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# Recommendation System for Selecting Maternity Hospitals in Pontianak using Weighted Product Method

**Ervayana Sari[1]*, Asrul Abdullah[2], Istikoma[3]**

[1,2,3]*Muhammadiyah University of Pontianak*
ervayanas@gmail.com[1*], asrul.abdullah@unmuhpnk.ac.id[2] , istikoma@unmuhpnk.ac.id[3]

**Abstract**

In this research, a decision support system for recommending the selection of maternity hospitals in Pontianak was developed using the Weighted Product (WP) method, with the constructed system in the form of a web-based application. The aim of this study is to facilitate pregnant women in choosing maternity hospitals in Pontianak based on criteria obtained from a survey of pregnant women, including distance, facilities, cost, and reputation. The WP method was applied through three main stages: weight normalization, vector S calculation, and vector V computation for final ranking. Testing in this research involves five alternative maternity hospitals, and each criterion is assessed on indicators ranging from 1 to 5. The results obtained indicate that Anugerah Bunda Khatulistiwa Maternity Hospital achieved the highest final ranking score among all evaluated alternatives. This system is expected to assist expectant mothers in making more informed decisions when selecting a maternity hospital that best suits their needs.

***Keywords***: *Decision support system (DSS); Maternity hospital; Recommendation; Web-based application*

## 1. Introduction

The development of information and communication technology media in the current era shows its increasing circulation in society. This is due to the numerous innovations and metamorphoses of communication media that are currently prevalent in today's society. One example we can see is the tendency of people to use mobile phones as a means of communication between one person and another in another location. This has become a common phenomenon in global society [1].

Healthcare is a fundamental need for the community. One crucial form of healthcare is hospital maternity care. Choosing the right maternity hospital is crucial for maintaining the health of mothers and newborns. This decision involves various factors such as location, facilities, quality of service, cost, and so on.

Pontianak, as one of Indonesia's major cities, has a number of maternity hospitals offering a wide range of services. This diverse selection of maternity hospitals complicates the decision-making process for expectant mothers, including factors such as bed availability, service quality, cost, distance, and facilities. Expectant mothers must consider various factors to choose the hospital that best suits their needs. There are five maternity hospitals in Pontianak: Nabasa Maternity Hospital, Jeumpa Maternity Hospital, Santo Antonius Pontianak Hospital, Dr. Soedarso Regional General Hospital, and Anugerah Bunda Khatulistiwa Hospital.

In this context, the use of a decision support system (DSS) can be an effective solution to help expectant mothers choose the maternity hospital that best suits their preferences and needs. A DSS is a computer system designed to aid decision-making by processing relevant data and information to generate the best recommendations or alternatives [2].

There are many methods that can be used in decision support systems, including Fuzzy Logic, Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), Analytical Hierarchy Process (AHP), Weighted Product (WP), and Simple Additive Weighting (SAW). However, the Weighted Product (WP) method has a simple concept for determining weights for criteria with similar values. The WP method allows users to assign weights to each relevant criterion and then calculate the weighted values for each alternative. The alternative with the highest weighted value will be the best recommendation.

This research aims to develop a decision support system (DSS) that can assist expectant mothers in selecting a maternity hospital in Pontianak using the WP method. This DSS will consider various relevant factors such as distance from home, available facilities, hospital reputation, service costs, and others. With this DSS, it is hoped that expectant mothers can make more informed and informed decisions in choosing the maternity hospital that best suits their needs [3].

Furthermore, this research is important because it can positively contribute to improving healthcare services for pregnant women in Pontianak. Furthermore, the use of the WP method in the Maternity Hospital Selection System (SPK) will also provide better insight into how various factors influence hospital selection decisions. Therefore, this research will serve as an important foundation for the development of similar SPKs in the healthcare sector in other cities across Indonesia [4].

# 2. Literature Review

## 2.1. Related Works

Several prior studies have applied the WP method in decision support systems. Sambani dkk. [5] developed a DSS for employee promotion at Plaza Asia using WP with criteria including attendance, productivity, integrity, skill, and loyalty, producing a system to assist promotion decisions. Susilo dan Supatman [6] developed a DSS for determining newborn health status based on anthropometric examination using WP with criteria such as weight, height, and head circumference. Supriyono dan Sari [7] built a residential selection system using WP in a web-based application, with results showing the system's calculations matched manual computation. Arsyad [8] developed a DSS for selecting candidates for student executive board chairman using WP.

## 2.2. Weighted Product (WP) Method

The WP method is one approach for solving *Multi Attribute Decision Making* (MADM) problems. Unlike the *Weighted Sum* method, WP uses multiplication in its calculations, hence also called dimensional analysis because its mathematical structure eliminates units of measurement [9]. Calculation consists of 3 steps:

1. Step 1 — Weight normalization: $Wj = Wj / \Sigma Wj$
2. Step 2 — Calculate vector S: $Si = \Pi(j=1 \text{ to } n)\ Xij^{wj}$ where $\Sigma Wj = 1$; wj is positive for benefit criteria and negative for cost criteria [10]
3. Step 3 — Calculate vector V (final ranking): $Vi = Si / \Sigma(Si)$

## 2.3. Supporting Technologies

The system is built as a web-based application using PHP (Hypertext Preprocessor), CSS (Cascading Style Sheet), JavaScript, and MySQL as the relational database management system. A web-based application requires a web server and browser to run, with centralized data and ease of access as its main advantages.

## 2.4. Maternity Hospital

According to Law No. 44 of 2009, a hospital is a health service institution providing comprehensive individual health services including inpatient, outpatient, and emergency services [11]. Hospitals in Pontianak are classified into general hospitals (Class A–D based on specialist facilities) and specialized hospitals.

# 3. Research Method

The system development method uses the System Development Life Cycle (SDLC) with a Waterfall approach. This model employs a systematic and sequential approach, where each phase must be completed before moving on to the next, resulting in higher-quality output [12]. These phases are: (1) Requirements Analysis, (2) System Design, (3) Coding, (4) Testing, and (5) Deployment.
Data were collected through a questionnaire distributed to pregnant women to identify selection preferences using a Likert scale (1–5). Based on the survey results, four main criteria were identified for the DSS:

**Table 1:** Hospital selection criteria

| Code | Criteria Name | Weight | Type |
|---|---|---|---|
| C1 | Distance | 5 | Cost |
| C2 | Facilities | 4 | Benefit |
| C3 | Cost | 3 | Cost |
| C4 | Reputation | 5 | Benefit |

The usability testing used Jacob Nielsen's five aspects: Learnability, Efficiency, Memorability, Errors, and Satisfaction [13], assessed via questionnaires distributed to users of the system.

# 4. System Design

The system receives input from two user types: (1) Administrator, inputs hospital data, news, and criteria; (2) Client, inputs preference values (distance, facilities, cost, reputation) to be processed as weights by the system. The system then applies the WP method and returns a ranked recommendation list.

## 4.1. Database Design

**Table 2:** Alternatif table structure

| No | Field | Type | Key | Description |
|---|---|---|---|---|
| 1 | id_alternatif | varchar(20) | PK | Hospital ID |
| 2 | alternatif | varchar(20) | | Hospital Name |
| 3 | K1 | varchar(20) | | Criterion 1 value |
| 4 | K2 | varchar(20) | | Criterion 2 value |

| | | | |
|---|---|---|---|
| 5 | K3 | varchar(20) | Criterion 3 value |
| 6 | K4 | varchar(20) | Criterion 4 value |

**Table 3:** Criteria table structure

| No | Field | Type | Key | Description |
|---|---|---|---|---|
| 1 | id_kriteria | varchar(20) | PK | Criteria ID |
| 2 | kriteria | varchar(20) | | Criteria Name |
| 3 | kepentingan | varchar(20) | | Weight value |
| 4 | cost_benefit | varchar(20) | | Cost/Benefit type |

### 4.2. WP Calculation Implementation

The core WP calculation in the system follows these steps as implemented in PHP:

```
// Step 1: Weight normalization
for($i=0; $i<$k; $i++) { $tkep += $kep[$i]; }
for($i=0; $i<$k; $i++) { $bkep[$i] = $kep[$i] / $tkep; }

// Step 2: Apply positive/negative exponent (benefit/cost)
for($i=0; $i<$k; $i++) {
   $pangkat[$i] = ($cb[$i]=="cost") ? (-1)*$bkep[$i] : $bkep[$i];
}

// Step 3: Calculate vector S
for($i=0; $i<$a; $i++) {
   for($j=0; $j<$k; $j++) { $s[$i][$j] = pow($alt[$i][$j], $pangkat[$j]); }
   $ss[$i] = $s[$i][0] * $s[$i][1] * $s[$i][2] * $s[$i][3];
}

// Step 4: Calculate vector V (final ranking)
$total = array_sum($ss);
for($i=0; $i<$a; $i++) { $v[$i] = round($ss[$i]/$total, 6); }
uasort($v, 'cmp'); // sort descending
```

## 5. Results and Testing

Testing was conducted on 5 maternity hospital alternatives in Pontianak. The system application consists of 6 main pages: Home (displaying system introduction), Data Kriteria (managing and editing criteria and their weights/types), Data Alternatif (managing hospital alternative data with criterion values 1–5), Edit Alternatif (editing hospital criterion values via dropdown selection), Analisa (displaying vector S and V results with bar chart visualization and summary ranking text), and Perhitungan (displaying the full calculation matrix including weight normalization, exponent values, vector S values, and final vector V ranking).

### 5.1. Usability Testing Results

**Table 4:** Usability testing questionnaire

| No | Question | Aspect |
|---|---|---|
| 1 | Is the website's layout easy to recognize? | System |
| 2 | Are the colors on the website pleasing to the eye and not boring? | System |
| 3 | Are the menus on the website easily recognizable? | User |
| 4 | Are the website's applications easy to read? | User |
| 5 | Are the menu symbols on the website easy to understand? | User |
| 6 | Is the website's application easy to use? | Interaction |
| 7 | Is this website useful and provides information about hospitals? | Interaction |
| 8 | Do the recommendations align with the input criteria? | Interaction |

### 5.2. WP Calculation Results

The WP calculation was performed on 5 alternative maternity hospitals with 4 criteria (C1: Distance/cost, C2: Facilities/benefit, C3: Cost/cost, C4: Reputation/benefit). After normalizing the weights (total weight = 17, normalized: W1=0.294, W2=0.235, W3=0.176, W4=0.294) and computing vector S and vector V for each alternative, the final ranking was obtained as follows:

**Table 5:** Final ranking result (Vector V)

| Rank | Hospital Name | Vector V |
|---|---|---|
| 1 | RS Anugerah Bunda Khatulistiwa | Highest |
| 2 | RSUD Dr. Soedarso | Second |
| 3 | RS Santo Antonius Pontianak | Third |
| 4 | RS Bersalin Jeumpa | Fourth |

| | | |
|---|---|---|
| 5 | RS Bersalin Nabasa | Lowest |

The results confirm that RS Anugerah Bunda Khatulistiwa has the highest final ranking (Vector V) value among all alternatives, making it the top recommendation based on the weighted combination of distance, facilities, cost, and reputation criteria. The system calculation results were verified to match manual WP calculations, confirming the accuracy of the system implementation.

## 6. Conclusion

This research successfully developed a web-based Decision Support System for recommending maternity hospital selection in Pontianak using the Weighted Product method. The system evaluates five maternity hospitals based on four criteria: distance, facilities, cost, and reputation. The WP method proved effective in providing objective, weighted recommendations, with RS Anugerah Bunda Khatulistiwa achieving the highest final ranking. The system is expected to help pregnant women make more informed decisions when choosing a maternity hospital that suits their needs, thereby improving overall satisfaction during the childbirth process.
For future development, it is recommended to: (1) expand the model by incorporating more criteria, (2) conduct larger-scale validation with a broader sample of pregnant women, (3) evaluate alternative decision-making methods for comparison, and (4) extend the research to other cities in Indonesia to assess the model's effectiveness in different contexts.

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