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Comparison of simple additive weighting (SAW) and composite performance index (CPI) methods in employee remuneration determination

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Abstract. The process of determining the employee remuneration for PT Sepatu Mas Idaman currently are still using Microsoft Excel-based spreadsheet where in the spreadsheet there is the value of criterias that must be calculated for every employee. This can give the effect of doubt during the assesment process, therefore resulting in the process to take much longer time. The process of employee remuneration determination is conducted by the assesment team based on some criterias that have been predetermined. The criteria used in the assessment process are namely the ability to work, human relations, job responsibility, discipline, creativity, work, achievement of targets, and absence. To ease the determination of employee remuneration to be more efficient and effective, the Simple Additive Weighting (SAW) method is used. SAW method can help in decision making for a certain case, and the calculation that generates the greatest value will be chosen as the best alternative. Other than SAW, also by using another method was the CPI method which is one of the calculating method in decision making based on performance index. Where SAW method was more faster by 89-93% compared to CPI method. Therefore it is expected that this application can be an evaluation material for the need of training and development for employee performances to be more optimal.

1. Introduction

The advances in technology cannot be separated from computerization, one of which is to support in decision making. The utilization of existing technology is expected to provide convenience in every problem faced. One of the problems is when companies are faced with several options for taking a decision.

The process of determining the remuneration of employees at PT Sepatu Mas Idaman currently still using Microsoft Excel-based spreadsheet where in the spreadsheet there is the value of criteria that must be calculated for each employee. This can give the affect of doubt during the assesment process, therefore resulting in the process to take much longer time. The process of employee remuneration determination is conducted by the assesment team based on some criterias that have been predetermined. The criteria used in the assessment process are the ability to work, human relations, job responsibility, discipline, creativity, achievement of targets, and presence. Based on this, it is necessary to design a system that can simplify the determination of remuneration of employees so that the process can run more efficiently and effectively. Therefore the aim of this research is to compare the Simple Additive Weighting (SAW) with the Composite Performance Index (CPI) in employee remuneration determination (Case Study at PT Sepatu Mas Idaman Bogor). The development of application is also

needed in order to support the decision making and evaluation needs in training and development for the employee to be more optimal in performance and quality.

2. Methodology

The research methods applied of the application development using SDLC (System Development Life Cycle). SDLC approach consists of six stages, namely planning, analysis, design, implementation, testing and utilization as in Figure 1.
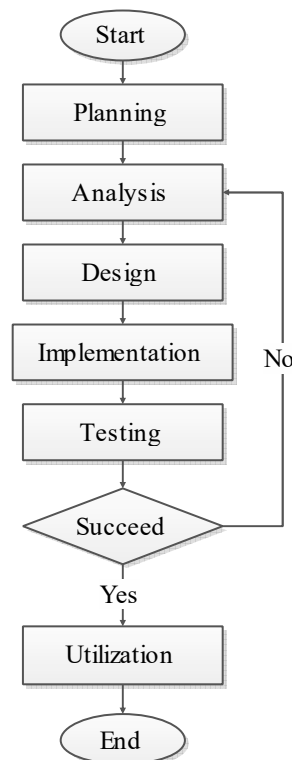

Figure 1. SDLC Approach

1.1 Planning stage
Planning stage was a process of collected some of the material presented as an initial basis to supplement the definition of the problem, including: interviews, and literature review.

1.2 Analysis stage
The analysis stage began with the data collection process. The data collected will be used as materials in the process of system analysis. Furthermore, analyzed the existing system and analyzed the ongoing system. The results analysis of the existing system will be the basis for system development.

Max value of each criterion
Ability to work: 6
Human relations: 6
Job responsibilities: 6
Creativity: 6
Discipline: 6
Achievement of targets: 8
Presence: 12

a.   The first way with Simple Additive Weighting (SAW)
The process of normalization (dividing the value of the alternative on each criterion with a max value of each criteria)

        Andi :
                Ability to work   :
                        C11   : 5 / 6 = 0.8333
                        C12   : 5 / 5 = 1
                        C13   : 3 / 5 = 0.6
                Human relation   :
                        C21   : 4 / 6 = 0.6667
                        C22   : 2 / 5 = 0.4
                        C23   : 4 / 5 = 0.8
                        C24   : 3 / 5 = 0.6
                        C25   : 3 / 5 = 0.6
                Job responsibility   :
                        C31   : 4 / 5 = 0.8
                        C32   : 4 / 4 = 1
                        C33   : 4 / 4 = 1
                Creativity   :
                        C41   : 5 / 5 = 1
                        C42   : 5 / 5 = 1
                        C43   : 4 / 5 = 0.8
                        C44   : 3 / 6 = 0.5
                        C45   : 3 / 5 = 0.6
                Discipline   :
                        C51   : 4 / 5 = 0.8
                        C52   : 3 / 5 = 0.6
                Achievement of target   :
                        C61   : 6 / 7 = 0.8571
                Presence   :
                        C71   : 6 / 10 = 0.6

Ranking process was done by multiplied the normal alternatives values with the weight of each criterion.

        Andi :
                Ability to work   :
                        C11   : 0.8333 * 0.17 = 0.1417
                        C12   : 1   * 0.17 = 0.17
                        C13   : 0.6   * 0.17 = 0.102

                Human relations   :
                        C21   : 0.6667 * 0.11 = 0.0733
                        C22   : 0.4   * 0.11 = 0.044
                        C23   : 0.8   * 0.11 = 0.088
                        C24   : 0.6   * 0.11 = 0.066
                        C25   : 0.6   * 0.11 = 0.066
                Job responsibility   :
                        C31   : 0.8   * 0.1 = 0.08
                        C32   : 1   * 0.1 = 0.1
                        C33   : 1   * 0.1 = 0.1

	Creativity	:		
	C41	: 1	* 0.12	= 0.12
	C42	: 11	* 0.12	= 0.12
	C43	: 0.8	* 0.12	= 0.096
	C44	: 0.5	* 0.12	= 0.06
	C45	: 0.6	* 0.12	= 0.072
Discipline		:		
	C51	: 0.8	* 0.14	= 0.112
	C52	: 0.6	* 0.14	= 0.084
Achievement of targets		:		
	C61	: 0.8571	* 0.16	= 0.1371
Presence		:		
	C71	: 0.6	* 0.2	= 0.012

The ranking result was:

Andi : 0.1417 + 0.17 + 0.102 + 0.0733 + 0.044 + 0.088 + 0.066 + 0.066
+ 0.08 + 0.1 + 0.1 + 0.12 + 0.12 + 0.096 + 0.06 + 0.0.72 + 0.112
+ 0.084 + 0.1371 + 0.12 = 1.9521

Percentage of performace	= 1.9521 / 0.026 = 75.08 %
Percentage of late rise	= 75.08 x 0.05 = 3.75 %
Nominal rise	= 3.75 x basic salary
	= 3.75 x 2.500.000
	= 93.850,96
New salary	= total salary + nominal rise
	= 2.500.000 + 93.850.96
	= 2.593.851

b.   The second way with Composite Performance Index (CPI)
With the same value, convert the smallest alternative value into number 100, then the other alternative value except the smallest value that had been converted into number 100 divided by the smallest value. The result of each alternative value was multiplied by the weight.

Andi :

Ability to work	: 13 = 100
Human relations	: 16 = 100
Job responsibility	: 12 = 100
Creativity	: 14 = 100
Discipline	: 8 = 100
Achievement of targets	: 6 = 6
Presence	: 6 = 100

Process of alternative value except the smallest value divided by the smallest value of each criteria.

Andi :

Ability to work	: 13 = 100
Human relations	: 16 = 100
Job responsibility	: 12 = 100

Creativity   : 14 = 100
Discipline   : 8 = 100
Achievement of targets   : 6 = (6/5) * 100) = 120
Presence   : 6 = 100
The result of each alternative value multiplied by the weight.

Andi :

Ability to work   : 100 * 0.17 = 17
Human relations   : 100 * 0.11 = 11
Job responsibility   : 100 * 0.10 = 10
Creativity   : 100 * 0.12 = 12
Discipline   : 100 * 0.14 = 14
Achievement of targets   : 120 * 0.16 = 19.20
Presence   : 100 * 0.20 = 20

The result was:

Andi : 17 + 11 + 10 + 12 +14 + 19.20 + 20 = 103.20

1.3 Design stage

The design stage of the system is to provide an overview of the system design will be built, the design includes the ERD (Entity Relationship Diagram), database, relationships tables, flowchart systems, and design process of interface. This design is based on the user interface design to fit with the goals and the system requirements, such as in Figure 2.
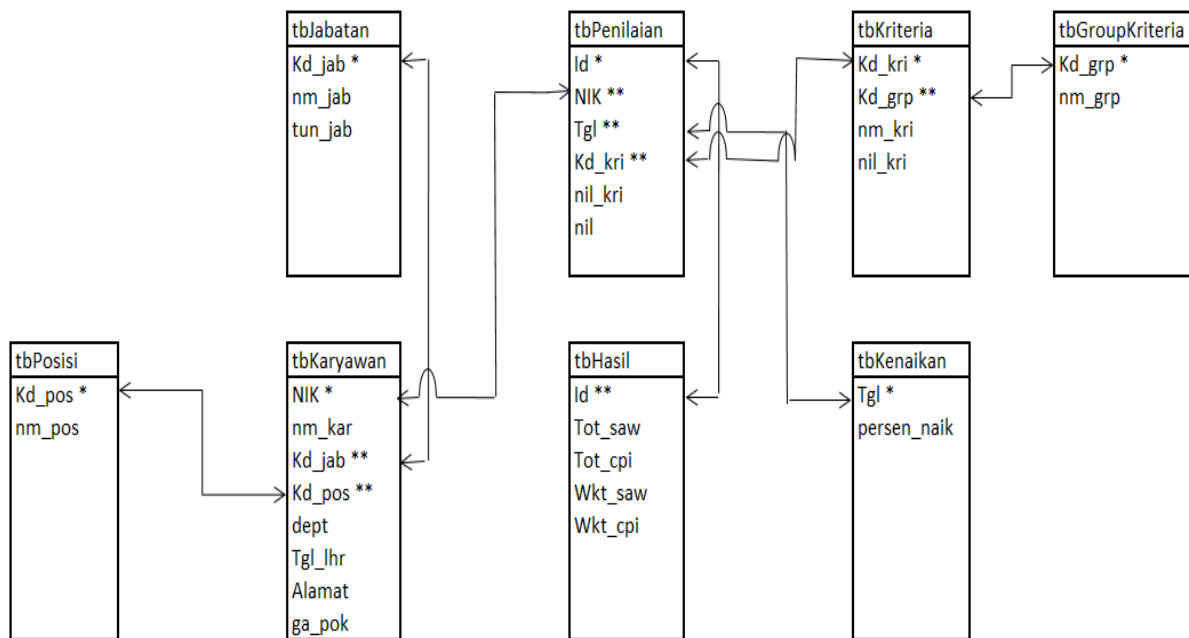
Figure 2. Relationship tables

In the system design also required a flowchart that illustrates the work flow process structured into several sections that will facilitate the implementation of the system, as shown in Figure 3.
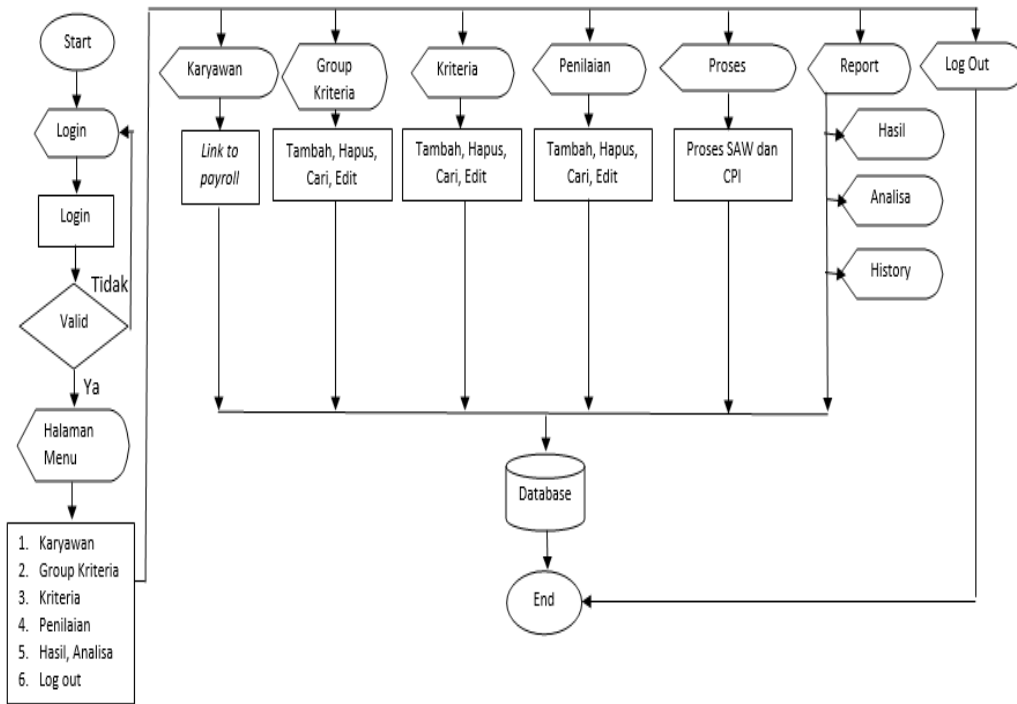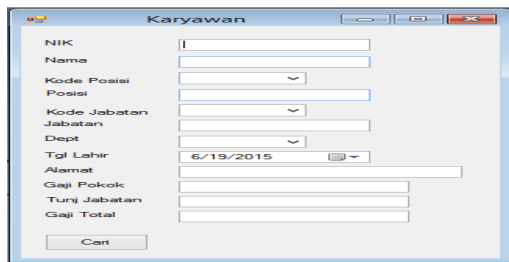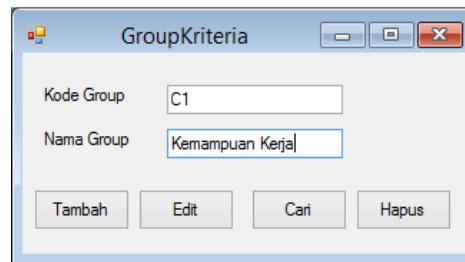
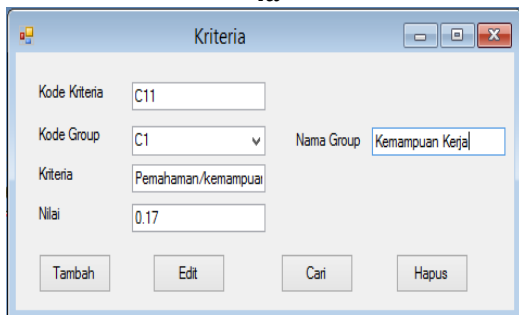**Figure 3.** Flowchart Menu

3. Result and Discussion

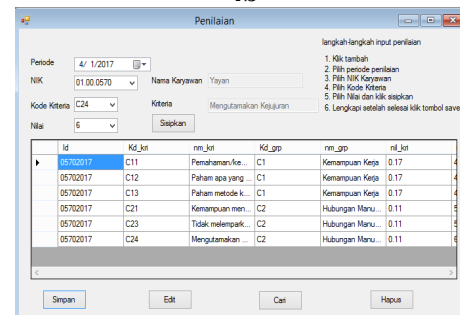Results of the application for SAW and CPI Comparison in the determination of employee remuneration shown in Figure 4.

4a

4b

4c

4d

Figure 4. Display of aplication : 4a. Display of employee, 4b. Display of group criteria, 4c. Display of criteria, and 4c. Display of assessments

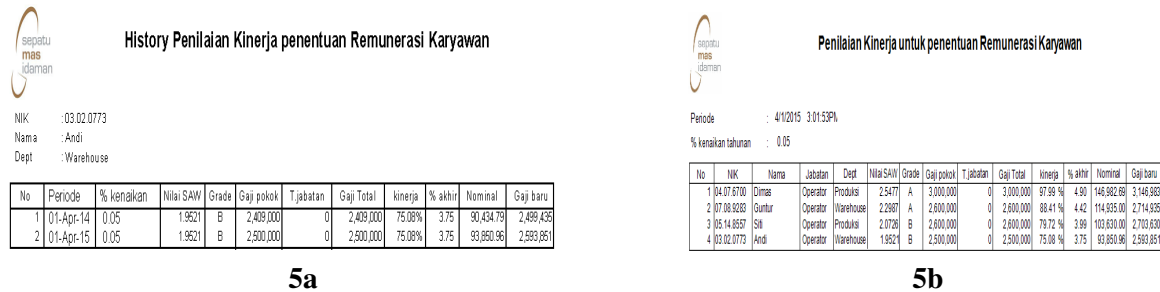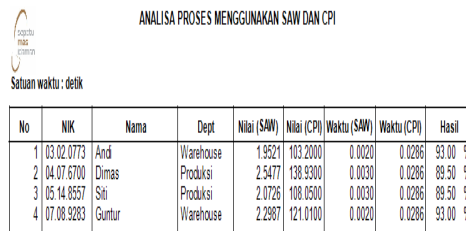The process of History rise and Reports shown in Figure 5.

5a   **5b**

Figure 5. Display of result : 5a. History of performance assessments, 5b. Performance assessments of employee renumeration determination

While the analysis process of SAW and CPI shown in Figure 6.

Figure 6. Analysis menu

By using the two methods: Simple Additive weighting method (SAW) and the Composite Performance Index (CPI) for data processing assessment, then the ranking of these two methods produce different values but gave the same rank. In addition of accuracy in showing the ranking, this study was also compared the time process of both methods, as shown in Table 4.

Table 4. The difference between SAW and CPI

Amount of data	SAW	CPI
4	0.0200 second	0.1142 second
5	0.0250 second	0.1900 second
10	0.0440 second	0.5643 second
20	0.0860 second	2.7286 second

The ranking process was done under computer of only one open application. From the time of two tested methods, SAW method was faster data processing time compared with the CPI method. From the overall processing time of SAW and CPI, there was no significant difference in time. From the rate average sample data used of SAW and CPI, SAW method was faster of 89-93 % than the CPI method. The time difference will increasingly appear to be associated with the amount of data processed, as shown in Figure 7.
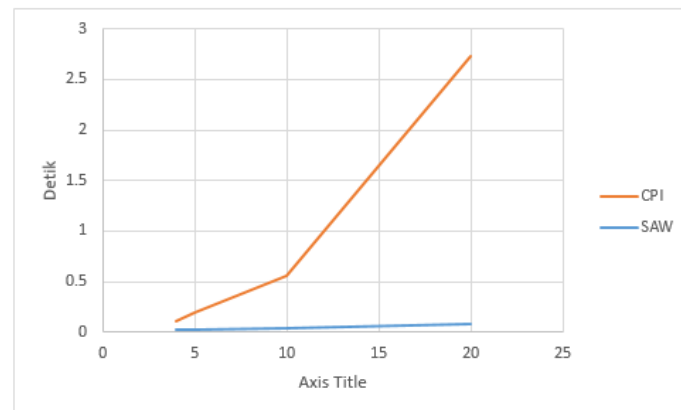
Figure 7. Time comparison chart

From both tests conducted, it is known that SAW method was the most superior in data processing as compared with the CPI method. The ranking process of SAW and CPI generate a sequence of the same ranking, but the more data processed then the CPI method will increasingly require a longer time in proceed the data because of many minimum value alternative of each criteria, so that it needed extra time to convert into the unit of 100 .

4. Conclusions

From this study was concluded that SAW and CPI methods produce the same grade, but the CPI method requires a longer time. SAW method was faster than the CPI method, because the CPI in data processing relies on the data processed, the more minimum value to be transformed into a value of 100 then the more need of extra time. SAW method does not depend on the data pattern, but the CPI method depends on the data pattern processed. The time difference will increasingly appear to be associated with the amount of data processed and the data patterns that must be processed when using the CPI method. The SAW method has more processing step instead of the CPI, but the CPI requires a longer time for processing because the processing should be completed in a structured and highly dependent on the amount of the minimum data pattern processed data.

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