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Comparing SAW and CPI Method in Decisions Systems Support to Evaluate Teachers Performance

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Abstract

At educational institutions like Junior High School, Human Resources especially teachers determines the quality of the school. To determine Junior High School have good quality teachers, then the best teacher selection is needed to spur the teacher's performance. However, the best teacher selection at Santa Maria 2 Junior High School which in Tangerang still doing direct observation and no method implements the calculation. To overcome those problems, then Decision Support System is needed to do a calculation and rating the teachers at ease and accurate. The proposed Decision Support System is using Simple Additive Weighting and Composite Performance Index methods, where's the calculation is obtained from each alternatives score and value weight from each criterion. The criteria in best teacher selection are reviewed from the absence aspect, professionalism, solidarity corps, personality, involving in activities from inside or outside school events. The final result from this calculation formed to ranking. The execution time of the SAW method has a faster average time of 0.489005 than the CPI method with an average time of 0.62258 seconds. On Relative Standard Deviation Testing CPI percentage greater than SAW with 3.90% and CPI 6.48%.

I. INTRODUCTION

In educational institutions such as Junior High Schools (SMP), Human Resources (HR), especially teachers, will determine the quality of the school. The teacher is a professional educator with the main task of educating, teaching, guiding, directing, training, assessing, and evaluating students in early childhood education through formal education, basic education, and secondary education [1].

The role and function of the teacher anonymously with ESMALIMDEF (*Educator*, *Manager*, *Administrator*, *Supervisor*, *Leader*, *Inovator*, *Motivator*, *Dinamissator*, *Evaluator* dan *Fasilitator*) [2]. To determine the school has a good quality of teachers, it is necessary to choose the best teacher to spur teacher performance. The selection of the best teachers is done by the assessment process and has a reward system for salary increases and rewards so that it can trigger the teacher to optimize his performance.

Santa Maria 2 Junior High School observed directly from the performance of the teachers. The process certainly takes a lot of time and produces inaccurate information and triggers the potential for subjective judgment. To get accurate and fast assessment results in accordance with the assessment criteria, we need a systematic automation process using information technology.

Therefore it is necessary to make a decision support system for selecting or determining the best teacher in order to save time in the assessment process and the results obtained can be objective, precise and accurate. The method that will be used is the Simple Additive Weighting (SAW) method and the Composite Performance Index (CPI).

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II. Literature Review

Exemplary teacher selection research using the CPI method in 2018 has been conducted and has the results of using a decision support system that can provide more effective results on the selection of model teachers and makes it easier to select exemplary teachers with a decision support system to minimize errors and the selection of exemplary teachers subjectively. [3]

Research selection of the best teachers with the SAW method in 2016 concluded that the system built can facilitate schools in determining the selection of the best teachers, by implementing a computerized system in selecting the best teachers, the data processing process will be more precise and reduce errors and by using a database, teacher data or the results of the assessment can be stored in it, so that if there is an error in inputting teacher data and assessment data, then the data can be corrected without having to re-enter. [4]

A comparative study of the SAW and CPI methods in determining employee salary increases in 2017 has the conclusion that the SAW and CPI methods produce the same value, but the CPI method requires more time, whereas the SAW method is faster than the CPI method, because CPI in data processing depends on amount of data processed. [5]

In this study will compare between the SAW and CPI methods to determine the best teacher performance.

III. Methods

Simple Additive Weighting *(*SAW) is one method that can be used to resolve Multiple Atribut Decision Making (MADM), MADM is a model of Multiple Criteria Decision Making (MCDM) [6]. MCDM itself is a decision making method to determine the best alternative from a number of alternatives based on certain criteria [7]. The SAW method is known as the combination of Linear Weighting or the simplest assessment technique and is often used as one of Multi Criteria Decision Making (MCDM) [8].

Metode SAW requires the decision matrix normalization process (X) to a scale that can be compared with all existing alternative ratings. The formula as follows:

$$r_{ij} = \begin{cases} \frac{x_{ij}}{max_i\, x_{ij}} & If\ j\ is\ the\ Benefit\ attribute \\ \frac{min_i\, x_{ij}}{x_{ij}} & If\ j\ is\ the\ Cost\ attribute \end{cases} \quad (1)$$

r_{ij} : Normalized performance rating of alternative A_i on the C_j attribute;
i : 1,2,…,m
j : 1,2,…,n
Max_i : Maximum value of each row and column
Min_i : Minimum value of each row and column
x_{ij} : Rows and columns of the matrix
Benefit : If the biggest value is the best
Cost : If the smallest value is the best

Preference value for each alternative (V_i) the formula as follows:

$$V_i = \sum_{j=1}^{n} w_j\, r_{ij} \quad (2)$$

V_i : Ranking for each alternative
W_j : Weight values for each criterion
r_{ij} : Normalized performance rating value

A greater V_i value indicates that the Ai alternative is preferred.The steps as follows:
1. Determine the criteria that will be used as a reference in making decisions, i.e. (C_i)
2. Determine the value of each alternative A_i on each predetermined C_j criterion, where the value of i = 1.2, ..., m and the value of j = 1.2, ..., n
3. Determine the weight value (W) for each criterion.
4. Make a decision matrix based on criteria (C_i), then normalize the matrix based on a formula that is adjusted to the type of attribute (profit attribute or cost attribute) to obtain a normalized matrix R.

The final result is obtained from each ranking process that is the sum of the multiplication of normalized matrix R with weight vector, so that the largest value is chosen as the best alternative (A_i) as the solution.

Metode *Composite Performance Index* (CPI) used to choose several alternatives. The CPI technique is a composite index (Composite Index) that can be used to determine ratings or rankings of various alternatives (i). [9] The index used to determine the rating or ranking of various alternative decisions based on several criteria from each alternative, is formulated as follows:
1. Normalization Matrix
   Normalization matrix by adjusting the Criteria Value with the specified Weight values

2. Determine Criteria Values:

$$A_{ij} = \frac{X_{ij(\text{MIN})}}{X_{ij}} x100 \text{ if the trend criterion is negative}$$
$$A_{ij} = \frac{X_{ij}}{X_{ij(\text{MIN})}} x100 \text{ if the trend criteria is positive} \quad (3)$$

3. Determine CPI Value:

$$I_i = \sum_{j=i}^{m} A_{ij}B_j; i = 1,2 \ldots, n \; dan \; j = 1,2, \ldots, m \quad (4)$$

A_{ij} : Alternative value i to criteria j
X_{ij} : The initial value of alternative i on criteria j
X_{ij} (min) : Alternative value i to criteria j
B_j : The weight of the criteria value to j
I_i : Composite index of criteria for alternative i

In this study the data used were Strada Santa Maria 2 teachers as many as 18 teachers as alternatives.

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Relative Standar Deviation (RSD) is a measure of relative accuracy method. [10] The formula as follows:

$$RSD = \frac{SD}{\bar{x}} \times 100\% \quad (5)$$

SD : Standard deviation of each method
$\bar{x}$: Average value of the end of each alternative

Where to get the value of Standard Deviation (s) use the following formula:

$$s = \sqrt{\frac{\sum_{i=1}^{n}(xi - \bar{x})^2}{n-1}} \quad (6)$$

s : Standard deviation
x_i : The value of x to -i
$\bar{x}$: Average Value
n : Sample size

IV. RESULTS

Criteria and weights used as a reference in this study that have been obtained from interviews with stakeholders are as follows:

TABLE I. All Criteria

Code	Criteria (C_i)	Weight (W_i)	Atribute
C1	Absence	4	Cost
C2	Professionality	5	Benefit
C3	Corps Solidarity	3	Benefit
C4	Personality	3	Benefit
C5	Involvement in school/outside school activities	2	Benefit

from the table I the evaluation criteria are determined by the principal based on the level of importance.

TABLE II. Absence Criteria (C1)

Absence	Value
>7	1
6-7	2
4-5	3
1-3	4
0	5

Table 2 is an assessment the teacher absence criteria. And for the assessment of professionalism criteria (C2) Corps Solidarity (C3) and personality (C4) are assessed directly by stakeholders based on daily performance (it's confidential) with a range of values 1-5.

TABLE III. Involvement in school/outside school activities Criteria (C5)

Involvement in school/ outside school activities	Nilai
1-2	1
3-4	2
5-6	3
7-8	4
>8	5

Table 3 is an assessment criteria for the involvement of both inside and outside the school activities.

TABLE IV. Alternative Assessment Criteria

Alternative	C1	C2	C3	C4	C5
A01	5.00	4.33	4.25	4.275333333	5.00
A02	5.00	3.83	3.88	4.092666667	4.00
A03	5.00	3.83	4.00	4.568000000	5.00
A04	5.00	3.67	4.00	4.104666667	2.00
A05	5.00	3.70	4.26	4.445333333	3.00
A06	5.00	3.67	4.00	4.369333333	3.00
A07	5.00	3.67	4.00	4.021333333	3.00
A08	5.00	3.73	4.00	4.371333333	3.00
A09	5.00	3.83	4.00	4.217333333	4.00
A10	5.00	3.83	4.00	4.416000000	2.00
A11	5.00	3.67	4.00	4.558666667	3.00
A12	5.00	3.83	4.00	4.376666667	3.00

A13	5.00	4.00	4.00	4.391333333	3.00
A14	5.00	4.00	4.13	4.460666667	5.00
A15	5.00	3.67	4.00	4.469333333	3.00
A16	5.00	3.67	3.75	4.542666667	2.00
A17	5.00	3.83	4.00	4.49200000	4.00
A18	5.00	3.67	4.00	4.451333333	5.00

Table 4 summarizes the initial assessment of 18 alternatives based on 5 predetermined criteria. And here are the results of normalized criteria weight values as follows:

TABLE V. Normalization of Criteria Weights

Code	Criteria (C_i)	Weight (W_i)	Weight Normalization (W_i)
C1	Absence	4	0.23529411764706
C2	Professionality	5	0.29411764705882
C3	Corps Solidarity	3	0.17647058823529
C4	Personality	3	0.17647058823529
C5	Involvement in school/outside school activities	2	0.11764705882353

Weight Normalization : $Wi = \frac{W_i}{\Sigma W_i}$

$W1 = \frac{4}{(4+5+3+3+2)} = 0.23529411764706$

and also for W2 - W5.

A. Simple Additive Weighting

The first step in the SAW method is normalization of the r_{ij} matrix from table 4 using equation (1). The result for alternative A01as follows:

$r_{11} = \frac{min_i x_{ij}}{x_{ij}} = \frac{5}{5} = 1$

$r_{12} = \frac{x_{ij}}{max_i x_{ij}} = \frac{4.33}{4.33} = 1$

$r_{13} = \frac{x_{ij}}{max_i x_{ij}} = \frac{4.25}{4.26} = 0.997652582$

$r_{14} = \frac{x_{ij}}{max_i x_{ij}} = \frac{4.275333333}{4.56800000} = 0.935858144$

$r_{15} = \frac{x_{ij}}{max_i x_{ij}} = \frac{5}{5} = 1$

from 18 alternative calculation results are entered into table VI with the following results:

TABEL VI. Normalization of the SAW Criteria Matrix

Alternative	C1	C2	C3	C4	C5
A01	1	1	0.997652582	0.935858144	1
A02	1	0.884526559	0.910798122	0.896015762	0.8
A03	1	0.884526559	0.938967136	1	1
A04	1	0.847575058	0.938967136	0.898642732	0.4

A05	1	0.854503464	1	0.973073555	0.6
A06	1	0.847575058	0.938967136	0.956436077	0.6
A07	1	0.847575058	0.938967136	0.88025394	0.6
A08	1	0.861431871	0.938967136	0.956873905	0.6
A09	1	0.884526559	0.938967136	0.923161121	0.8
A10	1	0.884526559	0.938967136	0.966725044	0.4
A11	1	0.847575058	0.938967136	0.998029772	0.6
A12	1	0.884526559	0.938967136	0.958187391	0.6
A13	1	0.923787529	0.938967136	0.961252189	0.6
A14	1	0.923787529	0.969483568	0.976576182	1
A15	1	0.847575058	0.938967136	0.978327496	0.6
A16	1	0.847575058	0.88028169	0.994527145	0.4
A17	1	0.884526559	0.938967136	0.983362522	0.8
A18	1	0.847575058	0.938967136	0.97438704	1

Normalization value is used to calculate preference value of equation (2), where for alternative preference value A01 is:

V_1 = (0.23529411764706) (1) + (0.29411764705882) (1) + (0.17647058823529) (0.997652582) + (0.17647058823529) (0.935858144) + (0.11764705882353) (1)
= 0.98827947596986

The results of calculating the SAW preference value of 18 alternatives are as follows:

TABLE VII. SAW Result

Alternative	Nilai Preferensi (V_i)	Rank
A01	0.98827947596986	1
A02	0.90840326658429	8
A03	0.95526671781812	3
A04	0.85591093994681	18
A05	0.90540922945300	9
A06	0.88966493191137	14
A07	0.87622102545212	16
A08	0.89381772895719	12
A09	0.91819038115385	6
A10	0.87880643142685	15
A11	0.89697924117273	11
A12	0.90081632119712	10
A13	0.91293026672963	7
A14	0.96805282239949	2
A15	0.89351524600000	13
A16	0.86248834100000	17
A17	0.92880128100000	5
A18	0.93987869500000	4

B. CPI

in CPI method normalization matrix A_{ij} using from table IV and uses equation (3). The result for alternative A01as follows:

$A_{11} = \frac{X_{ij(\text{MIN})}}{X_{ij}} x100 = \frac{5}{5} x100 \quad = 100$

$A_{12} = \frac{X_{ij}}{X_{ij(\text{MIN})}} x100 = \frac{4.33}{3.67} x100 \quad = 117.9836512$

$A_{13} = \frac{X_{ij}}{X_{ij(\text{MIN})}} x100 = \frac{4.25}{3.75} x100 \quad = 113.333333$

$A_{14} = \frac{X_{ij}}{X_{ij(\text{MIN})}} x100 = \frac{4.275333333}{4.021333333} x100 = 106.316837$

$A_{15} = \frac{X_{ij}}{X_{ij(\text{MIN})}} x100 = \frac{5}{2} x100 \quad = 250$

from 18 alternative calculation results are entered into table VIII with the following results:

TABLE VIII. Normalization of CPI Criteria Value

Alternative	C1	C2	C3	C4	C5
A01	100	117.9836512	113.333333	106.316837	250
A02	100	104.359673	103.466667	101.790599	200
A03	100	104.359673	106.666667	113.603581	250
A04	100	100	106.666667	102.089033	100
A05	100	100.8174387	113.6	110.544641	150
A06	100	100	106.666667	108.654564	150
A07	100	100	106.666667	100	150
A08	100	101.6348774	106.666667	108.704302	150
A09	100	104.359673	106.666667	104.874409	200
A10	100	104.359673	106.666667	109.823427	100
A11	100	100	106.666667	113.379756	150
A12	100	104.359673	106.666667	108.853519	150
A13	100	108.9918256	106.666667	109.201691	150
A14	100	108.9918256	110.133333	110.942552	250
A15	100	100	106.666667	111.141507	150
A16	100	100	100	112.981845	100
A17	100	104.359673	106.666667	111.713504	200
A18	100	100	106.666667	110.693857	250

After the normalized criterion value, then continued by calculating the final CPI value using equation (4), where for the alternative index value A01 is:

I_i = (0.23529411764706) (100) + (0.29411764705882) (117.9836512) + (0.17647058823529) (113.333333) + (0.17647058823529) (106.316837) + (0.11764705882353) (250)
=126.404045

The results of the combined CPI index value from 18 alternatives are as follows:

TABLE IX. CPI Result

Alternative	CPI Result	Rank
A01	126.40395265428	1
A02	113.97176371528	7
A03	122.50475638184	3
A04	101.54216726478	18

A05	110.38344077619	9
A06	108.58597285068	14
A07	107.05882352941	15
A08	109.07559586039	12
A09	115.08355182575	6
A10	104.19066682029	16
A11	109.41683569980	11
A12	109.90041093013	10
A13	111.32717136537	8
A14	124.00790158849	2
A15	109.02480886254	13
A16	102.28779840849	17
A17	116.28888807165	5
A18	120.71052426276	4

C. Comparing Method

The comparison of SAW method and CPI method result as follows:

TABLE X. Comparison of SAW and CPI Ranking

No	Alternative	SAW Result	SAW Rank	CPI Result	CPI Rank
1	A01	0.98827947596	1	126.40395265	1
2	A02	0.96805282239	2	124.00790158	2
3	A03	0.95526671781	3	122.50475638	3
4	A04	0.93989157248	4	120.71052426	4
5	A05	0.92880128050	5	116.28888807	5
6	A06	0.91819038115	6	115.08355182	6
7	**A07**	0.91293026672	**7**	111.32717136	**8**
8	**A08**	0.90840326658	**8**	113.97176371	**7**
9	A09	0.90540922945	9	110.38344077	9
10	A10	0.90081632119	10	109.90041093	10
11	A11	0.89697924117	11	109.41683569	11
12	A12	0.89381772895	12	109.07559586	12
13	A13	0.89352812342	13	109.02480886	13
14	A14	0.88966493191	14	108.58597285	14
15	**A15**	0.87880643142	**15**	104.19066682	**16**
16	**A16**	0.87622102545	**16**	107.05882352	**15**
17	A17	0.86247546358	17	102.28779840	17
18	A18	0.85591093994	18	101.54216726	18

The results of the comparison of the two methods with a total of 18 Alternatives have 14 alternatives with the same rank and as many as 4 alternatives have different rankings, which are ranked seventh and eighth and fifteenth and sixteenth ranks. So it was concluded that the results of the SAW and CPI ranking were not always the same.

D. Relatif Standar Deviation

To measure the relative accuracy of each method, the Relative Deviation Standard (RSD) is used in equation (5) which is generally expressed as a percent. And to get the value of Standard Deviation then use equation (6). The mean $\bar{x}$ results from the SAW method is = 0.909635846 and the mean $\bar{x}$ from CPI is = 112.3202795. The calculations are presented as follows:

TABLE XI. Standard Deviation Results of SAW and CPI

SAW				CPI		
No	xi	(xi – mean)	$(xi - mean)^2$	xi	(xi – mean)	$(xi - mean)^2$
1	0.98827947596	0.078643630	0.006184821	126.40395265	14.0836731616	198.3498497
2	0.96805282239	-0.001232579	1.519251000	124.00790158	1.6514842226	2.727400138
3	0.95526671781	0.045630872	0.002082177	122.50475638	10.1844768892	103.7235695
4	0.93989157248	-0.053724906	0.002886365	120.71052426	-10.7781122279	116.1677032
5	0.92880128050	-0.004226616	1.786430000	116.28888807	-1.9368387165	3.751344214
6	0.91819038115	-0.019970914	0.000398837	115.08355182	-3.7343066420	13.9450461
7	0.91293026672	-0.033414820	0.001116550	111.32717136	-5.2614559633	27.68291885
8	0.90840326658	-0.015818117	0.000250213	113.97176371	-3.2446836323	10.52797187
9	0.90540922945	0.008554536	7.318010000	110.38344077	2.7632723331	7.635673987
10	0.90081632119	-0.030829414	0.000950453	109.90041093	-8.1296126724	66.0906022
11	0.89697924117	-0.012656604	0.000160190	109.41683569	-2.9034437929	8.429985858
12	0.89381772895	-0.008819524	7.778400000	109.07559586	-2.4198685625	5.85576386
13	0.89352812342	0.003294421	1.085320000	109.02480886	-0.9931081273	0.986263753
14	0.88966493191	0.058416977	0.003412543	108.58597285	11.6876220958	136.6005103
15	0.87880643142	-0.016107722	0.000259459	104.19066682	-3.2954706301	10.86012667
16	0.87622102545	-0.047160382	0.002224102	107.05882352	-10.0324810842	100.6506767
17	0.86247546358	0.019165435	0.000367314	102.28779840	3.9686085790	15.74985405
18	0.85591093994	0.030255727	0.000915409	101.54216726	8.3902447701	70.3962073
		Total	0.021389633		Total	900.1314682

SAW Standard deviation results $s = \sqrt{\frac{0.021389633}{18-1}}$ = 0.035471308

CPI Standard deviation results $s = \sqrt{\frac{900.1314682}{18-1}}$ = 7.276600161

Use equation (5) to get the RSD results from each method.

The relative yield of the SAW standard deviation $\text{RSD} = \frac{0.035471308}{0.909635846} \times 100\%$ = 3.90%

The relative yield of the CPI standard deviation $\text{RSD} = \frac{7.276600161}{112.3202795} \times 100\%$ = 6.48%

It can be concluded from the calculation results above, the CPI method has a greater RSD percentage of 6.48% and the SAW method has a smaller percentage of 3.90%. The higher the RSD value, the more optimal the resulting calculation method.

E. Time of SAW and CPI Execution

In a comparative analysis of the SAW and CPI methods also tested the execution time speed of 18 alternatives. The result as follows:

TABLE XII. Time of SAW and CPI Execution

Number of trials	Time Execution (Second)	
	SAW Method	CPI Method
1	0.481118	0.590566
2	0.474842	0.628195
3	0.511055	0.648979

From table XII in three attempts by reloading the calculation menu page, the SAW method proved to be faster than the CPI method.

V. CONCLUSIONS

The results of the analysis process of decision support systems for the selection of the best teachers can be concluded:

a. The calculation results between the SAW and CPI methods do not have the same rank.
b. Comparison results of the SAW and CPI methods using RSD found that the accuracy of the CPI of 6.48% was better than the SAW of 3.90%.
c. The execution time of the SAW method has a faster average time of 0.489005 than the CPI method with an average time of 0.62258 seconds.

REFERENCES

[1] S. Grafika, *Undang-Undang Guru dan Dosen (UU RI No.14 Th.2005)*, 2nd ed. Jakarta: Sinar Grafika, 2009.

[2] N. Naim, *MENJADI GURU INSPIRATIF: MEMBERDAYAKAN DAN MENGUBAH JALAN HIDUP SISWA*. Yogyakarta: Pustaka Pelajar, 2009.

[3] N. S. Tanjung, P. D. Adelina, M. K. Siahaan, E. Purba, and J. Afriany, "Sistem Pendukung Keputusan Pemilihan Guru Teladan Dengan Menggunakan Metode Composite Performance Index (CPI)," *J. Ris. Komput. (JURIKOM*, vol. 5, no. 1, pp. 13–18, 2018.

[4] R. S. Hutasoit, A. P. Windarto, D. Hartama, and S. Solikhun, "Sistem Pendukung Keputusan Pemilihan Guru Terbaik Pada Smk Maria Goretti Pematangsiantar Menggunakan Metode Simple Additive Weighting (Saw)," *Jurasik (Jurnal Ris. Sist. Inf. dan Tek. Inform.*, vol. 1, no. 1, p. 56, 2017, doi: 10.30645/jurasik.v1i1.9.

[5] B. L, Karlitasari; D, Suhartini; Benny, "Comparison of simple additive weighting (SAW) and composite performance index (CPI) methods in employee remuneration determination," *IOP Sci.*, vol. 166, no. 1, 2017, doi: 10.1088/1742-6596/755/1/011001.

[6] A. Pataropura, R. Riki, and J. G. Manu, "Decision Support System for Selection of Assembly Using Profile Matching Method and Simple Additive Weighting Method (Case Study: GKIN Diaspora Church)," *bit-Tech*, vol. 2, no. 1, pp. 43–52, 2019, doi: 10.32877/bt.v2i1.100.

[7] M. Parida and B. A. Mutiara, "SISTEM PENDUKUNG KEPUTUSAN PENENTUAN PENILAIAN KARYAWAN BERPRESTASI MENGGUNAKAN METODE SAW DAN AHP," *J. Inf. dan Komput.*, vol. 4, no. 2, pp. 1–12, 2017, doi: 10.35959/jik.v4i2.88.

[8] B. Daniawan, "Evaluation of Lecturer Teaching Performance Using AHP and SAW Methods," *bit-Tech*, vol. 1, no. 2, 2018, doi: https://doi.org/10.32877/bt.v1i2.41.

[9] R. Rahim, M. Mesran, A. P. U. Siahaan, and S. Aryza, "Composite Performance Index for Student Admission," no. May, 2017, doi: 10.31227/osf.io/z9rua.

[10] H. Sismoro and Hartatik, "Multi Attribute Decision Making – Penggunaan Metode Saw Dan Wpm Dalam Pemilihan Proposal Umkm," *Jurnal Dasi*, vol. 14, no. 1. pp. 29–34, 2013.