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Analysis and Design of Decision Support System for Employee Performance Appraisal with Simple Additive Weighting (SAW) Method

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Abstract

The decision support system (DSS) for employee performance appraisal is a decision support system used in the employee performance appraisal process at PT. Surya Toto Tbk. Currently, the employee performance appraisal process still done manually (paper-based) so that the reports produced were not real-time. From the existing problems, this research aimed to analyze and design a decision support system according to the existing criteria using the Simple Additive Weighting (SAW) method to be able to develop into a Web-based DSS. The method used began with communication with management, especially the perpetrators of employee performance appraisals. Furthermore, planning, the process of data collection, analysis, design, and finally making reports carried out. The conclusion of this study provided a suggestion to use the criteria that had given two more criteria. By giving weights and calculations carried out for three employees, the value obtained for employee C got the highest score (0.98) followed by employee B, and the lowest score (0.85) was employee A.

Keyword: Analysis; Design; Decision Support System; Assessment; Employee Performance

1. Introduction

Information technology has now become a necessity in everyday life, including in company operations. Technology is a reference in the progress of a company such as financial applications, employee applications, attendance applications and other applications that can support the company's processes. By using IT technology, what do in the company would become more accessible, more effective and efficient. The more rapid the development of technology, the more practical and more comfortable what each employee does. That way, employee productivity would also be higher.

The merger of computer technology with telecommunications has resulted in a revolution in the field of information systems, in which technology plays a crucial role in increasing company productivity. Below are some of the essential roles of technology in company productivity and development. In general, the advantages of information technology for companies could change manual processes to be automatic, the time needed to do tasks outran, save costs, the system could integrate with all departments and decision making is faster.

To be able to make decisions quickly and precisely, a decision support system is needed using methods that are suitable for the company. There are many types of decision support systems that exist in the company, in this study discussed the Decision Support System for employee performance appraisal conducted at PT. Surya Toto Indonesia Tbk.

PT Surya Toto Indonesia, Tbk is a manufacturer of sanitary and fitting products. Examples of products produced are water taps, soap holders, tissue holders, towel hangers, and toilets. PT Surya Toto Indonesia, Tbk was founded on July 11, 1977, which headquartered at Jl. Tomang Raya No. 18 Jakarta. PT Surya

Toto Indonesia, Tbk was a collaboration between CV Surya as a national private party with Toto Limited from Japan as a Japanese private party.

On October 26 1978, PT Surya Toto Indonesia, Tbk was registered at the Jakarta District Court, then on November 21 1978, it was announced in the State Gazette of the Republic of Indonesia. In February 1978, PT Surya Toto Indonesia, Tbk had a production capacity of 1,027,080 pieces per year with a total of 2,600 employees. The area of the factory in the Serpong area is 5.8 hectares. In 1994, PT Surya Toto Indonesia, Tbk received a JIS (Japan Industrial Standard) certificate. By obtaining this certificate, PT Surya Toto Indonesia, Tbk increasingly trusted for its quality by national and international markets.

This research conducted at PT. Surya Toto which located on Jl. Jl. MH. Thamrin KM 7 Pakulonan Village, RT.004 / RW.002, Panunggangan, Kec. Pinang, Tangerang City, Banten 15325. With approximately 1,171 employees in 2020. With such a large number of employees, a proper decision support system needed especially to deal with employee performance appraisal problems.

The employee performance of appraisal Decision Support System is a system used for the process of appraising employee performance at PT. Surya Toto Indonesia Tbk. Currently, the employee performance appraisal process still done manually (paper-based) so that the reports produced are not real-time. The criteria used: work results, work mastery, work attitude, discipline and supporting factors where each of these criteria has different sub-criteria.

This research aimed to analyze and design a decision support system according to the existing criteria using the Simple Additive Weighting (SAW) method. Apart from designing, it also compares the speed and accuracy of assessments made using the SAW method.

2. The Basis of Theory

The definition of a Decision Support System (DSS) already existed in the 1970s defined by Little in Turban, Aronson and Liang (2005) explained that the DSS is a set of model-based procedures for processing data and assessments to help a manager make his decisions. According to Brien 2010 in Taufiq (2018), decision support systems are computer-based information systems that provide interactive information support for managers and professional business people during the decision-making process. DSS has components of model management, data management and user interface management (Haag and Cummings, 2013). According to Surbakti in Septarini (2017), Decision Support is defined by an interactive computer-based system that helps decision-makers utilize data and models to solve unstructured problems.

Several studies regarding decision support systems are using the AHP method, and the decision-making process is choosing an alternative. Moreover, AHP's primary equipment is a functional hierarchy with mainly human perception. With a hierarchy, a complex and unstructured problem solved into groups and, then the groups arranged into a hierarchical form (Taufiq & Fahrozi., 2017). Taufiq and Sugiharto (2011) concluded that a decision support system with multiple criteria has a positive impact on agencies in order to speed up and improve accuracy in the employee performance appraisal process.

The SAW method could solve the problem of an election with a weight that determined according to needs (Ismanto and Effendi, 2014). DSS with the SAW method could calculate precisely and accurately (Gumelar, 2017). DSS with SAW could facilitate the process of objectively assessing employee performance at LPM based on the weight and predetermined assessment criteria (Anto, Mustafidah and Suyadi, 2014).

In another study, it also stated that the decision support system for selecting majors helps in making decisions in determining student classes according to their abilities (Taufiq and Mustofa, 2017). Decision Support Systems could help existing problems because of the weighted values used; the scholarship acceptance process could be more effective and optimal (Liesnaningsih et al., 2020). Besides, the DSS made it easier to determine the eligibility or absence of employees to get a promotion and made it easier for the report preparation process (Suherdi et al., 2018). With the development of a web-based information system, it made it easier for users to carry out their activities (Taufiq, 2020).

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3. The Research Method

This research method had six steps consisting of communication, planning, data collection, analysis, design and reporting.

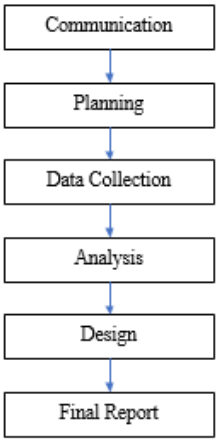

Figure 1. The Research Method

Communication was the first step in this research, which carried out in communication to find out the decision support system in the company, to find out the criteria used and problems regarding the employee performance appraisal process. The next step was planning, which done to make a plan on how to analyze and design, what tools are needed and how long it would use.

The third step was data collection, which carried out utilizing interviews, observation and literature. The fourth step was analysis, which carried out in the analysis, namely knowing how the process is running, calculating the criteria with a predetermined weight using the SAW method—the fifth step designed to make a logical design using the Unified Modeling Language (UML). Moreover, physical design by drawing the appearance of the proposed form.

The final step was to make a final report which will give to the management of PT. Surya Toto Tbk. From this report, the researchers hope that in the future, it could continue into web-based applications.

4. Analysis and Design

4.1 Communication

The communication carried out in this step got a running system, and some of the problems that exist using this system were: reports were not the real-time when needed, and the process was still taking a long time. So the company expected an excellent design to be studied first, and if the design were following what expected, then it would be developed into a web-based system.

4.2 Planning

In this planning, several things would use as a reference in conducting the analysis, namely: the criteria give appropriate weight, calculations carried out using the AHP method, a design made easy to use, the design made to be more flexible in determining criteria, sub-criteria and heaviness. So that if there was a change in the criteria used, it c could change quickly.

4.3 Data Collection

Data obtained through interviews and direct observation. These results: a picture of the running system in the form of a flowchart, the criteria used and their weight, the assessment process, evaluation of the assessment and how to decide in the assessment. Literature used to obtain theories from various sources, be it books, journals or proceedings.

4.4 Analysis

4.4.1 Recent system

Figure 2. The Running System

The steps currently being carried out were still manual, which consists of 8 steps. The first step was to make a print submission of the assessment form earlier, then distribute the printed form in the first step. Step 3, of the section, conducts employee appraisals by filling out the appraisal form followed by step 4, giving the completed form to HRD.

Step 5, HRD performs another input value where the value was according to the HRD version itself. Furthermore, in step 6, HRD assigned this value to the section for improvement. After the 6th step and returning to the 3rd step, if it was deemed clear, then from the 6th step, proceed to the 7th step, the final

score report and revisions made by the Manager. The final step after step 7 was to provide the appraisal file to the director for approval.

4.1.2 Criteria

Fifteen criteria are consisting of quality, delivery, implementation of SOPs, work mastery, minimal error, cooperation, morale and behaviour, persistence, initiative, attendance, on time, warning, 5S and K3 and innovation.

4.1.3 Calculation with SAW

There are several steps used, start from provide the weighted up to rating decisions.

1. Provide the weighted criteria value

Alternatif	Kriteria														
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15
A1	4	4	5	3	5	5	4	3	3	5	5	3	5	4	5
A2	5	5	5	4	3	3	4	5	4	4	5	4	5	4	4
A3	4	4	5	4	5	4	4	5	5	3	5	4	5	5	5

Figure 3 Criteria weight values

Figure 3 on the weighted value of these criteria explains the values given to each criterion (C) for the values of criteria 1-15. The A1-A3 is the code of Employee 1-Employee 3. The fifteen coded in C1-C5 consist of: quantity, quality, delivery, implementation of SOPs, work mastery, minimal errors, cooperation, morals and behaviour, tenacity, initiative, attendance, time, warning, 5S and K3, and the last one is innovation.

2. Normalization of each value of the alternative one employee

Normalization for employee 1 (A), the value was obtained, as shown in Figure 4 above. Normalization carried out for each employee with the value of Employee 1 to Employee 3. In this paper, only the normalization process for Employee 1 shown.

$$R_{11} = \frac{4}{\max(4,5,4)} = \frac{4}{5} = 0{,}8$$

$$R_{12} = \frac{4}{\max(4,5,4)} = \frac{4}{5} = 0{,}8$$

$$R_{13} = \frac{5}{\max(5,5,5)} = \frac{5}{5} = 1$$

$$R_{14} = \frac{3}{\max(3,4,4)} = \frac{3}{4} = 0{,}75$$

$$R_{15} = \frac{5}{\max(5,3,5)} = \frac{5}{5} = 1$$

$$R_{16} = \frac{\min(5,3,4)}{5} = \frac{3}{5} = 0{,}6$$

$$R_{17} = \frac{4}{\max(4,4,4)} = \frac{4}{4} = 1$$

$$R_{18} = \frac{3}{\max(3,5,5)} = \frac{3}{5} = 0{,}6$$

$$R_{19} = \frac{3}{\max(3,4,5)} = \frac{3}{5} = 0{,}6$$

$$R_{110} = \frac{5}{\max(5,4,3)} = \frac{5}{5} = 1$$

$$R_{111} = \frac{5}{\max(5,5,5)} = \frac{5}{5} = 1$$

$$R_{112} = \frac{\min(3,4,4)}{3} = \frac{3}{3} = 1$$

$$R_{113} = \frac{5}{\max(5,5,5)} = \frac{5}{5} = 1$$

$$R_{114} = \frac{4}{\max(4,4,5)} = \frac{4}{5} = 0{,}8$$

$$R_{115} = \frac{5}{\max(5,4,5)} = \frac{5}{5} = 1$$

Figure 4. Normalization of Employees 1

3. Normalization Matrix

$$R = \begin{bmatrix} 0{,}8 & 0{,}8 & 1 & 0{,}75 & 1 & 0{,}6 & 1 & 0{,}6 & 0{,}6 & 1 & 1 & 1 & 1 & 0{,}8 & 1 \\ 1 & 1 & 1 & 1 & 0{,}6 & 1 & 1 & 1 & 0{,}8 & 0{,}8 & 1 & 0{,}75 & 1 & 0{,}8 & 0{,}8 \\ 0{,}8 & 0{,}8 & 1 & 1 & 1 & 0{,}75 & 1 & 1 & 1 & 0{,}6 & 1 & 0{,}75 & 1 & 1 & 1 \end{bmatrix}$$

Figure 5 Normalization Matrix

Figure 5 normalization matrix was a summary of the normalization values that have obtained from Figure 4 normalization of employees 1. After normalization calculations for employees 1-3 carried out, the final results obtained are following Figure 5.

4. Assessment of Each Alternative

Kriteria	Rating (%)	Kriteria
C1	0.08	*benefit*
C2	0.08	*benefit*
C3	0.06	*benefit*
C4	0.08	*benefit*
C5	0.07	*benefit*
C6	0.07	*cost*
C7	0.08	*benefit*
C8	0.07	*benefit*
C9	0.08	*benefit*
C10	0.06	*benefit*
C11	0.05	*benefit*
C12	0.04	*cost*
C13	0.06	*benefit*
C14	0.07	*benefit*
C15	0.05	*benefit*

Figure 6. Assessment of each alternative

That value had given for assessment of each alternative as a per cent (%). Where alternative one was given a weighted value of 0.08 to alternative 15 was given a value of 0.05.

5. After performing the preference weight value for each alternative, the table order obtained as follows:

Table 1. Rating Decisions

No	Alternatives	The Total Value of Integral
1.	Employee C	0.98
2.	Employee B	0.91
3.	Employee A	0.85

Table 1 above described the order of employees who had assessed. Employee C got the highest score (0.98) followed by employee B, and the lowest score (0.85) was employee A.

4.5 Design

4.5.1 Logic Design

In the proposed research logic design, UML diagrams used to explain the system with a use case. The use case explained in the following Figure 7.

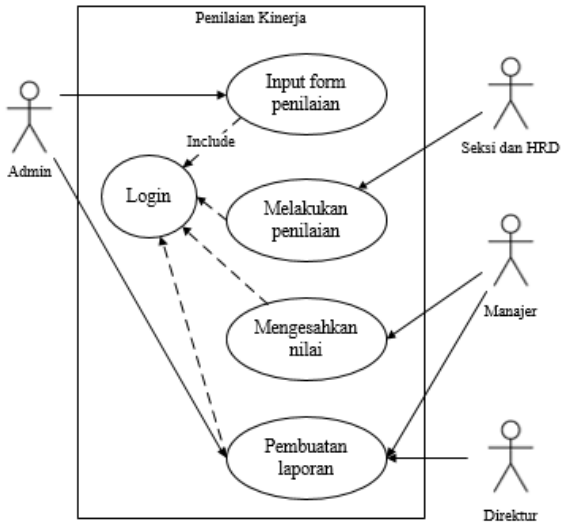

Figure 7. Proposed Use Case System

Figure 7 regarding the proposed use case system, four actors consist of Admin, Section and HRD, Manager and Director.

4.5.2 Physical Design

This physical design described the proposed appearance of a web-based application.

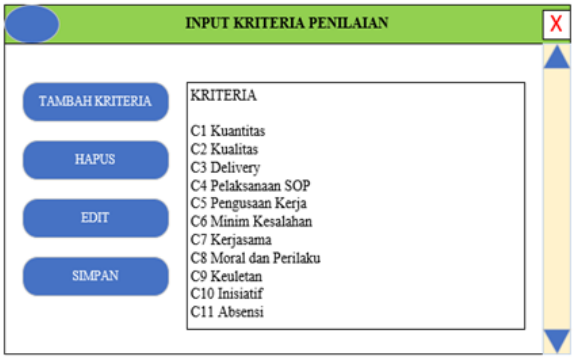

Figure 8. Form for Criteria input

The display in Figure 8 of the criteria input form illustrates that admins could input criteria, edit and delete criteria to match what they wanted.

The following Figure 9 explained how a user conducted an appraisal process for his employees.

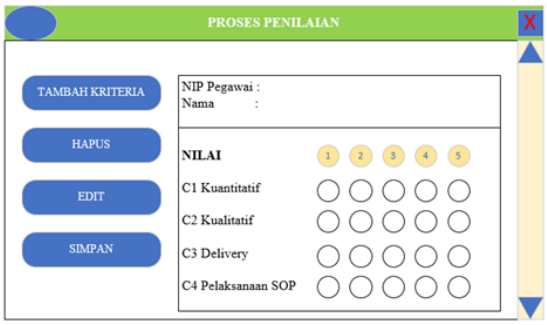

Figure 9. Assessment Form

5. Conclusion

The number of criteria used was 15 criteria. Each criterion assigned a weighting of 0.08 on criterion 1 and 0.05 for criterion 15. A value was fluctuating for each criterion. Use cases proposed to describe a system that will run if it has developed into a web-based system. Employee C got the highest score (0.98) followed by employee B, and the lowest score (0.85) was employee A.

6. Future Research

Further research is to make web-based applications. With this application, it hoped that the DSS Performance Assessment could have a tremendous impact on the company.

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