Designing a Fuzzy Inference System for Evaluating Job Satisfaction Using TOPSIS And Fuzzy ANP Techniques

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ABSTRACT

Human resources (HR) are crucial production resources, encompassing all organisational staff members. Occupational issues have always been a priority for nations, intertwined with personal, social, and cultural aspects. This study develops an expert system to assess employee job satisfaction using the Minnesota Questionnaire, TOPSIS, and fuzzy ANP techniques. The survey is completed by client-facing employees from different sectors. ANP and FNAP techniques are discussed, followed by an investigation of TOPSIS and Fuzzy TOPSIS decision-making methods. MATLAB software is used to design the expert system. Results show that implementing satisfaction programs and addressing organisational issues are vital for employee job satisfaction. Meeting employees' needs increases satisfaction while neglecting them causes dissatisfaction. Organisations must prioritise preserving job satisfaction by addressing employee needs.

1. Introduction

HR is the most important and valuable factor among the various production resources [1]. Committed HR creates profit and value for the organisation more than rearing, equipping, and training costs [2]. Conversely, unsatisfied, uncommitted, ineffective, and uninformed HR may

make false decisions and perform incorrectly, which adds to the organisation's problems and losses [3].

The role of the human factor in advancing society's affairs is of particular significance, and it is considered the most effective pillar of economic, social, and cultural changes. Economic and social progress entails paying special attention to the training committed by the specialised, skillful, and dynamic human workforce, which aligns with enhancing the factors influencing job satisfaction. More than 5000 studies and research have been conducted in this area since the 1930s.

Job satisfaction is a collection of feelings and beliefs individuals develop about their current occupations. Job satisfaction is one of the important factors in terms of job success; this is a factor that elevates efficiency and individual satisfaction feelings. Job satisfaction means loving the conditions and tools of a job, the conditions under which a task is to be done, and a reward is to be received for it [4].

Job satisfaction is an area about which many social, sociological, economic, political, and educational perspectives have been uniquely presented [5]. Job satisfaction leads to a reduction in absenteeism, a reduction in the displacement rate, and prevention of a decrease in the task completion pace. An organisation needs a model for becoming aware of its employees' job satisfaction to evaluate the changes in line with increasing satisfaction and planning for its achievement [6]. Therefore, determining the employees' job satisfaction is important for the organisation [7]. Human beings are an organisation's greatest and most valuable assets, never reflected in the firms' balance sheets and the loss-profit statements [8]. This is while the losses and profits of an organisation depend on the human beings, and the humans are to be viewed as the successful support of the organisations [9].

Therefore, the human factors should be treated with utmost respect and reverence because many years of the organisations and the society's time have been spent on the upbringing and fostering of the specialised, percipient, and committed humans so that they can reach the peak of their efficiency after years of planning [10].

Considering the abovementioned materials, it can be stated that "job satisfaction" means feeling pleasance and happiness about one's job, following which the individual would be more hopeful and more attached to the job. "Job satisfaction" is a pleasant, affectionate, and positive state stemming from job appreciation or occupational experiences; it is a concept possessing various aspects and variegated factors, and it has to be taken into consideration one way or another.

Amongst these factors, the worker or employee's attributes, work environment, and human relations of the work can be pointed out.

Considering that this research aims to design an expert system and offer a model, the method of design has been provided according to Minnesota scales for assessing job satisfaction.

2. Literature Review

V. E. Fisher and Hanna realise job satisfaction as an internal factor and consider it a sort of emotional compliance with the job and the occupational conditions; it means that if a job of choice provides an individual with a favourable pleasure, s/he will be found satisfied in addition to that. On the contrary, if the intended job fails to give the individual favourable pleasure, the individual would be found scorning oneself and may decide to change it [11].

According to R. Hoppock, job satisfaction is a complex and multidimensional concept interrelated with psychological, physical, and social factors. Not just one factor causes job satisfaction; rather, a certain combination of various factors causes the employee or worker to feel the job's satisfaction at a given time and tell oneself that s/he is satisfied with the job and enjoys it [12].

W. Porter and Stirs have expressed job satisfaction factors in an organisation: the overall organisational factors, immediate work environment factors, the contextual or actual activity-related factors, and the individual factors [13].

In 2008, in research about individual differences regarding job satisfaction, Klinger et al. found out that female workers give more value than their male counterparts to having colleagues. In contrast, male workers give more value than their female counterparts to consulting with others and influencing essential decisions [5].

In 1983, in research about the effect of participation *n* decision-making and reducing occupational pressures, Jackson used Solomon's four-group plan. He performed two posttests to investigate the impact of participation on the office workers and nurses. The study results showed that, after six months, participation negatively influences role dualities and perceived influence; they also displayed that individuals' participation in decision-making is a determinant of reducing occupational pressures [14].

In a study by S. S. Iman in 1990, 100 twenty-one to fifty-five-year-old teachers, half male and half female, were asked to complete a questionnaire assessing job satisfaction factors. The study results indicated no significant relationship between job satisfaction and variables like age, gender, education level, and monthly salaries [15].

In 1992, in research on 1438 university students, S. T. Kane, Healy, and Henson reported that part-time jobs create more satisfaction in them, and they work with more interest [16].

In a research performed by Taymuri et al. (2008) in Isfahan about employment and income statuses and leisure time and job satisfaction, the relationship between job types and job satisfaction was presented. The extracted results indicated that job satisfaction is slightly higher than the mean in-office affairs-related, commerce and sales jobs. It has been at its highest level in managerial and supervising positions and teaching and cultural jobs. This is while job satisfaction was found below the mean in scientific and specialised jobs, production and hygiene-related jobs, and treatment jobs, with the lowest job satisfaction belonging to the hygiene and treatment group's jobs [17].

As it is observed, many experts have dealt with the factors influencing job satisfaction. Many of these factors appear to be shared, including social factors, work nature, and work environment [4, 18-20].

In the Islamic Republic of Iran, many studies have also been carried out about job satisfaction and jobs. Of course, most of this research cannot be generalised and hence is limited to a given job, such as a teacher, nurse, or other occupation [21&22]. Thus, the present study aims to design a fuzzy inference system for evaluating job satisfaction using TOPSIS and fuzzy ANP techniques among the staff members of Tehran's general vocational and technical training organisation.

Table 1: studies related to the subject within the format of the research gap

Row	References	Quantitative	TOPSIS	ANP	Descriptive	Qualitative	Results
		Study method					
1	George Jones, 2011				✓		Introducing four essential factors influencing job satisfaction
2	Woodman and Helrichel, 2009				✓		Consideration of the worker and employee's attributes as the factor influencing job satisfaction
3	Shorters				✓		Introducing salary, job security, good work conditions, the possibility of progress and advancement, and human relations as the factors influencing job promotion
4	Cormen					✓	Classifying the factors leading to the enhancement of job satisfaction into two sets, named environmental factors and personal factors

Row	References	Study method					Results
		Quantitative	TOPSIS	ANP	Descriptive	Qualitative	
5	Mayo					✓	Creating relationships between the qualitative aspects and the human-mental bonds
6	Hawthorne's studies	✓					Correcting the employee-employer relations and improving the environmental conditions of the job within the format of a system
7	Emil Durkhim					✓	Introducing the principle of collectivism and socialism and giving importance to social subjects
8	Ginsberg	✓					Separating the concept of job satisfaction within the format of internal satisfaction and external satisfaction and categorising the relevant factors into separate groups
9	Barry Field and Crocket, 1995	✓					Paying attention to the concept of organisational research for increasing the staff members' job satisfaction
10	Herzberg, 1959	✓			✓		Satisfying the needs, motivation, and job satisfaction through the consideration of the employees' issues, feelings, and perceptions in the work environments
11	Hyulin, 1966	✓					The effect of welfare on the enhancement of the employee's job satisfaction
12	Scholler	✓					The effect of the role of individual differences on the staff's job satisfaction
13	This Paper	✓	✓	✓			Use of statistical techniques in quantitatively measuring the concept of job satisfaction

3. Method

The present study is survey-applied research. The information has been collected through field research. The main instrument of data gathering in this research has been the Minnesota Job Satisfaction Questionnaire (MSQ), comprised of 19 items and six subscales assessing the payment system (3 questions), job type (4 questions), progress opportunities (3 questions), organisational atmosphere (2 questions), leadership style (4 questions) and physical conditions (3 questions). The questionnaire was scored based on Likert's style in the following form: "completely disagree=1", "disagree=2", "no idea=3", "agree=4", and "completely agree=5".

As for the interpretation of the questionnaire, it can be stated that scores between 19 and 38 reflect low job satisfaction, scores between 38 and 57 show intermediate job satisfaction and scores above 57 suggest very good job satisfaction.

The questionnaire's reliability was obtained equal to 0.56 based on Cronbach's alpha test [23]. Moreover, the questionnaire's validity has been confirmed by the university professors.

The study population included employees working in Tehran's general vocational and technical training organisation, and the study sample volume was selected using random sampling and was equal to 50 employees. The current research aims to recognise and rate the factors influencing employees' satisfaction with their present jobs. In this research, and for purging and weighing the indicators influencing job satisfaction, the Minnesota Questionnaire was used to make decisions and perform ratings. TOPSIS and fuzzy ANP were the techniques of choice. The former technique is based on the idea that the most appropriate choice should fall at the lowest distance from the ideal positive point (the best possible state) and the highest distance from the ideal negative point (the worst possible state). TOPSIS is a logical and understandable concept, and the calculations are not so much complicated.

Users will be made of the analytic network process to prioritise the cases. To do so, the problems are seminally organised in the form of an analytic network process model, which is composed of two levels, with the first one being pertinent to the selection of the most important factors related to job satisfaction, and these latter cases are rated and prioritised based on fuzzy TOPSIS; the importance of each is examined in a prior stage as the output of fuzzy TOPSIS. The second level is related to the primary factors influencing job satisfaction. It is worth mentioning that the opinions of the experts, specialists, and knowledgeable individuals have been utilised for pairwise comparisons.

Analytic network process (ANP) is a comprehensive and strong method for precise decision-making by the use of empirical information and personal judgments of every decision-maker, and it provides a structure for organising the different scales and evaluating the importance and priority of each in comparison to the choices to ease the decision-making process.

Considering the fact the intended project was the first of its type, it was necessary to choose a very strong team of the organisation's experts as well as individuals with versatility in job satisfaction matters and even designing of the expert systems and also with the required interests in the performing of this research in the foresaid organisation. To do so, it was necessary to inquire about ideas from the organisation's senior managers in the first place for their greater recognition of the employees. Usually, individuals with long work histories and training records about job satisfaction were primarily nominated. Meanwhile, senior managers with good experience were needed in this regard. Still, they mostly were found to have little time. The most important scale

that can be used to select such individuals is their good analytical power and sufficient recognition of the subjects related to job satisfaction amongst the staff members.

The factors influencing job satisfaction were the payment system, job type, job opportunities, organisational climate, leadership style, and physical conditions. The experts codified the applied rules and ultimately formed our knowledge base. Finally, the system and model output will be the level of job satisfaction. This has been carried out in MATLAB.

An expert system is a computer program featuring a vast knowledge base in a given area and using complex inference reasoning to perform the task as a specialist. However, the fuzzy expert system uses fuzzy logic instead of Boolean (binary) logic. In other words, it can be recognised as a system based on regulations and knowledge, and it uses fuzzy logic in its knowledge base and reaches a conclusion with the assistance of the user's input data and fuzzy inference.

Because the goal of this research is designing an expert system, the designing method has been presented according to six primary factors of the Minnesota Questionnaire. This expert system can be utilised in all organisations. The present design method comprises two general stages: a "design system" and a "decision-making."

"Designing system" incorporates three stages: determination of the verbal variables and decision-making scales, designing fuzzy systems for decision-making scales, and elaborating fuzzy expert system regulations.

"Decision-making" also comprises inputs' fuzzification steps, fuzzy inference, and defuzzification. Since this research aims to develop an expert system and offer a model, the design method based on Minnesota scales for assessing job satisfaction has been offered accordingly. So, this expert system can be utilised in all organisations. The overview of the fuzzy expert system is shown in Figure (1).
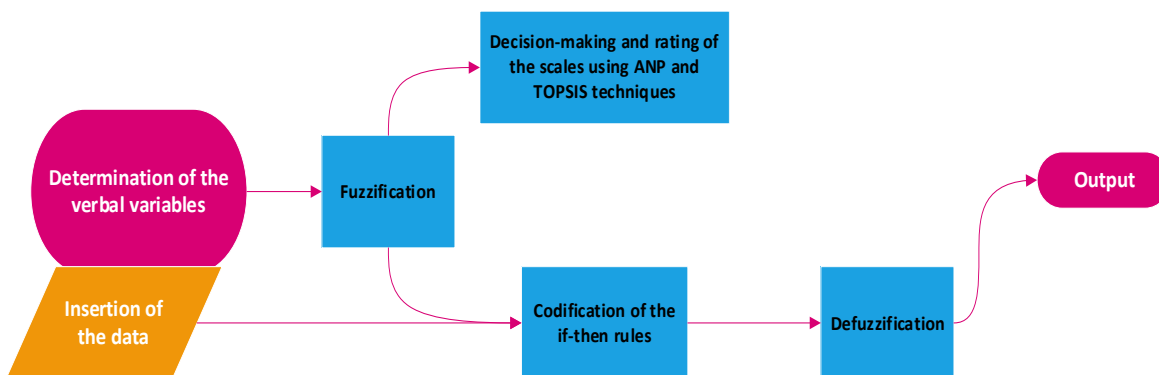

Figure (1): the overview of the fuzzy expert system

Defining the inputs and outputs of the fuzzy expert system outline model is as follows:
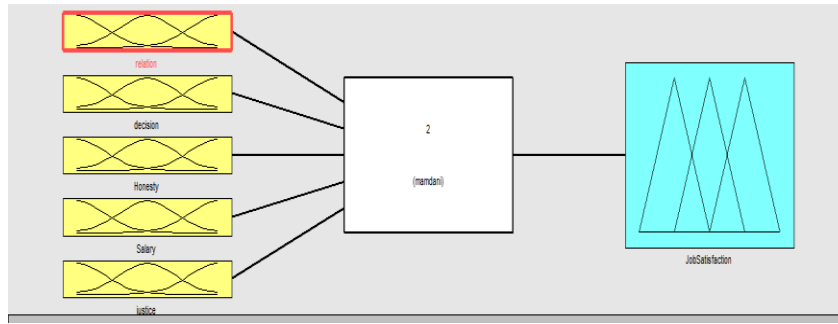

Figure (2): Specifying inputs and outputs and inference system in MATLAB

Also, in this method for applying the fuzzy method on criteria, the triangulation fuzzy function was used, which is why using that function is simple and popular. Due to the triangular fuzzy function's efficiency, it has also been used in many studies. Also, the coherence of this type of function with some study variables discussed in this research, such as leadership style and payment system, is another reason for this choice.

4. Findings
In TOPSIS, the best choice method is finding the choice in the nearest distance to the positive ideal solution and the farthest distance from the negative ideal solution. In this method, the experts first specify the relative importance of the scales and the subscales and then assess each choice's performance concerning each scale. However, human thoughts and the expression of appraisals are accompanied by uncertainty, which influences decision-making. To remove this problem, fuzzy decision-making methods are applied. In this state, the elements of the decision-making matrix or the choices' importance rates are expressed concerning the scales, and the importance rates of the scales (herein) are articulated in fuzzy forms and with fuzzy numbers.

The necessary steps for implementing the fuzzy TOPSIS method are the following: the formation of the fuzzy decision-making matrix and the matrix of the scales' relative importance according to the verbal scales, normalisation of the fuzzy decision matrix and calculation of the weighed normalised fuzzy decision matrix, determination of the fuzzy positive ideal solution $(A + FPS1)$ $\tilde{V}_j^*$ and the fuzzy negative ideal solution $(A - FNIS)/2$, calculation of the distance of each choice from

$\tilde{V}_j^*$ the amounts of the fuzzy positive/negative ideal idea and calculation of the nearness coefficients and choices' prioritisation.

By determining the nearness coefficient, the final step for rating all the choices can be started, and the decision-makers can choose the best from the various options. The nearness coefficient of each choice is computed as shown in relation (1).

$$CC_i = \frac{d_i^-}{d_i^+ + d_i^-}$$

(1)

CC_i *the* index is close to unity and showcases the amount of a choice's closeness to the positive ideal solution and the amount of its farness from the negative ideal solution. Therefore, larger CC_i Amounts are reflective of the AI option's better performance. Tables (2) to (11) display the stages of obtaining the nearness coefficient for the study scales.

Table 2: Unit Decision-Making Table for The Entire 50 Questionnaires

	Decision-making by all the 50 experts		
Scales	**Organisation's costs**	**Organisation's efficiency and effectiveness**	**Clients' satisfaction**
Payment system	1, 5.16, 9	1, 7.74, 9	1, 7.31, 9
Job type	1, 6.28, 9	1, 6.86, 9	1, 6.68, 9
Progress opportunities	1, 7.1, 9	1, 5.79, 9	1, 7.54, 9
Organisational climate	1, 5.76, 9	1, 7.83, 9	1, 8.13, 9
Leadership style	1, 7.23, 9	1, 7.56, 9	1, 7.94, 9
Physical conditions	1, 8.16, 9	1, 6.24, 9	1, 7.36, 9

Table 3: Table of Weights

Scales	**Organisational costs**	**Organisation's effectiveness and efficiency**	**Clients' satisfaction**
Weight	High	Intermediate	Very high
Weight	5, 7, 9	3, 5, 7	7, 9, 9

Table 4: Positive and Negative Ideals

Positive ideal	Organisation's effectiveness and efficiency; satisfaction of the clients
Negative ideal	Organisation's costs

Table 5: Normalisation of The Ideals

	Decision-making by all the 50 experts		
Scales	**Organisation's costs**	**Organisation's efficiency and effectiveness**	**Clients' satisfaction**
Payment system	$\frac{1}{9}, \frac{1}{5.16}, \frac{1}{1}$	$\frac{1}{9}, \frac{7.74}{9}, \frac{9}{9}$	$\frac{1}{9}, \frac{7.31}{9}, \frac{9}{9}$
Job type	$\frac{1}{9}, \frac{1}{6.28}, \frac{1}{1}$	$\frac{1}{9}, \frac{6.86}{9}, \frac{9}{9}$	$\frac{1}{9}, \frac{6.68}{9}, \frac{9}{9}$
Progress opportunities	$\frac{1}{9}, \frac{1}{7.1}, \frac{1}{1}$	$\frac{1}{9}, \frac{5.79}{9}, \frac{9}{9}$	$\frac{1}{9}, \frac{7.54}{9}, \frac{9}{9}$
Organisational climate	$\frac{1}{9}, \frac{1}{6.76}, \frac{1}{1}$	$\frac{1}{9}, \frac{7.83}{9}, \frac{9}{9}$	$\frac{1}{9}, \frac{8.13}{9}, \frac{9}{9}$
Leadership style	$\frac{1}{9}, \frac{1}{7.23}, \frac{1}{1}$	$\frac{1}{9}, \frac{1}{7.23}, \frac{1}{1}$	$\frac{1}{9}, \frac{7.94}{9}, \frac{9}{9}$
Physical conditions	$\frac{1}{9}, \frac{1}{8.16}, \frac{1}{1}$	$\frac{1}{9}, \frac{6.24}{9}, \frac{9}{9}$	$\frac{1}{9}, \frac{7.36}{9}, \frac{9}{9}$

Table 6: Ideals' Normalisation

	Decision-making by all the 50 experts		
Scales	**Organisation's costs**	**Organisation's efficiency and effectiveness**	**Clients' satisfaction**
Payment system	0.111, 0.193, 1	0.111, 0.56, 1	0.111, 0.812, 1
Job type	0.111, 0.159, 1	0.111, 0.762, 1	0.111, 0.742, 1
Progress opportunities	0.111, 0.140, 1	0.111, 0.643, 1	0.111, 0.873, 1
Organisational climate	0.111, 0.173, 1	0.111, 0.87, 1	0.111, 0.903, 1

Scales	Decision-making by all the 50 experts		
	Organisation's costs	Organisation's efficiency and effectiveness	Clients' satisfaction
Leadership style	0.111, 0.138, 1	0.111, 0.84, 1	0.111, 0.882, 1
Physical conditions	0.111, 0.122, 1	0.111, 0.693, 1	0.111, 0.817, 1

Table 7: Fuzzy Weights

Scales	Decision-making by all the 50 experts		
	Organisation's costs	Organisation's efficiency and effectiveness	Clients' satisfaction
Payment system	0.555, 1.351, 9	0.333, 4.3, 7	0.777, 7.308, 9
Job type	0.555, 1.113, 9	0.333, 3.81, 7	0.777, 6.678, 9
Progress opportunities	9,.098,0.555	7,3.215,0.333	0.777, 7.533, 9
Organisational climate	0.555, 1.211, 9	0.333, 4.32, 7	0.777, 8.127, 9
Leadership style	0.555, 0.966, 9	0.333, 4.2, 7	0.777, 7.939, 9
Physical conditions	0.555, 0.854, 9	0.333, 3.465, 7	0.777, 7.353, 9
Weight	5, 7, 9	3, 5, 7	7, 9 ,9

Table 8: Calculating the Positive and Negative Ideals

Scales	Decision-making by all the 50 experts		
	Organisation's costs	Organisation's efficiency and effectiveness	Clients' satisfaction
Payment system	0.555, 1.351, 9	0.333, 4.3, 7	0.777, 7.308, 9
Job type	0.555, 1.113, 9	0.333, 3.81, 7	0.777, 6.678, 9
Progress opportunities	0.555, 0.98, 9	0.333, 3.215, 7	0.777, 7.533, 9

Scales	Decision-making by all the 50 experts		
	Organisation's costs	**Organisation's efficiency and effectiveness**	**Clients' satisfaction**
Organisational climate	0.555, 1.211, 9	0.333, 4.32, 7	0.777, 8.127, 9
Leadership style	0.555, 0.966, 9	0.333, 4.2, 7	0.777, 7.939, 9
Physical conditions	0.555, 0.854, 9	0.333, 3.465, 7	0.777, 7.353, 9
Positive ideal	0.555, 1.351, 9	0.333, 4.32, 7	0.777, 8.127, 9
Negative ideal	0.555, 0.854, 9	0.333, 3.215,7	0.777, 6.678, 9

Table 9: Calculating the Distance from The Positive Ideals for Each of The Indicators

Scales	Decision-making by all the 50 experts			
	Organisation's costs	**Organisation's efficiency and effectiveness**	**Clients' satisfaction**	**Sum of the positive ideals**
Payment system	0	0.002828	0.115824	0.118652
Job type	0.033658	0.072125	0.20492	0.310703
Progress opportunities	0.052467	0.156271	0.084004	0.292742
Organisational climate	0.019799	0	0	0.019799
Leadership style	0.054447	0.016971	0.026587	0.098005
Physical conditions	0.070286	0.120915	0.10946	0.300661
Positive ideal	0.555,1.351,9	0.333,4.32,7	0.777,8.127,9	0

Table 10: Calculating the Distance from The Negative Ideals for Each of The Indicators

Scales	Decision-making by all the 50 experts			
	Organisation's costs	Organisation's efficiency and effectiveness	Clients' satisfaction	Sum of the negative ideals
Payment system	0.070286	0.153442	0.089095	0.312823
Job type	0.036628	0.084146	0	0.120774
Progress opportunities	0.017819	0	0.120915	0.138734
Organisational climate	0.050487	0.156271	0.20492	0.411678
Leadership style	0.015839	0.1393	0.178332	0.333471
Physical conditions	0	0.035355	0.95459	0.130814
Negative ideal	0.555, 0.854, 9	0.333, 3.215, 7	0.777, 6.678, 9	0

Table 11: Calculating the Nearness Coefficient

Scales	Sum of positive ideals	Sum of negative ideals	Rating
Payment system	0.118652	0.312823	1
Job type	0.310703	0.120774	0
Progress opportunities	0.292742	0.138734	0
Organisational climate	0.019799	0.411678	1
Leadership style	0.294581	0.136896	1
Physical conditions	0.300661	0.130814	0

The fuzzy ANP method is one of the multi-index decision-making methods about the fuzzy environment. In this method and through the super-matrix technique, the fuzzy ANP method is implemented. The weight of the scales can be obtained by methods like that invented by Chang or the improvement method. Then, using the ANP super-matrix technique, the final weight is calculated.

The difference between the fuzzy ANP method and the fuzzy AHP method is the existence of internal relationships. Due to the same reason, the first step in the fuzzy ANP method is the

determination of the interrelationships between the scales and the subscales. These relationships are achieved by techniques like fuzzy DEMATEL, asking questions from experts, or excerptions from related articles. Next, pairwise comparisons are made considering these interrelationships, and the weights are eventually attained.

Table 12: Verbal Scale for Evaluation (Sun, 2010)

Verbal variable	Triangular fuzzy number
Exactly identical	(1, 1, 1)
Equal importance or no preference	(0.5, 1, 1.5)
Relatively more important	(1, 1.5, 2)
More important	(1.5, 2, 2.5)
Much more important	(2, 2.5, 3)
Extremely more important	(2.5, 3, 3.5)

To determine the clusters' weights, ANP questionnaires were distributed to form a pairwise comparisons matrix between the primary clusters (organisational climate, leadership style, and payment system), as shown in Table (13). Based thereupon, the mean values of the experts' notions are determined, as also displayed in a table (13).

Table (13): Pairwise Comparisons Matrix for The Primary Factors

Row	Primary scale	Leadership style	Payment system	Organisational climate	$\sum_{j=1}^{m} M_{g_i}^{j}$		
					Left foot	Middle foot	Right foot
1	Leadership style	1, 1, 1	0.7, 1.3, 1.75	0.6, 0.7, 0.8	2.3	3	3.55
2	Payment system	0.75, 0.76, 1.42	1, 1, 1	1.5, 1.8, 2.1	3.25	3.56	4.52
3	Organisational climate	1.25, 1.42, 1.67	0.47, 0.55, 0.67	1, 1, 1	2.72	2.97	3.34

According to Table (13), it can be concluded that:

$S(1) = (2.3,3,3.55) * (0.09,0.1,0.12) * (0.20,0.31,0.43)$

$S(1) = (3.25,3.56,4.52) * (0.09,0.1,0.12) * (0.28,0.37,0.55)$

$$S(1) = (2.72,2.97,3.34) * (0.09,0.1,0.12) * (0.24,0.31,0.40)$$

In this step, after obtaining the S_i , compare them with each other and get the initial weights from the following equation:

$$V(1 > 2) = 0.71 \qquad\qquad V(1 > 3) = 1$$
$$V(2 > 1) = 1 \qquad\qquad V(2 > 3) = 1$$
$$V(3 > 1) = 1 \qquad\qquad V(3 > 2) = 0.66$$

Considering the minimum preference, the non-normalised weight is determined for each of the clusters, and, using the linear normalisation relation, the final weight of the factors is determined as depicted in Table (14).

Table 14: The Weights of The Primary Factors

Scale	Non-normalised weight	Normalised weight
Leadership style	0.71	0.30
Payment system	1	0.43
Organisational climate	0.66	0.27

To determine the weights of the scales, ANP questionnaires were distributed to form the pairwise comparisons matrix between the scales of each cluster; then, using the weight determination method through Chang's development method, the weight of each of the scales was determined. The results are in Tables (15) to (19).

Table 15: Pairwise Comparisons' Matrix for The Leadership Style's Scales

Scales	B1	B2
B1	1, 1, 1	0.85, 1.1, 1.3
B2	0.76, 0.9, 1.17	1, 1, 1

Table 16: Weights of The Leadership Style's Scales

Scale	Non-normalised weight	Normalised weight
B1	1	0.556180967
B2	0.797975947	0.443819033

Table 17: Pairwise Comparisons' Matrix for The Scales of Payment System

Scales	C1	C2
C1	1, 1, 1	0.7, 0.9, 1.15
C2	0.87, 1.11, 1.42	1, 1, 1

Table 18: Weight of The Payment System's Scales

Scale	Non-normalised weight	Normalised weight
C1	1	0.556180967
C2	1.205248525	0.670336289

In the end, by multiplying the primary scales' weights by the subscales' weights, the weights of the primary scales are determined, as shown in Table (19).

Table 19: The Scales' Weights Determined Using AHP

Scale	Weight
B1	0.16685429
B2	0.13314571
C1	0.194989361
C2	0.235010639
Organisational climate	0.27

To determine the weights of the scales using ANP, efforts were made to determine the subscales' interrelationships with each of the scales, and the investigations indicated the following:

- Organisational climate influences the leadership style and payment system
- Leadership style influences the payment system

Table 20: Weights of The Scales in Evaluations by Each Scale

		Organisational climate	Leadership style		Payment system	
		A1	B1	B2	C1	C2
Organisational climate	A1	1	0	0	0	0
Leadership style	B1	0.756332592	1	1	0	0
	B2	0.243667408	1	1	0	0
Payment system	C1	0.604734408	0.443819033	0.5	1	1
	C2	0.395265592	0.556180967	0.5	1	1

In the end, through matrix-multiplication of the two above tables, the weight of each scale is determined using ANP, as visible in Table (21).

Table 21: Scales' Weights Determined Using ANP Method

Scale	Non-normalised weight	Normalised weight
A1	0.235010639	0.091688365
B1	0.505881277	0.19736735
B2	0.385399504	0.150361918
C1	0.732086154	0.285620186
C2	0.704768136	0.274962181

4.1 Fuzzy Criterion Results

<u>**Criterion 1:**</u> Formal or intimate relationship according to language variables

• Formal or intimate relationship, low (50,0,0).

• Formal or intimate relationship, medium (100,50,0).

• Formal or intimate relationship, high (100,100,50).
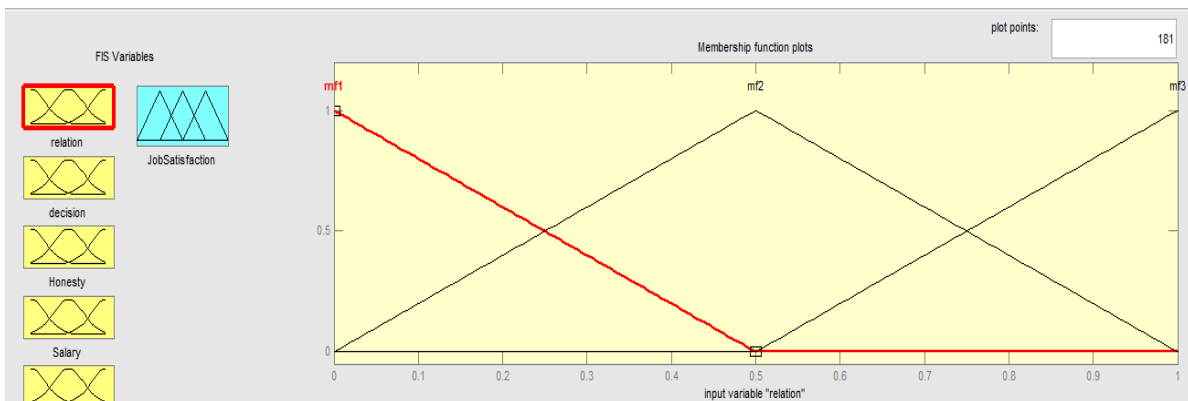
Figure (3): Fuzzy operations of the first criterion

<u>**Criterion 2:**</u> Participation in decision-making

• Participation in decision-making is low (50,0,0).

• Participation in decision-making, medium (100,50,0).

• Participation in decision-making, high (100,100,50).

<u>**Criterion 3:**</u> Honesty between colleagues

• Honesty between colleagues, low (50,0,0).

• Honesty among colleagues, average (100,50,0).

• Honesty among colleagues, high (100,100,50).

<u>**Criterion 4:**</u> Salary and benefits

• Salary and benefits, low (50,0,0).

• Salary and benefits, average (100,50,0).

• Salary and benefits, high (100,100,50).

Criterion 5: Justice in payment

• Justice in payment, low (50,0,0).

• Justice in payment, average (100,50,0).

• Justice in payment, high (100,100,50).

The output of the system is the level of job satisfaction that we have fuzzy according to the following language variables:

• Level of job satisfaction, low (50,0,0).

• Level of job satisfaction, average (100,50,0).
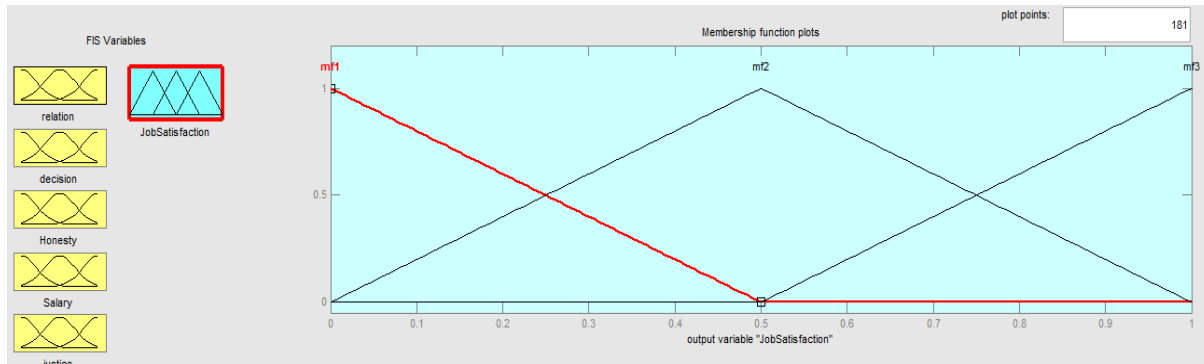
• Level of job satisfaction, high (100,100,50).

Figure (4): The fuzzy system output

4.2 Fuzzy inference (if-then rules)

In general, Mamdani or Larsen inference is used based on MIN or multiplication operators, respectively, which, in the present study, also uses Mamdani inference. If-then, the rules that are presented in the model and our knowledge base have been designed according to the opinions of experts and experts on organisational behaviour. Given the existence of five factors and several linguistic variables for each, here, $3 * 3 * 3 * 3 * 3 = 243$ will be the rule.

For example, we can give some examples of them:

Table 22: Some examples of if-then rules

15. **If** (relation is mf1) and (decision is mf1) and (Honesty is mf2) and (Salary is mf2) and (justice is mf2) **then** (Job Satisfaction is mf2) (0.2)

36. **If** (relation is mf2) and (the decision is mf2) and (Honesty is mf2) and (Salary is mf2) and (justice is mf1), **then** (Job Satisfaction is mf3) (0.2)

58. **If** (relation is mf3) and (the decision is mf3) and (Salary is mf2) and (justice is mf2), **then** (Job Satisfaction is mf2) (0.2)

64. **If** (relation is mf2) and (decision is mf2) and (Honesty is mf2), **then** (Job Satisfaction is mf3) (0.2)

5. Discussion and Conclusion

As for the classification of the factors influencing job satisfaction in Tehran Province's general Technical and Vocational Training Organization based on Minnesota Questionnaire and the use of fuzzy ANP and fuzzy TOPSIS techniques as well as the creation of a fuzzy expert system for the investigation of the staff's job satisfaction, the results obtained from this project signified that the adoption of the programs required for the preservation of the job satisfaction and identification and correction of the problems existing in the organisation feature primary significance for the study sample volume meaning that they have the highest effect in regard of this matter. This set of needs is related to the organisation's payment system, and if left unsatisfied, the staff members will become very dissatisfied. On the other hand, meeting these needs would enhance their satisfaction if they are inconsistent with the staff's wants.

Based on the investigations, participation in the decision-making and establishment of formal or cordial relationships, as two of the subscales of leadership style, feature adequate effectiveness for keeping the staff satisfied; furthermore, honesty between the coworkers, as a subscale of organisational climate, as well, is considered amongst the performance properties. Put differently, the highest frequency of the study sample volume's responses regarding these properties prioritises job satisfaction in the organisation above. Leadership style is a term referring to the set of needs of the meeting, which to any level would be followed by the staff's satisfaction at the same level, meaning that, considering the participation in decision-making and also the formal or sincere relationships, the meeting of these needs can be helpful seriously in regard of the process of keeping the staff members satisfied in the organisations; this can end with a large deal of effect on the employees' satisfaction and the more these needs are met, then, the more the employees' satisfaction would be heightened and vice versa. This set of scales results in the organisation's

persistence, the creation of job stability for the individuals, and the enhancement of the work performed.

The payment system is among the other primary scales of the Minnesota questionnaire selected in the TOPSIS ranking amongst the primary priorities. Its subscales were examined, and the need for its investigation in the ANP technique was felt. This scale is primary because it has a large deal of effect on the staff's job satisfaction and can enhance it surprisingly. The employees would never explicitly expect or express the payment system scale. The perfect meeting of this scale would improve the staff's satisfaction. Suppose the employees find themselves having an unfair payment system. In that case, they may feel dissatisfaction but may not be willing to express it because this may jeopardise their occupational margin. However, the observance of this set of scales changes the organisation into a safe work environment; from the perspective of the study sample volume, salary scales, benefits, and payment fairness are amongst the sub-branches in this set.

It can be concluded based on the study findings that the adoption of the programs needed for the preservation of the employees' satisfaction and identification and correction of the problems existing in various organisational units are minor things every organisation is obliged to perform for job satisfaction of its employees and, in case of falling short of dealing with these cases, the employees' job satisfaction would be lost whereas, in case of the better offering of this scale, it is expected that the employees' job satisfaction to be achieved in a high degree which will be accompanied by better efficiency and performance in the workplace; however, regarding the properties of the job, the job's type, progress opportunities and physical conditions, the issue is not like this, and they were found not having much of an effect on the job satisfaction of the employees in the organisation. Put another way, the more an organisation can improve such primary scales as a payment system, leadership style, and organisational climate, then the more it can achieve the highest performance for keeping the employees and the staff satisfied in case of being unable to do so, it may face dissatisfied staff who may leave the organisation in case of which the organisation's persistence would be put at risk. So, organisations should make efforts to improve these scales to the maximum possible extent, for the levels of meeting them are directly associated with the satisfaction levels of the employees in the organization [23-27].

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