Analysis and Design Decision Support System of New English Teacher by Using Analytical Hierarchy Process (AHP) in EF English First Bali

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***Abstract*—The purpose of this study is to develop a decision support system to decide the best new English Teacher. The methods used are method of analysis, design method, and literature study. The learning method that is done is to survey the running company system, conduct interview with HRD, and analysis the survey. In literature study conducted by looking for references sources related to the research undertaken. The design is data management subsystem, knowledge base model and user interface. The results achieved are the creation of an application decision support system that can be used to select the most appropriate English teacher and in accordance with the criteria required. This system helps support the decision-making process for new English teacher.**

***Keywords*—system, decision, *analytical hierarchy process* (AHP)**

I. Introduction

English First Education is a private English education institution founded by Bertil Hult in Sweden in 1965. It has branches in 51 countries including Indonesia. One of the branches located in Bali is Englishtown, an online English language school that offers English learning service system through internet (E-learning) for adult age. As part of EF Education First, Englishtown has assisted more than 1.200 companies and has approximately 15 million users.

To become a new English teacher in Englishtown as an international company, certainly has the criteria that must be achieved. During this time the HRD team at Englishtown Bali only use candidate tracking system by using workable website (http://www.workable.com/) and selecting new English teacher manually. It is certainly time-consuming to select new employee.

Given the recruitment process for the company is very important to support the company's success in achieving the goal, it is necessary a decision support system that is able to select new and competent qualified educators.

The method used in the recruitment support system is the Analytical Hierarchy Process (AHP). The AHP method is chosen because the AHP method is a decision support model model where the main equipment is a functional hierarchy with the main input being human perception.

II. Literature Review

A. Analytical Hierarchy Process (AHP)

AHP is a functional hierarchy with the main input of human perception. With hierarchy, a complex and unstructured problem solved into groups is organized into a hierarchical form. The AHP model uses human perceptions that are considered experts as the main input. Expert criterion here does not mean that the person must be genius, smart, hold a doctorate and so on but rather refers to people who understand the true problems raised feel the consequences of a problem or have an interest in the problem. (Suryadi, 1988)

B. Basic Principles of Analytical Hierarchy Process

In solving the problems with AHP there are several principles that must be understood, among them are as follows:

- Decomposition (making hierarchy), Complex systems can be understood by separating them into smaller, easier-to-understand elements.
- Comparative judgment (criteria and alternative assessment). Criteria and alternatives are done by pairwise comparisons. According to Saaty (1988), for various issues, the scale 1 to 9 is the best scale for expressing opinions. The value and definition of qualitative opinion and the comparison scale of Saaty can be calculated using the analytical table 1 below.

TABLE I. Fundamental Scale

Intensity of Importance	Note
1	Both elements are equally important
3	One element is slightly more important than the other
5	One element is more important than the other
7	One element is clearly more absolutely essential than other elements
9	One element is absolutely essential from other elements
2,4,6,8	Values between two values of adjacent considerations

- Synthesis of priority, determining the priority of the criterion elements can be viewed as the weight / contribution of that element to the purpose of decision making. AHP performs elemental priority analysis with

a pairwise coupling method between two elements so that all elements are included. This priority is determined based on the views of experts and stakeholders on decision making, either directly (in discussion) or indirectly (questionnaire).

- Logical Consistency (consistency logical), Consistency has two meanings. First, similar objects can be grouped according to uniformity and relevance. Second, it concerns the level of relationship between objects based on certain criteria. (Kosasi, Sandy.2002)

C. Analytical Hierarchy Process Procedure

In general the steps to be taken in using AHP for solving a problem are as follows:

1) Define the problem and determine the desired solution, then compile the hierarchy of problems encountered.

2) Define the priority of the element

a) The first step in defining the priority of the elements is to make a pair comparison, ie comparing the elements in pairs according to given criteria

b) A pairwise comparison matrix is filled with numbers to represent the relative importance of an element against other elements.

3) Synthesis

Considerations for paired comparisons are synthesized to obtain overall priority. The things done in this step are:

a) Sums up the values of each column in the matrix

b) Divide each value of the column by the corresponding column total to obtain the normalization of the matrix

c) Sums up the values of each row and divides it by the number of elements to get the average value.

4) Measuring Consistency

In making decisions, it is important to know how good the consistency is because we do not want decisions based on consideration with low consistency. The things done in this ledge are:

a) Multiply each value in the first column with the relative priority of the first element, the value in the second column with the relative priority of the second element, and so on.

b) Amount each row

c) The result of the sum of rows divided by the relevant relative priority element

d) Sum it up with the number of elements available, the result is called max.

5) Calculate Consistency Index (CI) with the formula: $CI = (\lambda\, maks - n)/n$where n = number of elements

6) Calculate Consistency Ratio by the formula: $CI = CI/IR$ where CI = Consistency Index, CR = Consistency Ratio and IR = Indeks Random Consistency

7) Check the consistency of the hierarchy. If the value is more than 10%, then the judgment data assessment should be improved. However, if the Consistency Ratio (CI / CR) is less than or equal to 0.1, then the calculation result can be stated correctly. (Kusrini, 2007)

D. General Terms

The general requirements for the acceptance of a new educator in English First Bali according to the HRD team are:

1) Applicants are American, British, Canadian, Australian, New Zealand, Ireland

2) Willing to work in Bali

3) Aged 25 - 50 years

4) Have a TEFL (Teaching English as a Foreign Language) certificate with a minimum score of 40

5) Has a Bachelor's degree diploma from any department

III. Analysis and Design

A. Current System Process Flow

The current process flow is as follows.

1) Applicants look at vacancies on vacancy website

2) Applicants make the process of applying online through workable links on the website (required: first name, last name, address, photo, resume, question list)

3) The HRD team sees candidate data on the workable, if the candidate meets the requirements, the candidate will conduct the interview process by emailing the candidate, otherwise the candidate will be rejected in the email manner.

4) If successful applicants conduct interviews, the recruitment moves the applicant step from step interview to step accepted in the system, then emails the applicant that the applicant is accepted or rejected.

B. Pieces Analysis

The analysis of pieces of this problem is as follows.

TABLE II. Pieces Analysis

Indicator	Analysis Result
Performance	The system is able to complete the process of teacher acceptance selection quickly in accordance with the target set by the company
Information	Users get information about applicant data accurately and relevant as expected
Economy	Reduce expenses in terms of paid fees charged every month
Control	Security of the system either because to access the user or admin view must go through the stage of authentication first
Efficiency	The system is designed to have features that allow users to perform the recruitment process with a user friendly display
Service	The system is expected to improve the better service in the process of recruiting teacher recruitment process

C. *Expected Process Flow*

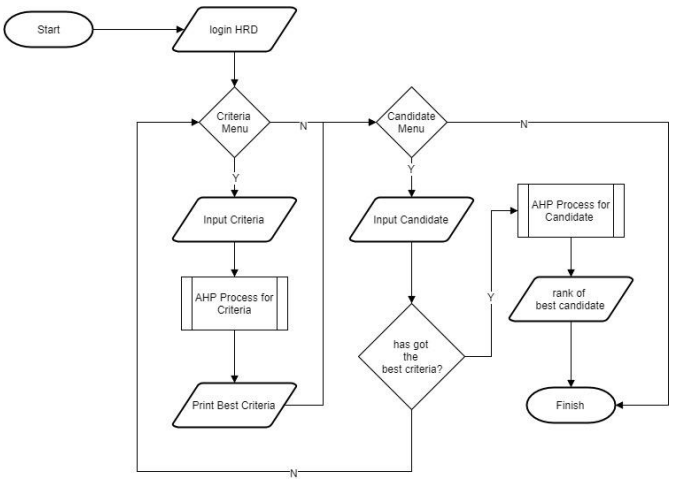

Fig 1. Flowchart System

The expected process flow is started from the login HRD (admin side) and admin can choose Criteria menu or Candidate menu. In the Criteria menu, admins enter existing criteria and include pair comparisons. After that, admins can enter candidate data. And do the candidate process. The expected end result is a candidate table of candidates.

D. *Designing User Interface*

Here is the design of the system user interface. Figure Fig 2. is a comparative analysis of criteria that have been entered and already through the process of AHP method.

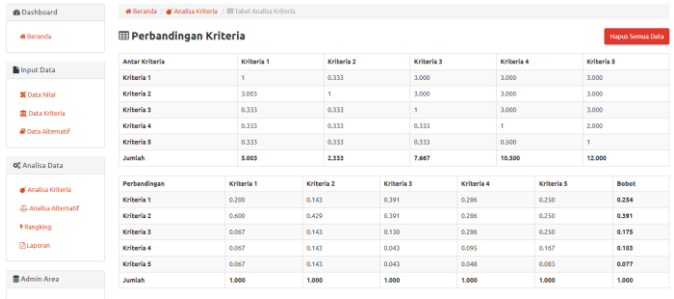

Fig 2. Display Result of Criteria Weighted Analysis

IV. RESULT

The candidate criteria already mentioned in II.D will be given weighting by Analytical Hierarchy Process method as below.

1) Define the problem and determine the desired solution, then compile the hierarchy of problems encountered.

The criteria mentioned in section II are 5, namely:

K1: Nationality of Applicants
K2: Availability of work in Bali
K3: Age
K4: TEFL Certificate
K5: Bachelor's Degree

The problem is determining which criteria are the most important of the criteria already mentioned. Here is a hierarchy of the purpose of the process of recruitment of new educators who serve as the basis of the criteria that must be included in the decision support system, and can be seen in the following figure.

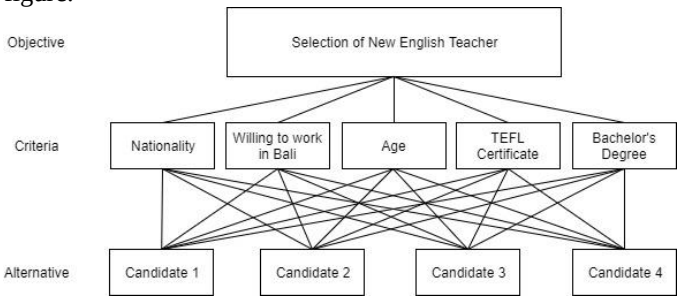

Fig 3. Hierarchy Purpose of New Teacher Receiving Process

2) Define the priority of the element

After the preparation of the process goal hierarchy, then the next step is to do a comparison matrix Here is the comparison matrix for each of the criteria. Then each column is summed to calculate normalization at a later stage.

TABLE III. COMPARATIVE MATRIX

	K1	K2	K3	K4	K5
K1	1.00	0.33	3.00	3.00	3.00
K2	3.00	1.00	3.00	3.00	3.00
K3	0.33	0.33	1.00	3.00	3.00
K4	0.33	0.33	0.33	1.00	2.00
K5	0.33	0.33	0.33	0.50	1.00
Sum	4.99	2.32	7.66	10.50	12.00

3) Determining the Priority Weight Scale

After obtaining the comparison matrix table, next is to normalize by dividing each value of the column by the total of the corresponding columns. Then add up the values of each row and divide by the number of elements to get the priority vector.

TABLE IV. NORMALIZATION AND PRIORITY

	K1	K2	K3	K4	K5	SUM	PRIORITY VECTOR
K1	0.20	0.14	0.39	0.29	0.25	1.27	0.25
K2	0.60	0.43	0.39	0.29	0.25	1.96	0.39
K3	0.07	0.14	0.13	0.29	0.25	0.87	0.17
K4	0.07	0.14	0.04	0.10	0.17	0.51	0.10

K5	0.07	0.14	0.04	0.05	0.08	0.38	0.08
Sum	1	1	1	1	1	5.00	

4) Measuring Consistency

Then the calculation is continued by multiplying each value in the first column with the relative priority of the first element, the value of the second element with the relative priority of the second element, and so on. Then number each line. The result of the sum of rows divided by the relevant relative priority element. Sum up the above by the number of elements that the result is called I max.

TABLE V. COMPARISON OF TIMES AND VECTOR PRIORITIES

	K1	K2	K3	K4	K5	PV	Times	HK/PV
K1	1.00	0.33	3.00	3.00	3.00	0.25	1.45	5.69
K2	3.00	1.00	3.00	3.00	3.00	0.39	2.22	5.66
K3	0.33	0.33	1.00	3.00	3.00	0.17	0.93	5.29
K4	0.33	0.33	0.33	1.00	2.00	0.10	0.53	5.13
K5	0.33	0.33	0.33	0.50	1.00	0.08	0.40	5.22

Then calculate CI, RI and CR with the formula in chapter II.C

TABLE VI. CONSISTENCY TABLE

λ	CI	RI	CR
5.397729618	0.099432	1.188	0.083697

Because CR Criteria is less than 0.1 then the value of comparison is considered consistent. From the results of vector priority obtained then the main conclusion is the aspect of K2 is the availability of work in bali. The availability of work in Bali is a priority priority vector 0.39, followed by Nationality of applicants with a priority vector of 0.25. Then the third rank is Age with priority vector 0.17, next is TEFL Certificate and the last is diploma.

V. CONCLUSION

From the results of the Analysis and Design of Decision Support System of New Educators with AHP Method on EF Bali, has successfully developed a SPK that helps support the decision making process for the selection of the best educators from the list of candidates. By utilizing this system, it is hoped that the process of recruitment of new educators will be easier and more objective. Besides, the output of this system produces the right educator rank according to the criteria set.

REFERENCES

[1] Arvita, Y. Analysis and Design of Decision Support System Determination of Loans at Bank XYZ in Media Sisfo Vol.11, No.1, pp. 787-804, April 2017

[2] Hermawan, J. Building a Decision Support System. Yogyakarta: Andi. 2005

[3] Kartawiguna, D. Adityo P., Y., Sutiono M., and Roesly, H. Analysis and Design of Decision Support System Selection of Suppliers Best Supplier Available with Analytical Hierarchy Process (AHP) Method: Case Study of Power Division PT Guna Elektro in ComTech Vol. 3 No 2, pp. 774-787, December 2012

[4] Manurung, P. Decision Support System of Scholarship Selection Selection with AHP and Topsis Method (Case Study: FMIPA USU). Medan: University of North Sumatra.

[5] Maricar, M. A., Wahyudin, W. and Sudarma, M. Decision Support System of the Employees Acceptance using Analytical Hierarchy Process (AHP) and Multi Factor Evaluation Process (MFEP) in International Journal of Engineering and Emerging Technology Vol.1 No. 1, pp.48-54, July 2016

[6] Saaty, T. L. 2008. Decision Making with the Analytic Hierarchy Process. Int. J. Services Sciences, 1(1): 83-98

[7] Sri Hartati and Adi Nugroho. Decision Support System Based on AHP for Determination of Land Use Adaptation (Case Study: Semarang Regency) Jurnal Informatika, July 2012; Vol. 6 No. 2: p. 630-641

[8] Suaryadi, Kadarsah and Ramadani, M. A. 2002. Decision Support System: A Structural Idealization and Implementation Discourse. Bandung. Youth Rosdakarya

[9] Thomas, S. L. and Luis, Vargas G. “Models, Methods, Concepts & Applications of The Analytic Hierarchy Process,”. International Series in Operations Research & Management Science. Second Edition. 2012.

[10] Turban, Efraim dan Aronson, J.E. 2004. Decision Support Systems and Intelligent Systems (11 ed). Yogyakarta: Andi Publisher