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APPLICATION OF THE WEIGHTED PRODUCT (WP) METHOD IN DOCTOR PERFORMANCE ASSESSMENT

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Abstract: In an effort to increase the spirit of better performance and achievement, an institution gives awards to doctors who are considered outstanding. Setia Husodo Hospital is one of the hospitals which is the center of health services in the city of Kisaran. In determining the performance assessment of doctors and leaders, they still use conventional methods. Doctors' performance evaluation is still done manually and the data processing process does not yet use application programs in making decisions. In the process of assessing the performance of doctors as the main professional staff in hospitals, it must be carried out realistically, objectively and based on evidence and specifically according to specialization and/or specific procedures. For this reason, a tool is needed in the form of designing a decision support system (DSS) in evaluating the performance of doctors which aims to understand the deficiencies of the performance that has been carried out, so that it can open up space for improvement or improvements to quality and efficiency in hospitals, for the purpose of providing incentives and reward programs and value-based purchasing strategies for doctors. The method in this study uses the Weighted Product method, with the concept of weighting the rating of an appraisal variable that will be selected as the best alternative. The system to be created is a decision support system using the Weighted Product (WP) method, which is a method of determining the order (priority) in multi-criteria analysis. The results of this system design are expected to be a tool for Setio Husodo Hospital in analyzing and deciding on the performance of doctors who will be given incentives and reward programs as well as value-based purchasing strategies for doctors.

Keywords: decision support system; performance of doctors; weighted product;

Abstrak: Untuk mendorong kinerja yang lebih baik dan semangat berprestasi, institusi memberikan penghargaan kepada dokter yang dianggap berprestasi.Metode tradisional masih digunakan untuk menilai kinerja dokter dan manajer. Evaluasi kinerja dokter masih bersifat manual, dan proses pengolahan data belum menggunakan program aplikasi untuk mengambil keputusan. Proses evaluasi kinerja dokter sebagai anggota staf rumah sakit penuh waktu harus realistis, objektif, berbasis bukti, dan spesifik untuk spesialisasi dan/atau prosedur tertentu. Oleh karena itu, diperlukan perancangan sistem pendukung keputusan (SPK) untuk evaluasi kinerja dokter sebagai alat yang bertujuan untuk memahami kekurangan dalam pelayanan yang diberikan dan memberikan ruang untuk perbaikan dan ruang untuk peningkatan kualitas dan efisiensi. Rumah sakit mendorong dan memberi dokter program penghargaan dan strategi pembelian berbasis nilai. Metode penelitian ini menggunakan metode weighted product dengan konsep pembobotan evaluasi terhadap satu variabel evaluasi yang dipilih sebagai pilihan terbaik. Sistem yang akan dibuat adalah sistem pendukung keputusan yang menggunakan metode WP (Weighted Product), yaitu metode untuk menentukan urutan (prioritas) dalam analisis multi kriteria. Hasil perancangan sistem ini dimaksudkan sebagai alat bagi RS Setio Husodo untuk menganalisis dan menentukan kinerja dokter penerima program insentif dan reward, serta strategi pembelian berbasis nilai dokter.

Kata kunci: kinerja dokter; sistem pendukung keputusan; weighted product.

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INTRODUCTION

The rapid development of technology has brought the world into a new era, especially in the field of information technology, where this technology can be applied in almost every aspect of the life of the world's people. Along with the rapid development of information technology that is happening now, information technology is not just a work tool, but also a part of the company's strategy to boost its performance and competitiveness. Not a few people use the application as a tool in making decisions and the application is used as material to obtain search results from a subject matter [1].

Every agency always faces the future in its activities, in order to achieve its vision and mission. In reaching optimal decisions on the activities of an agency, it is necessary to use an appropriate, systematic and accountable method. A doctor is someone who, because of his knowledge, tries to heal people who are sick. Becoming a doctor usually requires special education and training and a degree in medicine. Efforts made to increase the spirit of better performance and achievement, an institution gives awards to doctors who are considered achievers [2]. Setia Husodo Hospital is one the hospital which is health service centers in Asahan, established in 2011 and is located on Street Sisingamaraja. Doctors on duty at this hospital consist of general practitioners, specialist doctors, and polyclinics. The process of assessing the performance of doctors as the main professional staff in hospitals, must be carried out realistically, objectively, and based on evidence and specifically according to specialization and/or specific procedures. However, it is different at Setia Husodo Hospital in determining the performance appraisal of doctors and staff, leaders still use conventional methods. Doctors' performance evaluation is still done manually and the data processing process does not yet use application programs in making decisions[3][4]. Therefore it is necessary to design system support in making a decision for evaluating the performance of doctors at Setio Husodo Hospital.

Decision support systems are able to provide problem-solving skills and communication skills for problems with semi-structured and unstructured conditions. This system is used to assist decision-making in semi-structured situations and unstructured situations, where no one knows for sure how decisions should be made [5]. Basically, the decision support system is a further development of a computerized management information system that is designed in such a way that it is interactive with the user. The interactive nature is intended to facilitate integration between various components in the decision-making process such as procedures, policies, analytical, techniques, as well as managerial experience and insight to form a flexible decision framework [6].

The designed system will later apply a Weighted Product (WP) method. This method is often used to assist in setting goals or decisions. The concept used is weighting with the rating of an appraisal variable, this Weighted Product (WP) method only produces the largest value which will be selected as the best alternative[7]. The results of this system design are expected to be a tool for Setio Husodo Hospital in analyzing and deciding on the performance of doctors

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who will be given incentives and reward programs as well as value-based purchasing strategies for doctors. This method has been proven by several previous studies, including research conducted by [8] with the title decision support system for selecting Indonesian youth boat participants using the Weighted Product (WP) method. this method can be used to choose the best alternative or participant in the selection of the Nusantara Youth Ship participants, research conducted by [9] can provide convenience for Personnel in managing cashier performance appraisal data with more relevance at PT Lotte Mart Indonesia, and research conducted by [10] using the Weight Product method of performance appraisal Deli Serdang firefighters can be carried out more quickly, accurately and efficiently with an objective assessment.

The purpose of this research later is to design a web-based decision support system application evaluating the performance of doctors using the Weighted Product method, to help solve problems in evaluating the performance of doctors at Setio Husodo Hospital based on existing criteria including the Number of Polyclinic Patients, Doctor's Training/Compliance sop, polyclinic attendance time, and Visite time. implementing a good web-based application system to make it easier for the leadership process of recording doctor performance appraisals through applications that are easy, fast, precise, and accurate.

METHOD

This research framework is the steps that will be taken in solving the problem to be discussed. The framework for this research can be described in Image 1

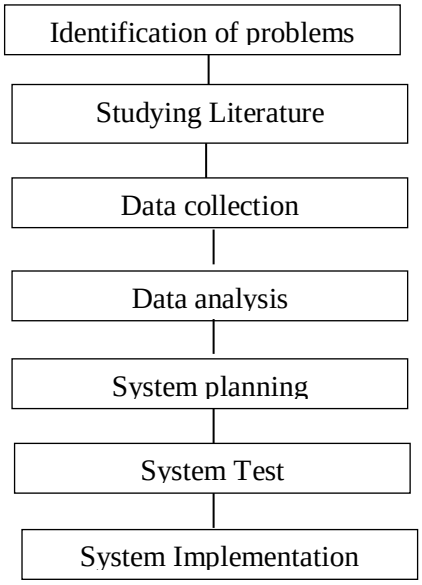

Image 1. Research Framework

Identification of problems

At this stage research was carried out to find out the problems that existed at Setio Husodo Hospital and find the right solution to these problems. In this case the problem with the process of evaluating the performance of doctors at Setio Husodo Hospital is still doing it manually and the data processing process has not used an application program in making decisions. For this reason, the author will create a website using the DSS concept with the weighted product method and using the PHP programming language to make it easier for Setio Husodo Hospital in evaluating doctor performance.

Studying Literature

In addition to the data obtained from the research site, the service team also collects literature related to research, namely collecting journals and books related to supporting decision systems using the weighted product method.

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Data collection

At this stage, the data collection process was carried out in the form of interviews and observations to carry out observations and analysis of the decision support system process for evaluating the performance of doctors at Setio Husodo Hospital so as to obtain the data, and information needed.

Data analysis

At this stage identification of problems in the system that is running. Thus, it is hoped that the research will find constraints and problems that occur in the support system for evaluating the performance of doctors at Setio Husodo Hospital.

System planning

System design using flowmap, UML (Unified Modeling Language), and database using MySQL. User interface design with input and output design with main menu display, doctor data menu, criteria menu, as well as doctor performance assessment calculation data display.

System Test

This stage is carried out after the creation of the system module has been completed with experiments on the computer User Interface. By conducting this trial, it can be seen that the deficiencies in the system that has been made are in accordance with the design of the system being designed and whether the handling of the problem is going well.

System Implementation

The system implementation stage is the stage of compiling an application program to draw a conclusion. This system is implemented into PHP and MySQL and uses Sublime Text 3.

The Weighted Product method is a method of solving the Multiple Attribute Decision Making (MADM) problem. This method evaluates several alternatives to a set of attributes or criteria, where each attribute is independent of one another. The weighted product method uses multiplication to connect attribute ratings, where the rating of each attribute must be raised to the first power of the attribute's weight[7][8]. This process is the same as the normalization process. The steps in completing the weighted product method are as follows:

1. Determine the criteria and the weight of each criterion.
2. Calculate the relative value of the initial weight (w_j) where $\sum w_j$=1

$$W_j = \frac{w_j}{\sum w_j} \text{.....(1)}$$

3. Make a comparison matrix of alternatives and criteria.
4. Calculate the value of the vector S.

$$S_i = \prod_{j=i}^{n} X_{ij}^{w_j} \text{ .....(2)}$$

5. Perform relative preference value calculations (Vector V)

$$V_i = \frac{S_i}{\prod_{j=1}^{n}(x_j^*)w_j} \text{ .....(3)}$$

6. Rank alternatives.

RESULTS AND DISCUSSION

In the process of a decision support system for assessing the performance of doctors who are entitled to a reward at Setio Husodo Hospital in evaluating the performance of doctors

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using the Weighted Product (WP) Method. The criteria for consideration on the data table 1:

Table 1. Criteria weighting data

Criteria	Criteria Name	Weight Value
C1	Number of Polyclinic Patients	5
C2	Training	3
C3	Polyclinic Attendance Time	3
C4	Time Visit	2

From table 1 it can be seen that the weight value of 5 in the number of polyclinic patients is a top priority in determining the awarding of doctors and then lowering it to adherence to SOP and then the time of attendance at the polyclinic, time visite. The preference weight value is the priority level of criteria for decision makers which is given as W. as alternative data in the proposed research on the data table 2:

Table 2. Alternative data

Alternative	Name Doctor
A1	Dr. Ansaruddin Nasution, Sp.A
A2	Dr. Ardyansyah Nasution, Sp.THT-KL
A3	Dr. Awaluddin Sibuea, Sp.B
A4	Dr. Binsar parulian Sitanggang, Sp.Og
A5	Dr. Darma liza efendi, M.ked (PD), Sp.PD
A6	Dr. Dina Mariana, M.Ked (PD), Sp.PD
A7	Dr. Intan Lismayani, M.Ked (Neu), Sp.s
A8	Dr. Janwar sahanda nasution, Sp.OG
A9	Dr. Julius Dariar, Sp.THT–KL
A10	Dr. Nini Deritana, Sp.P

Then determine the weight of each criterion, the criteria for the results of the value of the number of polyclinic patients is the result data for the value of the number of polyclinic patients based on the doctor's performance assessment.

Table 3. Number of Polyclinic Patients

Criteria	Subcriteria	Weight Value
Number of Polyclinic Patients	>3.600	5
	2.880-3.599	4
	<2.400	3

The criteria for the results of the education and training scores are data on the results of the education and training values based on the doctor's performance assessment.

Table 4. The criteria for the results of the training value

Criteria	Subcriteria	Weight Value
Training	>90 Hours	4
	60 s/d 89 Hours	3
	20 s/d 59 Hours	2

The criterion for polyclinic time attendance values is data resulting from polyclinic time attendance values based on doctors' performance assessments.

Table 5. The criteria for the results of the training value

Criteria	Subcriteria	Weight Value
Polyclinic Attendance Time	13.00 pm – 13.44 pm	4
	13.45 pm – 14.29 pm	3
	>14.30 pm	2

The criteria for the results of the time visit value are the results of the time visit value based on the doctor's performance assessment.

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Table 6. The criteria for the results of the time visit

Criteria	Subcriteria	Weight Value
The time visit	16.30 pm – 16.59 pm	4
	17.00 pm – 17.59 pm	3
	>18.00 pm	2

From each of these criteria, the weights will be determined as follows:

Table 7. Weight Value

Definition	Weight Value
Very less	1
Not enough	2
Enough	3
Well	4
Very good	5

At this stage, the discussion will be explained in solving the problems described in the previous introduction. In using the Weighted Product method, there are several simple steps that can be seen in the formula equations (1),(2), and(3) in the previous description. After determining the value of the match twig of each criterion. As for alternative data on each criterion in this study, it can be explained in table 8, which is used as a reference in processing assessment data.

The next stage is to improve the weight first, where the initial weight W = (5, 3, 3, 2) will be corrected with the first formula equation.

$$W_j = \frac{w_j}{\sum w_j}$$

W = (5 + 3 + 3 + 2) = 13

$$W1 = \frac{5}{5+3+3+2} = 0{,}385$$

$$W2 = \frac{3}{5+3+3+2} = 0{,}231$$

$$W3 = \frac{3}{5+3+3+2} = 0{,}231$$

$$W4 = \frac{2}{5+3+3+2} = 0{,}153$$

$$Wj \sum W = 0{,}385 + 0{,}231 + 0{,}231 + 0{,}153 = 1$$

Tabel 8. Alternate Weight Value

Alternate	Criteria			
	C1	C2	C3	C4
Dr. Ansaruddin Nasution, Sp.A	4	3	4	3
Dr. Ardyansyah Nasution, Sp.THT-KL	3	2	3	3
Dr. Awaluddin Sibuea, Sp.B	3	2	4	2
Dr. Binsar parulian Sitanggang, Sp.Og	4	2	3	3
Dr. Darma liza efendi, M.ked (PD), Sp.PD	4	3	3	3
Dr. Dina Mariana, M.Ked (PD), Sp.PD	3	3	4	3
Dr. Intan Lismayani, M.Ked (Neu), Sp.s	3	2	4	3
Dr. Janwar sahanda nasution, Sp.OG	3	3	3	3
Dr. Julius Dariar, Sp.THT–KL	3	2	3	3
Dr. Nini Deritana, Sp.P	5	3	2	2

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After correcting the weights, the next step is to calculate the value of the vector S by using multiplication to relate the attribute rating. Where the attribute rating must be raised to the first rank with the weight of the attribute in question. to calculate the vector value s using the 2nd formula equation.

$$S_i = \prod_{j=i}^{n} X_{ij}^{w_j}$$

$S_1 = (4^{0,38}) + (3^{0,23}) + (4^{0,23}) + (3^{0,15}) = 3,54$

$S_2 = (3^{0,38}) + (2^{0,23}) + (3^{0,23}) + (3^{0,15}) = 2,7$

After obtaining the vector S value for each alternative, the next step is to rank it to determine who deserves the prize. This ranking uses the value V where the formula for V is:

$$V_i = \frac{s_i}{\prod_{j=1}^{n}(x_j^*)w_j}$$

$$V1 = \frac{3,54}{30,27} = 0,12$$

$$V2 = \frac{2,7}{30,27} = 0,9$$

$$V3 = \frac{2,89}{30,27} = 0,1$$

$$V4 = \frac{3,02}{30,27} = 0,1$$

$$V5 = \frac{3,31}{30,27} = 0,11$$

Tabel 9. Vector S value for each alternative

Vektor S	Si
$S_1(A_1)$	3,54
$S_2(A_2)$	2,7
$S_3(A_3)$	2,89
$S_4(A_4)$	3,02
$S_5(A_5)$	3,31
$S_6(A_6)$	3,17
$S_7(A_7)$	2,89
$S_8(A_8)$	2,97
$S_9(A_9)$	2,7
$S_{10}(A_{10})$	3,09
$\sum S_i =$	**30,27**

Table 10. Rating result

Alternatives	Doctor Name	Grade V	Ranking
A1	Dr. Ansaruddin Nasution, Sp.A	0,12	1
A2	Dr. Darma liza efendi, M.ked (PD), Sp.PD	0,11	2
A3	Dr. Dina Mariana, M.Ked (PD), Sp.PD	0,1	3
A4	Dr. Nini Deritana, Sp.P	0,1	4
A5	Dr. Binsar parulian Sitanggang, Sp.Og	0,1	5
A6	Dr. Janwar sahanda nasution, Sp.OG	0,1	6
A7	Dr. Awaluddin Sibuea, Sp.B	0,1	7
A8	Dr. Intan Lismayani, M.Ked (Neu), Sp.s	0,1	8
A9	Dr. Ardiansyah Nasution, Sp.THT-KL	0,09	9
A10	Dr. Julius Dariar, Sp.THT–KL	0,09	10

CONCLUSION

Based on data and facts from previous research and current research on the use of the weighted product method in assessing physician performance, the results obtained are alternatives to A1 or Dr. Ansaruddin Nasution, Sp. A who is the doctor with the best performance from the other doctors' assessment data with the acquisition of a vector V value of 0.12 which is the maximum number

from the other data. The process of completing the weighted product method which is very easy to understand makes decision-making more efficient and effective. After obtaining data from the assessment results using the weighted product method, the hospital can make decisions in giving referrals to doctors in a transparent, accountable and effective manner.

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