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Ranking Identified Faults by FMEA Method for Taking Modification Measures by Multiple Attribute Decision Making (MADM)

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Abstract: FMEA is a systematized tool operating based on team work. It is applied in defining, identifying, evaluating, preventing, deleting or controlling reasons and effects of potential faults in a system, process, design or the service before delivered to the clients. FMEA aims to prioritize the errors based on the necessity to take modification measures. It is routinely carried out through examining three figures of severity, occurrence and detection for each fault and then calculating the number of RPN which is obtained by multiplying these three figures. Finally, each fault with more PRN will be prioritized to be modified. It is better to use area chart for prioritizing. However, this study looked for a way to prioritize the fault by MADM2 Model to take modification measures. Among these models, AHP, TOPSIS and VIKOR Models were applied and their results were compared with each other. It should be noted that for ranking the faults in the example, a practical sample of ranking faults in stove manufacturing in anindustrial complex were used.

Key words: Fault Mode Effective Analysis (FMEA), multiple attribute decision making, Analytic Hierarchy Process (AHP), TOPSIS, VIKOR

INTRODUCTION

The approach of preventing fault is one of the main factors in creating, establishing and applying management systems as well as increasing the quality and efficiency in organizations. By establishing management systems (quality management, environment management, security management, etc.) in the organizations and meeting the requirements helping the approach of preventing the fault, the needed capability to guarantee the effectiveness of the defined process will be obtained.

FMEA model is one of the tried out and useful methods to identify, classify and analyze the fault and evaluate risks caused by it. This method provides a framework to analyze the reason f potential failures (Chin *et al*., 2008, 2009). This framework creates an approach to shape a suitable structure to evaluate and update the design as well as to develop the process and policies inside the organization. The main purpose of FMEA is to explore and prioritize potential failure mode by calculating the Number of Risk Priority (PRN) (Abadian, 2011).

It is >40 years, since FMEA has been applied. The other aims of this study is to prevent the failure when creating and developing the products and process and predict and explore the failure and make priority for dealing with the failure. Finding the cheapest solution to prevent the failure can also be considered as one of the aims of this method. The Multiple Attribute Decision Making (MADM) approach with the purpose of prioritizing and selecting the best choice is utilized.

The information the decision maker access is inaccurate, uncertain and probable numbers, due to the obscure nature of the problem. A suitable multiple attribute decision making can be able to correctly indicate the internal relationship between different indices and alsoindicate the priority of each choice by each index (Bhattacharya *et al*., 2010).

Risk evaluation in FMEA is normally done by the Priority Risk Number (PRN) whose weakness is revealed in the practice (Liu *et al*., 2012). In this regard, many researches have been carried out to evaluate the risk by MADM techniques in accordance with real world and fuzzy condition whose application

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appeared in fuzzy TOPSIS, fuzzy AHP (Liu *et al*., 2013) prioritizing fuzzy sets (Chin *et al*., 2008) and fuzzy VIKOR (McDermott *et al*., 2009). Moreover, a number of studies have been carried out in non-fuzzy conditions by DEMETEL and ANP technique (Yazdi and Haddadi, 2011) in order to enhance the risk evaluation and comparison with classic method of FMEA.

In this study, it is aimed to evaluate risk in a case study by classic FMEA method, reevaluate failure risk by AHP, TOPSIS and VIKOR methods and compare the results with each other.

Literature review: This method was first used in 1950 in Grumman Aerospace Corporation as an important tool to secure production-process and reliability analysis in different fields of engineering (Yazdi and Haddadi, 2011). In 1963, this technique was used as a design methodology by NASA due to the importance and sensitivity of the issues related to safety and to prevent potential accidents in the aerospace industry. Its fast growth was occurred on 1977 in Ford Motor Company (Kutlu and Ekmekcioglu, 2012). Since, then FMEA has turned to a powerful tool to analyze the safety and reliability of products and process in various industries such as aerospace, nuclear industry and automobile manufacturing (Sharma *et al*., 2005).

FMEA is an analytic method in risk evaluation trying to identify and score the potential risk in risk evaluation areas and its related reasons and effects.it is a very useful method to identify, classify, analyze the injuries andevaluate the risks. In FMEA, risk or loss of a failure and its effects depends on the three following factors as the criteria for decision making in MADM methods.

- Severity: evaluating and measuring the failure results (if occurring)
- Occurrence: probability or counting the number of failures
- Detect: probability of risk identification before its occurrence

With the information at hand, the potential failure pattern and its effects areranked based on the three factors. It is ranked 1-10 (bottom-up) based on FMEA table (Chin *et al*., 2009).

By multiplying the three factors (Severity (S), Occurrence (O) and Detect (D)) PRN is obtained. PRN ranks 1-100 to classify the required modification measures for reducing or deleting the potential failure pattern. Those patterns with the highest PRN scores should be given preference. Severity of the class has great importance. If the severity of a class is 9 or 10, its reason should be quickly investigated. After modification measures, a new PRN is calculated by reassessing severity, occurrence and detect which is called resulted or new PRN. Optimization and modification continue until the resulted PRN reaches an acceptable level for all potential failure patterns. All FMEA including product, design or process pass ten following steps:

- Step 1: process review
- Step 2: brainstorming for determining the potential failure pattern
- Step 3: outlining the effect of potential failure
- Step 4: allocating a degree of severity for each effect
- Step 5: allocating a degree of occurrence for each pattern
- Step 6: allocating a degree of detect for each pattern and its effect.
- Step 7: allocating risk priority score for each failure pattern
- Step 8: detecting failure pattern priority for each required measure
- Step 9: required measure to delete or reduce the potential failurepatterns with high risk
- Step10: calculating PRN after reduction or deletion of effects of potential failure pattern (Opricovice and Tzeng, 2012)

Analytic Hierarchy Process (AHP): AHP is a profitable analytical tool in Multiple Criteria Decision Making (MCDM) widely used in different environments. AHP aims to provide a method to combine qualitative and quantitative analysis (Malmir *et al*., 2013; Zheng *et al*., 2012).

This method was first proposed by Thomas Saaty in 1970, based on human brain analysis of complicated and fuzzy problems.The different applications for this method were discussed. AHP and its application are based on the following principles:

- Establishing a linear structure and format for the problem
- Making preferences through pairwise comparisons (as the marginal rate of substitution)
- The establishing a logical consistency of measurements

MATERIALS AND METHODS

TOPSIS method: In this method, along withconsidering distance of choice A_i in ideal point, the distance of A_i from negative ideal point is taken into account. The selected choice must have a minimum distance from the ideal solution and yet the farthest distance from the negative ideal solution. The underlying facts of this method are as follows; the utility of each index must be monotonically increasing or decreasing (the morerij, the more utility or vice versa) in which a best value available from an index, provesits ideality and worst value of the index proves its negative ideality. Distance of a choice form ideal (or the negative ideal) may be calculated through euclidean distance (the square) or as the sum of the absolute values of linear distances (known as block distance) which depends on the rate and replacement of the exchange indices (Tzeng and Huang, 2011).

VIKOR method: This method is used to rank and select the choice according to the set of different indices. The main objective of this method is toapproximate the choices to the ideal answers in each index so that ranking is carried out on the basis of this aim (Paparella, 2007). The steps of this method are as follow:

- After creating decision matrix as affective indices on design can have different scale, theyshould be descaled by Euclidean descaling method
- Positive and negative amount of each index is determined based on its importance
- Distance of choices from positive ideal I each index is determined based on its importance

Practical example of study: We consider the example of study for ranking failures in a practical sample which is stove, to take modification measures. First, this task is done by FMEA Method, then the problem is solved using AHP, TOPSIS and VIKOR and finally the results are compared. Number of factors and criteria effective on decision making is limited duo to simplicity of calculations. Decision criteria are the very failure factors in FMEA that is severity, occurrence and detect. Moreover, in this example, decision making choices in potential failure on stove manufacturing are as follow:

- Failure in clinch device which makes the top ofaluminum tubes not be well clinched, leading to gas leak
- Failure in welding machine which preventsthe jointfromreachingthe boilingpoint, being separated by pressure or impact
- Failure in aluminum tube which causes a break in tube and increase gas leak
- Failure in the body color which makes the layers of color be spoiled and removed leading to unpleasant appearance

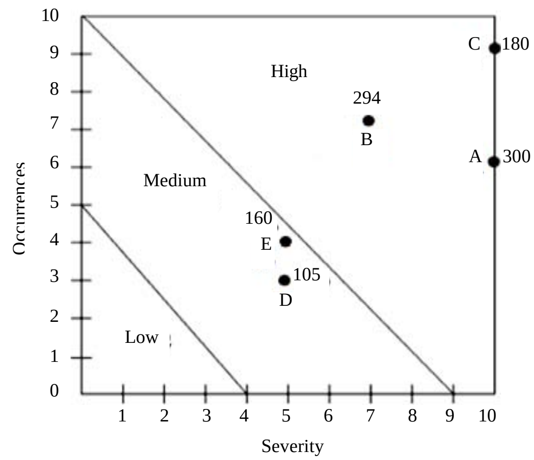

Fig. 1: Prioritizing failures

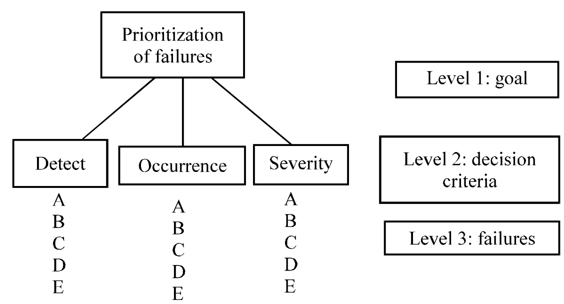

Fig. 2: Hierarchical structure

Failure in ovens which makes the painted layers not be well cooked or burnt so itturns to a rough and yellowish body. Now, FMEA tables are created for failures. Then by the help of area chart, the failures will be prioritized for modification measures. Area chart is a safe method to prioritize the faults in FMEA. The following area chart includes PRN of faults as well as severity and occurrence number. As observed, high PRN does not necessarily mean the critical failure and priority for taking modification measures. Even the lower PRN with high severity and occurrence number has priority in taking modification measures over PRN with higher failure (Opricovice and Tzeng, 2007). According to the chart above, prioritization of failures for taking modification is shown in Fig. 1. Solve the example by AHP method (Asgharpour, 2009); AHP method is used as follow:

- Defining the problem and determining its goal (explained before)
- Creating hierarchicalstructureof criteria and decision choices which are as follows (Fig. 2)

Table 1: Criteria of pairwise comparison in AHP priority

Clear judgment about priority	Allocation of figure
Ultimate superiority	9
Very strong to ultimate strong	8
Very superior	7
Strong to very strong	6
Strong superiority	5
Average t strong	4
Average superiority	3
Equal to average	2
Equal superiority	1

Table 2:Random consistency figures

Matrix size	1	2	3	4	5	6	7	8	9	10
Allocation consistency figure	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

Table 3: Pairwise comparison matrix for severity

Ranks	A	B	C	D	E
A	1.0	2.0	1.2	5	4.0
B	1.2	1.0	1.3	4	3.0
C	2.0	3.0	1.0	7	6.0
D	1.5	1.4	1.7	1	1.2
E	1.4	1.3	1.6	2	1.0

- Creating pairwise companion matrix for each choice of the question and a matrix for criteria of question, obtained by the help of criteria of relative assessment (Table 1)
- Creating combined matrix of pairwise comparison
- Calculating priority vector for all criteria
- Calculating total weighted matrix
- Calculating (λ_{Max})
- Calculating consistency index: CI = λ_{max}-n (n-1)
- Selecting suitable amount of Random consistency (RI) from the following Table 2
- Calculating Consistency Ratio(CR):

$$CR = \frac{CI}{RI}$$

- Investigating the consistency of pairwise comparison matrix to assure consistency or inconsistency of decision maker judgments

Therefore, if CR is <0.1, it is acceptable. Otherwise, judgment matrix is inconsistent and should be reviewed. To solve the problem, all the calculations related to criterion of severity are described and results of calculation of other criteria are just mentioned. First, pairwise comparison matrix for severity is shown in Table 3. Then, pairwise comparison combined matrix is obtained. This matrix is obtained through dividing each matrix member on the sum of its column. Moreover, priority vector is required. Each member of priority vector is obtained by average membersof each line of pairwise comparison combined matrix (Table 4). Then, total weighted matrix is obtained. For this purpose, priority vector matrix is multiplied in pairwise comparison matrix:

Table 4: Pairwise comparison combined matrix of severity

Ranks	A	B	C	D	E	Priority vector
A	0.253	0.304	0.233	0.263	0.276	0.266
B	0.127	0.152	0.156	0.211	0.207	0.170
C	0.506	0.456	0.467	0.368	0.414	0.442
D	0.051	0.038	0.067	0.053	0.034	0.048
E	0.063	0.051	0.078	0.105	0.069	0.073
Total						1

λ_{Max} = 5.102 CI = 0.0255; RI = 1.12; CR = 0.0228

$$0.266\begin{bmatrix}1\\1/2\\2\\1/5\\1/4\end{bmatrix}+0.170\begin{bmatrix}2\\1\\3\\1/4\\1/3\end{bmatrix}+0.442\begin{bmatrix}1/2\\1/3\\1\\1/7\\1/6\end{bmatrix}+$$

$$0.048\begin{bmatrix}5\\4\\7\\1\\2\end{bmatrix}+0.073\begin{bmatrix}4\\3\\6\\1/2\\1\end{bmatrix}=\begin{bmatrix}1.359\\0.861\\2.258\\0.243\\0.366\end{bmatrix}$$

$$\frac{1.359}{0.266}=5.11 \quad \frac{0.861}{0.170}=5.056 \quad \frac{2.258}{0.442}=5.11$$

$$\frac{0.243}{0.048}=5.063 \quad \frac{0.366}{0.073}=5.014$$

Then, the average of these amounts should be obtained:

$$\lambda_{Max}=\frac{5.11+5.065+5.11+5.063+5.014}{5}=5.072$$

Now, consistency index is calculated:

$$CI=\frac{(\lambda_{Max}-n)}{(n-1)}=\frac{5.072-5}{5-1}=0.018$$

By selecting random consistency figure for n = 5 from the random consistency table which equals to 1.12, consistency ratio is obtained:

$$CR=\frac{CI}{RI}=\frac{0.018}{1.12}=0.016$$

Table 5: Pairwise comparison matrix of occurrence

Ranks	A	B	C	D	E	Priority vector
A	1.0	1.2	1.3	5	4.0	0.176
B	2.0	1.0	1.3	6	4.0	0.236
C	3.0	3.0	1.0	9	8.0	0.490
D	1.5	1.6	1.9	1	1.2	0.040
E	1.4	1.4	1.8	2	1.0	1.060
Total	-	-	-	-	-	1.000

λ_{Max} = 5.118; CI = 0.0295; RI = 1.12; CR = 0.0263

Table 6: Pairwise comparison matrix of detect

Ranks	A	B	C	D	E	Priority vector
A	1.0	1.2	4	1.4	1.3	0.107
B	2.0	1.0	5	1.3	1.2	0.166
C	1.4	1.5	1	1.8	1.6	39.000
D	4.0	3.0	8	1.0	2.0	0.425
E	3.0	2.0	6	1.2	1.0	0.264
Total	-	-	-	-	-	1.000

λ_{Max} = 5.102; CI = 0.0255; RI = 1.12; CR = 0.0228

Table 7: Pairwise comparison matric of judgment criteria

Variables	Severity	Occurrence	Detect	Priority vector
Severity	1.0	2.0	5	0.568
Occurrence	1.2	1.0	4	0.334
Detect	1.5	1.4	1	0.098
Total	-	-	-	1.000

λ_{Max} = 3.025; CI = 0.0125; RI = 0.58; CR = 0.0215

Table 8: Choice priority matrix compared with criteria

Variables	Severity	Occurrence	Detect	Priority vector
A	0.266	0.176	0.107	0.220
B	0.170	0.236	0.166	0.192
C	0.442	0.490	0.390	0.419
D	0.048	0.040	0.425	0.082
E	0.073	0.060	0.264	0.087

Table 9: Relative index

Indices choice	C_1	C_2	--	C_n
A_1	r_{11}	r_{12}	--	r_{1n}
A_2	r_{21}	r_{22}	--	r_{2n}
⋮	⋮	⋮		⋮
A_m	r_{m1}	r_{m2}	--	r_{mn}
W_j	W_1	W_2	--	W_n

Consistency ration is <0.1. Therefore, judgment matrix is consistent. Now all, of these calculations are carried out for other criteria whose results are shown in Table 5 and 6. We should also be compared the importance of decision criteria. For this purpose, a pairwise comparison matrix for criteria is created (Table 7).

Finally, choice priority matrix compared with criteria is created and total priority vector is created from which priorities of judgment choices are shown (Table 8). Total priority vector for each choice is obtained by multiplying priority vector of criteria in the relative row in choice priority matrix. For example for choice A we have:

$$0.266\times 0.568 + 0.176\times 0.334 + 0.107\times 0.098 = 0.220$$

Therefore, by AHP method, priority of the above mentioned choices are as follows:

C>A>B>E>D

Table 10: Calculation of weights of index by entropy method

Variables	Criteria	Entropy (E_j)	Uncertainty amount (d_j)	Criteria weight (W_j)
1	S	0.971	0.029	0.238
2	O	0.957	0.043	0.357
3	D	0.951	0.049	0.405

Table 11: Decision making matrix

Variables	Positive severity	Positive occurrence	Negative detect
A	10.000	6.000	5.000
B	7.000	7.000	6.000
C	10.000	9.000	2.000
D	5.000	3.000	7.000
E	5.000	4.000	8.000
Weight	0.238	0.357	0.405

Table12: Normalized matrix

Variables	Severity	Occurrence	Detect
A	0.578	0.434	0.375
B	0.405	0.507	0.450
C	0.578	0.651	0.150
D	0.289	0.217	0.525
E	0.289	0.289	0.600

Solving the question by TOPSIS method: To solve the question by TOPSIS method, following steps should be followed (Yusuf, 2012).

Step 1: Creating decision making matrix in this matrix, the rows include choices, the columns are indices and the last row includes weight of each index. In coincidence of rows and columns, the importance of choice according to the relative index is shown Table 9. r_{ij} is the score of I choice in J index and w_j is the weight of j index. Weight of criteria is calculated by entropy method (Table 10). Table 11 indicates decision-making matrix for this project. It should be noted that decision making matrix is the calculating average of comments of all experts.

Step 2: Normalizing decision making matrix; to make this matrix comparable, it is turned to normalized matrix by Eq. 1:

$$n_{ij} = \frac{r_{ij}}{\sqrt{\sum_{i=1}^{m} r_{ij}^2}} \tag{1}$$

Table 12 shows normalized matrix.

Step 3: To obtain level normalized matrix (V), the calculated matrix (step 2) should be multiplied in square matrix ($w_{n\times n}$) whose elements of main diameter are weight of index and other elements are 0. Eq. 2:

$$V = N_1 \times W_{n\times n} \tag{2}$$

Table 13 shows the weighted normalized matrix.

Table13: Weighted normalized matrix

Variables	Severity	Occurrence	Detect
A	0.138	0.155	0.152
B	0.096	0.181	0.182
C	0.138	0.232	0.061
D	0.069	0.077	0.212
E	0.069	0.103	0.243

Step 4 (Determining factor of positive ideal and negative ideal): In this step, the most and the least importantchoices to view of respondentsshould be determined. For example, for positive indices, positive ideal is the biggest V and negative ideal is the smallest V. Moreover, for negative indices, positive ideal is the smallest V and negative ideal is the biggest V. Eq. 3 and 4 indicated this relation:

$$A^+ = \left\{ \begin{matrix} \left(\max_i V_{ij} \mid j \in J\right), \\ \left(\min_i V_{ij} \mid j = J'\right) \mid i = 1, 2, ..., m \end{matrix} \right\} = \left\{V_1^+, V_2^+, ..., V_n^+\right\} \quad (3)$$

$$A^- = \left\{ \begin{matrix} \left(\min_i V_{ij} \mid j \in J\right), \\ \left(\max_i V_{ij} \mid j = J'\right) \mid i = 1, 2, ..., m \end{matrix} \right\} = \left\{V_1^-, V_2^-, ..., V_n^-\right\} \quad (4)$$

In this equation, J is positive index and J is the negative index.

Step 5 (Calculating distance from positive and negative ideal): In this step, distance of each choice from positive and negative ideal is determined by Eq. 5 and 6:

$$d_i^+ = \sqrt{\sum_{j=1}^{n} \left(V_{ij} - V_j^+\right)^2}\ ; \quad i = 1, 2, ..., m \quad (5)$$

$$d_i^- = \sqrt{\sum_{j=1}^{n} \left(V_{ij} - V_j^-\right)^2}\ ; \quad i = 1, 2, ..., m \quad (6)$$

Distance of each choice from positive and negative ideal are indicated in Table 14.

Step 6: In this step, the approximate degree of each choice from positive and negative ideal (CL) is obtained by Eq. 7:

$$CL_i = \frac{d_i^-}{d_i^- + d_i^+} \quad (7)$$

Table 15 indicates the amount of CL for each choice.

Step 7: In this step, choices are ranked and prioritized based on CL amount. Each choice with higher CL will have higher rank. Table 11 showsthe ranking of choices. Eventually, ranking of choices based on descending relative proximity is carried out:

Table14: Positive and negative ideal of each index

Criterion	Positive ideal	Negative ideal
Severity	0.138	0.069
Occurrence	0.232	0.077
Detect	0.061	0.243

Table15: Ranking of choices

Rank	CL	Distance from negative ideal	Distance from positive ideal	Choice
2	0.536	0.138	0.120	A
3	0.471	0.123	0.138	B
1	1.000	0.249	0.000	C
4	0.118	0.030	0.228	D
5	0.100	0.026	0.234	E

C >A>B>D>E

RESULTS AND DISCUSSION

Solving the question by VIKOR method: Before start, weight of indices is determined by entropy method. VIKOR method is carried as follow:

- Normalizing decision making matrix by Euclidean method
- Determining positive and negative ideal among available indices: amount of I^+ and f_j^- are determined. If the index is positive then $fj^+ = \max_j f_{ij}$ and $f_j^- = \min_j f_i$. and if the index is negative then $f_j^+ = \min_j f_{ij}$ and $f_j^- = \max_j f_{ij}$

Decision making matrix is as follows. Here, severity and occurrence indices are positive and detect index is negative. Decision making matrix is created as before (Table 16). Positive and negative ideals for each index are shown in Table 17.

Calculating S and R in VIKOR method, Q is an advantage function which unites S and R (weights θ) by an equation. S and R are calculated through this equation (Table 18):

$$S_i = \sum_{j=1}^{n} w_j \left| \frac{f_j^+ - f_j}{f_j^+ - f_j^-} \right|$$

$$R_i = \max_i \left[w_j \left| \frac{f_j^+ - f_j}{f_j^+ - f_j^-} \right| \right]$$

Calculating Q by this equation:

$$Q_i = \vartheta \frac{S_i - S^+}{S^- - S^+} + \frac{(1-\vartheta)(R_i - R^+)}{R^- - R^+}$$

Finally, ranking of choices in VIKOR method is shown in Table 19.

Table 16: Decision making matrix

Rank	Severity	Occurrence	Detect
A	10	6	5
B	7	7	6
C	10	9	2
D	5	3	7
E	5	4	8

Table 17: Positive and negative ideals

Rank	Severity	Occurrence	Detect
Positive ideal	0.137639	0.232485	0.060712
Negative ideal	0.068819	0.077495	0.242848

Table18: Amounts of S and R

Rank	Si	Ri
A	0.381001	0.202500
B	0.531802	0.270002
C	0.000001	0.000001
D	0.932498	0.357000
E	0.940500	0.405001

Table 19:Ranking choices in VIKOR method

Result	C	A	B	D	E
VIKOR index	1	0.547449	0.383943	0.063514	0

C>A>B>D>E

CONCLUSION

FMEA technique is one of the efficient methodsin quality management to explore and identification of failures and faults of process and its prevention and modification. Three decision making methods of AHP, TOPSIS and VIKOR are used to prioritize the failures. In this paper, ranking the failures to prioritize the potential faults for taking modification measures is carried out byFMEA method and MADM techniques. The answers are calculated by four methods of chart area of AHP, TOPSIS and VIKOR. Finally, it was observed that the result of ranking of chart area was the same as AHP. Moreover, ranking of TOPSIS was similar to VIKOR. However, results of ranking of chart area and AHP weredifferent with those of TOPSIS and VIKOR. Therefore, in this empirical example of the papers, relative similarity of method of chat area in FMEA with AHP method and TOPSIS with VIKOR was indicated.

APPENDIX

Failure modes analysis and their effects

Explanation: FMEA in gas espadana factory	Team/department members		Related documents	Page: -- to --
	Designers:	Suppliers:	Engineering Specification (ES):	Date: / /
	Producer:	Clients:	PFD:	Confirmation
	Quality:	Reliability:		CP:
				Contract:
				Test plans:

Name of devices	Responsibility of device	Failure mode	Failure effect	Failure reason	S	O	D	RPN	Recommendation and modification measures
Perch	Perching top of aluminum tubes to placing the tubes in the vintury	Top of aluminum tubes is not correctly perched	Aluminum tube is not correctly and safely placed put into vintury, resulting in gas leak and health danger.	Perch device is not set and holder screw of aluminum tube is not fastened	10	6	5	300	Be careful in setting the perch device before each use. Controlling susceptible parts of device to make sure there is no defect in device and also fastening of holder screw
Welding machine	Making boiling point in connection specially body connections	Boiling point is not well made in connections.	The connections are detached due to impact or pressure	The temperature boiling is low or high because series of boiling point is not clean or two arms are not set	77	7	6	294	Filing a series of boiling spot to clean it Adjust two arms to connect two platinum Increase operator accuracy in creating the boiling point
Aluminum tube	Passing the gas and deliver it to the flame	A fraction in aluminum tube	Gas leak with threat the life of clients	Break in aluminum tube when cut by saw blade Break in aluminum tube when bent by hand.	10	9	2	180	Before each use of saw blade, make sure it is set. After certain function, the blades should be replaced When bending the tubes by hand do not act hastily
Paint	A material used for painting the stove body	Body turns yellow and the layers are removed	The body has a bad appearance	Low quality of paint The kinds of paint is not suitable for The layers the paint is corrupted	5	3	7	105	By the help of experts in paint factory, the paint suitable for the sheet is used. Before using the paint, make sure it is not corrupted. The inserted specification on the can or the laboratory can help in this regard

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