

APPLICATION OF THE WEIGHTED PRODUCT (WP) ALGORITHM FOR DETERMINING PRIORITY LOCATIONS FOR FAMILY PLANNING PROGRAM EXTENSIONS IN TANJUNGBALAI CITY

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Abstract

Background : Family Planning is a quality family that is established by promoting, protecting and helping to realize reproductive rights as well as providing the services, arrangements and support needed to form a family with the ideal marriageable age, regulate the number of children, the distance of children and the ideal childbearing age to regulate pregnancy and foster resilience and well-being of children. The family planning program aims to increase public awareness and participation in following family planning rules, namely through limiting the age of marriage, birth spacing, increasing family resilience, increasing family welfare, in order to realize the Small Happy and Prosperous Family Norm [1]. In an effort to launch a family planning program in Tanjungbalai City. The Office of Occupational Control and Family Planning (DPPKB) will conduct counseling on the family planning program to reduce the high birth rate. However, until now there are still many family planning consultation services carried out in several areas with low birth rates, if the location of the expansion is not always on target, it is feared that the program will not achieve its objectives. So we need a system analysis to help make decisions in site selection. **Method :** One technique that can be used to determine location selection is to use a decision support system (SPK) with the Weighted Product (WP) method. For that we need a computer-based decision support system that can combine models and data to provide support to decision makers in solving problems that involve users in depth. **Result :** From the above problems, the authors are interested in raising the issue and putting it into a thesis entitled "Application of the Weighted Product (WP) Algorithm for Determining Priority Locations for Family Planning Extension Program Tanjungbalai City". **Conclusion :** It is hoped that the Weighted Product method can provide convenience in determining the Priority Location of Family Planning Extension Programs to produce effective decisions and help the Department and the community.

Keywords: Information Systems, Decision Support System, Weighted Product(WP) Method, Family planning

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INTRODUCTION

In an effort to launch a family planning program in Tanjungbalai City. The Office of Occupational Control and Family Planning (DPPKB) will conduct counseling on the family planning program to reduce the high birth rate. However, until now there are still many family planning consultation services carried out in several areas with low birth rates. So we need a system analysis to help make decisions in site selection. One technique that can be used to determine location selection is to use a decision support system (SPK) with the Weighted Product (WP) method. For that we need a computer-based decision support system that can combine models and data to provide support to decision makers in solving problems that involve users in depth.

The system is made up of objects or elements that are related or related to each other in such a way that these elements constitute a processing unit or certain processing [2]. Information is data that has been classified or processed or interpreted for use in the decision-making process [2]. An Information System is a system within an organization that meets the needs of daily transaction processing that supports the managerial operational functions of the organization with the strategic activities of an organization to be able to provide certain external parties with the necessary reports [2]. Decision Support System is a decision support system as a computer-based information that produces various alternative decisions to assist management in dealing with various structured and unstructured problems using data and models[3].

The Weighted Product (WP) method is part of the well-known multi-criteria decision analysis (MCDA). Multi-criteria decision making (MCDM) method. The given multi-criteria decision analysis (MCDA) method is a limited set of decision alternatives described in terms of a number of decision criteria. Each decision alternative is compared with the others by switching a number of ratios, one for each decision criterion. Each ratio raised to power is equivalent to the relative weight of the corresponding criteria. This process is the same as the normalization process[4].

The steps in calculating the Weighted Product (WP) method are as follows:

1. Multiplying all attributes for all alternatives by the weight as a positive power for the cost attribute.
2. The multiplication results are added together to produce a value for each alternative.
3. Divide the value of V for each alternative by the value for each alternative.
4. Find the best alternative sequence that will be the decision.

The preference for alternative A_i is given in the following formula:

$$S_i = \prod_{j=1}^n X_{ij} w_j \text{ with } i = 1, 2, \dots, m$$

..... (1)

Where :

S : expressing preferential alternatives is analogous to a vector S.

X : declares the value of the criteria.

W : states the weight of the criteria.





i : states alternative.

j : state the criteria.

n : states many criteria.

where $w_j = 1$. w_j is a positive rank for the profit attribute, and a negative value for the cost attribute.

$$W_j = \frac{w_j}{\sum w_j} \dots \dots \dots (2)$$

The relative preference of each alternative, given in the formula:

$$V_i = \frac{\prod_{j=1}^n X_{ij} w_j}{\prod_{j=1}^n (X_{j*}) w_j} \text{ dengan } i = 1, 2, \dots, m \dots \dots \dots (3)$$

Where :

V : expressing preferential alternatives is analogous to a vector V .

X : declares the value of the criteria.

W : states the weight of the criteria.

i : states alternative.

j : state the criteria.

n : states the number of criteria.

In developing a decision support system of course by applying methods in data processing so that it will produce the value of results as expected. The method used to process lecturer data to produce the best lecturer data is the Weighted Product (WP) method. In order to obtain the final conclusion as an alternative decision to determine the best lecturer, this research requires a level of calculation process on each variable that has been determined later based on the criteria set by the higher education institution [11].

In research, the decision support system for the determination of recipients of home surgery assistance using the computerized Weighted Product method and testing the results of the determination of recipients of home surgery assistance will be easier to know and assist the Department of Housing and Residential Areas in completing tasks objectively and efficiently. The Weighted Product method can help solve the problem of determining the recipient of home surgery assistance [12].

Official Recruitment Decision Support System Using the Web-Based Weighted Product Method. This research aims to produce a website-based decision support system and can produce ranking results from each alternative with the Weighted Product method by looking at the result of the largest v vector value from each alternative that later it can be a consideration for the company to select new employee candidates. Based on the results of system testing with the blackbox testing method, the output displayed by the system has been in accordance with the input provided by the user[13].

The definition of Family Planning in general can be explained that family planning is an effort that regulates the number of births in such a way that for the mother and her baby and for the father and his family or the community concerned will not cause losses as a direct result of the birth. In the narrow sense, family planning in everyday life revolves around the prevention of conception or the prevention of conception, preventing the meeting between sperm cells (spermatozoa) from men and egg cells (ovums) from women [5]. Information





system flow is very useful to know the problems that exist in a system. From here it can be known whether the information system is still suitable for use or not, still manual or computerized. If the information system is no longer suitable then there needs to be a change in the data processing so as to produce fast and accurate information as well as better decisions. Here are the symbols from the Information System Flow (ASI) [6]. Flowchart is a symbolic representation of an algorithm or procedure to solve a problem, using a flowchart will make it easier for users to check the forgotten parts in problem analysis, besides that flowcharts are also useful as a facility to communicate between programmers who work in a project team [7]. "Unified Modeling language (UML) is a collection of diagrams that already have standards for building object-based software" [2]. According to some expert opinions for the definition of XAMPP as follows: Betha Sidik (2018:6) XAMPP is an abbreviation that each letter is [8]:

a. X: This program can run on many operating systems, such as Windows, Linux, Mac OS, and Solaris.

b. A: Apache, the Web application server. Apache's main task is to generate the correct web pages for the user against the PHP code already written by the web page maker. If the PHP code is also based on what is written, the database can be accessed first (for example MySQL) to support the web page produced.

c. M: MySQL, database application server. Its growth is called SQL short for Structured Query Language. SQL is a structured language that is used to process databases. MySQL can be used to create

and manage databases and their contents. Can also use MySQL to add, change, and delete data in the database. A web browser is a software or navigation device in the web that runs on the user's computer and is used to display pages of website documents that are on the internet or web server. One example of the web browser itself is Internet Explorer (IE), Mozilla Firefox (MF), Opera Mini, and many more [9]. SublimeText is an editor application for code and text that can run on various operating system platforms using Python API technology. The creation of this application was inspired by the Vim application. This application is very flexible and powerful. The functionality of this application can be expanded by using sublime-packages [10].

RESEARCH METHODS

The framework used is as a flow or stage in solving a problem of Determining the Priority Location of Family Planning Extension Program at the Tanjungbalai Population Control and Family Planning Office which is designed using the PHP and MySQL programming languages.

The qualitative research method is a method that emphasizes the aspect of in-depth understanding of a problem rather than looking at the problem for generalization research. This research method prefers to use in-depth analysis techniques, namely examining one problem that will differ from the nature of other problems. The purpose of this methodology is not a generalization but an in-depth understanding of a problem. Qualitative research serves to provide substantive categories and qualitative research hypotheses.





Data collection techniques are a method used by researchers in obtaining data in the field. Data collection techniques are a systematic and objective method with the aim of obtaining and collecting data and information that are examined in detail and correctly.

RESULTS AND DISCUSSION

The method used in decision-making to determine the location of family planning counseling is the Weighted Product (WP) method. Here is the analysis of the system and the calculation of the WP method:

1. Determine the types of criteria for determining the location of family planning counseling. In this research, the criteria needed for the location of family planning counseling are Number of KK, Number of Family Planning Participants, Number of Children, Age of Fertile Women.

2. Determining the weight of each alternative on each criterion evaluated with 1 to 5, that is with the following comparative value:

1 = Very Unimportant

2 = Not Important

3 = Doubtful

4 = Important

5 = Very Important

The weighting of Number of KK, Number of Family Planning Participants, Number of Children, Age of Fertile Women and Age of Fertile Women has been approved by the Tanjungbalai City Population and Family Planning Office

Criteria Admin. Here is Table 4.1 weighting criteria:

criteria	Scale	Weight
Number of Family Heads	< 1000	1
	1 200	2
	1300	3
	1400	4
	> 1500	5

Table 1. Weighting Criteria Total Head of Family

Criteria	Scale	Weight
Number of Family Planning Participants	< 100	1
	200	2
	300	3
	400	4
	> 500	5

Table 2 .Weighting Criteria for Total Family Planning Participants

Criteria	Scale (Each Village)	Weight
Number of children	50	1
	75	2
	100	3
	120	4
	> 125	5

Table 3. Weighting of Number of Children Criteria

Criteria	Scale	Weight
Age of fertile women	< 25	1
	30	2
	40	3
	50	4
	75	5

Table 4. Weighting of Fertile Women's Age Criteria

Criteria	Scale	Weight
Income	> Rp. 5000.000,-	1
	Rp. 4000.000,-	2
	Rp. 300.000,-	3
	Rp. 2500.000,-	4
	< Rp. 2000.000,-	5

Table 5. Weighting of Production Criteria

3. Five data samples will be used for this criterion. Location of family planning





counseling. Here is Table 4.6 sample data location of family planning counseling:

No	Village Name	Criteria				
		C1	C2	C3	C4	C5
1	Beting Kuala Kapias	2	2	3	2	5
2	Kapias Pulau Buaya	2	3	3	2	5
3	Pematang Pasir	4	3	3	3	4
4	Perjuangan	5	4	2	2	3
5	Sei Merbau	4	4	3	4	4
6	Keramat Kubah	5	5	5	4	4
7	Muara Sentosa	4	2	2	4	3
8	Pasar Baru	4	2	2	3	3
9	Sumber Sari	5	4	3	2	2
10	Sungai Raja	3	4	3	3	4
11	Pulau Sumardan	3	3	4	3	2
12	Selat Lancang	4	2	4	4	3
13	Tanjung Medan	5	2	3	3	2

Table 6. Criteria Weight of Each Family Planning Counseling Location

Further, the calculation of the Weighted Product (WP) method will be carried out by correcting the weighted correction value first. The initial weight $W = (4, 3, 4, 3, 3)$ will be improved until the total weight $\sum W_j = 1$, where W is the weight of each criterion entered by the Admin. As for the calculation of criteria improvement using equation 5.1:

$$W_j = \frac{W_{Initj}}{\sum_{j=1}^n W_{Initj}} \quad (5.1)$$

$$W1(\text{Jumlah KK}) = \frac{4}{4 + 3 + 4 + 3 + 3}$$

$$W1(\text{umlah KK}) = 0,2353$$

$$W2(\text{Jumlah Peserta KB}) = \frac{3}{4 + 3 + 4 + 3 + 3}$$

$$W2(\text{Jumlah Peserta KB}) = 0,1764$$

$$W3(\text{Jumlah Anak}) = \frac{4}{4 + 3 + 4 + 3 + 3}$$

$$W3(\text{Jumlah Anak}) = 0,2353$$

$$W4(\text{Usia Wanita Subur}) = \frac{3}{4 + 3 + 4 + 3 + 3}$$

$$W4(\text{Usia Wanita Subur}) = 0,1764$$

$$W5(\text{Penghasilan}) = \frac{3}{4 + 3 + 4 + 3 + 3}$$

$$W5(\text{Penghasilan}) = 0,1764$$

Figure 1. Criteria

The following is table above weight correction from Admin input:

Criteria	Interest Scale	Weight Repair
Number of Family Heads	4	0,2353
Number of Family Planning Participants	3	0,1764
Number of children	4	0,2353
Age of fertile women	3	0,1764
Income	3	0,1764

Table 7. Correction of weights from Admin input

2. Then the next step is to calculate the vector S , S is the value of each alternative. This calculation is done by multiplying all the attributes (criteria) for an alternative with W (weight) as a positive rank for the profit attribute and a negative rank weight for the cost attribute. When determining the KB Counseling Location, W (weight) is a positive rank because there is no cost attribute (attributes whose value is larger are more disadvantageous). How to calculate vector S is as follows:

$$S_1(A1) = 2^{(0,2353)} \times 2^{(0,1764)} \times 3^{(0,2353)} \times 2^{(0,1764)} \times 5^{(0,1764)}$$

$$S_1(A1) = 1,1771 \times 1,1301 \times 1,2950 \times 1,1301 \times 1,3285$$

$$S_1(A1) = 2,5864$$

$$S_2(A2) = 2^{(0,2353)} \times 3^{(0,1764)} \times 3^{(0,2353)} \times 2^{(0,1764)} \times 5^{(0,1764)}$$

$$S_2(A2) = 1,1771 \times 1,2139 \times 1,2950 \times 1,1301 \times 1,3285$$

$$S_2(A2) = 2,7782$$

$$S_3(A3) = 4^{(0,2353)} \times 3^{(0,1764)} \times 3^{(0,2353)} \times 3^{(0,1764)} \times 4^{(0,1764)}$$

$$S_3(A3) = 1,3857 \times 1,2139 \times 1,2950 \times 1,2139 \times 1,2772$$

$$S_3(A3) = 3,3773$$

$$S_4(A4) = 5^{(0,2353)} \times 4^{(0,1764)} \times 2^{(0,2353)} \times 2^{(0,1764)} \times 3^{(0,1764)}$$

$$S_4(A4) = 1,4604 \times 1,2772 \times 1,1771 \times 1,1301 \times 1,2139$$

$$S_4(A4) = 3,0120$$

$$S_5(A5) = 4^{(0,2353)} \times 4^{(0,1764)} \times 3^{(0,2353)} \times 4^{(0,1764)} \times 4^{(0,1764)}$$

$$S_5(A5) = 1,3857 \times 1,2772 \times 1,2950 \times 1,2772 \times 1,2772$$

$$S_5(A5) = 3,7382$$

$$S_6(A6) = 5^{(0,2353)} \times 5^{(0,1764)} \times 5^{(0,2353)} \times 4^{(0,1764)} \times 4^{(0,1764)}$$

$$S_6(A6) = 1,4604 \times 1,3285 \times 1,4604 \times 1,2772 \times 1,2772$$

$$S_6(A6) = 4,6213$$





$$S_7(A7) = 4^{(0,2353)} \times 2^{(0,1764)} \times 2^{(0,2353)} \times 4^{(0,1764)} \times 3^{(0,1764)}$$

$$S_7(A7) = 1,3857 \times 1,1301 \times 1,1771 \times 1,2772 \times 1,2139$$

$$S_7(A7) = 2,8580$$

$$S_8(A8) = 4^{(0,2353)} \times 2^{(0,1764)} \times 2^{(0,2353)} \times 3^{(0,1764)} \times 3^{(0,1764)}$$

$$S_8(A8) = 1,3857 \times 1,1301 \times 1,1771 \times 1,2139 \times 1,2139$$

$$S_8(A8) = 2,7165$$

$$S_9(A9) = 5^{(0,2353)} \times 4^{(0,1764)} \times 3^{(0,2353)} \times 2^{(0,1764)} \times 2^{(0,1764)}$$

$$S_9(A9) = 1,4604 \times 1,2772 \times 1,2950 \times 1,1301 \times 1,1301$$

$$S_9(A9) = 3,0847$$

$$S_{10}(A10) = 3^{(0,2353)} \times 4^{(0,1764)} \times 3^{(0,2353)} \times 3^{(0,1764)} \times 4^{(0,1764)}$$

$$S_{10}(A10) = 1,2950 \times 1,2772 \times 1,2950 \times 1,2139 \times 1,2772$$

$$S_{10}(A10) = 3,3206$$

$$S_{11}(A11) = 3^{(0,2353)} \times 3^{(0,1764)} \times 4^{(0,2353)} \times 3^{(0,1764)} \times 2^{(0,1764)}$$

$$S_{11}(A11) = 1,2950 \times 1,2139 \times 1,3857 \times 1,2139 \times 1,1301$$

$$S_{11}(A11) = 2,9884$$

$$S_{12}(A12) = 4^{(0,2353)} \times 2^{(0,1764)} \times 4^{(0,2353)} \times 4^{(0,1764)} \times 3^{(0,1764)}$$

$$S_{12}(A12) = 1,3857 \times 1,1301 \times 1,3857 \times 1,2772 \times 1,2139$$

$$S_{12}(A12) = 3,3643$$

$$S_{13}(A13) = 5^{(0,2353)} \times 2^{(0,1764)} \times 3^{(0,2353)} \times 3^{(0,1764)} \times 2^{(0,1764)}$$

$$S_{13}(A13) = 1,4604 \times 1,1301 \times 1,2950 \times 1,2139 \times 1,1301$$

$$S_{13}(A13) = 2,9320$$

3. After obtaining the value of the vector S, further determine the ranking of KB Extension Location alternatives by dividing the V value (vector value used for ranking) for each alternative by the total value of all alternative values (vector S). Here is the ranking calculation:

$$Vi = \frac{Si}{\sum_{j=1}^m Si}$$

$$\Sigma Vi = \frac{2,5864 + 2,7782 + 3,3773 + 3,0120 + 3,7382 + 4,6213 + 2,8580 + 2,7165 + 3,0847 + 3,3206 + 2,9884 + 3,3643 + 2,9320}{41.378}$$

$$\Sigma Vi = 41.378$$

$$V1(A1) = \frac{2,5864}{41.378}$$

$$V1(A1) = 0,0625$$

$$V2(A2) = \frac{2,7782}{41.378}$$

$$V2(A2) = 0,0671$$

$$V3(A3) = \frac{3,3773}{41.378}$$

$$V3(A3) = 0.0816$$

$$V4(A4) = \frac{3,0120}{41.378}$$

$$V4(A4) = 0,0728$$

$$V5(A5) = \frac{3,7382}{41.378}$$

$$V5(A5) = 0,0903$$

$$V6(A6) = \frac{4,6213}{41.378}$$

$$V6(A6) = 0,1117$$

$$V7(A7) = \frac{2,8580}{41.378}$$

$$V7(A7) = 0,0691$$

$$V8(A8) = \frac{2,7165}{41.378}$$

$$V8(A8) = 0,0657$$

$$V9(A9) = \frac{3,0847}{41.378}$$

$$V9(A9) = 0,0746$$

$$V10(A10) = \frac{3,3206}{41.378}$$

$$V10(A10) = 0,0803$$

$$V11(A11) = \frac{2,9884}{41.378}$$

$$V11(A11) = 0,0722$$

$$V12(A12) = \frac{3,3643}{41.378}$$

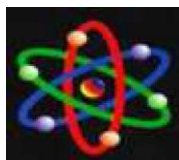
$$V12(A12) = 0,0813$$

$$V13(A13) = \frac{2,9320}{41.378}$$

$$V13(A13) = 0,0709$$

4. After calculating the value of vector V, the largest value is obtained which is the best alternative. The following is Table 4.13 of the results of alternative levels of KB Counseling Locations:





Alternative/Village Name	Results	Ranking
Beting Kuala Kapias	0.0625	13
Kapias Pulau Buaya	0.0671	11
Pematang Pasir	0.0816	3
Perjuangan	0.0728	7
Sei Merbau	0.0903	2
Keramat Kubah	0.1117	1
Muara Sentosa	0.0691	10
Pasar Baru	0.0657	12
Sumber Sari	0.0746	6
Sungai Raja	0.0803	5
Pulau Sumardan	0.0722	8
Selat Lancang	0.0813	4
Tanjung Medan	0.0709	9

Table 8. Ranking Results of Alternative Family Planning Counseling Locations

As for the data that is located around approximately 13 villages in the city of Tanjungbalai, for that the researcher took samples (alternatives), from the 13 locations were selected into 3 locations, then it can be obtained from the calculation of the alternative preferences of the KB Extension Location above, then the decision for the selection from the alternative is selected from the highest value, then the one selected as the recipient of the KB Counseling Location is Kelurahan xxxx, who is eligible to be recommended as the recipient of the KB Counseling Location.

CONCLUSION

The decision support system for determining the Family Planning Location can help the Tanjungbalai Population and Family Planning Office by using the WP method. Assist in determining the Family Planning Counseling Location at Tanjungbalai's Population and Family Planning Office which is selected based on alternative criteria and evaluation. This system is made dynamic so that if there are any changes or additions to determining

the location of KB Education can be done easily.

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