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ARTIFICIAL INTELLIGENT TECHNIQUE FOR ANALYSING DECISION BASED ON FAILURE DATA OF HOSTEL MAINTENANCE

Yuseni Ab Wahab[1], Hairul Hazlina Mohd Ali [2,]

[1] Kolej Universiti Islam Melaka (KUIM),
Kuala Sungai Baru 78200, Masjid Tanah, Melaka
[2,] Melaka State Department of Education Malaysia
Ministry of Education Malaysia,

[1]yuseni@kuim.edu.my, [2] mhairulhazlina@gmail.com

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Abstracts

The AHP methods has been proposed because the decision theory has become a useful tool for maintenance decision making the analysis thereof, focuses not only on making a decision, its goal is also to provide insight in the decision process. AHP contributes to analyses the decision-making context, organizing the process, increasing coherence on the goals and the final decision, and cooperation between the decision makers, leading to a better mutual understanding. It decomposes decision-making into the following using the priorities obtained from the elements at one level to weigh the priorities of the elements in the level immediately below them. The AHP is selected for this research because it is a well-established multiple criteria decision-making approach, both in academia and industry. Its specific benefits are designed to integrate objective, subjective, qualitative and quantitative information. Moreover, AHP creates a thorough understanding of the problem by structuring the problem hierarchically, compares the criteria and alternatives pairwise, providing simplicity and ease of use and produces plausible and defensible results.

Keywords: Analytic Hierarchy Process (AHP) Technique and Maintenance Decision

I.INTRODUCTION

Decision analysis is a method aims to provide a decision-making technique in order to assist the user makes a decision once the data collection and analysis have been done (1). In maintenance, the decision analysis offered assistance, for example how to identify the most critical components and to select an appropriate prevention action. The Demonstrates a practical methodology for adding value to data collected through offering decision analysis, as well as facilitating the link between preventive maintenance and emergency maintenance in an adaptable and dynamic approach (2). The research also emphasised that finding and improving the worst HFM is not a new concept, as it is the core concept of total productive maintenance (TPM). This combination provides features of fixed rules and flexible strategies (3). The presented model. The analysis includes a major fault analysis, cause of fault analysis, consequence of fault analysis, prevention action analysis and extra analyses (4). A other process comprising snapshot, FMECA, Availability and Reliability to the Decision Analysis using AHP to find the most critical components (5).

II. AHP Process

AHP is the method used for identifying the most important components according to the given historical failure data (absolute data) or a subjective data based on expert judgment (6). For this study, data collected from snapshot survey forms will be used. This method applies the concept of matrix which called pairwise comparison matrix. The first step is obtaining the objective/goal of the analysis, for this study, identifying the most important Hostel Facilities Maintenance (HFM) in terms of maintenance priority (7).

Figure 1. Shown the Conceptual Model of Decision Analysis Process in AHP and shows which criteria/sub criteria is most important

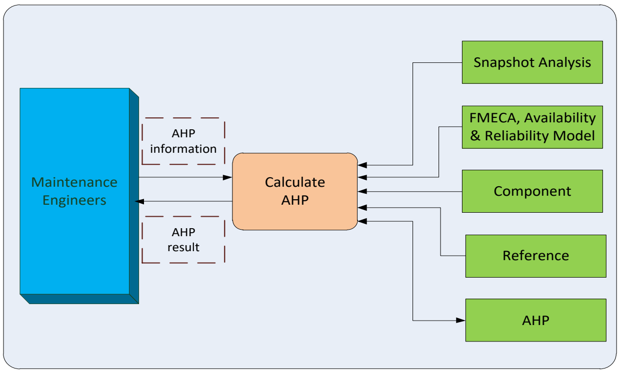

Figure 1 Conceptual Model of Decision Analysis Process

As shown in Figure 1 the criterion could also decompose the level of criteria by adding sub criteria. The weight of these criteria/sub criterions could be calculated and shows which criteria/sub criteria is most important. Finally, the ranked HFM based on various criteria from snapshot analysis will be set as an alternative to AHP method. Once all the process is followed properly and accepted by the system, then the rank will be displayed (8). The main process of the snapshot analysis is decomposed into several detail processes. The new detail of flow diagram is given in Figure 2.

Figure 2. AHP Module Decomposition

The use of AHP in solving a multi criteria decision making (MCDM) problem required the knowledge of vector concept, matrix notation and matrix multiplication (9).The interfaces that related to decision analysis process are shown in Figure 3.

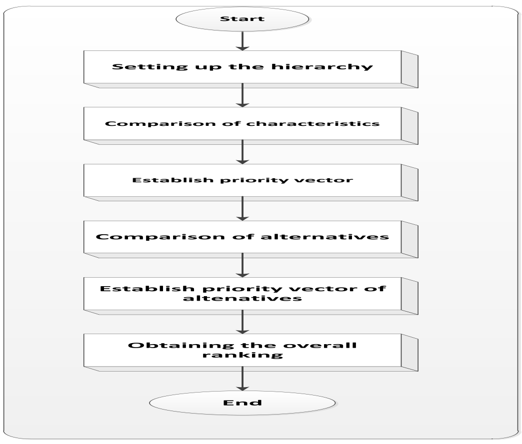

Figure 3. Analytic Hierarchy Process (AHP) Workflow

The weight for each alternative show which HFM is most important and could be ranked based on that It means that they have to calculate the AHP weight value for each of the criteria/ sub criteria to reach the alternative tab or to continue with the next process (10). The AHP provides a means of decomposing the problem into a hierarchy of sub problems which can more easily be comprehended and subjectively evaluated such as the Figure 3. The objective is to find the most critical component with sub-criteria snapshot of FMECA, availability and reliability model from component (Door, Lamp, Window and Toile) in HFM. The subjective evaluations are converted into numerical values and processed to rank each alternative on a numerical scale (11). The AHP produces weight values for each alternative based on the judged importance of one alternative over another with respect to a common criterion (12).

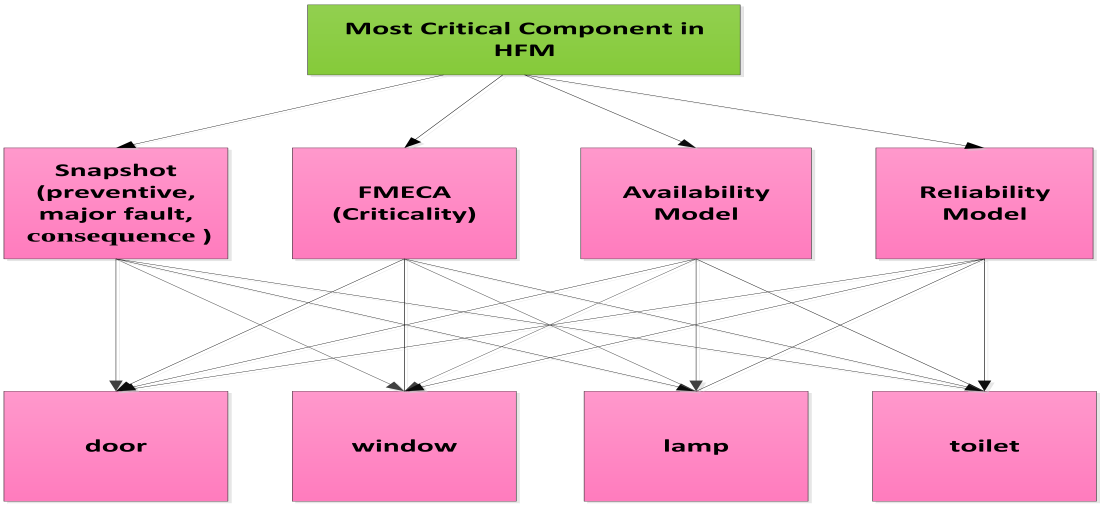

Figure 4.8 Interface of Criteria Rank

III RANKING

The subjective evaluations are converted into numerical values and processed to rank each alternative on a numerical scale. In this ranking there are 2 ranking, namely: -

1. Ranking element
2. Ranking component in HFM

In evaluating this ranking, AHP process used to look on the ranking of such data collected in the HFM.

1. Ranking element -Data are collected from experts or decision-makers corresponding to the hierarchic structure(12). The pairwise comparison of alternatives on a qualitative scale as described below. Experts can rate the comparison as equal, marginally strong, strong, very strong, and extremely strong(13). The opinion can be collected in a specially designed format as shown in Table 4.11.

Table 4. Interface of Element Rank

Pairwise Comparison

	Snapshot	FMEA	Availability	Reliability
Snapshot	1\1	1\2	1\7	5\1
FMEA	2\1	1\1	5\1	9\1
Availability	7\1	1\5	1\1	3\1
Reliability	1\5	1\9	1\3	1\1

The values in the normalized pairwise comparison matrix have been converted to decimal form. The result is usually represented as the (relative) priority vector.

Convert to Decimals

	Snapshot	FMEA	Availability	Reliability
Snapshot	1.0000	0.5000	0.1428	5.0000
FMEA	2.0000	1.0000	5.0000	9.0000
Availability	7.0000	0.2000	1.0000	3.0000
Reliability	0.2000	0.1111	0.3333	1.0000

Squaring the Matrix (^{2})

1.0000	0.5000	0.1428	5.0000
2.0000	1.0000	5.0000	9.0000
7.0000	0.2000	1.0000	3.0000
0.2000	0.1111	0.3333	1.0000

Step 1:- Sum the values in each column of the pairwise comparison matrix

Example :- (1.0000 *1.000) + (0.5000*2.000) +(0.1428*7.0000)+(5.0000*0.2000) = 4.9970

Result (1)

4.9970	1.5790	10.450	14.928
40.500	3.9999	13.285	43.000
15.000	7.2333	12.989	42.800
2.9530	6.3870	1.3070	3.9982

Step 2:-

EIGEN VICTOR (TO FOUR DECIMAL PLACES), First SUM THE ROW;

4.9970 +1.5790 + 10.450 + 14.928 = 31.954 = 0.1418

40.500 +3.9990 + 13.285 + 43.000 = 100.784 = 0.4470

15.000 + 7.2330 +12.9590 + 42080 =78.022 = 0.3461

2.9530 + 6.3870 + 1.3070 + 3.998 = 14.645 = 0.0650

SUM =225.405

Example: 31.954 Divided by 225.405 Equals 0.418

Table 1 shows a list of the results of HFM ranking.

3.9996	1.5790	13.285	14.928	31.954	0.1418
40.500	3.9990	13.285	43.000	100.784	0.4470
15.0000	7.2330	12.9590	42.800	78.022	0.3461
2.7200	6.3870	1.3070	3.998	14.645	0.0650
			Total	225.405	

Criteria	Ranking
Snapshot	= 0.1418
FMECA	=0.4470
Availability	=0.3461
Reliability	= 0.0650

In decision making problems, it may be important to know how well the consistency because they may not want the decision to be based on judgments that have such low consistency that appear to be random (14-15).

Table 1 shows a list of the results of HFM ranking. The value gives a previously calculated show that the highest weight component is FMECA with weight 0.4470, followed by Availability component with weight 0.3461 and other component lowest is Snapshot and Reliability with weight 0.1418 and 0.0650

2. The Ranking of the HFM Component (KUIM)

The ranking of the HFM component is aimed to view the most critical component in the HFM using AHP method (16).

Table 2 Interface of Component Rank (KUIM)

Equal 2. Moderate 5. Strong 7. Very strong 9 . Extreme

Pairwise Comparison

	Door	Toilet	Lamp	Window
Door	1\1	3\1	7\1	7\1
Lamp	1\3	1\1	9\1	3\1
Toilet	1\7	1\9	1\1	5\1
Window	1\7	1\3	1\5	1\1

The values in the normalized pairwise comparison matrix have been converted to decimal form (17). The result is usually represented as the (relative) priority vector (18).

Convert to Decimals

	Door	Toilet	Lamp	Window
Door	1.0000	3.0000	7.0000	7.0000
Toilet	0.3000	1.0000	9.0000	3.0000
Lamp	0.1428	0.1100	1.0000	5.0000
Window	0.1428	0.3000	0.2000	1.0000

The matrices A corresponding to the cases considered in the above example are shown below, together with their consistency evaluation based on the computation of the consistency index (18).

Squaring the Matrix (²)

1.0000	3.0000	7.0000	7.0000
0.3000	1.0000	9.0000	3.0000
0.1428	0.1100	1.0000	5.0000
0.1428	0.3000	0.2000	1.000

Example :- (1.0000 *1.000) + (3.0000*0.3000) +(7.000*0.145) + (7.0000*0.1428) = 3.8971

Result (1)

3.8971	8.8700	49.400	26.500
2.3136	3.7900	237.00	53.100
1.0326	2.1484	8.9890	11.343
0.547	1.1600	6.0990	8.0890

EIGENVICTOR (TO FOUR DECIMAL PLACES), First SUM THE ROW

3.8971+8.8700+ 49.400 + 26.500= 88.667 0.4197

2.3136 + 3.7900 + 23.700 + 53.100 = 82.904 0.3920

1 .326 + 2.1484 + 8.9890 + 11.343 = 23.803 0.1130

0.5470 + 1.1600 + 6.099 + 8.0890 = 15.895 0.0750

SUM =223.44

Example: 112.860 Divided by 223.44 Equals 0.4197

Total

3.8971	8.8700	49.400	26.500	88.667	0.4197
2.3136	3.7900	23.700	53.100	820904	0.3920
1.0326	2.1484	8.9890	11.343	23.803	0.1130
0.5470	1.160	6.099	11.343	15.895	0.0750
			Total	223.44	

In Table 5. show a list of the results of HFM ranking.

Criteria	Ranking
Door	=0.4197
Lamp	=0.3920
Toilet	=0.1130
Window	= 0.0750

In decision making problems, it may be important to know how good the consistency is, because the decision is based on judgments that have such low consistency.

In 5. show a list of the results of HFM ranking. The value gives a previously calculated show that the highest weight component is Door with weight 0.4197, followed by Lamp component with weight 0.3920 and other component lowest is Toilet and window with weight 0.1130 and 0.0750.

IV. CONCLUSION

The AHP technique is proposed to find the most critical components by utilising FMECA, availability and reliability models. A new analysis also offered to enrich the maintenance problem identification.

V. ACKNOWLEDGMENT

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