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Survey of Effectiveness Factors on Staff Satisfaction with FQFD and FAHP in Shazand Imam Khomeini Refinery

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ABSTRACT

This paper proposes an approach for staff wants development based on quality function deployment (QFD). This method considers quality by customer-oriented view and internalizes it in different stages of product/service, and finally concludes to recognition and preparation of priorities of system improvement and customer satisfaction. In this research, fuzzy QFD is used for staff of Imam Khomeiny Refinery as customers, services and rewards as technical specifications, and staff expectations as customers' wants. The staff was divided into four groups and relative weightings of each group were determined by the fuzzy analytic hierarchy process (FAHP) technique. A case in Shazand Imam Khomeini Refinery is given to illustrate the utilization of the proposed approach at this paper.
***KEYWORDS*:** Satisfaction, Staff wants, QFD, FAHP.

1. INTRODUCTION

Quality function deployment (QFD) has been widely used as a multi-functional design tool to translate customer requirements to a product's technical attributes. QFD originated in the late 1960s and early 1970s in Japan from the work of Akao (1990). At the beginning of QFD development, the primary functions of QFD are product development, quality management, and customer needs analysis. Thus, QFD is used to help design teams to develop products with higher quality to meet or surpass customer requirements. With the development and widespread use of QFD, its application areas expanded to much wider fields including design, planning, decision-making, engineering, management, teamwork, timing, costing and so on (Chan and Wu, 2002).

Job satisfaction is a general phenomenon with psychic, social, economic, and corporal dimensions. This affects efficiency and performance of staff and affects delay, resignation, and service break rates. Job satisfaction increases motive and motivation of staff and this can increase suitable performance, want, and innovation.

Previous researches about job satisfaction were often done by statistical methods. This removes a significant part of information and data are analyzed under effect of parametric function.

One of the basic problems in organizations is low level of job satisfaction and then service break especially expert staff. Managers and researchers say service break has high costs, problems, and worried outcomes for efficiency of organization. So, job satisfaction has attracted notice of many researchers and managers. Lack of job satisfaction incurs costs for supply, training, social investments, and indirect costs. Thus, if organizations can identify effective factors on job satisfaction, they can effectively manage by recognition of effective management methods to preserve their human resource.
The goal of this research is:

1) Identify staff's wants to increases their satisfaction
2) Identify technical and engineering requirements to staff's wants
3) Ranking staff's wants and technical and engineering requirements

In section 3 we proceed to methodology of research. In this section we execute steps of this methodology and document the discoveries.

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2. LITERATURE REVIEW

The literature on this research can be grouped in to three sections: QFD method, Fuzzy method and AHP method.

1.2 QFD METHOD

QFD belongs to the sphere of quality management methods, offering us a linear and structured guideline for converting the customer's needs into specifications for, and characteristics of new products and services. The method involves developing four matrixes, or 'houses', that we enter by degrees as a project for a given product or production process is developed on increasingly specific levels (Akao, 1990). In the present article, our attention focuses on the Planning Matrix, or (HOQ) (Hauser and Clausing, 1988) (Fig. 1).

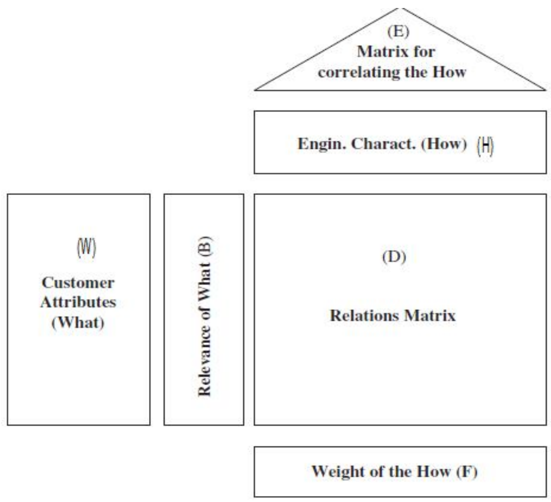


Fig. 1. House of quality.

The HOQ provides the specifications for product design (or engineering characteristics) in terms of their relative importance and of target values that have to be reached in design and production. In a sense, the HOQ is the hub of the whole QFD method: its construction enables us to proceed from the customer's requirements to the design specifications (Schmidt, 1997; Fariborz and Rafael, 2002).

This paper describes the HOQ and its process following the approaches suggested by section 3.

QFD is an important tool for quality management planning, so that customers' wants are identified and analyzed, then the same wants are produced as products.

In QFD, a set of graphs and two-dimensional matrices are used, in which customers' wants are in the vertical columns and qualitative specifications are in the horizontal rows. These matrices are used as a base for effective planning in each stage of product progress cycle.

2.2 FUZZY LOGIC

In dealing with a decision process, the decision-maker is often faced with doubts, problems and uncertainties. To cope with and ''handle'' such uncertainties and in accuracies,he generally relies on tools provided by probability theory, accepting the principle that an inaccuracy, whatever its nature, is governed by random law. In a real decision-making process, however, we have to deal with different types of uncertainty and inaccuracy, each of which needs to be treated with the aid of a specific tool. Probability theory is fine for representing the stochastic nature of decisional analysis, but is unable to measure the inaccuracies or uncertainty that stem from human behavior, which is neither stochastic nor random. The fundamental role of the decision-maker or other parties involved in the decisional process poses a number of problems that cannot be handled appropriately by probability theory. Referring specifically to a multi-criterion analysis, this means that the values of a certain alternative concerning a given attribute often cannot be precisely defined, the decision-maker is unable (or unwilling) to express his preferences precisely, the evaluations or opinions are expressed in linguistic terms, and so on. To deal with this type of uncertainty correctly we can resort to fuzzy logic (Zadeh, 1965). The logical tools that people can rely on are generally considered the outcome of a bivalent logic (yes/no, rue/false), but the problems posed by real-life situations and human thought processes and approaches to problem-solving are by no means bivalent (Tong and Bonissone, 1980). Just as conventional, bivalent logic is based on classic sets, fuzzy logic is based on fuzzy sets. A fuzzy set is a set of objects in which there is no clear-cut or predefined boundary between the objects that are or are not members of the set. The key concept behind this definition is that of ‘‘membership’’: each element in a set is associated with a value indicating to what degree the element is a member of the set. This value comes within the range [0,1], where 0 and 1, respectively, indicate the minimum and maximum degree of membership, while all the intermediate values indicate degrees of ‘‘partial’’membership.

There are various types of fuzzy number, each of which may be more suitable than others for analyzing a given ambiguous structure; the present analysis uses triangular fuzzy numbers. Triangular fuzzy numbers are often used to quantify linguistic data. The use of triangular fitness functions is fairly common in the literature (Karsak, 2004; Chan and Wu, 2005), because triangular fuzzy numbers are among the few fuzzy number forms that are easy to manage from the computational point of view. (Zahedi, Yousefi and Cheshmberah, 2011)
For instance, let U = {VL; L;M;H;VH} be a linguistic set used to express opinions on a group of attributes (VL = very low :(0, 1, 2), L = low :(2, 3, 4), M = medium :(4, 5, 6) , H = high :(6, 7,8), VH = very high :(8, 9, 10)). The linguistic variables of U can be quantified using triangular fuzzy numbers as follows:

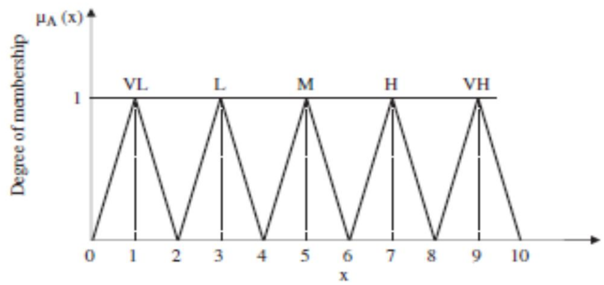


Fig. 2. Linguistic scale for relative importance.

Consider two triangular numbers $M_1 = (l_1, m_1, u_1)$ and $M_2 = (l_2, m_2, u_2)$, which are drawn in fig.3. there are various Concepts and definitions of triangular fuzzy numbers as follows:

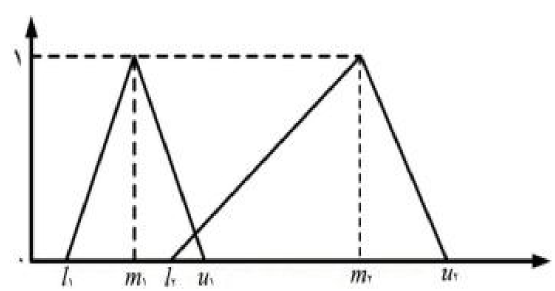


FIG.3. Triangular Numbers M1 and M2

Their mathematical operators are:

$$M_1 + M_2 = (l_1 + l_2, m_1 + m_2, u_1 + u_2) \quad (1)$$

$$M_1 * M_2 = (l_1 * l_2, m_1 * m_2, u_1 * u_2) \quad (2)$$

$$M_1 - M_2 = (l_1 - u_2, m_1 - m_2, u_1 - l_2)$$

$$M_1^{-1} = \left(\frac{1}{u_1}, \frac{1}{m_1}, \frac{1}{l_1}\right), \qquad M_2^{-1} = \left(\frac{1}{u_2}, \frac{1}{m_2}, \frac{1}{l_2}\right) \quad (3)$$

(4)

Finally, If $M_1 = (l_1, m_1, u_1)$ is a fuzzy number, then its CRISP value is:

$$\frac{L_1 + 2m_1 + u_1}{4} \quad (5)$$

3.2 FUZZY ANALYSIS HIERARCHICAL PROCESS (FAHP)

The analytic hierarchy process (AHP) method introduced by Saaty (1980) shows the process of determining the priority of a set of alternatives and the relative importance of attributes in a multi-criteria decision-making (MCDM) problem (Saaty, 1980;Wei, Chien, & Wang, 2005). The primary advantage of the AHP approach is the relative ease with which it handles multiple criteria and performs qualitative and quantitative data (Kahraman, Cebeci,& Ruan, 2004; Meade & Sarkis, 1998). However, AHP is frequently criticized for its inability to adequately accommodate the inherent uncertainty and imprecision associated with mapping decisionmaker perceptions to extract number (Kwong & Bai, 2003; Chan & Kumar, 2007; Lee, Chen, & Chang, 2008). It is difficult to respond to the preference of decision-makers by assigning precise numerical values. To improve the AHP method and to determine the relative weight of criteria for risk assessment, this study applies the fuzzy analytic hierarchy process (FAHP) and uses triangular fuzzy numbers to express the comparative judgments of decision-makers. Some calculation steps are essential and explained as follows:

Step 1. Establishing the hierarchical structure: Construct the hierarchical structure with decision elements, decision-makers are requested to make pair-wise comparisons between decision alternatives and criteria using a ninepoint scale. All matrices are developed, and all pair-wises comparisons are obtained from each n decision-maker.

Step 2. Calculating the consistency: To ensure that the priority of elements is consistent, the maximum eigenvector or relative weights and kmax are calculated. Then the consistency index (CI) for each matrix order n using Eq. (1) is computed. Based on CI and random index (RI), the consistency ratio (CR) is calculated using Eq. (2). The CI and CR are defined as follows (Saaty,1980):

$$\mathrm{CI} = \frac{\lambda_{\max} - n}{n-1}, \quad (6)$$

$$\mathrm{CR} = \frac{CI}{RI}, \quad (7)$$

where n is the number of items being compared in the matrix $\lambda_{\max}$ is the largest eigenvalue, and RI is a random consistency index obtained from a large number of simulation runs, and it varies upon the order of the matrix (see Table 1).

Table 1
Random index (RI) (Saaty, 1980)

N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48	1.56	1.57	1.58

Step 3. Construct a fuzzy positive matrix: A decision-maker transforms the score of pair-wise comparison into linguistic variables via the positive triangular fuzzy number (PTFN) listed in Table 2. The fuzzy positive reciprocal matrix can be defined as (Buckley, 1985)

$$\widetilde{A}^k = \left[\widetilde{A}^k_{ij}\right], \quad (8)$$

where $\widetilde{A}^k$ is a fuzzy position reciprocal matrix of decisionmaker k $\widetilde{A}^k_{ij}$ is the relative importance between i and j of decision elements

$$\widetilde{A}^k_{ij} = 1 \;\; \forall i = j, \quad \widetilde{A}^k_{ij} = 1/A^k_{ij} \;\; \forall i,j = 1,2,\ldots,n. \quad (9)$$

Step 4. Calculate fuzzy weights value: According to the Lambda Max method proposed by Csutora and Buckley (2001),the fuzzy weights of the hierarchy can be calculated. This process is described as follows:

Let α = 1 to obtain the positive matrix of the decision maker $\widetilde{A}^k_m = [a_{ijm}]_{n\times n}$. Then AHP is applied to calculate the weight matrix W^k_m.

$$W^k_m = [w^k_{im}], \quad i = 1,2,\ldots,n. \quad (10)$$

Let α = 0 to obtain the lower bound and upper bound of the positive matrix of the decision-maker, $\widetilde{A}^k_l = [a_{ijl}]_{n\times n}$ and $\widetilde{A}^k_u = [a_{iju}]_{n\times n}$. Then AHP is applied to calculate the weight matrix, W^k_l and W^k_u.

$$W_l^k = [w_{il}^k], \quad i = 1, 2, \ldots, n, \tag{11}$$
$$W_u^k = [w_{iu}^k], \quad i = 1, 2, \ldots, n. \tag{12}$$

To ensure the fuzziness of weight, two constants, S^k_l and S^k_u, are calculated as follows:

$$S_l^k = \min\left\{\frac{w_{im}^k}{w_{il}^k} | 1 \leqslant i \leqslant n\right\}, \tag{13}$$

$$S_u^k = \min\left\{\frac{w_{im}^k}{w_{iu}^k} | 1 \leqslant i \leqslant n\right\}. \tag{14}$$

The lower bound $(W_l^{k^*})$ and upper bound $(W_u^{k^*})$ of the weight matrix are defined as:

$$W_l^{k^*} = [w_{il}^{k^*}], \quad w_{il}^{k^*} = S_l^k w_{il}^k, \quad i = 1, 2, \ldots, n, \tag{15}$$
$$W_u^{k^*} = [w_{iu}^{k^*}], \quad w_{iu}^{k^*} = S_u^k w_{iu}^k, \quad i = 1, 2, \ldots, n. \tag{16}$$

Aggregating $W_l^{k^*}$, $W_m^{k^*}$ and $W_u^{k^*}$ the fuzzy weight for decision-maker k can be acquired as follows:

$$\widetilde{W}_i^k = (w_{il}^{k^*}, w_{im}^{k^*}, w_{iu}^{k^*}), \quad i = 1, 2, \ldots, n. \tag{17}$$

Applying the geometric average to incorporate the opinions of decision-makers is defined as follows:

$$\tilde{\widetilde{W}}_i = 1/k(\widetilde{W}_i^1 \otimes \widetilde{W}_i^2 \otimes \cdots \otimes \widetilde{W}_i^n), \tag{18}$$

where $\tilde{\widetilde{W}}_i$ is the fuzzy weight of decision-makers i is incorporated with K decision-makers; $\widetilde{W}_i^k$ is the fuzzy weight of decision element i of k decision-maker; K:number of decision-kers.

3. THE PROPOSED METHODOLOGY

Data analysis method in this research is according to the model shown in fig.4. In this research, staff of refinery are considered as customers, services and rewards as technical specifications, and expectations of staff as customers' wants.

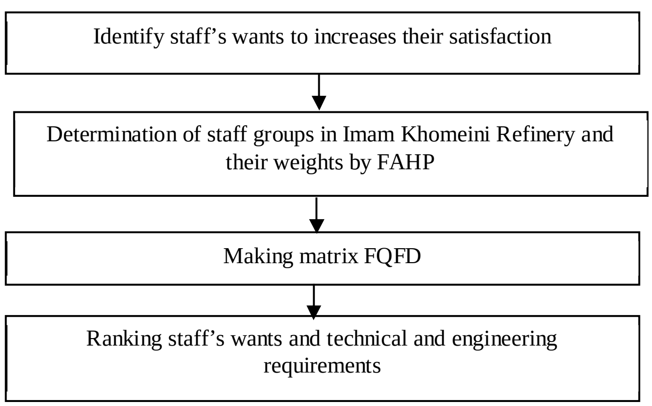


FIG. 4: Executive Model Of Research

1.3 Forming expert team

Expert team to evaluate job satisfaction was comprised of 4 managers of Imam Khomeini Refinery and the researcher. Each expert was selected from one of the groups of technical employee, administrative employee, technical manager, and administrative manager. They were supposed to be familiar with staff's wants and evaluation of their satisfactions.

2.3 Weight of each staff group

The FAHP was utilized to determine the weights of four staff groups by four managers who are responsible in the illustrated case company. The fuzzy comparison judgments of the four main staff groups with respect to the overall goal are shown in Table 2.

TABLE 2: PAIR COMPARISON MATRIX FOR WEIGHTS OF INDICES

	Technical manager	Administrative employee	Administrative manager	Technical employee
Technical manager	(1, 1, 1)	(0.13, 0.14, 0.17)	(4 ،5 ،6)	(6 ،7 ،8)
Administrative employee	(6,7,8)	(1, 1, 1)	(0.25, 0.33, 0.5)	(0.25, 0.33, 0.5)
Administrative manager	(0.17, 0.2, 0.25)	(2,3,4)	(1, 1, 1)	(2,3,4)
Technical employee	(0.13, 0.14, 0.17)	(2,3,4)	(0.25 ،0.33 ،0.5)	(1, 1, 1)

λ_{max}= 4.24 , CI= 0.08, CR= 0.089

Since CR<0.1, the pair comparison matrix is compatible.

Finally, Weights of indices are shown in table 3 after calculation and fuzzy-removing. The Technical manager (0.38) is regarded as the most important criterion, followed by the Administrative employee (0.22), the Administrative manager (0.22), and the Technical employee (0.15) as shown in Table 3.

TABLE 3: WEIGHTS OF EMPLOYEE GROUPS

Employee group	Weight
Technical manager (EM)	0.38
Administrative employee (AE)	0.27
Administrative manager (AM)	0.22
Technical employee (TE)	0.15

3.3 Execution of 7 steps of QFD

To test the efficacy of the proposed method, it was applied in the illustrated case company, so Execution of FQFD is containing 7 step follow as:

Step 1: Identifying the ''WHATs'': Wants and qualitative requirements of staff in Imam Khomeini Refinery

Our customers in this research are staff of Imam Khomeini Refinery. Table 4 was formed during different sessions.

TABLE 4: QUALITATIVE WANTS AND REQUIREMENTS OF STAFF

Qualitative requirements (What's)
Payment system proportional to agents dispatched to the refinery to initiate new phases (W1)
Options proportional to duties of staff (W2)
Equity in ranking and elections (W3)
Distinct reward payment criteria (W4)
Awareness of directors from duties of employees(W5)
Easy access to internet (W6)
Modification of evaluation system (W7)
Correspondence of duties and educations (W8)
Distinct job progress path (W9)
Friendly relationship with colleagues (W10)
Distinct welfare assignment criteria (W11)
Participation of employees in decision-making (W12)
Notice to job and family problems (W13)
Regarding experiments of old employees (W14)
Increment of welfare facilities and journeys (W15)

By study of customer sound table (wants of staff in Imam Khomeini Refinery), staff's wants were classified in three groups according to Cano model and customers' qualitative needs. These groups are basic needs, performance needs, and motivation needs. So, each need can be classified in a basic, performance, or motivation class.

a) Basic class

1. Identifying job progress path
2. Options proportional to duties of staff
3. Awareness of directors from duties of employees

4. Correspondence of duties and educations

b) Performance class

5. Payment system proportional to agents dispatched to the refinery to initiate new phases
6. Equity in ranking and elections
7. Regarding experiments of old employees
8. Modification of evaluation system
9. Participation of employees in decision-making
10. Distinct welfare assignment criteria
11. Distinct reward payment criteria

c) Motivation class

12. Increment of welfare facilities and journeys
13. Easy access to internet
14. Friendly relationship with colleagues
15. Notice to job and family problems

Step 2: Identifying the Technical and engineering requirements in Imam Khomeini Refinery(''HOWs'')

After classification of customers' expectations in form of their needs, necessary definitions are identified by QFD team as table 5.

TABLE 5: TECHNICAL AND ENGINEERING REQUIREMENTS OF STAFF

Technical and engineering requirements (How's)
Effort to change staff evaluation system and modification of limiting percentages for talents A and B (H1)
Holding sessions to correct payment system (H20
Holding periodical Q & A sessions (H3)
Preparing suitable criteria for employees to understand welfare facilities (H4)
Contract with hotels in tourism cities (H5)
Preparing distinct rewarding and election criteria (H6)
Installing coffee-nets in company (H7)

Step 3: Determining the ''HOW''–''WHAT'' correlation scores

Finding relationship between customers' needs and technical definitions is very complicated, because each technical definition may affect many customers' needs, and vice versa. Quality cell of each employee group is used to determine communication matrix. This is identified after brain-storming session and is registered in table 6.

After determinatin of views of employees, average of views is registered in the quality cell (table.6).

Rating = { r_{ij} , where i= 1,2,…,K and j= 1,2,…,n}

$r_{ij} = 1/n \otimes (r_{ij} \otimes w_j \oplus \ldots \oplus r_{in} \otimes w_n)$

Where k is the number of ''WHATs'' and n the number of decision-makers (k = 15 and n = 4 in our case).

TABLE 6: RELATIONSHIPS BETWEEN CUSTOMERS' NEEDS AND TECHNICAL DEFINITIONS

HOWS / WHATS	H_1				H_2				H_3				H_4				H_5				H_6				H_7			
	DM_1	DM_2	DM_3	DM_4	DM_1	DM_2	DM_3	DM_4	DM_1	DM_2	DM_3	DM_4	DM_1	DM_2	DM_3	DM_4	DM_1	DM_2	DM_3	DM_4	DM_1	DM_2	DM_3	DM_4	DM_1	DM_2	DM_3	DM_4
W_1	VH	H	H	VH	VH	VH	VH	H	L	VL	VL	L	M	L	L	L	L	VL	VL	L	H	H	H	H	L	L	L	L
W_2	M	M	L	M	H	H	M	M	VH	VH	VH	H	L	L	L	L	M	M	M	M	L	L	VL	L	M	M	H	M
W_3	H	M	H	M	M	M	M	M	L	L	L	L	H	VH	VH	H	L	L	L	L	VH	VH	VH	H	H	H	H	H
W_4	H	H	VH	H	VH	VH	VH	H	M	L	L	M	H	VH	VH	VH	L	L	L	L	M	VL	H	H	L	VL	VL	L
W_5	H	H	H	H	H	H	M	H	L	L	L	M	M	M	M	M	L	L	VL	L	H	H	H	H	VL	VL	VL	L
W_6	H	M	H	M	VH	VH	H	H	VL	L	L	M	H	VH	VH	VH	M	M	M	M	H	H	VH	H	H	H	VH	H
W_7	VH	H	H	VH	M	M	M	M	VH	VH	VH	H	M	L	L	L	M	M	M	M	VH	VH	VH	H	L	VL	VL	L
W_8	M	M	L	M	VH	VH	VH	H	L	L	L	L	L	L	L	L	L	VL	VL	L	M	VL	H	H	L	L	L	L
W_9	H	H	VH	H	M	M	M	M	M	L	L	M	M	L	L	L	M	M	M	M	L	L	VL	L	M	M	H	M
W_{10}	H	H	H	H	VH	VH	VH	VH	L	L	L	M	L	L	L	L	L	L	L	L	VH	VH	VH	H	H	H	H	H
W_{11}	H	M	H	M	H	H	M	H	M	L	L	M	H	VH	VH	VH	L	L	L	L	M	VL	H	H	L	VL	VL	L
W_{12}	M	M	L	M	VH	VH	H	H	L	L	L	M	M	M	M	M	L	L	VL	L	H	H	H	H	M	M	H	M
W_{13}	H	M	H	M	H	H	M	H	M	L	L	M	H	VH	VH	VH	M	M	M	M	H	H	VH	H	L	L	L	L
W_{14}	H	H	VH	H	VH	VH	VH	VH	L	L	L	M	M	M	M	M	L	L	VL	L	VH	VH	VH	H	M	M	H	M
W_{15}	H	H	H	H	H	H	M	H	VL	L	L	M	H	VH	VH	VH	M	L	M	M	M	VL	H	H	H	H	H	H

The fuzzy values for the ''HOW''–''WHAT'' correlation scores are shown in the Fig. 5.

Step 4: Priority of wants and qualitative requirements of staff

Importance level of each want, including products or services features, must be determined.

After determination of view of each employee group, the average is registered in the quality cell by the following relation (Table.7):

Importance $_{what}$ = { r_{ij} , where i= 1,2,…,K and j= 1,2,…,n}

$W_i = 1/n \otimes (r_{ij} \otimes w_j \oplus \ldots \oplus r_{in} \otimes w_n)$

Where k is the number of ‘‘WHATs’’ and n the number of decision-makers (k = 15 and n = 4 in our case).

TABLE 7: IMPORTANCE LEVELS OF WANTS OF EMPLOYEE GROUPS

WHATS	DM_1	DM_2	DM_3	DM_4
W_1	VH	VH	H	H
W_2	M	L	M	L
W_3	H	M	M	M
W_4	M	M	L	M
W_5	L	VL	L	L
W_6	M	L	L	L
W_7	VH	VH	H	H
W_8	M	L	M	L
W_9	H	M	M	M
W_{10}	M	M	L	M
W_{11}	L	VL	L	L
W_{12}	M	L	L	L
W_{13}	L	VL	L	L
W_{14}	M	L	L	L
W_{15}	VH	VH	H	H

The fuzzy values for the weights of the ‘WHATs’’ are shown in the Fig. 5.also the final ratio weight of each WHATs is shown in Table 8.

Step 5: Development of prioritized needs (improvement of wants and qualitative requirements of staff)

Prioritized needs include many columns. These columns are located in the right of importance level in the quality cell and are: improvement ratio, correction factor, absolute weight, and relative weight. After determination of improvement level for each qualitative want (What’s), relative importance level of each qualitative requirement is calculated for more analysis in the next steps of QFD. Thus, regarding to improvement ratio and importance level of each qualitative want, absolute weight of each product/service specification is: D= Importance× B× C

The fuzzy values for the absolute weight of each product/service specification are shown in the Table. 8.

TABLE.8. DEVELOPMENT OF PRIORITIZED NEEDS (WHATS)

Survay of organization				plan of organization				Importance ratio			sail point	Absolute Weight			Ratio Weight			Crisp weight
L	2.00	3.00	4.00	H	6.00	7.00	8.00	0.25	0.43	0.67	1.50	0.70	1.36	2.37	0.08	0.09	0.09	0.09
H	6.00	7.00	8.00	H	6.00	7.00	8.00	0.75	1.00	1.33	1.50	0.91	1.60	2.64	0.11	0.10	0.10	0.10
L	2.00	3.00	4.00	M	4.00	5.00	6.00	0.33	0.60	1.00	1.50	0.61	1.32	2.58	0.07	0.09	0.10	0.09
L	2.00	3.00	4.00	M	4.00	5.00	6.00	0.33	0.60	1.00	1.20	0.36	0.84	1.70	0.04	0.05	0.06	0.05
H	6.00	7.00	8.00	H	6.00	7.00	8.00	0.75	1.00	1.33	1.00	0.28	0.63	1.18	0.03	0.04	0.04	0.04
L	2.00	3.00	4.00	M	4.00	5.00	6.00	0.33	0.60	1.00	1.00	0.23	0.57	1.21	0.03	0.04	0.05	0.04
H	6.00	7.00	8.00	VH	8.00	9.00	10.00	0.60	0.78	1.00	1.50	1.67	2.46	3.55	0.20	0.16	0.13	0.16
H	6.00	7.00	8.00	VH	8.00	9.00	10.00	0.60	0.78	1.00	1.00	0.49	0.83	1.32	0.06	0.05	0.05	0.05
M	4.00	5.00	6.00	H	6.00	7.00	8.00	0.50	0.71	1.00	1.20	0.73	1.26	2.06	0.09	0.08	0.08	0.08
L	2.00	3.00	4.00	H	6.00	7.00	8.00	0.25	0.43	0.67	1.00	0.23	0.50	0.95	0.03	0.03	0.04	0.03
L	2.00	3.00	4.00	H	6.00	7.00	8.00	0.25	0.43	0.67	1.00	0.09	0.27	0.59	0.01	0.02	0.02	0.02
L	2.00	3.00	4.00	H	6.00	7.00	8.00	0.25	0.43	0.67	1.00	0.18	0.41	0.81	0.02	0.03	0.03	0.03
VL	0.00	1.00	2.00	M	4.00	5.00	6.00	0.00	0.20	0.50	1.00	0.00	0.13	0.44	0.00	0.01	0.02	0.01
L	2.00	3.00	4.00	M	4.00	5.00	6.00	0.33	0.60	1.00	1.20	0.28	0.69	1.45	0.03	0.04	0.06	0.04
H	6.00	7.00	8.00	VH	8.00	9.00	10.00	0.60	0.78	1.00	1.50	1.67	2.46	3.55	0.20	0.16	0.13	0.16
												8.42	15.31	26.40				1.00

Step 6: Development of prioritized technical and engineering requirements

As shown in fig. 4, prioritized technical requirements include many rows. QFD team identifies technical definitions with the highest importance to fulfill customers’ needs.

Prioritizing technical and engineering specifications of product Absolute and relative rates show the cases which should be notice more. Absolute and relative weights are obtained by:

$$WEIGHT_{SHOW} = \{W_j, \text{where } j = 1, \ldots, m\},$$

$$W_j = \frac{1}{k} \otimes \left[(r_{j1} \otimes w_1) \oplus \cdots \oplus (r_{jk} \otimes w_k)\right]$$

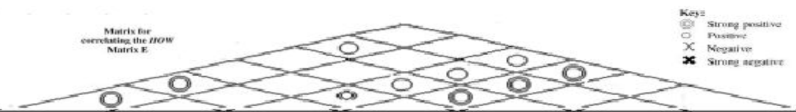
Where the usual conventions are assumed for k and m. Each Wj on the WEIGHTS HOW vector represents the eight of each technical requirements. The Wj are, once again, triangular fuzzy numbers defined by means of the triplets Wj =(̃Wi;Wj;Wk). The fuzzy values for the weights of the ‘‘HOWs’’ are shown in the Fig. 5.

Step 7: Developing the matrix of correlations between the

‘‘HOWs’’Some of technical specifications of each product correlate with each other and changes of one affect the other. Thus, mutual correlations between technical specifications must be identified. Lack or existence of correlation, positive or negative correlation, and strength and weakness of it are show as squares in the quality cell created by cross-section of sides of each two technical specifications (Hines et al, 1998).

This table shows which technical definition complies with the other one and which not. Opposite technical definition is very important for decision-making.

In this research, correlation matrix in completed regarding to technical specifications relation, and the completed quality cell are shown in fig 5.



Customer Attributes (*WHAT*) Matrix A	Relevance of *WHAT* Matrix B			H_1			H_2			H_3			H_4			H_5			H_6			H_7		
W_1	1.86	2.11	2.37	1.80	2.05	2.31	1.97	2.22	2.48	0.27	0.52	0.78	0.70	0.96	1.21	0.27	0.52	0.78	1.53	1.79	2.04	0.51	0.77	1.02
W_2	0.81	1.07	1.32	0.91	1.17	1.42	1.35	1.60	1.86	1.97	2.22	2.48	0.51	0.77	1.02	1.02	1.28	1.53	0.40	0.66	0.91	1.13	1.39	1.64
W_3	1.21	1.47	1.72	1.32	1.58	1.83	1.02	1.28	1.53	0.51	0.77	1.02	1.78	2.03	2.29	0.51	0.77	1.02	1.97	2.22	2.48	1.53	1.79	2.04
W_4	0.91	1.17	1.42	1.64	1.90	2.15	1.97	2.22	2.48	0.78	1.03	1.29	1.85	2.11	2.36	0.51	0.77	1.02	0.94	1.19	1.45	0.27	0.52	0.78
W_5	0.38	0.63	0.89	1.53	1.79	2.04	1.42	1.68	1.93	0.59	0.84	1.10	1.02	1.28	1.53	0.40	0.66	0.91	1.53	1.79	2.04	0.08	0.33	0.59
W_6	0.70	0.96	1.21	1.32	1.58	1.83	1.86	2.11	2.37	0.40	0.65	0.91	1.85	2.11	2.36	1.02	1.28	1.53	1.64	1.90	2.15	1.64	1.90	2.15
W_7	1.86	2.11	2.37	1.80	2.05	2.31	1.02	1.28	1.53	1.97	2.22	2.48	0.70	0.96	1.21	1.02	1.28	1.53	1.97	2.22	2.48	0.27	0.52	0.78
W_8	0.81	1.07	1.32	0.91	1.17	1.42	1.97	2.22	2.48	0.51	0.77	1.02	0.51	0.77	1.02	0.27	0.52	0.78	0.94	1.19	1.45	0.51	0.77	1.02
W_9	1.21	1.47	1.72	1.64	1.90	2.15	1.02	1.28	1.53	0.78	1.03	1.29	0.70	0.96	1.21	1.02	1.28	1.53	0.40	0.66	0.91	1.13	1.39	1.64
W_{10}	0.91	1.17	1.42	1.53	1.79	2.04	2.04	2.30	2.55	0.59	0.84	1.10	0.51	0.77	1.02	0.51	0.77	1.02	1.97	2.22	2.48	1.53	1.79	2.04
W_{11}	0.38	0.63	0.89	1.32	1.58	1.83	1.42	1.68	1.93	0.78	1.03	1.29	1.85	2.11	2.36	0.51	0.77	1.02	0.94	1.19	1.45	0.27	0.52	0.78
W_{12}	0.70	0.96	1.21	0.91	1.17	1.42	1.86	2.11	2.37	0.59	0.84	1.10	1.02	1.28	1.53	0.40	0.66	0.91	1.53	1.79	2.04	1.13	1.39	1.64
W_{13}	0.38	0.63	0.89	1.32	1.58	1.83	1.42	1.68	1.93	0.78	1.03	1.29	1.85	2.11	2.36	1.02	1.28	1.53	1.64	1.90	2.15	0.51	0.77	1.02
W_{14}	0.70	0.96	1.21	1.64	1.90	2.15	2.04	2.30	2.55	0.59	0.84	1.10	1.02	1.28	1.53	0.40	0.66	0.91	1.97	2.22	2.48	1.13	1.39	1.64
W_{15}	1.86	2.11	2.37	1.53	1.79	2.04	1.42	1.68	1.93	0.40	0.65	0.91	1.85	2.11	2.36	0.89	1.14	1.40	0.94	1.19	1.45	1.53	1.79	2.04
	weight of the HOW matrix			w1			w2			w3			w4			w5			w6			w7		
				0.10	0.11	0.13	0.09	0.11	0.13	0.06	0.08	0.09	0.07	0.09	0.11	0.05	0.06	0.08	0.09	0.11	0.12	0.06	0.08	0.10
	NORMAL WEIGHT			0.13	0.18	0.25	0.12	0.17	0.25	0.08	0.12	0.17	0.09	0.14	0.21	0.07	0.10	0.15	0.12	0.17	0.24	0.08	0.12	0.18
	CRISP WEIGHT			0.181			0.180			0.123			0.145			0.106			0.171			0.129		

FIG.5. COMPLETED HOQ

4. Conclusion and Proposals

The QFD multi-attribute decisional method, designed to support the development of products conforming to the customer’s needs and requirements, was applied to the problem of preparation of priorities of system improvement and customer satisfaction.

In this general picture, the QFD—and the HOQ in particular—have demonstrated their potential as key tools for reconciling conventional needs (which remain important) with assessment criteria of the staff wants. The fuzzy logic proved to be useful because the main variables neither quantitatively defined nor attributable to specific sets, were expressed as linguistic variables instead and because the general ‘‘if–then–else’’ rules were fundamental tools for linking the input linguistic variables with the system’s outputs. Therefore, the proposed method is used in the Survey of Effectiveness Factors on Staff Satisfaction in the case study.

The Proposals of this research is following as:

1. Implementing participation system: Difference between participation in current conditions and participation for increment of job satisfaction by respondents show importance of job participation. In this regard, participation management culture in different levels of an organization can be developed, including encourage offering valuable proposals, granting money to proposals, selection and refine of proposals, and announcing them.
2. Solving unsuitable payment to agents and offering it to related directors.
3. Maintaining near relationship with staff**:** Managers must identify reasons for decisions by holding sessions and maintaining near relationship with staff. They must notice to staff’s proposals and views to increase job satisfaction.

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