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Decision support system to determine the best customer using weighted aggregated sum product assessment method

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Abstract

A business engaged in the sale of building materials and building tools. Customers are important assets that must be maintained properly, because each customer will bring profits that can keep the business running. To maintain customer loyalty, business owners provide an appreciation and appreciation for the best customers. However, determining the best customer is still difficult because the process of determining the best customer is still done manually and randomly. The number of customers is also an obstacle to the process of determining the best customer. The method used is weighted aggregated sum product assessment (WASPAS) to determine the best customer by looking at 5 criteria including: Total Spend, Visit Loyalty, Quantity of Shopping, Distance, Frequency of Complaints. This method was chosen because it can reduce errors - errors or optimize in estimation for the selection of the highest and lowest values. The best customers will be rewarded and appreciated by business owners. The result of this study is a Decision Support System to Determine the Best Customer Using the WASPAS Method. Questionnaire testing obtained user satisfaction results as much as 65% strongly agree, 25% agree, 10% sufficient and 0% disagree which shows that the system is in accordance with the needs and can be used.

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1. Introduction

The development of technology at this time has experienced a very rapid increase, especially in the business world in the field of trade, where computer technology has an important role as a means of supporting the running of a business activity. A business engaged in the sale of building materials and building tools. This trading business sells various materials and tools to make a building such as cement, bricks, wood, foundation iron, ceramics, paint, shovels, hammers, meters and other supplies. Customers are the most valuable assets to benefit because customers are a person, agency, institution, or organization that buys the product continuously [1]. To maintain customer loyalty and relationships, business owners give an appreciation and appreciation to the best customers in the form of shouvenir, namely: glasses, t-shirts and also parcels for selected customers [2].

Decision making to determine the best customer is an important part of a sales activity because it will have an impact on business success which can be seen from the increase in sales volume of the products sold [3]. However, in making decisions to determine the best customers, they experience difficulties, because the process of determining them is still done manually without the help of a system. The large number of existing customers makes the process of determining the best customer even more difficult, because every day there are more than 30 customers making transactions. In determining the best customer, the business owner does not look at the time when the determination of the best customer is carried out, because the selection of the best customer is carried out randomly and at an uncertain time, this makes the selection of the best customer felt unfair and inappropriate. Therefore, the decision-making process needs the help of a decision support system which is expected to be a solution and alternative in making decisions to determine the best customer.

Decision support systems can help determine the best customers because they aim to facilitate and speed up determining the best customers, because decision support systems are flexible so that they are easy to adjust to changes in the environment and users [4]. Decision Support System (DSS) is an interactive information system that provides information that assists in decision making, not a decision-making tool, SPK requires information from data that has been obtained and processed to make decisions about a problem more quickly and accurately [5]. Decision Support Systems (DSS) are intended to assist decision makers in solving a semi-structured and unstructured problem with a focus on presenting information that can later be used as the best decision-making material [6].

Previously there was research that had almost the same problems, this research discussed the extension of employee work contracts, this research used the Oreste method [4]. research that discusses the selection of stock investments, the method used is SMART [6]. Research that discusses the eligibility of customers to get price discounts, this study uses the WASPAS method [7].

The decision support system in this study uses the Weighted Aggregated Sum Product Assessment (WASPAS) method. The Weighted Aggregated Sum Product Assessment (WASPAS) method is a method that can reduce errors or optimize the assessment for selecting the highest and lowest values [7]. This method is a combination of two methods, namely the Weighted Sum Model (WSM) and the Weighted Product Model (WMP). The WASPAS method combines the advantages of both methods. The WSM method has the advantage of easy alternative evaluation using weighted sums. The WMP method, the advantage is to prevent getting a solution with a low value [8].

The decision support system used is a website-based system, a system that is easy to use and more concise because it is easy to access as long as it is connected to an internet connection [9]. A website can be interpreted as a collection of pages that are used to display information in the form of text, still or moving images, animation, or a combination of them, both static and dynamic, which are available via the internet so that they can be accessed throughout the world as long as there is an internet network connection [10] [11].

2. Research Method

The stages of the research flow carried out are shown in Figure 1.

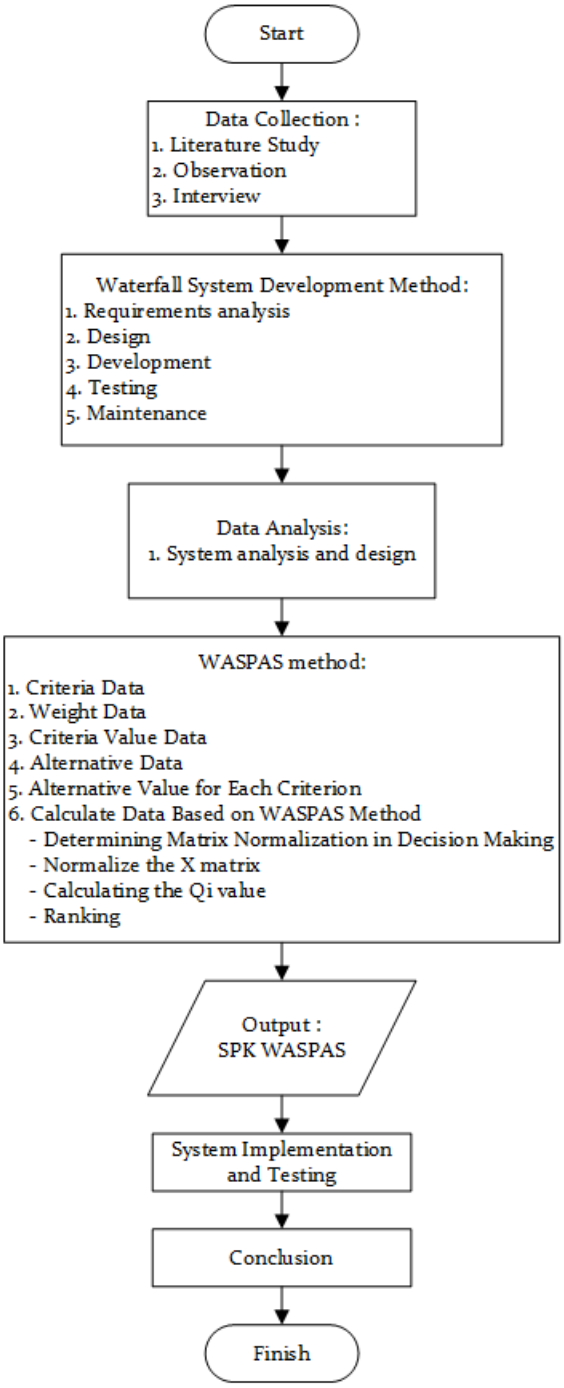

Figure 1. Research flow

This research phase starts with data collection starting from literature study, observation and interviews. Then proceed with developing the system with the method waterfall namely requirements analysis, system design, writing program code, program testing, program implementation and maintenance. After that, data analysis was carried out starting from system analysis, system design. Then enter the WASPAS calculation method for the data that has been obtained, namely benefit-cost criteria data, weight data, criteria value data, alternative data, alternative values for each criterion. Then everything is calculated using the WASPAS method and produces the output of a decision

support system to determine the best customer. After the system has been implemented, system testing is then carried out to ensure that the system does not exist error. Next is the conclusion of the research.

2.1 Method of collecting data

Carrying out research always requires appropriate research methods, so that research can achieve maximum results as expected. The method used is as follows:

a. Literature review
   At this stage the researcher collects data from various sources obtained such as journals, various studies, articles and books related to the object of research [12] [13].
b. Observation
   At this stage the researcher collects data by observing directly the various activities that occur in TB. DIAN MAJU by observing, recording and analyzing the research object, namely TB. DIAN MAJU [14].
c. Interview
   The interview was conducted as a follow-up to the observation data collection method stage. This stage is generally used if the observation stage cannot support the existing data [15]. At this stage the researcher collects data by asking directly owner and employees TB. DIAN MAJU.

2.2 Development Method

Method Waterfall is a model of a systematic research method that is appropriate to be applied in conducting this research because this method presents a stage that is very appropriate to the conditions in the field [16]. Method stagesWatefall namely needs analysis, system design, writing program code, program testing and program implementation and maintenance [17]. Although the method model waterfall this includes the old ones, but for the developers this method is very feasible to use [18]. The following are the steps for the waterfall method development procedure in Figure 2.

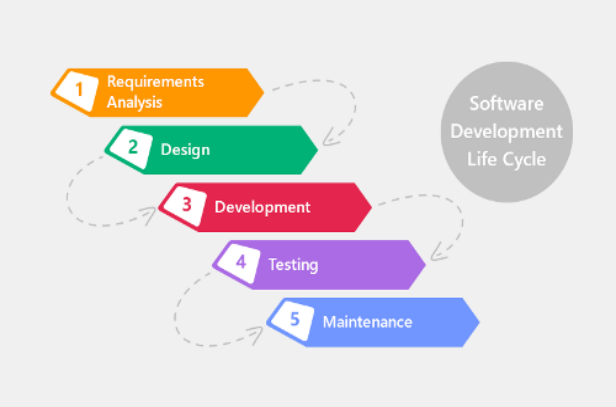

Figure 2. Waterfall method

2.2.1 Requirements Analysis

Requirements analysis, at this stage researchers conduct interviews with owners TB. DIAN MAJU from the interview obtained transaction data for 1 year, namely in 2022. The assessment of expert information is obtained from purchase transaction data. The data used in this study is purchase transaction data, from the large amount of purchase transaction data 10 sampling data were taken to be used in this study. System requirements analysis then defines what needs must be met by programs and systems in detail that serve as system specifications that will be applied to this study.

2.2.2 Design

System design, at this stage the researcher makes a database modeling design, system display design and system design using UML (Unified Modeling Language) diagrams ieUse Case Diagrams andClass Diagram [19].

2.2.3 Development

Writing program code, at this stage the researcher will write program code according to the UML modeling design (Unified Modeling Language) which has been created using the programming language PHP and MySQL as a database [20]. Programs built using the sublime text application will be tested for functionality in general to minimize errors (error) and ensure the resulting results are as desired.

2.2.4 Testing

Program Testing, this stage after the program code is created and the program can run, testing can begin. Testing is focused on logic and functional and ensure that all parts are tested for minimization error and the output must match. Program testing is carried out to look for all possible errors both from the manufacturing sidecode as well as checking whether the application is running properly and functions as expected. Program testing using black box testing [21].

2.2.5 Maintenance

Program Implementation and Maintenance, at this stage an application can be run and used by the user and maintenance is carried out. This maintenance aims to find errors that were not found in the previous stage so that system changes and updates can be carried out in accordance with technological developments. The system that has been implemented is expected to be used and not stop halfway [22]. In order to be used properly, the software must be checked if any error or bug on the running system.

2.3 Metode *Weight Aggregated Sum Product* (WASPAS)

The WASPAS method, this method is an approach that combines Weighted Sum and Weighted Product Models (WSM and WPM) [23].Weighted Aggregated Sum Product Assessment (WASPAS) is a method that can reduce errors or optimize the assessment for selecting the highest and lowest values. Thus, the main goal of the MCDM approach is to select the best option from a set of alternatives in the face of conflicting criteria. In this paper, an attempt is made. To justify the appropriateness and applicability of a nearly new MCDM approach, namely the weighted aggregate scoring method (WASPAS) [24] [25].

The steps for the calculation process apply the WASPAS method, namely:

a. Determining Matrix Normalization in Decision Making

$$x = \begin{bmatrix} x_{11} & x_{12} & . & x_{1n} \\ x_{21} & x_{22} & . & x_{2n} \\ . & . & . & . \\ x_{m1} & x_{m1} & . & x_{mn} \end{bmatrix} \quad (1)$$

b. Normalize the X matrix

Kriteria Benefit

$$\bar{x}ij = \frac{xij}{maXiXij} \quad (2)$$

Kriteria Cost

$$\bar{x}ij = \frac{minXiXij}{xij} \quad (3)$$

c. Calculating the Qi value

$$Qi = 0{,}5 \sum_{j=1}^{n} Xijw + 0{,}5 \prod nj = 1(xij)wj \quad (4)$$

Where:

Qi = Value fromQ to i
Xijw = Multiply the Xij value with the weight (w)
o,5 = Determination

The best alternative is the one with the highest Qi value.

3. Result and discussion

3.1 System Planning

System planning is the stage to plan or design a system to be made. In planning this system using UML (Unified Modeling Language). The purpose of making this system design is to provide an overview of the flow of the system being made.

3.1.1 *Use Case* Diagram

Use case a diagram is a diagram that displaysactor, use case, and relations in a system, ause case will represent an interaction between actors and the system. Following use case the diagram found in Figure 3:

Figure 3. Use Case Diagram

3.2 WASPAS Method Calculation Process

Method Weighted Aggregated Sum Product Assesment (WASPAS) is a method that can reduce errors or optimize the assessment for selecting the highest and lowest values.

3.2.1 Criteria Data

It takes several criteria used to select the best customer. The required criteria are shown in Table 1.

Table 1.
Criteria

Criteria	Description
C1	Total Spend
C2	Visit loyalty
C3	Shopping quantity
C4	Distance
C5	Complaints Frequency

3.2.2 Weight Data

In method Weighted Aggregated Sum Product Assesment (WASPAS), it takes the weight used to select the best customer. The weight values are shown in Table 2.

Table 2.
Weight

Criteria	Description	Weight	Type
C1	Total Spend	30 %	Benefit
C2	Visit loyalty	30 %	Benefit
C3	Shopping quantity	20 %	Benefit
C4	Distance	10 %	Cost
C5	Complaints Frequency	10 %	Cost

Above the value of the total shopping weight and visit loyalty is the highest, because it is felt that these 2 criteria are the most important for a business to make a profit or profit from the sale of goods to customers.

3.2.3 Criteria Value Data

The level of assessment uses a value interval of 1 to 5, where value 1 is the lowest value and 5 is the highest value. The details are as follows:

Very good = 5
Good = 4
Enough = 3
Bad = 2
Very bad = 1

Furthermore, the criterion value data is the child variable of the criteria. Where the criterion value here is the data used to give value to alternative data. The following is the criteria value data:

a. Total Spend

Total Expenditure is the range of customer spending in TB. DIAN MAJU within 1 month. Seen in Table 3.

Table 3.
Total Spend

Total Spend	Value
< Rp200.000	1
Rp200.000 – Rp500.000	2
Rp500.000 – Rp800.000	3
Rp800.000 – Rp1.100.000	4
> Rp1.100.000	5

b. Visit Loyalty

Visit loyalty is the range of customer visits to TB. DIAN MAJU within 1 month, customer visits can be seen from the purchase receipt and interview with Mr. Dino Aprianto. Seen in Table 4.

Table 4.
Visit Loyality

Visit Loyalty	Value
1 – 2	1
2 – 3	2
4- 5	3
6 - 7	4
> 8	5

c. Shopping Quantity

Shopping quantity is a criterion for selling goods that is used as a reference for valuation, the valuation is determined by the sales results that are the most salable and profit the highest. Seen in Table 5.

Tabel 5.
Shopping Quantity

Shopping quantity	Value
No Criteria	1
Iron	2
Wood	3

Shopping quantity	Value
Cement	4
Light weight Brick	5

d. Distance

Distance is the distance between the buyer's house and TB. DIAN MAJU whose purchased goods were delivered employees by TB. DIAN MAJU. Nearest or farthest as an assessment material. Seen in Table 6.

Table 6.
Distance

Distance	Value
> 2 km	1
1,5 km – 2 km	2
1 km – 1,5 km	3
500 m – 1 km	4
< 500 m	5

e. Complaint Frequency

The frequency of complaints is customer complaints against TB. DIAN MAJU such as service, late delivery of goods, damaged goods etc. The categories of complaints and the number of complaints from the frequency of complaints are detailed as follows:

Table 7.
Categories of Complaint Frequency

Category	Number of Complaints
Very Heavy	8 – 10
Heavy	6 - 7
Medium	4 –5
Light	1 – 3
No Complaint	-

Furthermore, from the complaint category data and the number of complaints above, the value data for the frequency of complaints is made as shown in Table 8.

Table 8.
Complaint Frequency

Complaint Frequency	Value
Very Heavy	1
Heavy	2
Medium	3
Light	4
No Complaint	5

3.2.4 Alternative data

The following are alternatives that will be used to determine the best customers addressed in Table 9.

Table 9.
Alternative

Alternative	Customer Name
A1	Mas Teguh
A2	Pak Yanto
A3	Pak Tri
A4	Pak Kardoyo
A5	Endah
A6	Pak Yoyok
A7	Pak Aan
A8	Pak Kinin
A9	Pak Didik
A10	Dinas Kesehatan Jepara

3.2.5 Alternative values for each criteria

The following are alternative values based on predetermined criteria in Table 10.

Table 10.
Alternative Values on Each Criteria

Alternative	Criteria				
	C1	C2	C3	C4	C5
Mas Teguh	2	1	3	2	5
Pak Yanto	1	1	1	4	5
Pak Tri	1	1	1	3	5
Pak Kardoyo	5	1	1	3	5
Endah	1	1	1	5	5
Pak Yoyok	5	2	2	2	3
Pak Aan	5	1	1	2	5
Pak Kinin	2	1	1	1	5
Pak Didik	5	1	4	2	3
Dinas Kesehatan Jepara	5	1	1	1	5

3.2.6 Completion of the waspas method

The following are the completion steps of the method Weighted Aggregated Sum Product Assesment (WASPAS) in determining the best customer:

a. Decision Matrix (X)

$$X = \begin{bmatrix} 2 & 1 & 3 & 2 & 5 \\ 1 & 1 & 1 & 4 & 5 \\ 1 & 1 & 1 & 3 & 5 \\ 5 & 1 & 1 & 3 & 5 \\ 1 & 1 & 1 & 5 & 5 \\ 5 & 2 & 2 & 2 & 3 \\ 5 & 1 & 1 & 2 & 5 \\ 2 & 1 & 1 & 1 & 5 \\ 5 & 1 & 4 & 2 & 3 \\ 5 & 1 & 1 & 1 & 5 \end{bmatrix}$$

b. Matrix normalization (X)

Criteria 1 (C1)
Max = {2;1;1;5;1;5;5;2;5;5}
= 5
Min = {2;1;1;5;1;5;5;2;5;5}
= 1

$\bar{x}11 = \left(\frac{2}{5}\right) = 0{,}4$
$\bar{x}21 = \left(\frac{1}{5}\right) = 0{,}2$
$\bar{x}31 = \left(\frac{1}{5}\right) = 0{,}2$
$\bar{x}41 = \left(\frac{5}{5}\right) = 1$
$\bar{x}51 = \left(\frac{1}{5}\right) = 0{,}2$
$\bar{x}61 = \left(\frac{5}{5}\right) = 1$
$\bar{x}71 = \left(\frac{5}{5}\right) = 1$
$\bar{x}81 = \left(\frac{2}{5}\right) = 0{,}4$
$\bar{x}91 = \left(\frac{5}{5}\right) = 1$
$\bar{x}101 = \left(\frac{5}{5}\right) = 1$

Criteria 2 (C2)
Max = {1;1;1;1;1;2;1;1;1;1}
= 2
Min = {1;1;1;1;1;2;1;1;1;1}
= 1

$\bar{x}12 = \left(\frac{1}{2}\right) = 0{,}5$
$\bar{x}22 = \left(\frac{1}{2}\right) = 0{,}5$
$\bar{x}32 = \left(\frac{1}{2}\right) = 0{,}5$
$\bar{x}42 = \left(\frac{1}{2}\right) = 0{,}5$
$\bar{x}52 = \left(\frac{1}{2}\right) = 0{,}5$
$\bar{x}62 = \left(\frac{2}{2}\right) = 1$
$\bar{x}72 = \left(\frac{1}{2}\right) = 0{,}5$
$\bar{x}82 = \left(\frac{1}{2}\right) = 0{,}5$
$\bar{x}92 = \left(\frac{1}{2}\right) = 0{,}5$
$\bar{x}102 = \left(\frac{1}{2}\right) = 0{,}5$

Criteria 3 (C3)
Max = {3;1;1;1;1;2;1;1;4;1}
= 4
Min = {3;1;1;1;1;2;1;1;4;1}
= 1

$\bar{x}13 = \left(\frac{3}{4}\right) = 0{,}75$
$\bar{x}23 = \left(\frac{1}{4}\right) = 0{,}25$
$\bar{x}33 = \left(\frac{1}{4}\right) = 0{,}25$
$\bar{x}43 = \left(\frac{1}{4}\right) = 0{,}25$
$\bar{x}53 = \left(\frac{1}{4}\right) = 0{,}25$
$\bar{x}63 = \left(\frac{2}{4}\right) = 0{,}5$
$\bar{x}73 = \left(\frac{1}{4}\right) = 0{,}25$
$\bar{x}83 = \left(\frac{1}{4}\right) = 0{,}25$
$\bar{x}93 = \left(\frac{4}{4}\right) = 1$
$\bar{x}103 = \left(\frac{1}{4}\right) = 0{,}25$

Criteria 4 (C_4)
Max = {2;4;3;3;5;2;2;1;2;1}
= 5
Min = {2;4;3;3;5;2;2;1;2;1}
= 1

$\bar{x}14 = \left(\frac{1}{2}\right) = 0{,}5$
$\bar{x}24 = \left(\frac{1}{4}\right) = 0{,}25$
$\bar{x}34 = \left(\frac{1}{3}\right) = 0{,}33$
$\bar{x}44 = \left(\frac{1}{3}\right) = 0{,}33$
$\bar{x}54 = \left(\frac{1}{5}\right) = 0{,}2$
$\bar{x}64 = \left(\frac{1}{2}\right) = 0{,}5$
$\bar{x}74 = \left(\frac{1}{2}\right) = 0{,}5$
$\bar{x}84 = \left(\frac{1}{1}\right) = 1$
$\bar{x}94 = \left(\frac{1}{2}\right) = 0{,}5$
$\bar{x}104 = \left(\frac{1}{1}\right) = 1$

Criteria 5 (C_5)
Max = {5;5;5;5;5;3;5;5;3;5}
= 5
Min = {5;5;5;5;5;3;5;5;3;5}
= 3

$\bar{x}15 = \left(\frac{3}{5}\right) = 0{,}6$
$\bar{x}25 = \left(\frac{3}{5}\right) = 0{,}6$
$\bar{x}35 = \left(\frac{3}{5}\right) = 0{,}6$
$\bar{x}45 = \left(\frac{3}{5}\right) = 0{,}6$
$\bar{x}55 = \left(\frac{3}{5}\right) = 0{,}6$
$\bar{x}65 = \left(\frac{3}{3}\right) = 1$
$\bar{x}75 = \left(\frac{3}{5}\right) = 0{,}6$
$\bar{x}85 = \left(\frac{3}{5}\right) = 0{,}6$
$\bar{x}95 = \left(\frac{3}{3}\right) = 1$
$\bar{x}105 = \left(\frac{3}{5}\right) = 0{,}6$

Matrix normalization results

$$\bar{X} = \begin{bmatrix} 0{,}4 & 0{,}5 & 0{,}75 & 0{,}5 & 0{,}6 \\ 0{,}2 & 0{,}5 & 0{,}25 & 0{,}25 & 0{,}6 \\ 0{,}2 & 0{,}5 & 0{,}25 & 0{,}33 & 0{,}6 \\ 1 & 0{,}5 & 0{,}25 & 0{,}33 & 0{,}6 \\ 0{,}2 & 0{,}5 & 0{,}25 & 0{,}2 & 0{,}6 \\ 1 & 1 & 0{,}5 & 0{,}5 & 1 \\ 1 & 0{,}5 & 0{,}25 & 0{,}5 & 0{,}6 \\ 0{,}4 & 0{,}5 & 0{,}25 & 1 & 0{,}6 \\ 1 & 0{,}5 & 1 & 0{,}5 & 1 \\ 1 & 0{,}5 & 0{,}25 & 1 & 0{,}6 \end{bmatrix}$$

W = {0,3 0,3 0,2 0,1 0,1}

c. Qi Value

Q_1 = (0,5)∑((0,4x0,3)+(0,5x0,3)+(0,75x0,2)+(0,5x0,1)+(0,6x0,1))
= (0,5)∑((0,12)+(0,15)+(0,15)+(0,05)+(0,06)
= (0,5) (0,53)
= 0,265
= $(0{,}5)\prod(0{,}4)^{0{,}3} * (0{,}5)^{0{,}3} * (0{,}75)^{0{,}2} * (0{,}5)^{0{,}1} * (0{,}6)^{0{,}1}$
= (0,5)∏(0,759) * (0,812) * (0,944) * (0,933) * (0,950)
= (0,5) (0,516)
= 0,258

= 0,265 + 0,258
= **0,523**

Q_2 = (0,5)∑((0,2x0,3)+(0,5x0,3)+(0,25x0,2)+(0,25x0,1)+(0,6x0,1))

= (0,5)∑((0,06)+(0,15)+(0,05)+(0,025)+(0,06)
= (0,5) (0,345)
= 0,172
= (0,5)∏$(0,2)^{0,3} * (0,5)^{0,3} * (0,25)^{0,2} * (0,25)^{0,1} * (0,6)^{0,1}$
= (0,5)∏(0,617) * (0,812) * (0,757) * (0,870) * (0,950)
= (0,5) (0,314)
= 0,157

= 0,172 + 0,157
= **0,329**

Q_3 = (0,5)∑((0,2x0,3)+(0,5x0,3)+(0,25x0,2)+(0,33x0,1)+(0,6x0,1))
= (0,5)∑((0,06)+(0,15)+(0,05)+(0,033)+(0,06)
= (0,5) (0,353)
= 0,176
= (0,5)∏$(0,2)^{0,3} * (0,5)^{0,3} * (0,25)^{0,2} * (0,33)^{0,1} * (0,6)^{0,1}$
= (0,5)∏(0,617) * (0,812) * (0,757) * (0,895) * (0,950)
= (0,5) (0,323)
= 0,161

= 0,176 + 0,161
= **0,338**

Q_4 = (0,5)∑((1x0,3)+(0,5x0,3)+(0,25x0,2)+(0,33x0,1)+(0,6x0,1))
= (0,5)∑((0,3)+(0,15)+(0,05)+(0,033)+(0,06)
= (0,5) (0,593)
= 0,296
= (0,5)∏$(1)^{0,3} * (0,5)^{0,3} * (0,25)^{0,2} * (0,33)^{0,1} * (0,6)^{0,1}$
= (0,5)∏(1) * (0,812) * (0,757) * (0,895) * (0,950)
= (0,5) (0,524)
= 0,262

= 0,296 + 0,262
= **0,558**

Q_5 = (0,5)∑((0,2x0,3)+(0,5x0,3)+(0,25x0,2)+(0,2x0,1)+(0,6x0,1))
= (0,5)∑((0,06)+(0,15)+(0,05)+(0,02)+(0,06)
= (0,5) (0,34)
= 0,17
= (0,5)∏$(0,2)^{0,3} * (0,5)^{0,3} * (0,25)^{0,2} * (0,2)^{0,1} * (0,6)^{0,1}$
= (0,5)∏(0,617) * (0,812) * (0,757) * (0,851) * (0,950)
= (0,5) (0,307)
= 0,153

= 0,17 + 0,153
= **0,323**

Q_6 = (0,5)∑((1x0,3)+(1x0,3)+(0,5x0,2)+(0,5x0,1)+(1x0,1))
= (0,5)∑((0,3)+(0,3)+(0,1)+(0,05)+(0,1)
= (0,5) (0,85)
= 0,425

$= (0,5)\prod(1)^{0,3} * (1)^{0,3} * (0,5)^{0,2} * (0,5)^{0,1} * (1)^{0,1}$
$= (0,5)\prod(1) * (1) * (0,870) * (0,933) * (1)$
$= (0,5)\ (0,812)$
$= 0,406$

$= 0,425 + 0,406$
$=$ **0,831**

$Q_7 = (0,5)\sum((1x0,3)+(0,5x0,3)+(0,25x0,2)+(0,5x0,1)+(0,6x0,1))$
$= (0,5)\sum((0,3)+(0,15)+(0,05)+(0,05)+(0,06)$
$= (0,5)\ (0,61)$
$= 0,305$
$= (0,5)\prod(1)^{0,3} * (0,5)^{0,3} * (0,25)^{0,2} * (0,5)^{0,1} * (0,6)^{0,1}$
$= (0,5)\prod(1) * (0,812) * (0,757) * (0,933) * (0,950)$
$= (0,5)\ (0,545)$
$= 0,272$

$= 0,305 + 0,272$
$=$ **0,577**

$Q_8 = (0,5)\sum((0,4x0,3)+(0,5x0,3)+(0,25x0,2)+(1x0,1)+(0,6x0,1))$
$= (0,5)\sum((0,12)+(0,15)+(0,05)+(0,1)+(0,06)$
$= (0,5)\ (0,48)$
$= 0,24$
$= (0,5)\prod(0,4)^{0,3} * (0,5)^{0,3} * (0,25)^{0,2} * (1)^{0,1} * (0,6)^{0,1}$
$= (0,5)\prod(0,759) * (0,812) * (0,757) * (1) * (0,950)$
$= (0,5)\ (0,444)$
$= 0,222$

$= 0,24 + 0,222$
$=$ **0,462**

$Q_9 = (0,5)\sum((1x0,3)+(0,5x0,3)+(1x0,2)+(0,5x0,1)+(1x0,1))$
$= (0,5)\sum((0,3)+(0,15)+(0,2)+(0,05)+(0,1)$
$= (0,5)\ (0,8)$
$= 0,4$
$= (0,5)\prod(1)^{0,3} * (0,5)^{0,3} * (1)^{0,2} * (0,5)^{0,1} * (1)^{0,1}$
$= (0,5)\prod(1) * (0,812) * (1) * (0,933) * (1)$
$= (0,5)\ (0,757)$
$= 0,378$

$= 0,4 + 0,378$
$=$ **0,778**

$Q_{10} = (0,5)\sum((1x0,3)+(0,5x0,3)+(0,25x0,2)+(1x0,1)+(0,6x0,1))$
$= (0,5)\sum((0,3)+(0,15)+(0,05)+(0,1)+(0,06)$
$= (0,5)\ (0,66)$
$= 0,33$
$= (0,5)\prod(1)^{0,3} * (0,5)^{0,3} * (0,25)^{0,2} * (1)^{0,1} * (0,6)^{0,1}$
$= (0,5)\prod(1) * (0,812) * (0,757) * (1) * (0,950)$
$= (0,5)\ (0,584)$

= 0,292

= 0,33 + 0,292
= **0,622**

d. Rangking

Table 11 is the result of calculating the final results and ranking of each alternative from the highest to the lowest has been carried out.

Table 11.
Ranking Results

Alternative	Total	Rank
Mas Teguh	0,523	6
Pak Yanto	0,329	9
Pak Tri	0,338	8
Pak Kardoyo	0,558	5
Endah	0,323	10
Pak Yoyok	0,831	1
Pak Aan	0,577	4
Pak Kinin	0,462	7
Pak Didik	0,778	2
Jepara Health Office	0,622	3

It can be seen in table 11 that Pak Yoyok has the highest priority to become the Best Customer at TB. DIAN MAJU because it has the highest score.

3.3 System implementation

At this stage the researcher implements the program design that the researcher previously made into a system that can be operated, or can be called building a real system.

3.3.1 Calculation data page

The calculation data page is a page that contains information about the results of calculating values that have been entered by using the WASPAS method. As shown in Figure 4.

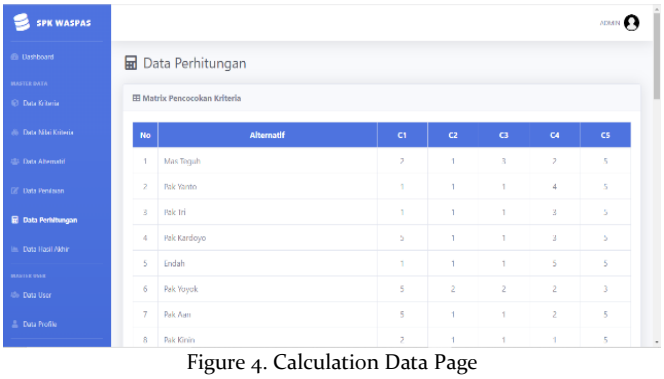

Figure 4. Calculation Data Page

3.3.2 Final result data page.

The final result data page is a page that contains information about the final calculation results and also the ranking of each alternative. On this page can manage the final output data such as printing data. As shown in Figure 5.

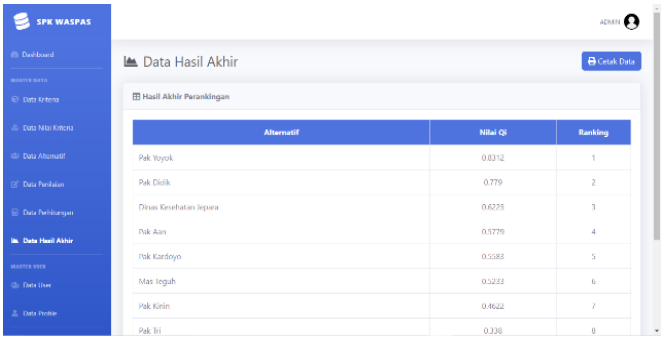

Figure 5. Final Result Data Page

3.4 System black box testing.

Test use black box this is to find out the functions of the software from input to output, whether they are in accordance with what is needed or not. Here are the test results black box shown in Table 12.

Table 12.
Black Box Testing

NO	Test Case	Status
1	Login	Valid
2	Criteria Data	Valid
3	Criteria Value Data	Valid
4	Alternative Data	Valid
5	Assessment Data	Valid
6	Calculation Data	Valid
7	Final Result Data	Valid
8	User Data	Valid
9	Profile Data	Valid

3.5 Testing the user satisfaction survey system.

Testing is carried out so that the system created gets an assessment from system users. The purpose of this test is to assess whether the system created is in accordance with user requirements. So that the author can find out the errors that exist in the system so that the author can fix the system according to user needs. Testing the questionnaire was distributed to 4 users, namely: shop owner, cashier and 2 employees which contained 5 questions on a scale of 1 to 4. The survey results are shown in Figure 6. In graphical form diagram at pie.

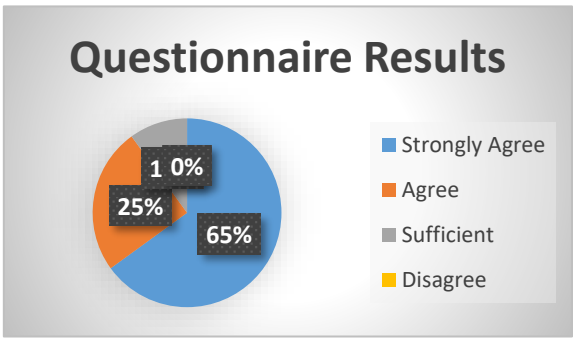

Figure 6. Questionnaire Testing Chart

Figure 6 explains the results of the overall questionnaire from each category, namely 65% strongly agree, 25% agree, 10% sufficient and 0% disagree. From the results of testing the questionnaire, it can be concluded that the Decision Support System for Determining the Best Customers using the Weighted Aggregated Sum Product Assessment (WASPAS) method is in accordance with the needs and gets good responses from respondents so that it can be used in TB. DIAN MAJU.

4. Conclusion

A decision support system using the Weighted Aggregated Sum Product Assessment (WASPAS) method can assist in the process of determining the best customer in TB. DIAN MAJU. The decision support system that has been made has implemented an assessment based on the weight of each criterion so that determining the best customer is more precise and easier. Through testing the questionnaire that has been done to 4 respondents in TB. DIAN MAJU regarding the decision support system for determining the best customer, the results are 65% strongly agree, 25% agree, 10% is sufficient and 0% disagree which shows that the system is in accordance with the needs and gets good responses from respondents so that it can be used on TB. DIAN MAJU. This system can be developed for use on systems other than to determine the best customer, such as selecting a supplier to purchase goods. This decision support system needs to be added to the final ranking chart to make it easier to see and determine the best customer. The system can be developed with other recommendation methods such as moora. There are many who use the waspas and moora methods for comparison of values, with the 2 different methods it will be possible to compare the best results from the waspas method and the moora method.

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