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THE BEST NURSE RECOMMENDATION SUPPORT SYSTEM AT THE SRI MURTI HUSADA CLINIC IN SURAKARTA WITH THE WEIGHTED PRODUCT METHOD

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Abstract

The Health Agency is a health institution that is needed in a place for treatment of a disease. The current outbreak of the coronavirus demands optimal public health services. The role of medical personnel is an important concern in the world of health. Every Health Agency strives to be able to provide good and competent medical personnel in their fields to be able to help the community. Sri Murti Husada Clinic is a maternity clinic to serve patients of mothers who are about to give birth, check their wombs, place family planning, treat premature babies and others. In developing this clinic there are general practitioners, field doctors and nurses who have similar performance. The problem in this study is the large number of patient requests for quality nurse performance services, for this reason the clinic must be able to provide the best nurses with criteria such as: Performance, Education, Years of Service, Discipline, Attitude and Productivity. In the old system that has been running in determining the best nurse only based on years of service and ignoring other criteria. This old system model can lead to inaccurate and unfair decision results. Research aims to make a decision support system application for determining the best nurse performance at the Sri Murti Husada Clinic using the Weighted Product Algorithm Method. This method was chosen because it has the ability in ranking to determine the best alternative by applying all the criteria. The result of this study is the formation of a decision support system application that can provide the best nurse recommendations by applying all the criteria. Based on the functionality tests carried out, successful results were obtained and the validity test results obtained appropriate results.

Keywords: *Decision Support System, Best Nurse, Weighted Product*

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1. INTRODUCTION

The Health Agency is a health institution that is needed in a place for the treatment of a disease. With the current coronavirus outbreak, the role of health agencies is an important part of society. In providing health services, the role of medical personnel is an essential concern in the world of health. Every Health Agency strives to provide good and competent medical personnel in their fields to produce quality products[1].

Sri Murti Husada Clinic is a maternity clinic to serve patients of mothers who are about to give birth, check their wombs, place family planning, treat premature babies and others. Sri Murti Husada Clinic is supported by expert doctors, midwives and nurses. At the Sri Murti Husada Clinic 10 nurses have various levels of performance.

The main problem in this study is the large number of patient requests for quality nurse performance services, which requires the clinic to provide the best nurses. The basic criteria for the best nurse are: Performance, Education, Years of Service, Discipline, Attitude and Productivity. In the old system that has been running in determining the best nurse only based on years of service and ignoring other criteria. This old system model can lead to inaccurate and unfair decision results.

The research objective was to make a decision support system application for determining the best nurse performance at the Sri Murti Husada Clinic using the Weighted Product Algorithm Method. This method was chosen because it has the ability in

ranking to determine the best alternative by applying all criteria [2]. This research was able to solve one of the problems related to the health sector in accordance with the National Research Priorities (PRN) for 2020-2024 in the field of ICT infrastructure and access.

The references to previous research are: Decision Support Systems for Hiring Employees Using the Web-Based Weighted Product Method, By: I M. S. D Mahendra, 2020. Explains that the Weighted Product Method has the ability to determine alternative new employees with the right results because it is able to apply all the criteria [3].

Previous research entitled: Implementation of Weighted Products in Making Assessment Systems for Medical Personnel in Kampung Bali - Bengkulu City, By: Lena Elfianty, 2019. The purpose of this research is to create a system that can determine the level of achievement of medical staff. Algorithm Method: Weighted Product Method. There are 4 variables such as: education, years of service, attendance and performance. The end result of this research is the formation of a system that is able to rank the best medical personnel appropriately [4].

Decision Support System for Selection of the Best Sales Executive at KIA Motors Siliwangi Using Weighted Products, By: Yaumil Khairiyah, 2022. The purpose of this study was to determine the performance of the best sales target level at KIA Motors Siliwangi. Weighted Product Method. There are 4 such as: Attitude, Discipline, Skill and Performance. The final results of this study indicate that the assessment of Sales Executives has met the predetermined criteria [5].

Decision Support System for Selection of the Best Doctor at the District Health Office. Simalungun Using the MABAC Method, By: Saima Ronita Purba, 2020. The purpose of this research is to make it easier and faster to determine the best doctor according to existing criteria. Algorithm Method: MABAC Method. There are 5 variables such as: absence, discipline, responsibility, experience, and age. The end result is the creation of a system that can determine the choice of the best doctor with quick decisions [6].

Implementation of the Weighted Product Method for Selecting the Best Midwife at the Lalang Batubara Health Center, By: Jeperson Hutahaean, 2019. The purpose of this study was to find out the system for determining the best midwife at the Lalang Batubara Health Center. Algorithm Method: Weighted Product Method. There are 5 variables such as: Knowledge, time discipline, responsibility, skills and teamwork. The end result of this research is the formation of a system that can determine the best midwife with accurate results [7].

Based on the description of the previous research, there are differences with the current research, namely the object of research at the Sri Murti Husada Clinic in Surakarta has never been done, the number of different criteria variables in this study uses 6 criteria variables according to the Decree of the Minister of Health R.I No. 857/Menkes/SK/IX/2009, criteria for HR in Health Agencies such as: Performance, Education, Years of Service, Discipline, Attitude and Productivity While these 6 variables have never been used from previous research, so researchers are interested in developing this research that is more Good.

Based on the background above, the authors are interested in conducting research with the title "Decision Support System for the Best Nurse Recommendations at the Sri Murti Husada Clinic in Surakarta with the Weighted Product Method". So that it is hoped that it can help the Sri Murti Husada Surakarta Clinic in making decisions on the best nurse recommendations.

2. RESEARCH METHOD

This research is included in the quantitative experimental research by conducting trials on nurse data, certain criteria and weights for designing application systems.

2.1 Data Source

This study uses nurse data, criteria and weights originating from the Sri Murti Husada Clinic with the address: Jl. Professor DR. Soeharso No. 109, Jajar, Laweyan, Surakarta.

2.2 Method of collecting data

The method used in the framework of collecting the necessary data in this study is as follows:

1) Interview

At this stage, the researcher interviewed directly the information center section of the Personnel field at the Sri Murti Husada Clinic in Surakarta because it had a direct bearing on the case studies being carried out in the research.

2) Observation

At this stage, direct observation by recording and analyzing the problems that are being processed in this research process so that systematic data can be obtained about the things being studied[15].

3) Library Studies

At this stage the researcher conducted a literature study by collecting official reference materials regarding the Best Nurse Recommendation Support System with the Weighted Product Method and several other references that support the research objectives.

2.3 System Development Method

The system development method is useful for developing systems according to the stages:

1. Data Analysis

Based on the data that has been obtained, the discussion of this research is carried out by following steps: Data Identification, Data Selection, Data Grouping, Data Selection and Dataset

2. Role System

In the design stage of this application system there are core parts of the system such as:

a. Master Data Input (Nurse Data, Criteria and Criteria Weight).
b. The Selection Process with the Weighted Product Method to determine the best nurse.
c. Reports, in the form of three types, namely: Nurse Data Reports, Reports on Overall Selection Results and Reports on the Best Selection Results.

3. System Design

In the application system design stage, several core designs were made as follows:

a. Input and Output Design

In the design, the input is in the form of a filling form to fill in nurse data, criteria data and criteria weight data while the output design is nurse data reports, overall selection results reports and reports on the best selection results[16].

b. Database Design

In database design it is useful to determine table structure, number of tables, data types and table relationships. In the process of table data relations, the Entity Relationship Diagram (ERD) model is used, which is a data model that uses several notations to describe in the context of entities and relationships described by entities[10].

4. System Modeling

In modeling this application system, several models are made as follows:

a. Context Diagram

Context diagram is a general system overview of the entire system from input to system output. It aims to provide an overview of the whole system[11].

b. HIPO

Hierarchy Input Process Output (HIPO) is a program documentation technique that describes the flow or work system of the program that has been designed. HIPO is useful for describing system flow in stages[12].

c. DAD (Data Flow Chart)

DAD is a graphical representation that describes the flow of information and the transformation of information that is applied as data flowing from input and output. DAD is useful for representing a complete system through several levels of abstraction[13].

5. System Implementation

In the implementation stage this application system will be made using the PHP Programming Language and MySQL Database.

6. System Testing

In the application system testing phase, this will be carried out using functionality testing and validity testing. Functional Testing is useful for testing each application menu, with the Black Box testing method, so that the results of system feasibility recommendations are obtained. Validity testing is carried out by comparing the results of manual algorithm calculations with test results from application programs[14]. This system is designed to be able to assist in making decisions according to certain criteria and weights that have been developed in the Algorithm[17].

The algorithm method used in this research is the Weighted Product (WP) method. The Weighted Product method is one of the methods used to complete a decision-making system by considering the criteria and weights. The purpose of this method is to assist in making a decision by solving semi-structured and unstructured problems [8].

The steps in the calculation of the Weighted Product Method Algorithm are as follows

1. The initial stage determines alternative nurse data according to the criteria.
2. Perform normalization calculations on the criteria data that has been processed according to formula1

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

3. Calculating the Value of Vector S

The process of calculating the value of vector s can use formula 2.

$$S_i = \prod_{j=1}^{n} \left(X_{ij}^{w_j}\right) \text{.....(2)}$$

4. Calculating the Value of Vector V

The process of calculating the value of vector s can use formula 3.

$$Vi = \frac{\prod_{j=1}^{n} Xij^{wj}}{\prod_{j=1}^{n} Xij*Wj} \; atau \; Vi = \frac{S_i}{\sum S_i} \text{.....(3)}$$

5. Calculating the ranking process

The calculation of the ranking value is taken based on the calculation results of the highest vector value then determined as the best alternative.

The Implementation Process of the Weighted Product Method Algorithm is used as a tool to assist in decision making to determine the best nurse[9].

3. RESULTS AND DISCUSSION

The results of this discussion are the overall system design data. Discussion of the results of this study contains the process of analysis of the implementation of the Weighted Product Method algorithm in determining the best nurse.

3. 1 Criteria and Weight

In the Weighted Product Method, there are criteria and weights needed to carry out the selection process for selecting the best nursewhich can be see in table 1

Table 1. Criteria and Weight

No	Code	Criteria	Weight Value	Criteria Category
1	K1	Performance	10	Benefit
2	K2	Education	9	Benefit
3	K3	Years of service	8	Benefit
4	K4	Discipline	7	Benefit
5	K5	Attitude	6	Benefit
6	K6	productivity	5	Benefit

The explanation of each criterion in the decision support system for selecting the best nurse is as follows.

1. Performance Criteria

The criteria for nurse performance are taken because the best nurse must have professional performance. So that this performance criterion is feasible to be set as one of the measuring tools to determine the best nurse choices. The conversion of these criteria is presented in table 2.

Table 2. Conversion of Performance Criteria

No	Performance	Mark
1	Very good	10
2	Good	9
3	Quite good	8
4	Not good	7

2. Education

The criterion for nurse education is a form of scientific level possessed by the best nurse candidates. Education is an important part in measuring the quality of nurse performance. Convert the value of nurse education criteria as shown in table 3.

Table 3. Conversion of Performance Criteria

No	Education	Mark
1	>=S2	10
2	S1	9
3	D4	8
4	<=D3	7

3. Working Period

The criterion of the nurse's tenure is a form of performance that is measured based on the length of work of the nurse, this provides a consideration value in determining the best nurse because tenure is a form of loyalty from the nurse, the longer the tenure, the more priority the nurse takes. For years of service there is no need for a value conversion because this criterion is already in the form of a number.

4. Discipline

The criterion for nurse discipline is a form of performance that is measured based on the number of attendance of the best nurse candidates. The more diligent the nurse is to attend, the more prioritized in determining the best nurse. For this disciplinary criterion, there is no need for value conversion because the disciplinary criteria are already in the form of numbers so that they can be directly used in the Algorithm calculation process.

5. Attitude

On the criteria of nurse attitude is a form of behavior that is owned by the best nurse candidates. The best nurse must have a good attitude, so the better the nurse's attitude, the more appropriate she is to be named the best nurse. The conversion value of the nurse's attitude criteria is shown in table 4.

Table 4. Conversion of Attitude Criteria

No	attitude	Mark
1	Very good	10
2	Good	9
3	Pretty good	8
4	Not good	7

6. Productivity

The productivity criteria are used to assess the effectiveness of a job to achieve certain goals from nurses. The conversion value of nurse productivity is shown in table 5.

Table 5. Productivity Criteria Conversion

No	Productivity	Nilai
1	Very Productive	10
2	Productive	9
3	Productive enough	8
4	Less Productive	7

3. 2 System Planning

1. Context Diagrams

Contex Diagram for the decision support system for selecting the best nurse recommendations, there are 3 entities. The admin entity plays a role in inputting nurse data, criteria and weights to the system. In the nurse entity, the role is to provide nurse data to the system. In the leadership entity, the role is to view or get reports from the system. The Context Diagram model of this system is presented in figure 1.

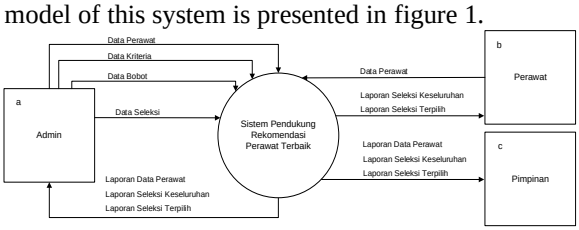

Figure 1. Context Diagram

2. Hierarchy of Input Process Output (HIPO)

The Hierarchy of Input Process Output (HIPO) used in this study consists of three parts, starting from input, process and output. The HIPO image of the Best Nurse Selection Decision Support System can be seen in figure 2.

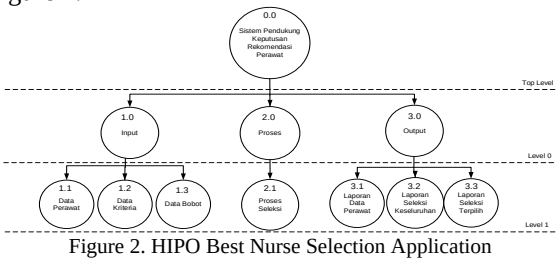

Figure 2. HIPO Best Nurse Selection Application

3. Diagram Arus Data (DAD)

Data Flow Diagram (DAD) from this study there are 3 entities that function as part of the system manager. The Admin entity is in charge of inputting nurse data, the nurse entity gets report results and the leadership entity also functions to get reports. The

following is DAD level 0 for the Best Nurse Recommended Decision Support System. The description of DAD Level 0 can be seen in figure 3.

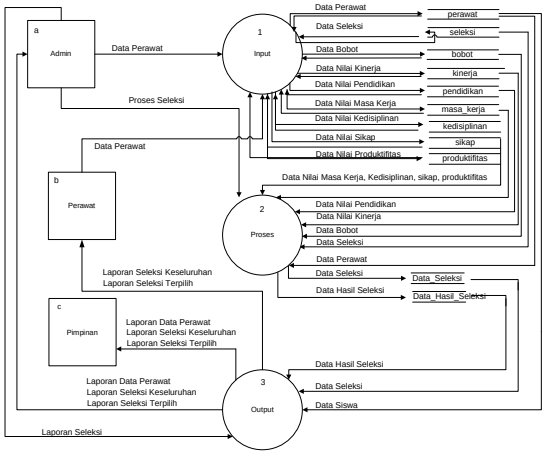

Figure 3. DAD Best Nurse Selection Application

3. 3 System Implementation

System implementation is the process of making a system in the form of designing the Best Nurse Recommendation Selection System Application.

1. Application Login

In using the Best Nurse Recommendation Selection System Application, it starts from the application login as shown in figure 4.

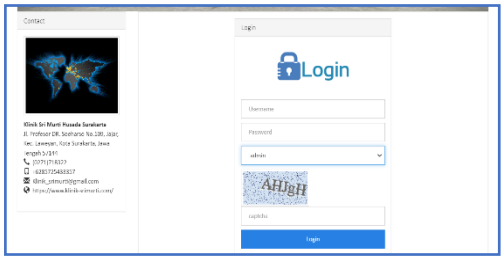

Figure 4. Login to the Best Nurse Recommended SPK Application

2. Nurse data input

The data input display used to input nurse data into the application program can be shown in Figure 5.

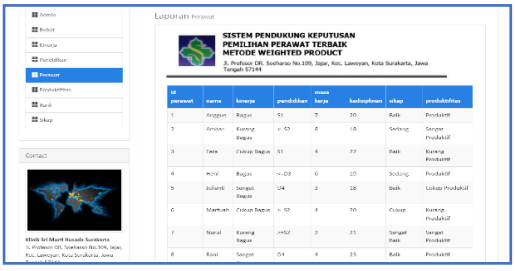

Figure 5. Nurse Data Input Form

3. Nurse Data Display

After the nurse data is inputted into the application program, all data will be stored in the program. Display of nurse data from the application program is presented in figure 6.

Figure 6. Nurse Register Form

4. Criteria Weight Setting Display

The appearance of the Criteria weight form is used to determine the weight value of each criterion. Display weight criteria in this application program is presented in figure 7.

Figure 7. Nurse Register Form

5. Display of Performance Criteria

In setting these criteria there are performance, education, attitude and productivity. In this section, the author only presents one design criterion, namely performance, because the other criteria have almost the same appearance design. The display of the performance criteria convention menu can be seen in figure 8.

Figure 8. Performance Criteria Form

5. Selection Result Report

The results of the decision support system for selecting nurse recommendations are in the form of 3 reports, namely the nurse data report, the overall selection results report and the selected selection results report.

a. Nurse Data Report

Reports of nurse data from this system can be seen in figure 9.

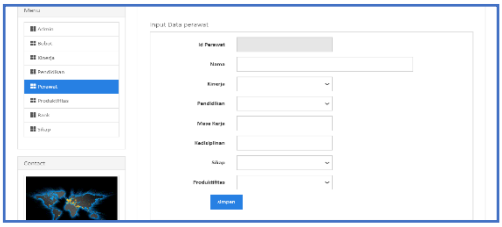

Figure 9. Nurse Data Report

b. Overall Selection Result Report

Report on the results of the overall selection of this system can be seen in figure 10.

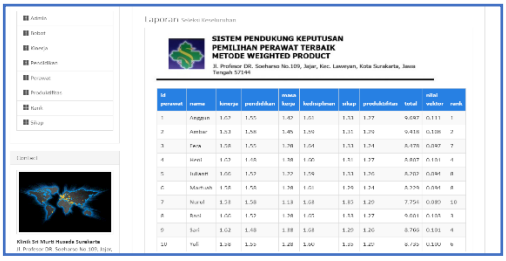

Figure 10. Overall Results Report

c. Selected Selection Result Report

Reports on the selected selection results from this system can be seen in figure 11.

Figure 11. Selected Selection Report

3. 4 System Testing

System testing is carried out with 2 test stages, namely functionality testing and validity testing. The recap of the functional test results can be seen in table 6.

Table 6. Functionality Test

No	Tested System Components	Test Scenario	Expected Results	Test Result
1	Admin Login Form	• Enter the username and password, then select the admin level and fill in the capca code correctly	• The admin main menu page appears	Success
2	Nurse Input Form	• Enter nurse's data completely and correctly	• Nurse's data is stored properly and correctly	Success
3	Performance Value Criteria Input Form	• Enter performance value data completely and correctly	• Criteria data is stored properly and correctly	Success
4	Educational Value Criteria Input Form	• Enter education data completely and correctly	• Criteria data is stored properly and correctly	Success
5	Weight Input Form	• Enter weight data completely and correctly	• Weight data is stored properly and correctly	Success

In addition to testing the system by testing the functionality of the researchers also tested the system by testing the validity. Based on Formula 2, the Calculation Process for the Weighted Product Method is as follows:

1. Determine Nurse Data

The first step that must be prepared is to collect nurse data which will be carried out in the process of selecting the best nurse recommendations as shown in table 7.

Table 7. Nurse Data

No	Name	C1	C2	C3	C4	C5	C6
1	Anggun	Good	S1	7	20	Good	P
2	Ambar	Not good	>=S2	8	18	Pretty good	VP
3	Fera	Quite good	S1	4	22	Good	LP
4	Heni	Good	<=D3	6	19	Pretty good	P
5	Julianti	Very good	D4	3	18	Good	PE
6	Marfuah	Quite good	>=S2	4	20	Not good	LP
7	Nurul	Not good	>=S2	2	21	Very good	VP
8	Rani	Very good	D4	4	23	Good	P
9	Sari	Good	<=D3	6	21	Not good	LP
10	Yuli	Quite good	S1	4	19	Very good	VP

Note:
C1 : Performance
C2 : Education
C3: Years of service
C4 : Discipline
C5: Attit-ude
C6: Produ-ctivity

Note C6 :
VP = Very Productive
P = Productive
PE = Productive Enough
LP = Less Productive

2. Value Conversion

After the nurse data is collected, so that the calculation process can be carried out, it is necessary to convert the values according to the criteria, as in table 8.

Table 8. Conversion Value Data

No	Name	C1	C2	C3	C4	C5	C6
1	Anggun	9	9	7	20	9	9
2	Ambar	7	10	8	18	8	10
3	Fera	8	9	4	22	9	7
4	Heni	9	7	6	19	8	9
5	Julianti	10	8	3	18	9	8
6	Marfuah	8	10	4	20	7	7
7	Nurul	7	10	2	21	10	10
8	Rani	10	8	4	23	9	9
9	Sari	9	7	6	21	7	8
10	Yuli	8	9	4	19	10	10

3. Criteria weighting

This stage is carried out to normalize the criteria weight values so that they can be used to continue in the normalization process. The process of weighting the criteria is as presented in table 9.

Table 9. Criteria Weighting Process

No	Criteria	Weight Value	Weight Normalized Value
1	Performance	10	10/45 = 0,22
2	Education	9	9/45 = 0,2
3	Years of service	8	8/45 =0,18
4	Discipline	7	7/45 =0,16
5	Attitude	6	6/45 =0,13
6	productivity	5	5/45 =0,11
	Results	45	

4. Calculating Vector Values

Determining the Vector Value S, which can be calculated by calculating the vector value and then ranking it as presented in table 10.

Table 10. Calculation of Vector Values

No	Name	Performance	Education	Years of service	Discipline	Attitude	Productivity	Results	Vector Value	Rank
1	Anggun	$9^{0,22}$=1,62	$9^{0,2}$=1,55	$7^{0,18}$=1,42	$20^{0,16}$=1,61	$9^{0,13}$=1,33	$9^{0,11}$=1,27	9,697	0,111	1
2	Ambar	$7^{0,22}$=1,53	$10^{0,2}$=1,58	$8^{0,18}$=1,45	$18^{0,16}$=1,59	$8^{0,13}$=1,31	$10^{0,11}$=1,29	9,418	0,108	2
3	Fera	$8^{0,22}$=1,58	$9^{0,2}$=1,55	$4^{0,18}$=1,28	$22^{0,16}$=1,64	$9^{0,13}$=1,33	$7^{0,11}$=1,24	8,478	0,097	7
4	Heni	$9^{0,22}$=1,62	$7^{0,2}$=1,48	$6^{0,18}$=1,38	$19^{0,16}$=1,6	$8^{0,13}$=1,31	$9^{0,11}$=1,27	8,807	0,101	4
5	Julianti	$10^{0,22}$=1,66	$8^{0,2}$=1,52	$3^{0,18}$=1,22	$18^{0,16}$=1,59	$9^{0,13}$=1,33	$8^{0,11}$=1,26	8,202	0,094	8
6	Marfuah	$8^{0,22}$=1,58	$10^{0,2}$=1,58	$4^{0,18}$=1,28	$20^{0,16}$=1,61	$7^{0,13}$=1,29	$7^{0,11}$=1,24	8,229	0,094	8
7	Nurul	$7^{0,22}$=1,53	$10^{0,2}$=1,58	$2^{0,18}$=1,13	$21^{0,16}$=1,63	$10^{0,13}$=1,35	$10^{0,11}$=1,29	7,754	0,089	10
8	Rani	$10^{0,22}$=1,66	$8^{0,2}$=1,52	$4^{0,18}$=1,28	$23^{0,16}$=1,65	$9^{0,13}$=1,33	$9^{0,11}$=1,27	9,001	0,103	3
9	Sari	$9^{0,22}$=1,62	$7^{0,2}$=1,48	$6^{0,18}$=1,38	$21^{0,16}$=1,63	$7^{0,13}$=1,29	$8^{0,11}$=1,26	8,766	0,101	4
10	Yuli	$8^{0,22}$=1,58	$9^{0,2}$=1,55	$4^{0,18}$=1,28	$19^{0,16}$=1,6	$10^{0,13}$=1,35	$10^{0,11}$=1,29	8,735	0,1	6

Notes:

At Total Value = 1.62x1.55x1.42x1.61x1.33x1.27 = 9.697.

Vector Value = 9.745 / 87.092 = 0.111

Based on the calculation process using the Weighted Product (WP) Method, the best nurse was obtained, namely Anggung because it had the highest result of all the alternatives. Highest Yield = 0.111. So it deserves to be designated as the Best Nurse at the Murti Husada Clinic in Surakarta. After that, the manual calculation results are compared with the calculation results in the Application program as shown in figure 12.

Figure 12. Selection Results in the Program

From the results of a comparison between manual calculations and application programs, the same results were obtained, namely Anggun was selected as the best nurse, so this system was declared valid.

4. CONCLUSION

The conclusions from the study with "Decision Support System for Selection of the Best Nurse Recommendations at Klink Murti Husada Surakarta Using the Weighted Product Method" are as follows: The results of this study are the realization of a Decision Support System Application Program for Selection of the Best Nurse Recommendations with the Weighted Product Method based on criteria such as Performance, Education, Years of Service, Discipline, Attitude and Productivity.

Based on the results of system testing that has been carried out on the functionality test, it produces an accepted test status on all system test forms and on the validity test, namely comparing the computerized results with real data, valid results have been obtained, so that the system is declared normal. Validity test results that have been carried out between the results of application programs compared to manual calculations with the Weighted Product Method Algorithm have obtained valid results.

5. ACKNOWLEDGEMENT

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