DSS using AHP in Selection of Lecturer

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Abstract

This paper was conducted to apply Analytical Hierarcy Process (AHP), applied as Decision Support System (DSS) model in selection of lecturer at STAIN Batsangkar. Data collected by through observation and interview done in shares of administration academic data center at college. Here in data analyzed to learn the pattern from method used and added with the reference from literature. Experiment done using Microsoft Excel and Expert Choice Software, known that method can yield the optimal decision in selection of lecturer. There by the method recommended to be applied to getting optimal result in decision making.

Keywords: *Decision Support System, Analytical Hierarchy Process, Decomposition, Pairwise Comparison, Consistency Ratio*

1. Introduction

The development of information technology enables decision making and representation of information can be done quickly in accordance with the development of the use computer. Presentation of data and information is highly dependent on the software used [1]. The software is a technology can be used to process, find, assemble, store and manipulate data. Software designed should pay attention to things like scalabiity, security and execution. Beside its architecture must be defined clearly, so that the bugs is easily found and corrected, either by programmers or by others. Another advantage of mature architectural planning is sharing use of the return module or component for other software applications that require the same functionality [2]. The data processing [3] into information can be done by a system which starts from Electronic Data Processing (EDP) to Management Information System (MIS) and continious into a Decision Support System (DSS). EDP was placed on data storage, processing and information flow as well as efforts to increase the efficient processing [4]. MIS focused on the presentation of information [5] for middle managers. DSS focused on a decision addressed to officials of the decision makers as well as resting on flexibility, adaptability and fast response can be controlled by the user [6]. DSS is a system can be developed, able to support data analysis and decision modelling, oriented on planning on the future and can not be planned intervals (periods) of time use [7]. In a decision that just involves a little factors in it. Then decison can be taken intuitvely (which underlies the reasoning in thoughts or opinions that come out spontaneously from someone). However, in the decision making that involves many factors, its necessary to use a particular method [8]. The decision in selection of lecturer, in it there are factors that need to be considered. These factors keep in mind its contribution to selection of lecturer in order that criteria and strategies that will be done is right to on target a decision to be optimal. DSS can expose an alternative choice to the decision makers. Whatever an however the process, on the most difficult stages of information that will

be faced by decision makers in terms of application. Analytical Hierarchy Process (AHP) developed by Thomas L. Saaty, usefull help decision makers [9]. To get the best decision by comparing factors such as criteria. AHP allows decision makers to confront the real factors and factors that are not real [10]. The advantages of AHP in comparison to the other due to structure of hierarchical structure [11], as a consequence of chosen criteria, until the sub-section of the most detailed criteria [12]. Take into account validity up to the limit of tolerance inconsistencies of various criteria [13], and alternatives chosen by decision-makers [14]. This paper aims to build AHP as DSS model with the implementation into Microsoft Excel and Expert Choice Software. This paper used in selection of lecturer so that decision-making becomes rational and optimal.

2. Research Method

2.1. Framework Research

In this paper, more generally in accordance with the purposes for which its expected, framework research that will be examined are as follows:

- The study of literature on AHP method as DSS model.
- Observation in applying AHP method as DSS model in selection of lecturer.
- Implementation of AHP method as DSS model in selection of lecturer on the application software.
- Evaluate AHP method in application software in DSS to selection of lecturer to make optimal decision.

2.2. Proposed Method

Proposed method in DSS model: decision, criteria and alternative. AHP method as decision model software and software (Microsoft Excel and Expert Choice) for data processing. DSS model can be seen in Figure 1.

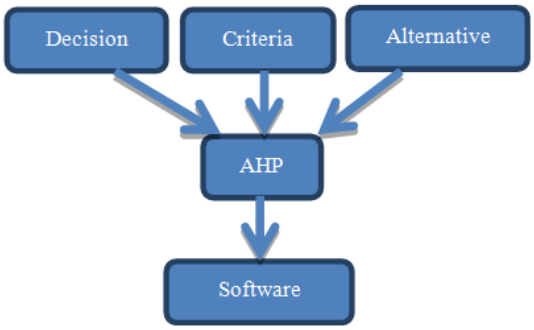

Figure 1. DSS Model

2.3. AHP Method

In selection of lecturer, in which fundamental issues is comprehensively planning and integrated to turn down level of risk failure in selection of lecturer carefully. The problem arises because the process of determining criteria, in deciding difficult choice consider

personal accident and resulting in a complex assessment and consideration of decision makers tend to refraction and subjective. For this problem, the method of Analytical Hierarchy Process (AHP) can be used. AHP method in selection of lecturer can be seen in Figure 2.

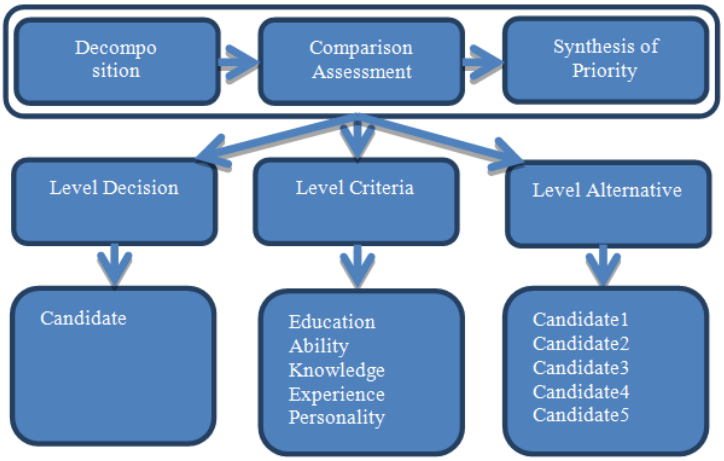

Figure 2. AHP Model

AHP method in selection of lecturer in Figure 2, shown the decomposition process that breaks down the question of a whole into its elements. The resolution will result in some level of an issue. Further comparisons of the assessment process conducted by making use of pairwise comparison. Prior to the determination of priority synthesis, first occurrence can be determined the business feasibility of the results values of factors obtained by measuring the level of consistency. The procedure performs different synthesis according to the hierarchy. In the end an alternative with the highest total value was chosen as the best alternative.

3. Result and Discussion

3.1. Preliminary Data

Data source to be analyzed to determine the formula of the selection criteria lecturer with data classification objectives, criteria and alternative making can be seen on Table 1.

Table 1. Classification Level

Level Objectivies	Level Criteria	Level Alternative
Selection of lecturer	Education	Candidate1
	Abiltiy	Candidate2
	Knowledge	Candidate3
	Experiece	Candidate4
	Personality	Candidate5

3.2. Selection of Lecturer

The objectives, criteria and alternative in DSS for selection of lecturer, where C1 is candidate1 and so on, can be seen in Figure 3.

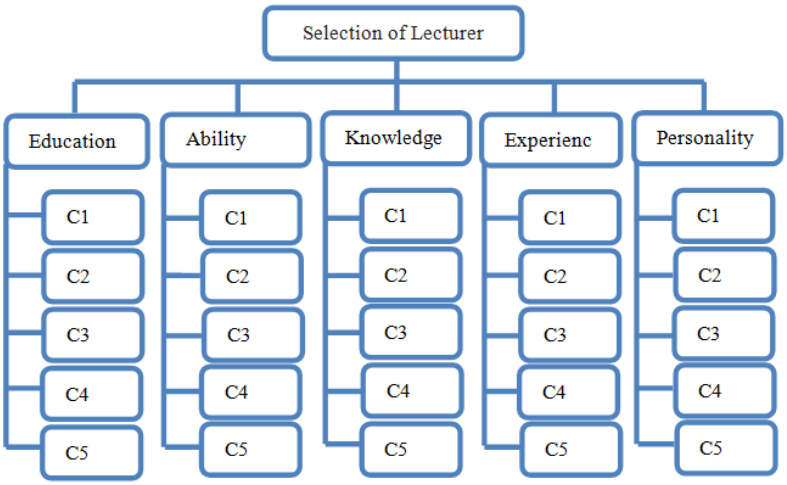

Figure 3. Decision Hierarchy

Figure 3 is a hierarchy of decision for selection of lecturer who have three different levels. Top Level describes the overall decision that the selection of lecturer. High Level in the hierarchy to explain the criteria into consideration is: education, ability, knowledge, experience and personality. The Lowest Level of the hierarchy's decision shows the alternative prospective lecturer that candidate1, candidate2, candidates3, candidates 4 and candidate5 (for this case there five candidates despite the fact it could have been a lot). Pairwise comparison is the most important aspect in using AHP. Decision makers to compare the two alternatives that differ in one level by using a scale that varies can be seen in Figure 4.

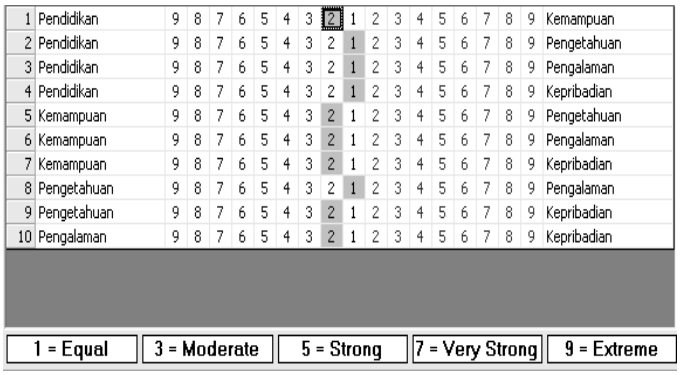

Figure 4. Pairwise Comparison

Figure 4 shown that pairwise comparison made reference to the scale, but scale weight comparison could be made by the decision maker of origin in accordance with the terms based on a predetermined scale.

3.3. Pairwise Comparison

Pairwise comparison is done based on criteria weights for validation rules as shown on Table 2.

Table 2. Weighting of Criteria

Parameter	Scale
Pretty Important	1
Important	2
Very Important	3

Starting with a look at the criteria and do a comparison between education, ability, knowledge, experience and personality by using parameters on the table and scale the weighting criteria. Education criteria and ability criteria.Then, education criteria compared with knowledge criteria. Education criteria compared to the education criteria compare with experience criteria, and edaucation criteria compared with personality criteria. A comparison between criteria with the others criteria using the pairwise matrix. Pairwise comparison matrix for criteria such as the following:

Crt	Edu	Abl	Knw	Exp	Psn
Edu	1/1	2/1	1/1	1/1	1/1
Abl		1/1	2/1	2/1	2/1
Knw			1/1	1/1	2/1
Exp				1/1	2/1
Psn					1/1

Description:
Crt: Criteria
Edu: Education
Abl: Ability
Knw: Knowledge
Exp: Experience
Psn: Personality

Where 2/1 is the representation of a value of 2 for the education criteria and value 2 to ability criteria, 2/1 that education criteria considered important one level above ability criteria and so on.

3.4. Comparative Matrix

Normally, pairwise comparison matrix for anything, may be placed number 1 diagonally on the top left corner to the lower right corner, because it means thatcomparison of two is the same thing 1 or equally preferred. To accomplish this can be elaborated that if education criteria is twice ability criteria, then it can be inferred that the ability criteria is viewed essential half of value education criteria. So did the comparison more so pairwise comparison matrix obtained new ones such as below:

Crt	Edu	Abl	Knw	Exp	Psn
Edu	1/1	2/1	1/1	1/1	1/1
Abl	½	1/1	2/1	2/1	2/1
Knw	1/1	½	1/1	1/1	2/1
Exp	1/1	½	1/1	1/1	2/1
Psn	1/1	½	1/1	½	1/1

3.5. Evaluation of Criteria

After a full comparison matrix pair is created, the next step is to start counting for evaluation of criteria. To facilitate the calculation of the figures in pairwise comparison matrix can be modified in the form of numbers with a decimal format and then done the sums each of columns. Results of the reciprocal matrix evaluation of criteria can be seen on Table 3.

Table 3. Reciprocal Matrix

Crt	Edu	Abl	Knw	Exp	Psn
Edu	1,0000	2,0000	1,0000	1,0000	1,0000
Abl	0,5000	1,0000	2,0000	2,0000	2,0000
Knw	1,0000	0,5000	1,0000	1,0000	2,0000
Exp	1,0000	0,5000	1,0000	1,0000	2,0000
Psn	1,0000	0,5000	0,5000	0,5000	1,0000
Sum	4,5000	4,5000	5,5000	5,5000	8,0000

The next step is to determine the Normalized Matrix (NM) for criteria by means of matrix values divided by the number of criteria (Sum) matrix of criteria fore ducation column as follows:

NM: 1,0000→1,0000 / 4,5000 = 0,2222
NM: 0,5000→0,5000 / 4,5000 = 0,1111
NM: 1,0000→1,0000 / 4,5000 = 0,2222
NM: 1,0000→1,0000 / 4,5000 = 0,2222
NM: 1,0000→1,0000 / 4,5000 = 0,2222 +
1,0000

The same thing is done on the column the column ability until personality criteria. Each row is calculated to get normalized value matrix each comparison as shown on Table 4.

Table 4. Normalized Matrix

Normalized Matrix (NM)						Sum
Edu	0,2222	0,4444	0,1818	0,1818	0,1250	1,1553
Abl	0,1111	0,2222	0,3636	0,3636	0,3636	1,3106
Knw	0,2222	0,1111	0,1818	0,1818	0,2500	0,9470
Exp	0,2222	0,1111	0,1818	0,1818	0,2500	0,9470
Psn	0,2222	0,1111	0,0909	0,0909	0,1250	0,6502
Sum	1,0000	1,0000	1,0000	1,0000	1,0000	5,0000

To specify the priority oneducation critera on Table 4 is obtained from the average value of pairwise comparison matrix row with normalized criteria matrix the first row with a value of 1,1553 divided by the number of criteria that is five so obtained the results of 0,2311. The same way done also on ability criteria, knowledge criteria, experience criteria and personality criteria. The results of priority vector in the first line, second line, third line.The line of the fourth and fifth row (depending on the data criteria and alternative criteria in decision making). The results of calculations as shown on Table 5.

Table 5. Priority Vector

Criteria	Sum	Priority Vector
Edu	1,1553	0,2311
Abl	1,3106	0,2621
Knw	0,9470	0,1894
Exp	0,9470	0,1894
Psn	0,6402	0,1280
Sum	5,0000	1,0000

Table 5 shown the Priority Vector (PV) is the highest on the criteria of ability with a value of PV 0,2621 followed by the criteria of education with a value of PV 0,2311, criteria of

knowledge and experience with the criterion value of PV 0,1894 as well as the criteria of personality with a value of PV 0,1280. In the same way used to obtain the results of the evaluation based on the criteria for each alternative. But before setting the value of the evaluation criteria as the basis for later assessment, needs to be determined in advance whether the pairwise comparison done fairly consistent or not (inconsistency) and how to determine the ratio of consistency.

3.6. Consistency of Ratio

Determination consistency ratio begins with determining the weighted sum vector or maximum value of lambda. This can be done by multiplying the number of evaluation criteria in this case education criteria on the table the first column reciprocal matrix evaluation criteria with the value of the first column of the table in PV. In the same way used for columns of the second, third, fourth and fifth.Then summing the value or number of lines per line as follows:

λ = (4,5000 * 0,2311) + (4,5000 * 0,2621) + (5,5000 * 0,1894) + (5,5000 * 0,1894) + (8,0000 * 0,1280)
= 5,3269.

The next step is determining the value of Consistency Index (CI), and n is the size of the matrix are then retrieved the value of CI as follows:

CI = (λ – n) / (n - 1)
= (5,3296 – 5,0000) / (5,0000 – 1,0000)
= 0,0817.

The last one in calculation of AHP is counting Consistency Ratio. Consistency Ratio (CR) is the same with the Consistency Index (CI) divided by Random Index (RI). RI is determined based on a table of RI. Random Index is a direct function of the number of alternatives or systems that are being considered. Table 6 are presented below and are followed by a calculation of the end Consistency Ratio.

Table 6. Matrix Size and Random Index

Matrix Size	Random Index	Matrix Size	Random Index	Matrix Size	Random Index
1	0,00	6	1,24	11	1,51
2	0,00	7	1,32	12	1,48
3	0,58	8	1,41	13	1,56
4	0.09	9	1,45	14	1,57
5	1,12	10	1,49	15	1,59

Generally, CR = CI/RI with the size of the matrix (n) in this case 5 with RI = 1.12. In this case,

CR = CI/RI
= 0,0817/0,0730
= 1.12.

The results of calculation of AHP to the criteria can be seen on Table 7 and Table 8.

Table 7. Reciprocal Matrix

Reciprocal Matrix (RM)					
Crt	Edu	Abl	Knw	Exp	Psn
Edu	1,0000	2,0000	1,0000	2,0000	1,0000
Abl	0,5000	1,0000	1,0000	1,0000	2,0000
Knw	1,0000	1,0000	1,0000	2,0000	1,0000
Exp	0,5000	1,0000	0,5000	1,0000	2,0000
Psn	1,0000	0,5000	1,0000	0,5000	1,0000
Sum	4,5000	4,5000	5,5000	5,5000	8,0000

Table 8. Calculation of Normalized Matrix

Normalized Matrix (NM)						Sum	PV
Edu	0,2222	0,4444	0,1818	0,1818	0,1250	1,1553	0,2311
Abl	0,1111	0,2222	0,3636	0,3636	0,2500	1,3106	0,2621
Knw	0,2222	0,1111	0,1818	0,1818	0,2500	0,9470	0,1894
Exp	0,2222	0,1111	0,1818	0,1818	0,2500	0,9470	0,1894
Psn	0,2222	0,1111	0,0909	0,0909	0,1250	0,6402	0,1280
Sum	1,0000	1,0000	1,0000	1,0000	1,0000	5,0000	1,0000
λ=	5,3269	-	-	λ=Weighted Sum Vector			
CI=	0,0817	N	5	CI=Consistency Index			
CR=	0,0730	-	-	CR=Consistency Ratio			

The value of CR shown less consistent comparison is done, while the value of the CR the lower indicate the more consistent comparison is done. Normally, if the CR is 0.10 or less, then the comparisons carried out the decision makers including the value of the results of the comparison to base decision-making on a relative basis is said to be consistent.

4. Conclusion

Based on the calculations that have been done in which the value of the CR for the criteria indicate values that are smaller than 1, then it can be inferred that the pairwise comparison done by decision makers is consistent, so that results of value evaluation of criteria can be accepted.

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