moderate	3	(2, 3, 4)
Strong	5	(4, 5, 6)
Very Strong	7	(6, 7, 8)
Extreme	9	(9, 9, 9)

Figure 4: Linguistic scale of membership functions

The intermediate fuzzy numbers (2,4,6,8) and the fractional numbers are also replaced by the scale of fuzzy number are show in below figure (figure: 5).

	Fuzzy Number	Scale of Fuzzy Number
Intermediate values	2	(1, 2, 3)
	4	(3, 4, 6)
	6	(5, 6, 7)
	8	(7, 8, 9)
Values for inverse comparison	1/3	(1/4, 1/3, 1/2)
	1/5	(1/6, 1/5, 1/4)
	1/7	(1/8, 1/7, 1/6)
	1/9	(1/10, 1/9, 1/8)

Figure 5: Intermediate number and values for inverse comparison

The fractional numbers uses formula(eq: 8) to convert reciprocal of fuzzy number to the scale of relative fuzzy numbers.

The pair-wise comparison matrix (TABLE II) will be converted into fuzzified pair-wise comparison matrix. To create a fuzzified comparison matrix, this study uses symmetric triangular method for fuzzy number (fig 1). The linguistic variables (fig 2) are replaced by the scale of fuzzy numbers (Table III).

TABLE 3: FUZZIFIED PAIR_WISE COMPARISON MATRIX FOR RELIABILITY

	Q.P.	Exp.	J.S.	E. I.	Er. R.	A.R.
Q. P.	1,1,1	2,3,4	3,4,5	1,2,3	9,9,9	2,3,4
Exp.	1/4,1/3,1/2	1,1,1	4,5,6	5,6,7	9,9,9	1,2,3
J.S.	1/5,1/4,1/3	1/6,1/5,1/4	1,1,1	6,7,8	4,5,6	4,5,6
E. I.	1/3,1/2,1/1	1/7,1/6,1/5	1/8,1/7,1/6	1,1,1	2,3,4	1,2,3
Er. R.	1/9,1/9,1/9	1/9,1/9,1/9	1/6,1/5,1/4	1/4,1/3,1/2	1,1,1	4,5,6
A.R.	1/4,1/3,1/2	1/3,1/2,1/1	1/6,1/5,1/4	1/3,1/2,1/1	1/6,1/5,1/4	1,1,1

This fuzzified pair-wise comparison matrix then arranged onto Fuzzy geometric mean vlaue and then the fuzzy weights are calculated from fuzzy geometric mean values using equation given in fig 3.

TABLE 4: FUZZIFIED GEOMETRIC MEAN VALUE AND FUZZY WEIGHT

	Fuzzy Geometric mean values $\tilde{r_i}$	Fuzzy weight $\tilde{w_i}$
Q.P.	2.18, 2.94, 3.59	0.2171, 0.3599, 0.5627
Exp.	1.89, 2.37, 2.88	0.1882, 0.2900, 0.4513
J.S.	1.20, 1.43, 1.70	0.1195, 0.1750, 0.2664
E.I.	0.47, 0.64, 0.85	0.0468, 0.0783, 0.1332
Er.R.	0.35, 0.40, 0.46	0.0349, 0.0489, 0.0720
A.R.	0.29, 0.39, 0.56	0.0289, 0.0478, 0.0878

The fuzzy weights are still fuzzy triangular number and it's need to be de-fuzzified for further calculation using center of area method.

Center of Area (COA) $wi = \frac{l + m + u}{3}$ (18)

Example :

For Job Satisfation (J.S) → (0.1195+0.1750+0.2664) / 3

→ 0.186966

The formulae center of area (eq: 9) helps to find values for each criteria preferences and then it is perpetrated onto weights of preferences.

TABLE 5: WEIGHTED VALUE OF EACH CRITERION

Q.P.	**Exp.**	**J.S.**	**E.I.**	**Er.R.**	**A.R.**
0.37989	0.30990	0.18699	0.08612	0.05197	0.05479
0.36	**0.29**	**0.17**	**0.08**	**0.05**	**0.05**

The table (TABLE 5) of six criterions that showing the result of numbers interest. It is perpetrated by the observations Fuzzy AHP method.

The point forwards, our study uses ELECTRE method. Normally, ELECTRE method aim to reduces size of alternative sets. For that, the employee data needs to be normalized and then it will be arranged onto weighted normalized matrix (Table VI).

4.3: Weighted Normalized Matrix

TABLE 6: WEIGHTED NORMALIZED MATRIX

Emp_ID	Q.P.	J.S.	E.I.	A.R.	Exp.	Er.R.
S1	0.04302823	0.048591266	0	0.000874505	0.07309634	0
S2	0.08605646	0.048591266	0	0.013117582	0.095025242	0
S3	0.04302823	0.048591266	0	0.013117582	0.065786706	0
S4	0.08605646	0.029154759	0.028971439	0.016615604	0.051167438	0
S5	0.08605646	0.038873013	0	0.016615604	0.058477072	0
S6	0.08605646	0.029154759	0	0.003498022	0.087715608	0
S7	0.08605646	0.048591266	0.043457158	0.013992088	0.043857804	0
S8	0.04302823	0.038873013	0.036214298	0.007870549	0.051167438	0
S9	0.08605646	0.038873013	0	0.006121538	0.065786706	0
S10	0.04302823	0.029154759	0	0.013992088	0.03654817	0.031980107
S11	0.08605646	0.048591266	0	0.010494066	0.07309634	0
S12	0.08605646	0.038873013	0	0.011368571	0.058477072	0
S13	0.08605646	0.029154759	0	0.011368571	0.065786706	0.031980107
S14	0.08605646	0.029154759	0	0.001749011	0.058477072	0
S15	0.04302823	0.029154759	0	0.016615604	0.051167438	0
S16	0.12908469	0.029154759	0	0.002623516	0.07309634	0
S17	0.08605646	0.038873013	0.021728579	0.003498022	0.043857804	0.010660036
S18	0.08605646	0.019436506	0.043457158	0.012243077	0.095025242	0.010660036
S19	0.08605646	0.029154759	0	0.007870549	0.051167438	0.010660036
S20	0.08605646	0.048591266	0	0.014866593	0.058477072	0.010660036

Weighted normalized matrix is a powerful quantitative technique and it exploits a set of choices against a set of attributes. After getting the weighted normalized matrix of employees then it arranged onto concordance and discordance interval set (Table 7) for all employees.

In this study we are going to rank the best alternatives and for that the computing process are proposed by using ELECTRE method with respect to equation 2 and 3.

4.4: Concordance and Discordance Interval Sets

Table 7: CONCORDANCE & DISCORDANCE INTERVAL SET

ID	Concordance {}	Discordance {}	ID	Concordance {}	Discordance {}
1,2	2,3,6	1,4,5	2,1	1,2,3,4,5,6	-
1,3	1,2,3,5,6	4	2,3	1,2,3,4,5,6	-
1,4	2,5,6	1,3,4	2,4	1,2,5,6	3,4
1,5	2,3,5,6	1,4	2,5	1,2,3,5,6	4
1,6	2,3,6	1,4,5	2,6	1,2,3,4,5,6	-
1,7	2,5,6	1,3,4	2,7	1,2,5,6	3,4
1,8	1,2,5,6	3,4	2,8	1,2,4,5,6	3
1,9	2,3,5,6	1,4	2,9	1,2,3,4,5,6	-
1,10	1,2,3,5	4,6	2,10	1,2,3,5	4,6
1,11	2,3,5,6	1,4	2,11	1,2,3,4,5,6	-
1,12	2,3,5,6	1,4	2,12	1,2,3,4,5,6	-
1,13	2,3,5	1,4,6	2,13	1,2,3,4,5	6
1,14	2,3,5,6	1,4	2,14	1,2,3,4,5,6	-
1,15	1,2,3,5,6	4	2,15	1,2,3,5,6	4
1,16	2,3,5,6	1,4	2,16	2,3,4,5,6	1
1,17	2,5	1,3,4,6	2,17	1,2,4,5	3,6
1,18	2	1,3,4,5,6	2,18	1,2,4,5	3,6
1,19	2,3,5	1,4,6	2,19	1,2,3,4,5	6
1,20	2,3,5	1,4,6	2,20	1,2,3,5	4,6
3,1	1,2,3,4,6	5	4,1	1,3,4,6	2,5
3,2	2,3,4,6	1,5	4,2	1,3,4,6	2,5
3,4	2,5,6	1,3,4	4,3	1,3,4,6	2,5
3,5	2,3,5,6	1,4	4,5	1,3,4,6	2,5
3,6	2,3,4,6	1,5	4,6	1,2,3,4,6	5
3,7	2,5,6	1,3,4	4,7	1,4,5,6	2,3
3,8	1,2,4,5,6	3	4,8	1,4,5,6	2,3
3,9	2,3,4,5,6	1	4,9	1,3,4,6	2,5
3,10	1,2,3,5	4,6	4,10	1,2,3,4,5	6
3,11	2,3,4,6	1,5	4,11	1,3,4,6	2,5
3,12	2,3,4,5,6	1	4,12	1,3,4,6	2,5
3,13	2,3,4,5	1,6	4,13	1,2,3,4	5,6
3,14	2,3,4,5,6	1	4,14	1,2,3,4,6	5
3,15	1,2,3,5,6	4	4,15	1,2,3,4,5,6	-
3,16	2,3,4,6	1,5	4,16	2,3,4,6	1,5
3,17	2,4,5	1,3,6	4,17	1,3,4,5	2,6
3,18	2,4	1,3,5,6	4,18	1,2,4	3,5,6
3,19	2,3,4,5	1,6	4,19	1,2,3,4,5	6
3,20	2,3,5	1,4,6	4,20	1,3,4	2,5,6

5,1	1,3,4,6	2,5	6,1	1,3,4,5,6	2
5,2	1,3,4,6	2,5	6,2	1,3,6	2,4,5
5,3	1,3,4,6	2,5	6,3	1,3,5,6	2,4
5,4	1,2,4,5,6	3	6,4	1,2,5,6	3,4
5,6	1,2,3,4,6	5	6,5	1,3,5,6	2,4
5,7	1,4,5,6	2,3	6,7	1,5,6	2,3,4
5,8	1,2,4,5,6	3	6,8	1,5,6	2,3,4
5,9	1,2,3,4,6	5	6,9	1,3,5,6	2,4
5,10	1,2,3,4,5	6	6,10	1,2,3,5	4,6
5,11	1,3,4,6	2,5	6,11	1,3,5,6	2,4
5,12	1,2,3,4,5,6	-	6,12	1,3,5,6	2,4
5,13	1,2,3,4	5,6	6,13	1,2,3,5	4,6
5,14	1,2,3,4,5,6	-	6,14	1,2,3,4,5,6	-
5,15	1,2,3,4,5,6	-	6,15	1,2,3,5,6	4
5,16	2,3,4,6	1,5	6,16	2,3,4,5,6	1
5,17	1,2,4,5	3,6	6,17	1,4,5	2,3,6
5,18	1,2,4	3,5,6	6,18	1,2	3,4,5,6
5,19	1,2,3,4,5	6	6,19	1,2,3,5	4,6
5,20	1,3,4,5	2,6	6,20	1,3,5	2,4,6
7,1	1,2,3,4,6	5	8,1	1,3,4,6	2,5
7,2	1,2,3,4,6	5	8,2	3,6	1,2,4,5
7,3	1,2,3,4,6	5	8,3	1,3,6	2,4,5
7,4	1,2,3,6	4,5	8,4	2,3,5,6	1,4
7,5	1,2,3,6	4,5	8,5	2,3,6	1,4,5
7,6	1,2,3,4,6	5	8,6	2,3,4,5	1,5
7,8	1,2,3,4,6	5	8,7	5,6	1,2,3,4
7,9	1,2,3,4,6	5	8,9	2,3,4,6	1,5
7,10	1,2,3,4,5	6	8,10	1,2,3,5	4,6
7,11	1,2,3,4,6	5	8,11	3,6	1,2,4,5
7,12	1,2,3,4,6	5	8,12	2,3,6	1,4,5
7,13	1,2,3,4	5,6	8,13	2,3	1,4,5,6
7,14	1,2,3,4,6	5	8,14	2,3,4,6	1,5
7,15	1,2,3,6	4,5	8,15	1,2,3,5,6	4
7,16	2,3,4,6	1,5	8,16	2,3,4,6	1,5
7,17	1,2,3,4,5	6	8,17	2,3,4,5	1,6
7,18	1,2,3,4	5,6	8,18	2	1,3,4,5,6
7,19	1,2,3,4	5,6	8,19	2,3,4,5	1,6
7,20	1,2,3	4,5,6	8,20	3	1,2,4,5,6

9,1	1,3,4,6	2,5	10,1	1,3,4,6	2,5
9,2	1,3,6	2,4,5	10,2	3,4,6	1,2,5
9,3	1,3,5,6	2,4	10,3	1,3,4,6	2,5
9,4	1,2,5,6	3,4	10,4	2,6	1,3,4,5
9,5	1,2,3,5,6	4	10,5	1,2,4,5	3,6
9,6	1,2,3,4,6	5	10,6	2,3,4,6	1,5
9,7	1,5,6	2,3,4	10,7	4,6	1,2,3,5
9,8	1,2,3,4,5,6	-	10,8	1,4,6	2,3,5
9,10	1,2,3,5	4,6	10,9	3,4,6	1,2,5
9,11	1,3,6	2,4,5	10,11	3,4,6	1,2,5
9,12	1,2,3,5,6	4	10,12	3,4,6	1,2,5
9,13	1,2,3,5	4,6	10,13	2,3,4,6	1,5
9,14	1,2,3,4,5,6	-	10,14	2,3,4,6	1,5
9,15	1,2,3,5,6	4	10,15	1,2,3,6	4,5
9,16	2,3,4,6	1,5	10,16	2,3,4,6	1,5
9,17	1,2,4,5	3,6	10,17	4,6	1,2,3,5
9,18	1,2	3,4,5,6	10,18	2,4,6	1,3,5
9,19	1,2,3,5	4,6	10,19	2,3,4,6	1,5
9,20	1,3,5	2,4,6	10,20	3,6	1,2,4,5
11,1	1,2,3,4,5,6	-	12,1	1,3,4,6	2,5
11,2	1,2,3,6	4,5	12,2	1,3,6	2,4,5
11,3	1,2,3,5,6	4	12,3	1,3,6	2,4,5
11,4	1,2,5,6	3,4	12,4	1,2,5,6	3,4
11,5	1,2,3,5,6	4	12,5	1,2,3,5,6	4
11,6	1,2,3,4,6	5	12,6	1,2,3,4,6	5
11,7	1,2,5,6	3,4	12,7	1,5,6	2,3,4
11,8	1,2,4,5,6	3	12,8	1,2,4,5,6	3
11,9	1,2,3,4,5,6	-	12,9	1,2,3,4,6	5
11,10	1,2,3,5	4,6	12,10	1,2,3,5	4,6
11,12	1,2,3,5,6	4	12,11	1,3,4,6	2,5
11,13	1,2,3,5	4,6	12,13	1,2,3,4	5,6
11,14	1,2,3,4,5,6	-	12,14	1,2,3,4,5,6	-
11,15	1,2,3,5,6	4	12,15	1,2,3,5,6	4
11,16	2,3,4,5,6	1	12,16	2,3,4,6	1,5
11,17	1,2,4,5	3,6	12,17	1,2,4,5	3,6
11,18	1,2	3,4,5,6	12,18	1,2	3,4,5,6
11,19	1,2,3,4,5	6	12,19	1,2,3,4,5	6
11,20	1,2,3,5	4,6	12,20	1,3,5	2,4,6

13,1	1,3,4,6	2,5	14,1	1,3,4,6	2,5
13,2	1,3,6	2,4,5	14,2	1,3,6	2,4,5
13,3	1,3,5,6	2,4	14,3	1,3,6	2,4,5
13,4	1,2,5,6	3,4	14,4	1,2,5,6	3,4
13,5	1,3,5,6	2,4	14,5	1,3,5,6	2,4
13,6	1,2,3,4,6	5	14,6	1,2,3,6	4,5
13,7	1,5,6	2,3,4	14,7	1,5,6	2,3,4
13,8	1,4,5,6	2,3	14,8	1,5,6	2,3,4
13,9	1,3,4,5,6	2	14,9	1,3,6	2,4,5
13,10	1,2,3,5,6	4	14,10	1,2,3,5	4,6
13,11	1,3,4,6	2,5	14,11	1,3,6	2,4,5
13,12	1,3,4,5,6	2	14,12	1,3,5,6	2,4
13,14	1,2,3,4,5,6	-	14,13	1,2,3	4,5,6
13,15	1,2,3,5,6	4	14,15	1,2,3,5,6	4
13,16	2,3,4,6	1,5	14,16	2,3,6	1,4,5
13,17	1,4,5,6	2,3	14,17	1,6	2,3,4,6
13,18	1,2,6	3,4,5	14,18	1,2	3,4,5,6
13,19	1,2,3,4,5,6	-	14,19	1,2,3,6	4,6
13,20	1,3,5,6	2,4	14,20	1,3,6	2,4,6
15,1	1,3,4,6	2,5	16,1	1,3,4,5,6	2
15,2	3,4,6	1,2,5	16,2	1,3,6	2,4,5
15,3	1,3,4,6	2,5	16,3	1,3,5,6	2,4
15,4	2,4,5,6	1,3	16,4	1,2,5,6	3,4
15,5	3,4,6	1,2,5	16,5	1,3,5,6	2,4
15,6	2,3,4,6	1,5	16,6	1,2,3,6	4,5
15,7	4,5,6	1,2,3	16,7	1,5,6	2,3,4
15,8	1,4,5,6	2,3	16,8	1,5,6	2,3,4
15,9	3,4,6	1,2,5	16,9	1,3,5,6	2,4
15,10	1,2,3,4,5	6	16,10	1,2,3,5	4,6
15,11	3,4,6	1,2,5	16,11	1,3,5,6	2,4
15,12	3,4,6	1,2,5	16,12	1,3,5,6	2,4
15,13	2,3,4	1,5,6	16,13	1,2,3,5	4,6
15,14	2,3,4,6	1,5	16,14	1,2,3,4,5,6	-
15,16	2,3,4,6	1,5	16,15	1,2,3,5,6	4
15,17	4,5	1,2,3,6	16,17	1,5	2,3,4,6
15,18	2,4	1,3,5,6	16,18	1,2	3,4,5,6
15,19	2,3,4,5	1,6	16,19	1,2,3,5	4,6
15,20	3,4	1,2,5,6	16,20	1,3,5	2,4,6

17,1	1,3,4,6	2,4	18,1	1,3,4,5,6	2
17,2	1,3,6	2,4,5	18,2	1,3,5,6	2,4
17,3	1,3,6	2,4,5	18,3	1,3,5,6	2,4
17,4	1,2,6	3,4,5	18,4	1,3,5,6	2,4
17,5	1,2,3,6	4,5	18,5	1,3,5,6	2,4
17,6	1,2,3,4,6	5	18,6	1,3,4,5,6	2
17,7	1,5,6	2,3,4	18,7	1,3,5,6	2,4
17,8	1,2,6	3,4,5	18,8	1,3,4,5,6	2
17,9	1,2,3,6	4,5	18,9	1,3,4,5,6	2
17,10	1,2,3,5	4,6	18,10	1,3,5	2,4,6
17,11	1,3,6	2,4,5	18,11	1,3,4,5,6	2
17,12	1,2,3,6	4,5	18,12	1,3,4,5,6	2
17,13	1,2,3	4,5,6	18,13	1,3,4,5	2,6
17,14	1,2,3,4,6	5	18,14	1,3,4,5,6	2
17,15	1,2,3,6	4,5	18,15	1,3,5,6	2,4
17,16	2,3,4,6	1,5	18,16	3,4,5,6	1,2
17,18	1,2,6	3,4,5	18,17	1,3,4,5,6	2
17,19	1,2,3,6	4,5	18,19	1,3,4,5,6	2
17,20	1,3,6	2,4,5	18,20	1,3,5,6	2,4
19,1	1,3,4,6	2,5	20,1	1,2,3,4,6	5
19,2	1,3,6	2,4,5	20,2	1,2,3,4,6	5
19,3	1,3,6	2,4,5	20,3	1,2,3,4,6	5
19,4	1,2,5,6	3,4	20,4	1,2,5,6	3,4
19,5	1,3,6	2,4,5	20,5	1,2,3,5,6	4
19,6	1,2,3,4,6	5	20,6	1,2,3,4,6	5
19,7	1,5,6	2,3,4	20,7	1,2,4,5,6	3
19,8	1,4,5,6	2,3	20,8	1,2,4,5,6	3
19,9	1,3,4,6	2,5	20,9	1,2,3,4,6	5
19,10	1,2,3,5	4,6	20,10	1,2,3,4,5	6
19,11	1,3,6	2,4,5	20,11	1,2,3,4,6	5
19,12	1,3,6	2,4,5	20,12	1,2,3,4,5,6	-
19,13	1,2,3	4,5,6	20,13	1,2,3,4	5,6
19,14	1,2,3,4,6	5	20,14	1,2,3,4,5,6	-
19,15	1,2,3,5,6	4	20,15	1,2,3,5,6	4
19,16	2,3,4,6	1,5	20,16	2,3,4,6	1,5
19,17	1,4,5,6	2,3	20,17	1,2,4,5,6	3
19,18	1,2,6	3,4,5	20,18	1,2,4,6	3,5
19,20	1,3,6	2,4,5	20,19	1,2,3,4,5,6	-

The 2nd formula (eq: 8) are used calculate concordance interval set and the 3rd formula (eq: 9) are used to calculate discordance interval set. Then it arranged onto concordance interval matrix by using the

formula in equation 10. Such as, the concordance interval index of $c_{(1,3)} = \{1,2,3,5,6\}$ can be calculate like

$$c_{(1,3)} = \sum_{j \varepsilon c13}^{\cdot} w_j$$

$$= 0.36 + 0.17 + 0.08 + 0.29 + 0.05 \quad = 0.95$$

Similarly, Concordance Interval Index of $c_{(2,4)} = \{1,2,5,6\}$ are as follows:

$$c_{(2,4)} = \sum_{j \varepsilon c24}^{\cdot} w_j$$

$$= 0.36 + 0.17 + 0.29 + 0.05 \quad = 0.87$$

Concordance interval matrix for full dataset is given below in the Table 8.

4.5: Concordance and Discordance Interval Matrix and their Boolean Matrix

TABLE 8: CONCORDANCE INTERVAL MATRIX's

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	Sum
S1	0	0.54	0.95	0.51	0.59	0.3	0.51	0.87	0.59	0.9	0.59	0.59	0.54	0.59	0.95	0.59	0.46	0.17	0.54	0.54	11.32
S2	1	0	1	0.87	0.95	1	0.87	0.92	1	0.9	1	1	0.95	1	0.95	0.64	0.87	0.87	0.95	0.9	17.64
S3	0.71	0.35	0	0.51	0.59	0.35	0.51	0.92	0.64	0.9	0.35	0.64	0.59	0.64	0.95	0.35	0.51	0.22	0.59	0.54	10.86
S4	0.54	0.54	0.54	0	0.54	0.71	0.75	0.75	0.54	0.95	0.54	0.54	0.66	0.71	1	0.35	0.54	0.58	0.95	0.49	12.22
S5	0.54	0.54	0.54	0.92	0	0.71	0.75	0.92	0.71	0.95	0.54	1	0.66	1	1	0.35	0.87	0.58	0.95	0.78	14.31
S6	0.83	0.49	0.78	0.87	0.78	0	0.7	0.7	0.78	0.9	0.78	0.78	0.9	1	0.95	0.64	0.7	0.53	0.9	0.73	14.74
S7	0.71	0.71	0.71	0.66	0.66	0.71	0	0.71	0.71	0.95	0.71	0.71	0.66	0.71	0.66	0.35	0.95	0.66	0.66	0.61	13.21
S8	0.54	0.13	0.49	0.59	0.3	0.59	0.34	0	0.35	0.9	0.13	0.3	0.25	0.35	0.95	0.35	0.59	0.17	0.59	0.08	7.99
S9	0.54	0.49	0.78	0.87	0.95	0.71	0.7	1	0	0.9	0.49	0.95	0.9	1	0.95	0.35	0.87	0.53	0.9	0.73	14.61
S10	0.54	0.18	0.54	0.22	0.87	0.35	0.1	0.46	0.18	0	0.18	0.18	0.35	0.35	0.66	0.35	0.1	0.27	0.35	0.13	6.36
S11	1	0.66	0.95	0.87	0.95	0.71	0.87	0.92	1	0.9	0	0.95	0.9	1	0.95	0.64	0.87	0.53	0.95	0.9	16.52
S12	0.54	0.49	0.49	0.87	0.95	0.71	0.7	0.92	0.71	0.9	0.54	0	0.66	1	0.95	0.35	0.87	0.53	0.95	0.73	13.86
S13	0.54	0.49	0.78	0.87	0.78	0.71	0.7	0.75	0.83	0.95	0.54	0.83	0	1	0.95	0.35	0.75	0.58	1	0.78	14.18
S14	0.54	0.49	0.49	0.87	0.78	0.66	0.7	0.7	0.49	0.9	0.49	0.78	0.61	0	0.95	0.3	0.41	0.53	0.66	0.49	11.84
S15	0.54	0.18	0.54	0.56	0.18	0.35	0.39	0.75	0.18	0.95	0.18	0.18	0.3	0.35	0	0.35	0.34	0.22	0.59	0.13	7.26
S16	0.83	0.49	0.78	0.87	0.78	0.66	0.7	0.7	0.78	0.9	0.78	0.78	0.9	1	0.95	0	0.41	0.53	0.9	0.73	14.47
S17	0.54	0.49	0.49	0.58	0.66	0.71	0.7	0.58	0.66	0.9	0.49	0.66	0.61	0.71	0.66	0.35	0	0.58	0.66	0.49	11.52
S18	0.83	0.78	0.78	0.78	0.78	0.83	0.78	0.83	0.83	0.73	0.83	0.83	0.54	0.83	0.78	0.47	0.83	0	0.83	0.78	14.67
S19	0.54	0.49	0.49	0.87	0.49	0.71	0.7	0.75	0.54	0.9	0.49	0.49	0.61	0.71	0.95	0.35	0.75	0.58	0	0.49	11.9
S20	0.71	0.71	0.71	0.87	0.95	0.71	0.92	0.92	0.71	0.95	0.71	1	0.66	1	0.95	0.35	0.92	0.63	1	0	15.38
Sum	12.56	9.24	12.83	14.03	13.53	12.19	12.39	15.07	12.23	17.23	10.36	13.19	12.25	14.95	17.11	7.83	12.61	9.29	14.92	11.05	254.86

As like Concordance interval index, the discordance interval index can be obtained by the help of equation 11. Discordance interval index for $d_{(1,2)}$ ={1,4,6}

$$d_{(1,2)} = \frac{max(|0.043-0.086|,|0.0009-0.0131|,|0-0|)}{\max(|0.043-0.086|,|0.0486-0.0486|,|0-0|,|0.0009-0.0131|,|0.0731-0.0950|,|0-0|)}$$

$$d_{(1,2)} = \frac{0.043}{0.043}$$

$$d_{(1,2)} = 1$$

Similarly, the discordance interval index for $d_{(3,4)}$ = {1,3,4} are as follows:

$$d_{(2,4)} = \frac{max(|0.0430-0.0861|,|0-0.0290|,|0.0131-0.0161|)}{max(|0.0430-0.0861|,|0.0486-0.0292|,|0-0.0290|,|0.0131-0.0161|,|0.0658-0.0512|,|0-0|)}$$

$$d_{(2,4)} = \frac{0.0430}{0.0430}$$

$$d_{(2,4)} = 1$$

So, the same way we can calculate the discordance interval index matrix for full dataset. The discordance interval matrix for full dataset is given in table 9.

TABLE 9: DISCORDANCE INTERVAL MATRIX

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	Sum
S1	0	1	1	1	1	1	1	1	1	0.88	1	1	1	1	0.72	1	1	1	1	1	18.59
S2	-	0	-	0.66	0.10	-	0.85	0.83	-	0.55	-	-	1.00	-	0.08	1.00	0.42	1.00	0.24	0.29	7.02
S3	0.60	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.18	1.00	1.00	1.00	1.00	1.00	17.78
S4	0.51	1.00	0.45	0.00	0.34	1.00	1.00	0.23	0.50	0.74	0.76	0.34	1.00	0.25	-	1.00	0.81	1.00	0.37	0.67	11.97
S5	0.34	1.00	0.23	1.00	0.00	1.00	1.00	0.84	0.70	0.74	1.00	-	1.00	-	-	1.00	1.00	1.00	1.00	1.00	13.85
S6	0.45	1.00	0.45	0.79	0.45	0.00	0.99	0.84	0.44	0.63	1.00	0.33	1.00	-	0.30	1.00	0.50	1.00	0.29	0.66	12.13
S7	0.67	1.00	0.50	0.38	0.34	1.00	0.00	0.17	0.50	0.74	0.67	0.34	0.74	0.34	0.17	0.99	0.49	1.00	0.25	0.34	10.61
S8	0.61	1.00	0.40	1.00	1.00	1.00	1.00	0.00	1.00	0.88	1.00	1.00	1.00	1.00	0.24	1.00	1.00	1.00	1.00	1.00	17.13
S9	0.23	1.00	0.23	1.00	1.00	1.00	1.00	-	0.00	0.74	1.00	0.72	1.00	-	0.24	1.00	0.99	1.00	0.73	1.00	13.88
S10	1.00	1.00	0.91	1.00	0.74	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.46	1.00	1.00	1.00	1.00	1.00	18.11
S11	-	1.00	0.06	1.00	0.42	0.75	1.00	0.84	-	0.74	0.00	0.06	1.00	-	0.14	1.00	0.74	1.00	0.49	0.73	10.98
S12	0.34	1.00	0.23	1.00	1.00	1.00	1.00	0.84	1.00	0.74	1.00	0.00	1.00	-	0.12	1.00	1.00	1.00	1.00	1.00	15.27
S13	0.45	0.91	0.45	0.91	0.30	0.69	1.00	0.84	0.30	0.06	0.61	0.30	0.00	-	0.12	1.00	0.99	1.00	-	0.91	10.86
S14	0.45	1.00	0.45	1.00	1.00	1.00	1.00	0.84	1.00	0.74	1.00	1.00	1.00	0.00	0.35	1.00	1.00	1.00	1.00	1.00	16.83
S15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	20.00
S16	0.23	0.51	0.23	0.67	0.33	0.34	1.00	0.42	0.23	0.37	0.45	0.23	0.74	-	0.16	0.00	0.50	1.00	0.25	0.45	8.11
S17	0.23	1.00	0.51	1.00	0.67	1.00	1.00	0.34	1.00	0.50	1.00	0.67	1.00	0.67	0.30	1.00	0.00	1.00	0.34	0.67	13.90
S18	0.67	0.67	0.67	0.22	0.45	0.22	0.57	0.44	0.45	0.36	0.67	0.45	0.49	0.22	0.22	0.99	0.38	0.00	0.22	0.67	9.05
S19	0.51	1.00	0.45	1.00	0.91	1.00	1.00	0.84	1.00	0.50	1.00	0.91	1.00	0.69	0.20	1.00	1.00	1.00	0.00	1.00	16.01
S20	0.34	1.00	0.25	1.00	0.16	1.00	1.00	0.84	0.69	0.50	1.00	-	1.00	-	0.04	1.00	1.00	1.00	-	0.00	11.82
Sum	8.62	18.09	8.47	16.63	12.20	16.00	18.41	13.16	12.81	12.41	16.16	10.34	17.97	7.17	5.06	18.98	15.83	19.00	11.17	15.40	**273.89**

From the above table (table 8 and table 9) it can be calculate the Boolean matrix for both of the concordance and discordance. The 4th formulation is used to calculate concordance Boolean matrix and 5th formulation is used to calculate discordance Boolean matrix.

From above table (table 8) c bar value for Concordance set can be determine by (equation 12), that is expressed are as follows:

$$\bar{c} = \sum_{a=1}^{20} . \sum_{b=1}^{20} \frac{c(a,b)}{20 * (20-1)}$$

$$= \frac{254.86}{380}$$

$$= 0.67$$

When we found the critical value for concordance matrix then it is easy to find out the Boolean matrix for concordance set by using the formula given in equation in 13. If the value greater than or equals the critical value the it will put 1, otherwise 0. The concordance Boolean matrix for complete dataset is given (Table 10).

TABLE 10: CONCORDANCE BOOLEAN MATRIX's

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20
S1	0	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0
S2	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
S3	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0
S4	0	0	0	0	0	1	1	1	0	1	0	0	0	1	1	0	0	0	1	0
S5	0	0	0	1	0	1	1	1	1	1	0	1	0	1	1	0	1	0	1	1
S6	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	0	1	1
S7	1	1	1	0	0	1	0	1	1	1	1	1	0	1	0	0	1	0	0	0
S8	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0
S9	0	0	1	1	1	1	1	1	0	1	0	1	1	1	1	0	1	0	1	1
S10	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S11	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	0	1	1
S12	0	0	0	1	1	1	1	1	1	1	0	0	0	1	1	0	1	0	1	1
S13	0	0	1	1	1	1	1	1	1	1	0	1	0	1	1	0	1	0	1	1
S14	0	0	0	1	1	0	1	1	0	1	0	1	0	0	1	0	0	0	0	0
S15	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
S16	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	0	0	0	1	1
S17	0	0	0	0	0	1	1	0	0	1	0	0	0	1	0	0	0	0	0	0
S18	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	0	1	1
S19	0	0	0	1	0	1	1	1	0	1	0	0	0	1	1	0	1	0	0	0
S20	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	0	1	0

Similarly, the way from above table (Table 9), the d bar value for discordance set can be evaluated by using equation 14.

Example

$$\bar{d} = \sum_{a=1}^{20} . \sum_{b=1}^{20} \frac{d(a,b)}{20 * (20-1)}$$

$$= \frac{273.89}{380} \quad = 0.673$$

The way can determine the concordance Boolean matrix, exact same way it can also be determine discordance Boolean matrix (Table 11) for full dataset by using formula (equation 15). The difference is that if the value is greater than d bar then it will put 0, otherwise 1. The complete Boolean matrix for the whole dataset are given in Table 11 below-

TABLE 11: DISCORDANCE BOOLEAN MATRIX's

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20
S1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
S2	0	1	0	1	1	0	0	0	0	1	0	0	0	0	1	0	1	0	1	1
S3	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
S4	1	0	1	1	1	0	0	1	1	0	0	1	0	1	0	0	0	0	1	1
S5	1	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
S6	1	0	1	0	1	1	0	0	1	1	0	1	0	0	1	0	1	0	1	1
S7	1	0	1	1	1	0	1	1	1	0	1	1	0	1	1	0	1	0	1	1
S8	1	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0
S9	1	0	1	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0
S10	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0
S11	0	0	1	0	1	0	0	0	0	0	1	1	0	0	1	0	0	0	1	0
S12	1	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0
S13	1	0	1	0	1	1	0	0	1	1	1	1	1	0	1	0	0	0	0	0
S14	1	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
S15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S16	1	1	1	1	1	1	0	1	1	1	1	1	0	0	1	1	1	0	1	1
S17	1	0	1	0	1	0	0	1	0	1	0	1	0	1	1	0	1	0	1	1
S18	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
S19	1	0	1	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1	0
S20	1	0	1	0	1	0	0	0	1	1	0	0	0	0	1	0	0	0	0	1

So, regarding on Concordance and discordance interval matrix it can be calculate the net superiors and inferiors' values for each individual employee to figure out the hardest worker and idle worker among others. The superior value says who is going to be promoted and the inferior value describes which employee is going to be quit.

4.6: Superior and Inferior

TABLE 12: SUPERIOR AND INFERIOR VLAUES

	Superior Value	Superior Rank	Inferior Value	Inferior Rank
E1	-1.24	13	9.98	19
E2	**8.4**	**1**	-11.08	1
E3	-1.97	15	9.30	17
E4	-1.81	14	-4.66	7
E5	0.78	10	1.64	12
E6	2.55	6	-3.87	8
E7	0.82	9	-7.80	4
E8	-7.08	18	3.98	13
E9	2.38	7	1.07	11
E10	**-10.87**	**20**	**5.71**	**16**
E11	6.16	3	-5.18	6
E12	0.67	11	4.93	15
E13	1.93	8	-7.11	5
E14	-3.11	17	9.66	18
E15	-9.85	19	14.94	20
E16	6.64	2	-10.87	2
E17	-1.09	12	-1.93	10
E18	5.38	4	-9.95	3
E19	-3.02	16	4.84	14
E20	4.33	5	-3.58	9

Above table (Table 12) show that second employee having strongest relation with criterions and it has the highest superiority value by comparing with other. It also exploits the highest the difference is the first priority for promotion purpose. Oppositely, employee number ten having weakest relationship with criterions and it has the lowest superior value by comparing with others. The inferior dataset exploits lowest the difference is having highest priority.

CHAPTER 5

RANK & OUTCOMES

TABLE 13: MOST ELIGIBLE EMPLOYEE

Employee Number	Superior Value	Superior Rank	Inferior Value	Inferior Rank	Rank Subtraction	Rank
E 1	-1.24	13	9.98	19	-11.22	16
E2	**8.4**	**1**	**-11.08**	**1**	**19.48**	**1**
E 3	-1.97	15	9.30	17	-11.27	17
E 4	-1.81	14	-4.66	7	2.85	9
E 5	0.78	10	1.64	12	-0.86	12
E 6	2.55	6	-3.87	8	6.42	8
E 7	0.82	9	-7.80	4	8.62	6
E 8	-7.08	18	3.98	13	-11.06	15
E 9	2.38	7	1.07	11	1.31	10
E 10	-10.87	20	5.71	16	-16.58	19
E 11	6.16	3	-5.18	6	11.34	4
E 12	0.67	11	4.93	15	-4.26	13
E 13	1.93	8	-7.11	5	9.04	5
E 14	-3.11	17	9.66	18	-12.77	18
E 15	**-9.85**	**19**	**14.94**	**20**	**-24.79**	**20**
E 16	6.64	2	-10.87	2	17.51	2
E 17	-1.09	12	-1.93	10	0.84	11
E 18	5.38	4	-9.95	3	15.33	3
E 19	-3.02	16	4.84	14	-7.86	14
E 20	4.33	5	-3.58	9	7.91	7

In above table (Table 13) show the result for most eligible employees by subtracting inferior values from superior values and finally ranked them by their superior and inferior values. The value having high superior value means it has the highest relationship with criterion and the value having high inferior values means exact opposite. In this table (Table 13) our second employee having highest relationship and fifteenth number employees having weakest relationship by comparing with other employees. This statistic also gives a result that if a company want to fire an employee than fifteenth number employee will get depart from the company and second employee has highest preference to get promotion by the company.

FUTURE WORK

The methods we used in our study gives complete information about most eligible employee for cleaned dataset. But in reality, the dataset may be noisy and error prone. So, the thing can be reverse for noisy dataset and we will try to implement and convert these methods into dynamically environments. Such that any dataset we are able to use and get the result.

As we learned the process and procedures, we will try to implement these methods to find eligible employees based on specification through web applications. Such that, we are able to get the highest accurate result possible with minimum cost.

CONCLUSION & DISCUSSION

Employee promotion process requires almost every organization all across the world and it's important choosing the right method to make the task easier. There are many types of systemic method to make right man on the right position. In this study we combined AHP, FAHP and ELECTRE method for eligible employee selection by the help of general acknowledges. Based on organizational requirements the criteria can be changed, added or subtracted.

The conclusion of this study is to determine the eligible employees for an organization by the help of AHP, FAHP and ELECTRE methods. Initially, we adopt, AHP and FAHP just to get the weights of each criterion preference and then we used ELECTRE method to make single decision. The ranking of employees (Table 13) says about the employees who is going to be promoted and the employees who is going to be quiet. We can conclude that our second employee (E2) has strongest relation among alternatives and criteria and fifteenth number employee has strong negative relation among criteria and alternatives.

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