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Is The Analytical Hierarchy Process (AHP) Model Suitable For Determining The Priority Scale For The Utilization Of School Operational Assistance (BOS) Funds In Indonesian Vocational High Schools (SMK)? Worthy!

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Abstract

The purpose of this research was to see whether AHP model could assist the SMK BOS Management Team, which includes principals, treasurers, teachers, parents, and committees, determine the priority scale and budget ceiling for the use of SMK BOS funds. There were numerous anomalies in the use of BOS funds, according to the conclusions of the Financial Audit Board of the Republic of Indonesia (BPK), the most prominent of which was the absence of planning and involvement of the whole BOS management team. In this study, the AHP model was utilized as a solution for involving all members of the BOS Management Team in deciding the priority scale for the usage of SMK BOS funding. The research was conducted in 31 Indonesian schools across five provinces, with baseline data collected in 2020 before and after the AHP model was implemented. Based on the consistency ratio test and t paired t test with consistent and statistically different results before and after employing AHP, the results demonstrated that the AHP model was feasable to use.

Keywords— AHP, BOS SMK, Priority Scale

I. INTRODUCTION

The impact of education fund investment allocation on the growth of Indonesia's GDP (Gross Domestic Product) is negligible. According to the Summary of Indonesia's Education Sector Assessment, education investment spending has a 3.6 percent influence on GDP (LaRocque, 2015). It was also stated that, according to international norms, the minimal contribution of education investment spending to GDP is 6%. Some of these issues suggest that Indonesia is not making the best use of its education budget. The allocation of 20% of the State Revenue and Expenditure Budget (APBN) to education has had little influence on enhancing educational quality in Indonesia (Ningsih, N. H., Siwi, N. Y., Dana, D., Umum, A., & Khusus, 2019). School Operational Assistance (BOS) could be described as a result of poor money management in various areas (Oebadillah, 2019). School workers, the education office, and school-working groups were all involved in the misappropriation and misuse of BOS funding. This is supported by the conclusions of the Financial Audit Board of the Republic of Indonesia (BPK) in numerous provinces about the use of 2019 BOS funds. The incompatibility of spending implementation with regulated aims, the principal's dominance in defining the planning and spending of BOS funds, and the planning's weakness due to the little input of committee members and connected parties are all flaws in BOS administration (Bahri, S. A., Kurnaesih., & Karlina, 2019). The finding of inefficiencies in the use of BOS funds in Vocational Schools is due to the fact that schools are oriented toward budget absorption, which also leads to the possibility of fraud in

implementation and accountability. The probable usage of BOS funding in SMK was further outlined as being dominated by the purchase of practicum materials and consumables. Because there is a risk of overspending the budget, there is a high risk of fraud (Baedhowi, Martono, T., Wardani, D. K., Totalia, S. A., Laksono, P. W., Triyanto, & Octaria, 2017).

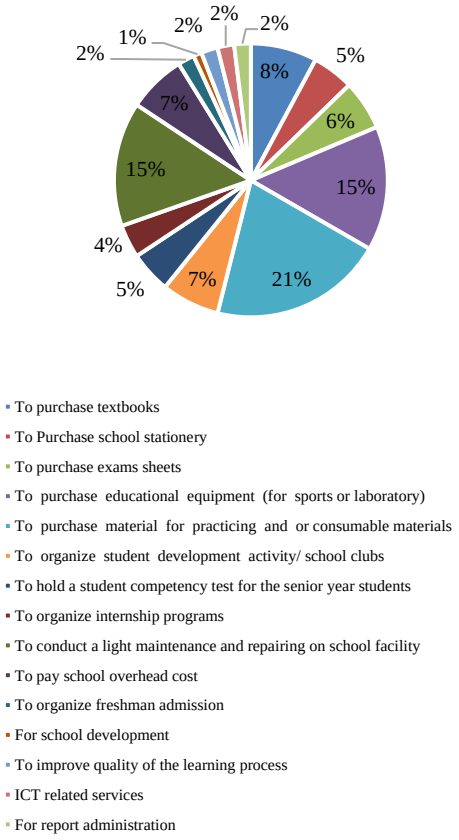

Figure 1. Profile of the Use of Vocational High School BOS Funds in Indonesia
Source: (Baedhowi et al., 2017).

The planning process or BOS fund application from the school's internal parties are common problems and obstacles that schools experience while using BOS funds. The primary issues include a lack of planning and participation of the school ecosystem in the development of plans, planning documents, and a model for determining the priority scale of program and activity plans based on the school's BOS ceiling. Second, impediments to BOS implementation or expenditure are frequently encountered in the control of the use of public finances, which is governed by highly specific laws. Third, there are various BOS applications that refer to spending details; additionally, the system has a different format from one system to the next, which refers to the 8 National Education Standards (SNP) of the Ministry of Education and Culture and refers to the format of spending on goods and services referring to the Ministry of Internal Affairs standards for adjusting the 12 BOS targets to these systems. Fourth, the school perceives the present supervision to be prone to finding fault and blaming the school due to a lack of mentoring (Totalia, n.d.). This study involves the entire boss management team in determining the priority scale of BOS SMK targets using the AHP model. As a result, the purpose of this study is to see whether AHP model can be used to estimate the priority scale of the SMK BOS targets.

II. RESEARCH METHOD

R&D (Borg, W. R., & Gall, 1983) combined with limited testing, as modified by Plomp, is the research approach (Plomp, 1997) and Educational Design research, (Plomp, T., 2007). The stages of the development model are 1) conceptual, i.e., a model with analytical properties that demonstrates, analyzes, and explains the link between product components; 2) theoretical, that is, a description of the theory in the form of a framework of thought that is supported by empirical evidence; 3) hypothetical, that is a model to which practitioners and experts have contributed through focus group discussions, and 4) final, that is the model's empirical testing is complete.
A survey questionnaire was given to stakeholders with an interest in the management of the Regular BOS of SMK, including the Principal, Treasurer, Teachers, Committees, Parents, and Guardians, for the purposes of needs analysis. Several questions about planning, utilization, and evaluation/reporting are included in this survey. The questionnaire to stakeholders is evaluated using a Likert scale with a value ranging from 1 to 9.
The populations in this research were all SMK in Indonesia, which included 13,710 public and private schools. The population was divided

into three clusters based on the Regular BOS disbursement data for 2020. Cluster 1 is an SMK with little or minimum absorption, cluster 2 has medium absorption, and cluster 3 has maximal absorption, according to the measurements. Based on clusters and their administration for each cluster, samples were taken proportionally from Central Java, East Java, South Kalimantan, Bali, and Nusa Tenggara Barat (NTB).

An iteration analysis was performed using BOS 2020 budget absorption data to determine the three clusters that would be used as samples in the research. To obtain the best and most precise cluster results, the iteration analysis process was repeated three times, as shown as Table 1:

Table 1. Iteration History

Iteration	Change in Cluster Centers		
	1	2	3
1	1.055	.357	2.350
2	.000	.168	.486
3	.000	.000	.000

The standardized z-score value generated from the average value of each cluster with the fundamental reference of BOS Channels in each City/Regency used to determine the cluster based on the iteration analysis results. Table 2 shows how this works:

Table 2. *Final Cluster Centers*

	Cluster		
	1	2	3
Zscore (sasaran)	-1.08080	.23154	1.28685
Zscore (penerima)	-1.09945	.25353	1.25506
Zscore (sek_lapor)	-1.09945	.25353	1.25506
Zscore (salur_1)	-1.03173	.08692	1.63075
Zscore (cair_1)	-1.06322	.11555	1.60260
Zscore (salur_2)	-1.02051	.06324	1.68120
Zscore (cair_2)	-1.02051	.06324	1.68120
Zscore (salur_4)	-.99878	.03620	1.72250
Zscore (cair_3)	-.99878	.03620	1.72250
Zscore (total_salur)	-1.02166	.06568	1.67602
Zscore (total_cair)	-1.03447	.07549	1.67006

According to the results of the standardized Z-Score study, a negative value acquired by a cluster group indicates that the cluster value is below the average, while a positive value received by the cluster group indicates that the cluster value is above the average. Cluster 1 has a negative value, indicating that the cluster's distribution and absorption capacity of Regular BOS SMK is lower than the average, while cluster 2 has a smaller mean difference value compared to cluster 3 and is larger than cluster 1, and cluster 3 has the highest average distribution and absorption capacity of Regular BOS in SMK. As a result, the sample cluster is divided into three groups in this study.

A feasibility test was utilized to address the study questions, as proposed by (Monica, 2017; Plomp, T., 2007; Sugiyono, 2012), which consisted of three tests: Validity Test, Practicality Test, and Effectiveness Test. Experts performed the validity test in this research, including mathematicians, statisticians, AHP experts, and education finance experts. The BOS SMK management team (principals, treasurers, teachers, parents, and committees), which includes schools in three study clusters, is used in the Practicality Test. The Consistency Ratio (CR) value is used in the effectiveness test, which is calculated using Expert Choice software By Saaty. The CR values that is consistent and practical to utilize, according to (Saaty, T. L., & Vargas, 2012), is less than 0.10. The paired t test was also utilized to evaluate if there was a difference in the BOS management team's choice of priority scale before and after applying the AHP model.

III.RESULTS AND DISCUSSION

Model AHP BOS SMK

The AHP method is a theory of measurement. The four types of measuring scales are nominal, original, interval, and ratio scales, which are normally employed in that order. It is possible to classify a higher scale as a lower scale, but not the other way around. Monthly income can be categorized into income levels (high, medium, low) or nominal categories on a ratio scale (high, medium, poor). Data with a higher scale could not be obtained if the data supplied at the time of assessment was categorical or ordinal. The AHP addresses some of these difficulties (Saaty, 2007). The AHP is used to calculate the ratio scale from several discrete or continuous pairwise comparisons. Pairwise comparisons can be made using actual or relative assessments of like, interests, or feelings. As a result, this method is particularly useful for creating a ratio scale for items that were previously difficult to measure, such as opinions, attitudes, behaviors, and beliefs (Saaty, 2007). The construction of a hierarchical structure or network of problems to be investigated is the first step in this technique. The hierarchy will take into account the main objectives, criteria, sub-criteria, and alternatives. Pairwise comparisons are used to determine relationships within the structure. As a result of this pairwise comparison, which yields a matrix, the ratio scale is generated in terms of the major vector eigenvalues or eigenfunctions. The matrix's inverse, aij = 1/aji, can be both positive and negative (Saaty, T. L., & Vargas, 2012). AHP simplifies and accelerates the decision-making process by separating an issue into sections, organizing them in a hierarchical style, and assigning values to them (Saaty, T. L., & Vargas, 2012). A decision-making framework is a set of guidelines that guides you through the process of deciding Combine these factors with a numerical assessment of the variable's relevance to determine which variable takes precedence and works to influence the situation's outcome. As it grows, the AHP may solve complex or difficult problems with a variety of elements or criteria. The complexity is exacerbated by the unclear problem structure, uncertainty in decision-making perceptions, and uncertainty in the availability or even absence of adequate statistical data (Harker, P. T., & Vargas, 1987). There are times when perceived and observed decision challenges must be handled as soon as possible, yet the variations are so complex that the data can only be documented qualitatively, that is, based on observation, experience, and intuition. When using the AHP technique, other models may be used in the decision-making process, especially when looking at individual decision-makers.

When using AHP to select priority targets for BOS SMK, 5 decision makers are given 12 options to choose from. Weighing is required for this, and the processes are as follows:

a. Using Mathematical Formulas as the foundation for creating Microsoft Excel-based methods to determine the priority of regular BOS targets.

1. Using supporting indicators/criteria, create a hierarchical structure for goals.
2. Users/stakeholders make pairwise comparisons based on actual circumstances. For each n criterion, the number of comparisons are:

$$C_2^n = \frac{n!}{2!(n-2)!} \quad (1)$$

Because there are have requirements (n) = 12, So:

$$C_2^{12} = \frac{12!}{2!(12-2)!} = 66 \quad (2)$$

Matrix of comparison:

$$A = \begin{bmatrix} a_{11} & a_{12} & a_{13} & \cdots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \cdots & a_{2n} \\ a_{31} & a_{32} & a_{33} & \cdots & a_{3n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & a_{n3} & \cdots & a_{nn} \end{bmatrix}$$

$a_{ij} = 1$; untuk $i = j$

$$a_{ij} = \frac{1}{a_{ji}} \quad ; \text{untuk } i < j$$

3. Analytical Hierarchy Process Data Analysis

a) Normalization of comparison matrix

$$B = \begin{bmatrix} b_{11} & b_{12} & b_{13} & \cdots & b_{1n} \\ b_{21} & b_{22} & b_{22} & \cdots & b_{22} \\ b_{31} & b_{32} & b_{33} & \cdots & b_{3n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ b_{n1} & b_{n2} & b_{n3} & \cdots & b_{nn} \end{bmatrix} \quad (4)$$

$$b_{ij} = \frac{a_{ij}}{\sum_{i=1}^{n} a_{ij}} \quad (5)$$

b) Priority Vektor

$$V = \begin{bmatrix} v_1 \\ v_2 \\ v_3 \\ \vdots \\ v_n \end{bmatrix} \quad (6)$$

$$v_i = \frac{\sum_{j=1}^{n} b_{ij}}{n} \quad (7)$$

c) Lambda value

$$H = BV = \begin{bmatrix} h_1 \\ h_2 \\ h_3 \\ \vdots \\ h_n \end{bmatrix} \quad (8)$$

$$\lambda = \frac{1}{n} \sum_{i=1}^{n} \frac{h_i}{v_i} \quad (9)$$

d) Consistency Index (CI)

$$CI = \frac{\lambda - n}{n - 1} \quad (10)$$

e) Consistency Ratio (CR)

$$CR = \frac{CI}{RI} \quad (11)$$

The table yields the Random Index (RI), which in this case is RI=1.48 for n=12.

f) Final result

If CR ≤ 0.1, the priority scale determination is consistent.

b. Create a hypothetical model (BOS SMK AHP Tree)

After determining the stages, criteria, and weighting, a hypothetical model was created in this research based on the technical instructions for the implementation of BOS SMK issued by the Ministry of Education and Culture of the Republic of Indonesia by involving the BOS Management Team, which included the principal, treasurer, teachers, parents, and the committee to select the priority scale for the use of BOS funds into 12 targets, as shown in Figure 2.

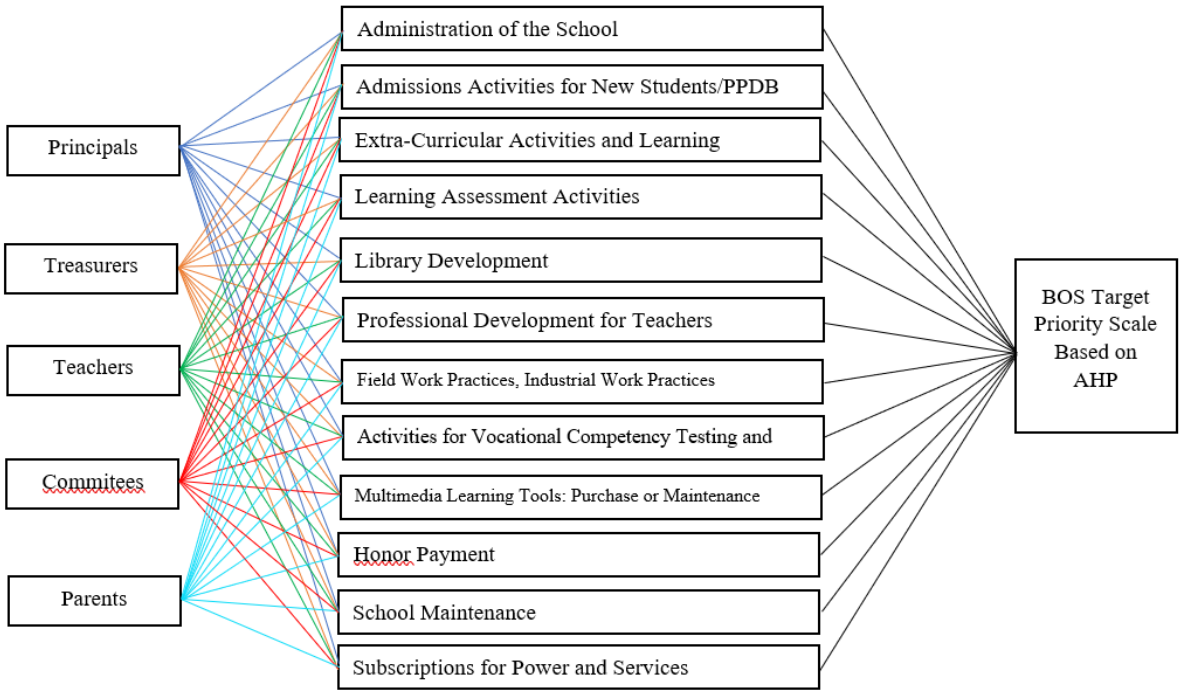

Figure 2. Tree Of AHP BOS SMK

IV. RESULT AND DISCUSSION

The following are the results of the AHP model's feasibility test:

a. Validity test

The validators of Mathematics and Statistics experts, AHP Experts, Material Content Experts, and System Substances were used, and the three experts produced positive results, indicating that the AHP BOS model was viable to apply.

b. Practicality Test

The figure 3 below shows user responses to the usage of the AHP model to plan the BOS Regular SMK budget ceiling:

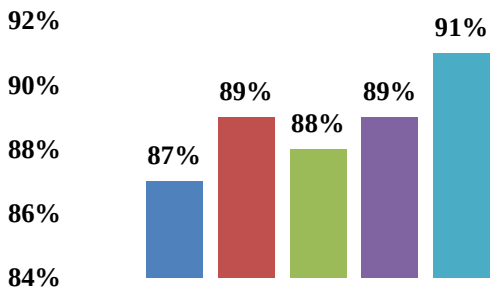

Figure 4. The BOS SMK Management Team's Practical Test Results

Based on the picture above, it can be seen that the AHP model can be used to plan the use of SMK BOS funds, identify the priority scale of SMK BOS aims, and help the SMK BOS Management team perform better. This is demonstrated by the 91 percent utility rating given by AHP model users. Other characteristics, such as simplicity, clarity, convenience, and attractiveness, were also praised by the BOS management team. The BOS Management Team considers the AHP approach for planning the utilization of BOS money to establish the priority scale of BOS targets to be simple and easy to learn or use. The researchers conclude that the AHP model for planning the use of BOS money is viable to adopt and apply in every SMK based on the findings above.

Validity Test

Consistency Ratio (CR)

Inconsistent priority values (comparison data between a pair of criteria) can be filled in by users of the AHP approach. If this occurs, the AHP method's solution is not the best, and it should be checked by measuring its Consistency Ratio (CR). It must be accompanied with a Consistency Index calculation to determine the level of consistency

of user input, so that it becomes a mandatory prerequisite for every AHP method development. The findings of the consistency index are compared to the Random Consistency Index (RI) for each of the n objects. The degree of consistency is good when CR ≤ 0.10 (10%). If the CR value is greater than 0.10, it indicates that the comparison scale for a pair of criteria is not consistent. If this occurs, it is almost probable that the AHP method's solution will be meaningless to the user. The researcher employed Saaty's expert decision software to determine the Consistency Ratio. The CR value of each respondent was determined to be 0.04, school treasurer 0.01, teachers 0.02, parents 0.03, and the committee 0.02 based on the findings of the Consistency Ratio (CR) calculation partially or simultaneously utilizing the expert choice application described above. Because all respondents' CR values are less than 0.1, the target filling carried out by respondents can be regarded to be consistent because they meet the 0.1 criteria.

BOS Management Team's Average Percentage

By comparing before using the AHP BOS SMK model (in 2020) and after using the AHP BOS SMK model (in 2021), the average percentage of the SMK BOS Management Team is taken from the priority preferences for selecting the BOS Regular SMK target (in 2021). It can be explained in the following graphic, which is based on the average priority decisions of the full BOS Management Team from all sample schools:

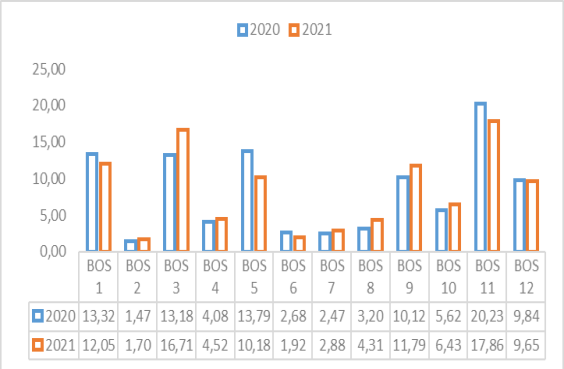

Figure 5. Differences in BOS SMK BOS Management Team priority preferences before and after applying the AHP BOS Model

According to Figure 5, there has been a movement in the priority choices of target choices between before and after utilizing the AHP BOS SMK model. The table below provides more information:

Table 3. Differences in Priority Scale Options before and after using the AHP BOS SMK model

No	BOS Fund Allocation Targets: 12	Order of allocation targets per fiscal year	
		2020	2021
1	Library Development	3	3
2	Admissions Activities for New Students/PPDB	12	12
3	Extra-Curricular Activities and Learning	4	2
4	Learning Assessment Activities	8	8
5	Pengelolaan Sekolah	2	5
6	Professional Development for Teachers	10	11
7	Field Work Practices, Industrial Work Practices	11	10
8	Activities for Vocational Competency Testing and Certification	9	9
9	Multimedia Learning Tools: Purchase or Maintenance	5	4
10	Honor Payment	7	7
11	School Maintenance	1	1
12	Subscriptions for Power and Services	6	6

Table 3 shows the shift in target selection in the learning evaluation activity targets from priority number 4 to priority number 2, as well as the shift in target selection in the school management target from priority number 2 to priority number 5. In addition, the target for

teacher professional development was moved to priority sequence number 11 from priority sequence number 10, and the targets for industrial work practices and field work practices were swapped (PKL). From priority number 5 to priority number 4, purchase or maintain learning multimedia tools. These results indicate that by incorporating the entire smk boss management team in the boss ahp model, the priority order may be shifted.

T-Paired Simple T Test Difference Test

The following assumptions were developed based on the average priority of the 12 BOS target selections made by the 5 BOS Management Teams before and after utilizing the AHP BOS SMK model:

H0 : The BOS Management Team's selection of BOS targets differs significantly before and after utilizing AHP BOS.

H1 : There is no discernible difference in the BOS Management Team's choice of BOS targets before and after utilizing AHP BOS.

The following criteria for hypothesis testing are:

T count compared to T table

If t count < t table, then H0 is accepted and H1 is rejected.

If t count > t table, then H0 is rejected and H1 is accepted.

Probability Value

If the probability value is > 0.05, then H0 is accepted and H1 is rejected.

If the probability value < 0.05, then H0 is Rejected and H1 is Accepted.

The following results were obtained as a result of data processing using the SPSS 23 program:

Table 4. Paired Samples Test

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	SebelumBOSAHP - SesudahBOSAHP	.00000	1.86908	.53956	-1.18756	1.18756	.000	11	1.000

The following judgments can be taken based on the data processing results shown in Table 4 above:

According to the t test, H0 is accepted, indicating that there is a substantial difference in the BOS Management Team's choice of BOS targets before and after implementing AHP BOS. On the 11th df, t count (0.000) is smaller than t table (2.200983).

Based on the probability value, H0 is accepted, implying that the BOS Management Team's choice of BOS targets before and after adopting AHP BOS differs significantly. If the probability value of 1,000 is larger than 0.05, the condition is met.

V. CONCLUSION

Based on the research and feasibility tests described above, it can be concluded that using the BOS SMK AHP Model to determine priority targets and BOS SMK budget ceilings is feasible, and that the BOS SMK AHP Model meets the eligibility criteria through validity, practicality, and effectiveness tests. Is it possible to apply the AHP model to identify the priority scale of SMK BOS targets and maximize the role and involvement of the whole SMK BOS management team? Yes!

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