DEVELOPMENT OF DECISION SUPPORT SYSTEM IN DETERMINING PROSPECTIVE STUDENT RECIPIENTS OF THE PROGRAM INDONESIA PINTAR USING THE WEIGHTED PRODUCT METHOD

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ABSTRACT

Program Indonesia Pintar (PIP) is a national program that provides educational cash assistance to all school-aged children (6-21 years) who receive the Kartu Indonesia Pintar, or who come from poor and vulnerable families (for example, from families or households holding the Kartu Keluarga Sejahtera or children who meet predetermined criteria. PIP aims to remove barriers for students to attend school by helping poor students gain access to more appropriate education services, preventing children from dropping out of school, helping underprivileged children meet their needs in school activities, and supporting the completion of the 9-year compulsory basic education and universal secondary education.PIP distribution has been carried out by the government in almost all schools in Indonesia. SMP Negeri Persiapan Supnin is one of the recipients of the PIP scholarship. PIP is a scholarship that can be provided by the government for students of SMPN Persiapan Supnin which are categorized as incapacitated with reference to several criteria, such as student active status, certificate of inability, orphan condition, parents' salary, and absenteeism percentage. The PIP distribution process caried out at SMP Negeri Persiapan Supnin has not been optimal so far. The researcher design a study entitled Development of a Decision Support System in Determining Prospective Student Recipients of the Program PIP at SMP Negeri Persiapan Supnin in Raja Ampat Regency Using the Weighted Product Method. Decision support system technology is used as an objective decision making solution because the use of information systems will minimize subjective judgments in determining prospective scholarship recipients.

Keywords: *Decision support system, Weighted Product, Student, Program Indonesia Pintar*

1. INTRODUCTION

Education is a benchmark for nation-building, which is why every Indonesian citizen has the same responsibility to participate in the educational process [1][2]. Education is the maturation process of a person to become himself, which grows in line with his talents and abilities. It is a conscious effort to realize something of cultural inheritance from one generation to another [3].

Education is a continuous process that is carried out for life. It plays an important role in ensuring that the quality of human life is better prepared to face changes in the era of globalization. Improving the quality of human life starts with education. As stated in Law Number 20 of 2012, Article 1 concerning the National Education System: "Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their

potential to have religious spiritual strength, self-control, personality, intelligence, noble character, and the skills needed by themselves, society, nation, and state."

Education will run well if there is attention from various parties, especially the government [1]. One manifestation of the government's attention to the education center is the Scholarship Program and *Program Indonesia Pintar* (PIP). PIP is a national program that provides educational cash assistance to all school-aged children (6-21 years) who receive the *Kartu Indonesia Pintar* (KIP), or who come from poor and vulnerable families (for example, from families or households holding the *Kartu Keluarga Sejahtera* (KKS) or children who meet predetermined criteria [4][5][6].

PIP aims to remove barriers for students to attend school by helping poor students gain access to more appropriate education services, preventing children from dropping out of school, helping underprivileged children meet their needs in school activities, and supporting the completion of the 9-year compulsory basic education and universal secondary education (compulsory education: 12 years). PIP through KIP is part of the poor students assistance program or *Program Bantuan Siswa Miskin* (BSM) since the end of 2014 [4] [5].

PIP distribution has been carried out by the government in almost all schools in Indonesia [5][6]. SMP Negeri Persiapan Supnin is one of the recipients of the PIP scholarship. It is the first high school to be located in Urai Village, Supnin District, Raja Ampat Regency, and is an educational institution that has just been built since 2016 and has received some assistance from the government. Assistance received from the government namely school operational assistance or *Bantuan Operasional Sekolah* (BOS) and PIP. BOS funding assistance is used by schools in procuring school equipment and supplies, while PIP is a scholarship that can be provided by the government for students of SMPN Persiapan Supnin which are categorized as incapacitated with reference to several criteria, such as student active status, certificate of inability, orphan condition, parents' salary, and absenteeism percentage.

The PIP distribution process caried out at SMP Negeri Persiapan Supnin has not been optimal so far. This can be seen by the fact that the process of determining the potential PIP recipients has not been on target. The current condition is that there are many students with active status at school as well as the economic conditions of their families at the lower economic level, but they have not had the opportunity to get PIP funding because the selection process is not objective.

Based on the problems above, the researcher design a study entitled "Development of a Decision Support System in Determining Prospective Student Recipients of the *Program Indonesia Pintar* (PIP) at SMP Negeri Persiapan Supnin in Raja Ampat Regency Using the Weighted Product Method". Decision support system technology is used as an objective decision making solution because the use of information systems will minimize subjective judgments in determining prospective scholarship recipients [7] [2].

Providing scholarships is a useful thing but can also be problematic if it cannot accommodate all existing needs. Based on this, the aim of this research is to provide an information system that can be used as a medium for objectively considering decisions about granting scholarships to students with certain criteria. To overcome the wide range of readers' interpretations, our research focuses on schools located in Urai Village, Supnin District, Raja Ampat Regency, as a case study. The findings from this research can empower schools to use digitalized technology in their work, so that it becomes easier and faster.

2. RELATED WORK

First previous study entitled "*Sistem Pendukung Keputusan Prioritas Calon Penerima Program Indonesia Pintar Pada Siswa Sekolah Menengah Pertama Menggunakan Metode Topsis*". In this study, there were still many obstacles that resulted in not being on target in the provision of educational assistance programs. This system was created to determine the priority of potential PIP recipients by adding more basic criteria. This study designed a decision support system using the TOPSIS (Technique for Order Performance By Similarity to Ideal Solutions) method with several criteria, such as active status of students, certificate of poor, orphan's condition, parents' salary, presentation of absenteeism. In this application, the final result is the priority ranking of students who will receive PIP assistance [8].

The next previous study entitled "*Sistem Rekomendasi Calon Penerima Program Indonesia Pintar Menggunakan Metode Profile Matching Pada Siswa Sekolah Menengah Kejuruan Swasta (SMKS) Tanada di Daerah Wadung Asri Kecamatan Waru Kabupaten Sidoarjo*." The recommendation system is expected to assist schools in recommending prospective recipients to take part in the PIP. There are two aspects for

determining potential PIP recipients namely family economic aspects and supporting aspects. For family economic aspects, consist of 5 criteria: Parents' occupation, parents' income, number of dependents, child status, residence, and supporting aspects, which consist of 3 criteria: certificate of disadvantage or *Surat Keterangan Tidak Mampu* (SKTM), family hope program or *Progam Keluarga Harapan* (PKH) and, prosperous family card or *Kartu Keluarga Sejahtera* (KKS) [9].

The current research focuses on the development of a decision support system for determining prospective student recipients of the PIP at the SMPN Persiapan Supnin. Based on the problems that have been described above, the researchers designed a study using the weighted product (WP) method.

Providing scholarships is an activity that requires precision and precise criteria. This research is a research in the field of technology studies that has only ever been carried out on objects. This research also uses the Weighed Product method based on the criteria required by the object, whereas previous research did not have the same object and used the Profile Matching and TOPSIS methods. This is different and yet discussed in previous research.

This research aims to study the criteria for awarding scholarships to research objects as well as designing and building a decision support system for distributing scholarships using the Weighted Product method. This is to answer student needs and ensure the criteria used are in line with general perception.

The WP method was chosen because it is in a decision-making system where decision-making can be done more quickly and precisely in accordance with the desired criteria, or at least close to the desired criteria. The alternative choices are expected to provide a list of references to the decision-maker before actually making a final decision. The object of research is at SMPN Persiapan Supnin, Raja Ampat Regency. The research focuses on how to determine prospective students who will receive the *Program Indonesia Pintar* (PIP). The decision support system developed in this study applies the MD5 algorithm as a system security method.

3. THEORITICAL BACKGROUND

3.1 Decision Support System (DSS)

Decision support system (DSS) developed by Keen dan Scoot Mortoon in 1970, they define DSS as the combination of individual sources of intelligence with component capabilities to improve the quality of decision. It is an interactive computer-based system that helps decision-makers utilize data and models to solve unstructured problems [7].

3.1 The Characteristics of Decision Suport System

Decision Support System (DSS) is adaptive and interactive and have an easy interface [7]. The decision-maker has full authority to control all stages of the decision support system. DSS is able to provide solutions to unstructured problems for individuals or groups. The following are the number of characteristic and capabilities of DSS:

1. DSS is a computer-based system with an interface between machine/computer and the decision maker.
2. DSS is adaptive, interactive and, an easy interface that is easy to use.
3. Decision-maker has full authority to control all stages in the decision support system.
4. DSS is able to provide solutions to unstructured problems for both individuals and groups.
5. In its use, DSS requires components such as data, databases, and decision analysis methods.
6. DSS is able to adapt at any time and is flexible.
7. This system only helps provide alternative solutions for decision makers to solve problems, not as a substitute for the human position as a decision maker. [2] [7] [2], [8] [10]

3.2 Weighted Product Method

Weighted Product method (WP) is a method for solving Multi Attribute Decision Making (MADM). WP uses a multiplication technique to connect rating attribute, where the rating of each attribute must be raised first with the attribute weight in question [2][7].

The steps taken in solving the problem using weighted product method are as follows:

1. Define Criteria
   Determine the criteria that will be used as a reference in decision-making, namely Ci and the nature of each criterion.
2. Determine the match rating
   Determine the suitability rating for each alternative on each criterion and create a decision matrix.
3. Determination of W weight value
   The Formula for finding the value of W

$$Wj = \frac{Wj}{\Sigma W\text{I}} \qquad (1)$$

Description:

Wj = Weight Value

∑wj = Sum value of all wight

4. Determining the value of S Vector

Determine the value of the vector S by multiplying all the criteria with alternative results of normalization or improvements of weights that have positive rank for benefit criteria and those that have a negative rank for cost criteria, which is the preference criterion, is the criterion value, and the is number of criteria.

The formula for finding S value:

$$S_i = \prod^n x_{ij} w_j \qquad (2)$$

Description:

S : Alternative Preference

X : Value of Criteria

w : Weight of Criteria

i = Alternative

j = Criteria

n = The number of criteria

wj is rank with a positive value for the criterion of benefits and negative value for the cost criterion.

5. Determining the value of V vector, with i = 1, 2, …, n

Determine the vector value, where the vector is an alternative preference that will be used for ranking each of the vector values with the total vector values.

6. Ranking Vector value

Determining the ranking of vector V values as well as making conclusions as the final stage [7] [10] [11] [12][13]

3.3 Program Indonesia Pintar Scholarship

Program Indonesia Pintar (PIP) is a national program that aims to increase primary and secondary education participation rates, increase continuing education rates, reduce disparities in educational participation, and increase the readiness of secondary education students to face the job market [5] [14] .

4. MATERIAL AND METHODS

4.1 Prototype Method

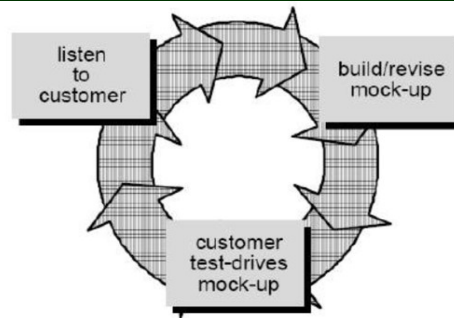Prototype method is used in building this system.

Figure 1: Prototype Method

The stage used are as follows:

1. Listening to customers

At this stage, the author collects the needs of the system by listening to complaints from clients "The PIP school scholarship manager". The result of listening to the client is that it can facilitate the calculation and determination of PIP recipient.

2. Stages of building and repairing the market.

In this stage, the researcher carried out system development, starting with sketching, making interface design using Balsamiq and compiling code so that the system usingthe PHP programming language, Boostrap framework, and MySQL database could be realized and ready to operate.

3. Trials

At this stage, researchers conducted trials with black box testing.

4.1 Research Focus

The focus of the research are:

1. The object of research is at SMP Negeri Persiapan Supnin, Raja Ampat regency.

2. This research is limited to how to determine prospective students receiving PIP at SMP Negeri Persiapan Supnin, Raja Ampat regency.

3. The method used is *Weighted Product*.

4. The criteria used are:

a. Students activeness,

b. Certificate of incapacity,

c. Orphans,

d. Parents salary,

e. Absences percentage.

5. The weight of the criteria in this study is as follows:

Tabel 2: Weight Criteria

No.	Criteria	Weight	Attribute
C1	Students activeness	10	Profit
C2	Certificate of incapacity	20	Cost

C3	Orphans	20	Profit
C4	Parents salary	40	Cost
C4	Absences	10	Profit

4.2 Data Collection

Data collection in this study was divided into two categories, namely primary data and secondary data, as follows:

1. Primer Data

    Primary data was collected and obtained by using interview methods and direct observation at the research location, namely "the school PIP scholarship manager". Interviews were conducted to obtain information related to the process of determining previous scholarship recipients along with the criteria used, and observations were made to directly find out the location of the research.

2. Secondary Data

    Secondary data was obtained in the form of student data, criteria data, and library data that supported the preparation of this research report.

4.3 Needs Analysis

What is done in the analysis of system requirements is to understand the requirements of the new system and develop the system. To make it easier to analyze data, the system requirements analysis is divided into s of parts, namely as follows:

1. Functional Needs

    Functional system needs are those that contain any processes that will be carried out by the system. The functional requirements that can be explained in this description are the needs of the administrator, as follows:

    a. The administrator logs in to enter the system.

    b. Admins can add, edit, and delete student data.

    c. The administrator logs out.

2. Non-functional Needs

    Non-functional system needs are requirements that focus on the behavioral properties of the system.

    a. Hardware requirements

1. Dell Inspiron Notebook 15 3000 Series
2. Operating system Windows 10 Pro 64-bit
3. Processor Intel Core i3
4. Memory 8 Gb
5. HDD 500 GB

    b. Software requirements

    1. Framework Boostrap
    2. Microsoft Visio 2013

3. Balsamiq Mockup 3
4. XAMPP

c. User requirements

    Admin will be used as decision support system in this design.

5. RESULT AND DISCUSSION

5.1 Planning System

The Decision Support System for Accepting PIP Scholarships at SMPN Persiapan Supnin using the weighted product method aims to assist the admin in inputting student data, which used to be a manual system. With this new system, the admin can input data accurately and quickly and can also minimize processing time the admin can input data accurately and quickly and can also minimize processing time. This system can also help users quickly determine whether they are entitled to a PIP scholarship or not.

5.2 Planning Process

A program flowchart is a chart that explains in detail the steps of the program. The following is a flowchart of the Decision Support System for Acceptance of PIP Scholarships Using the Weighted Product Method:
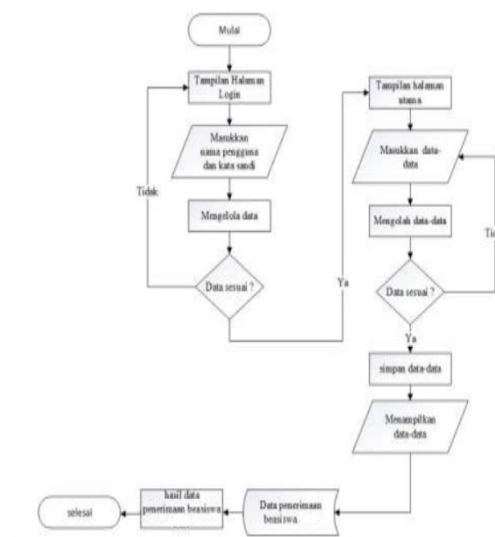

Figure 2: Flowchart System

Figure 2 describes the work process of the SPK system for PIP scholarship recipients. The user admin performs the login process first by entering a username and password as a condition for access as a user admin on this system. If the username and password do not match, the login page will return, and if the login process is correct and successful,

the user admin will enter the PIP scholarship system. Admin users can fill in the data of PIP scholarship recipients in the scholarship acceptance system. If the data entered does not match the actual data, it can be changed by selecting and clicking the change data link, the delete/delete link to delete data, the add link to add data, and the save link to save. The next step is to view the data that has been stored by selecting the alternative selection menu. After the activity is finished and you want to get out of the system, go to the direction where it says logout and click logout to exit the system. This means the work has been completed. The data that has been stored, then see the results displayed on the system.

5.3 Designing Process

Unified Modeling Language (UML) can be interpreted as a system based on graphics or images to describe, specify, build, and document an object-based software development system. The following illustrates the admin use case diagram on the system
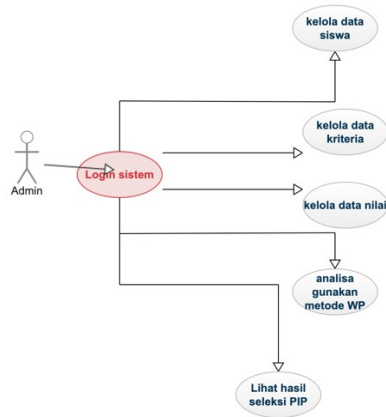
Figure 3: Use Case Diagram System

Figure 3 explains that in the use case diagram, admins carry out activities. Admin login in to the PIP scholarship management system. Managing student data, data criteria, value data, analysis using the WP method, and scholarship acceptance reports.

5.4 System Implementation

The results of this study are a web-based information system that can be used to perform several functions, such as inputting criteria values, alternatives, and weighting values for each criterion. In this section, the interface display of the application that has been made will be presented. The following is the implementation of the

interface for the Decision Support System for Acceptance of PIP Scholarships at SMPN Persiapan Supnin Using the Weighted Product Method:

A. Decision Support System Program Code
Code Program 1: SPK Database Connection

```php
<?php
//koneksi.php
$dbhost="localhost";
$dbname="spk_wp";
$dbuser=" userspkwp";
$dbpassword="userspkwp";
function opendb()
{
        global $dbhost, $dbuser, $dbpassword,
$dbname, $dbconnection;
        $dbconnection=mysql_connect($dbhost,
$dbuser, $dbpassword)
        or die ("gagal membuka database");
        $dbselect=mysql_select_db($dbname);
}function closedb()
{global $dbconnection;
        mysql_close($dbconnection);
} function querydb($query)
{$result=mysql_query($query)  or  die  ("gagal
melakukan Query=$query");return $result; } ?>
```

Program code 1 is a database connection program code with a decision support system developed in this study.

Program Code 2. S Vector Calculation and Preference Value

```php
<!-- TABEL #2 Vektor S -->
<h6>Vektor S</h6>
<?php
$qk="SELECT id_kriteria, kriteria, nilai_atribut,
bobot_perbaikan FROM wp_kriteria ORDER BY
id_kriteria ASC";
$hk=querydb($qk);
$jmlkkolom=mysql_num_rows($hk);
?>
<table width="100%" border="0" cellspacing="0"
cellpadding="4">
  <tr>
   <td width="24" rowspan="2" style="vertical-
align:middle;">No.</td>
   <td width="82" rowspan="2" style="vertical-
align:middle;">Kode</td>
   <td width="551" rowspan="2" style="vertical-
align:middle;">Alternatif      [<?php      echo
$set_alternatif; ?>]</td>
   <td colspan="<?php echo $jmlkkolom; ?>"><div
style="text-align:center;">Nilai Kriteria</div></td>
   </tr>
  <tr>
   <?php
```

```php
    while($dk=mysql_fetch_array($hk)){
        ?>
    <td          width="244"><div          style="text-
align:center;"><?php        echo        "$dk[kriteria]";
?></div></td>
    <?php } ?>
  </tr>

<?php
$no=0;
$queryX="SELECT id_alternatif, kode, alternatif
FROM  wp_alternatif  ORDER  BY  id_alternatif
ASC";
$hqueryX=querydb($queryX);
while ($dquX=mysql_fetch_array($hqueryX)){
        $no=$no+1;
?>
  <tr>
   <td><?php echo"$no"; ?></td>
   <td><?php echo"$dquX[kode]"; ?></td>
   <td><?php echo"$dquX[alternatif]"; ?></td>
   <?php
                $urut=0;
                $qk2="SELECT        id_kriteria,
kriteria,  nilai_atribut,  bobot_perbaikan  FROM
wp_kriteria ORDER BY id_kriteria ASC";
                $hk2=querydb($qk2);

        while($dk2=mysql_fetch_array($hk2)){
                        $urut=$urut+1;
                        $qn="SELECT     nilai
FROM         wp_nilai_kriteria         WHERE
id_kriteria='$dk2[0]'                         and
id_alternatif='$dquX[id_alternatif]'";
                        $hn=querydb($qn);

        $dn=mysql_fetch_array($hn);
                        ?>
                        <td>
        <div style="text-align:center;">
                        (       <?php      echo
$dn['nilai'];      ?>      <sup><?php      echo
number_format($dk2['bobot_perbaikan'],4,',','.');
?></sup> )
                </div>
                        </td>
   <?php } ?>
   </tr>
<?php } ?>
</table>

<br />

<!-- TABEL #1 Nilai S -->
<h6>Nilai Preferensi S</h6>
<table width="100%" border="0" cellspacing="0"
cellpadding="4">
  <tr>
   <td          width="103"          style="vertical-
align:middle;">No</td>
    <td          width="103"          style="vertical-
```

```php
align:middle;">Kode</td>
    <td          width="361"          style="vertical-
align:middle;">Alternatif      [<?php      echo
$set_alternatif; ?>]</td>
    <td width="328"><span style="color:#F30; font-
weight:bold;">Nilai S</span></td>
   </tr>
<?php
$no=0;
$queryX="SELECT      a.id_alternatif,      a.kode,
a.alternatif,  b.nilai  FROM  wp_alternatif  as  a,
wp_nilai_s        as        b        WHERE
a.id_alternatif=b.id_alternatif ORDER BY b.nilai
DESC";
$hqueryX=querydb($queryX);
while ($dquX=mysql_fetch_array($hqueryX)){
    $no=$no+1;
?>
  <tr>
   <td><?php echo"$no"; ?></td>
    <td><?php echo"$dquX[kode]"; ?></td>
    <td><?php echo"$dquX[alternatif]"; ?></td>
    <td><span         style="color:#F30;         font-
weight:bold;"><?php echo round($dquX['nilai'], 4);
?></span></td>

  </tr>
<?php } ?>
</table>

<br />
<!-- TABEL #4 Nilai Akhir -->
<h6>Nilai Preferensi (V) (Perangkingan)</h6>
<table  width="100%"  border="0"  cellspacing="0"
cellpadding="4">
  <tr>
    <td          width="47"          style="vertical-
align:middle;">No</td>
    <td          width="103"          style="vertical-
align:middle;">Kode</td>
    <td          width="361"          style="vertical-
align:middle;">Alternatif      [<?php      echo
$set_alternatif; ?>]</td>
    <td width="328"><span style="color:#F30; font-
weight:bold;">Skor      Akhir      (N.      Pref.
(V))</span></td>
    <td width="300">Hasil</td>
   </tr>
<?php
$no=0;
$queryX="SELECT      a.id_alternatif,      a.kode,
a.alternatif,  b.nilai  FROM  wp_alternatif  as  a,
wp_nilai_v        as        b        WHERE
a.id_alternatif=b.id_alternatif ORDER BY b.nilai
DESC";
$hqueryX=querydb($queryX);
while ($dquX=mysql_fetch_array($hqueryX)){
        $no=$no+1;
        $hasil=($dquX['nilai']>=0.2) ? "Diterima"
: "Tidak Diterima";
?>
```

```
<tr>
  <td><?php echo"$no"; ?></td>
  <td><?php echo"$dquX[kode]"; ?></td>
  <td><?php echo"$dquX[alternatif]"; ?></td>
  <td><span          style="color:#F30;          font-
weight:bold;"><?php echo round($dquX['nilai'], 4);
?></span></td>
  <td><span          style="color:blue;          font-
weight:bold;"><?php echo $hasil; ?></span></td>
  </tr>
<?php } ?>
</table>
```

Program code 2 is an alternative selection menu program code, which in this program code shows the function of calculating S and V preference vector values using the WP method by utilizing predetermined criteria and weight criteria.

B. Admin Menu Login

The system login menu is a system page that functions to verify system user access rights. In this menu, the user must enter valid username and password data in order to access the system.
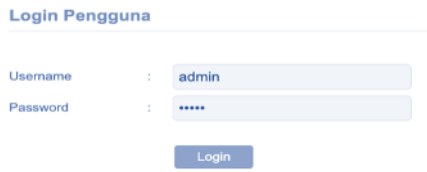
Figure 4: Login Page

C. Main Menu

Homepage is a menu where the admin logs in after the login menu, and in the main menu there are other working menus such as criteria data, alternative data, value data, alternative selection, and users.
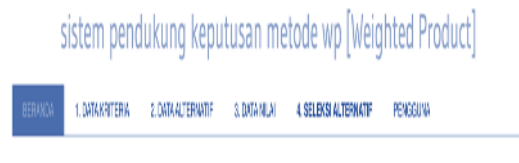
Figure 5: Homepage Menu

D. Criteria Data Menu

The criteria data menu is a menu where the criteria data is filled in, and there are add, edit, search, and delete menus.

Figure 6: The Criteria Page

E. Alternative Data Menu

The alternative data menu is a menu that contains alternative data in the form of the name of the scholarship recipient candidate.

Figure 7: The Alternative Page

F. Data Value Analysis Menu (Survey Result)

Figure 8: Criteria Data Value Page

G. Alternative Selection Result Menu

The alternative selection menu is the menu used for the final calculation or ranking based on searching for vector S values, and the final step is to calculate preference values (V)

Figure 9: Criteria Data Value

The visualization of this system provides easy access for users especially for the scholarship management from the school in order to distribute scholarships to those who need them. Functionally, this system has been running well to the needs. There are 5 criteria and 6 alternatives are used as requirements for calculations using the Weighted Product method. The implementation of these 5 criteria and 6 alternatives is quite complex and can be accurately used as a requirement for fulfilling the stages in this decision support system. This not only contributes to the success of providing scholarships, but also increases the transparency and accountability of the school's work.

6. CONCLUSION

Raja Ampat, as a district in Southwest Papua Province, still has many junior high school age children who live within family economic limitations. Many students are worried they will not be able to cover their school expenses through the end of the semester. The inability to pay fees and other education expenses keeps many children out of school. *Program Indonesia Pintar* (PIP) is one of the government scholarship policies which is aiming to help children from poor families attend school. Many students all over Indonesia are channeled through the PIP. However, this program cannot cover all students from poor families in one particular area due to the large need due to the fact that there is a predetermined quota. The presence of this decision support system can be a medium in helping schools decide which participants can receive PIP. This system will also open up more opportunities for transparency and accountability from school to the public. Everyone can claim to receive it, but of course there are always those who deserve it more. This can be done easier using this decision support system because its built with the supportive criteria. Based on the development of a decision support system for determining prospective students as recipients of the PIP scholarship at SMP Negeri Persiapan Supnin , Raja Ampat Regency using the Weighted Product method, the following conclusions are obtained:

1. The determination of prospective PIP scholarship recipients is carried out using a system that produces objective result.
2. 5 (five) criteria and the weight of the criteria used in this study support the calculation of the WP method, both manually and systematically.

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