Jurnal RESTIA Volume 2, Nomor 1, Februari 2024 **Hal 28-43**
e-ISSN : 2988-5663

DECISION SUPPORT SYSTEM FOR BEST MINIMARKET BRANCH LOCATION SELECTION USING WEB-BASED SIMPLE ADDITIVE WEIGHTING METHOD

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ABSTRACT
Minimarkets are shops that sell daily necessities. This mini market is located on Jalan Station Kauman, Krikilan Hamlet, Dawungan Village, Masaran District, Sragen Regency, Central Java Province. In developing inter-company leaders, it is difficult to make decisions about the location of new branches, because there are many criteria such as: strategic location, distance and population to facilitate decision making. The purpose of this study is that researchers assist company leaders in choosing the best new minimarket branch locations using the SAW algorithm method. This method was chosen because it is able to carry out the process of ranking and weighting the best alternatives by applying many criteria. The technique used in this research is observation (observation), interview (interview), and literature study. In the design of this system is made with Context Diagram, HIPO, DAD, relations between tables and database design. This application is made using the PHP programming language and the database uses MySQL. The final result is a report on the best location data. System testing is done by testing the functionality and testing the validity of the obtained results are 100% valid.
Keywords: Minimarket, location, Branch.

1. Introduction

Bumi Sakinah Minimarket is a shop that sells goods for daily needs. This minimarket is located on Jalan Stasiun Kauman, Krikilan Hamlet, Dawungan Village, Masaran District, Sragen Regency, Central Java Province. In developing a business, this business needs to establish a new branch in the best location, so decision-making criteria are formed such as: location conditions strategic location, distance between branches and population. This makes it difficult for branch managers to determine the best mini market branch location.

For this reason, it is necessary to have a decision support system that can assist managers in making decisions in determining the best mini market branch location.

Based on the description above, the solution to this problem is that the researcher will assist in the Design of a Decision Support System for Selection of Locations for New Cabanag Mini Market Bumi Sakinah using the Simple Additive Weighting (SAW) method[1]. Based on previous research from Wahyu et al, 2018 with the title Decision Support System for Determining Locations for Opening New Store Branches Using the Fuzzy SAW Method, it is explained that the SPK SAW method can be used to determine the location of opening store branches with accurate results.

The aim of this research is that researchers will assist in the selection process for selecting the best new mini market branch locations using the SAW algorithm method. This method was chosen because it is capable of carrying out the process of ranking and weighing the best alternatives from a number of other alternatives, in this case the alternative in question is the new branch location. Therefore, the author is interested in highlighting this matter in a scientific paper in the form of a thesis with the title "Decision Support System for Selecting Mini Market Branch Locations Using the Simple Additive Weighting Method".

2. Literature Review

2.1 Definition of Location

Location is a place to serve consumers, it can also be interpreted as a place to display merchandise. The definition of location is the place where the company operates or where the company carries out activities to produce goods and services that are important to the economic

aspect. Determining location is the main strategy in retail businesses. A strategic location will be the opening that determines the success of a retail business. Many retail entrepreneurs sometimes do not understand the importance of location when opening a retail business so they do not carry out location surveys and develop appropriate strategies in selecting the location [2].

2.3 Decision Support System (DSS)

Decision Support System (DSS) or Decision Support System (DSS) is an interactive information system that provides information, modeling and data manipulation. The system is used to assist decision making in semi-structured situations and unstructured situations, where no one knows exactly how the decision should be made [4].

The application of the new Decision Making System can be said to be successful or useful if the following conditions exist:

1. The existence of a very large database, making it difficult to utilize it.
2. The importance of transformation and computing in the process of reaching decisions.
3. There is limited time, both in determining results and in the process.
4. The importance of assessing common sense considerations to determine and understand the main problem, as well as developing alternatives and evaluating solutions [4].

2.4 Simple Additive Weighting (SAW) Method

The Simple Additive Weighting SAW method is often also known as the weighted addition method. The basic concept of the Simple Additive Weighting (SAW) method is to find the weighted sum of the performance ratings for each alternative on all attributes. The Simple Additive Weighting (SAW) method requires a process of normalizing the decision matrix (X) to a scale that can be compared with all existing alternative ratings [10].

The SAW method formula determines benefits and costs, in formula 1.

$$r_{ij} = \begin{cases} \dfrac{Xij}{\underset{i}{Max}\, Xii} & \text{If j is the profit attribute (benefits)} \\ \dfrac{\underset{i}{Min}\, Xii}{Xij} & \text{If j is the cost attribute (cost)} \end{cases} \quad \text{.....(1)}$$

Information :
rij = normalized performance rating value
xij = attribute value for each criterion. Maxij = largest value for each criterion
Minij = smallest value of each criterion Benefit = if the largest value is the best Cost = if the smallest value is the best
Where rij is the normalized performance rating of alternative Ai on attribute Cj; i=1,2…m and j=1,2,..n. The preference value for each alternative (Vi) is given as in formula 2.

$$V_i = \sum_{j=1}^{n} W_j\, r_{ij} \quad \text{.....(2)}$$

Information :
Vi = ranking for each alternative

Wj = weight value of each criterion
rij = normalized performance rating value
A larger Vi value indicates that alternative Ai is more selected among the other alternatives.

The work steps for calculating the SAW method are as follows:

1. Give a value to each alternative (Ai) for each predetermined criterion (Cj), where the values i=1,2,…m and j=1,2,…n.
2. Provide a weight value (W) obtained based on the crisp value.
3. Normalize the matrix by calculating the normalized performance rating value, the normalized performance rating value of alternative Ai on attribute Cj based on an equation adjusted to the type of attribute (profit attribute = MAXIMUM or cost attribute = MINIMUM). If it is a profit attribute, the crisp value (Xij) of each attribute column is divided by the crisp MAX value (MAX Xij) of each column, while for the cost attribute, the crisp MIN value (MIN Xij) of each attribute column is divided by the crisp value (Xij) each column.
4. Carry out a ranking process for each alternative (Vi) by multiplying the weight value (wi) by the normalized performance rating value.

2.5 PHP Programming Language

PHP is a repeated abbreviation of PHP Hypertext Preprocessor, formerly called Personal Home Page, first created by Rasmus Lerdof in 1995. A popular function of PHP is its ability as a server side programming / scripting language in creating websites, or website-based applications. Server Side Programming / Scripting is a language that runs on the server side (in this case the Web Server) so that the public computer (Client / Web Browser) does not know what is happening on the Web Server. The computer (Client / Web Browser) only receives output from the process produced by the Web Server [5].

2.6 MySQL

MySQL is an RDBMS (Relational Database Management System) product that we can enjoy for free. The data that we want to store will be used by the RDBMS as tables that are interconnected / can be linked / or stand alone in the Database. The database itself is essentially a collection of many tables. SQL itself is an abbreviation of Structured Query Language, which is the standard database language used today. With Query, we can perform operations on the Database. For example, creating a table, changing a table, deleting, inserting, creating a table relationship or connecting tables [6].

2.5 Previous Research

Previous research is a comparison of references with current research, as for the comparison between previous research and current research, such as: Determining the Location of the New Branch of Hema Mini Market Using the Analytical Hierarchy Process Method, by: Denny Agus Trianto, Year: 2020. The research results explain that the AHP method has been able to determining the selection of new mini market branch locations with 90% accuracy results., Decision Support System for Determining Locations for Opening New Store Branches Using the Fuzzy - SAW Method, By: Wahyuni, Year: 2018 The results of this research, namely the Decision Making System, have helped in determining the location of new stores best using the SAW method., SPK Determining ATM Locations Using the AHP and SAW Methods, By: Gede Surya Mahendra, Year: 2019 The results of this research are that the AHP and SAW methods have been able to determine the best ATM locations within the city., Decision Support System for Determining Repair Locations Roads, Using the Simple Additive Weighting (SAW) Method (Case Study: P.U Bina Marga Service, Ogan Ilir Regency), By: Resi Arsita, Year: 2020 The results of this research are that SPK has helped a lot in determining the best location for road repairs using the SAW Method. , Decision Support System for Determining the Layout of Pesawaran Police Station Offices Using the Simple Additive, Weighting Method, By: Widi Ayu Pangestu, Year: 2016, The results of this research are that SPK has been able to help determine the best police station layout using the SAW method.

3. Research Methods

The research methods used to complete this research are as follows:

3.1 Data Collection Methods

The data collection method is as follows:

1. Interview
   At this stage, researchers directly interview competent parties related to assessment issues.

2. Observation
   At this stage, the author carries out data collection by systematically recording data and observing the matters being investigated directly.

3. Literature Study
   At this stage the author conducted a literature study, namely collecting reference materials from books, articles, journals, papers, and internet sites regarding a Decision Support System for Selecting the Best Minimarket Branch Locations using the SAW (Simple Additive Weighting) Method and other sources that support it. research purposes.

3.2 System Development Methods

The following methods in system development are as follows:

1. System Analysis
   At the system analysis stage, several actions are carried out such as: data collection, system analysis, selection process for system requirements [7].
2. System Design
   In the system design stage there are system design processes such as: Contex Diagram (CD), Input Process Output Hierarchy (HIPO) and Data Flow Diagram (DAD) [8].
3. System Design
   In the system design stage several designs are required such as input design, output design, technology design and database design [9].
4. System Implementation
   System implementation is the process of creating the entire system application from start to finish so that it can be used using the Weighted Product method. The system was created using the PHP programming language and MySQ database [11].
5. System Testing
   System testing is carried out in two ways, namely functionality testing and validity testing.

4. Results and Discussions

The results of this discussion are the overall system design data as follows:

4.1 Criteria and Weighting

In the SAW (Simple Additive Weighting) method, there are criteria and weights needed to carry out the selection process for new minimarket branch locations, which can be seen in Table1.

Table 1. Criteria and Weights

No	Criteria	Category	Criteria Weight
1	Benefit	Conditions	10
2	Distance	Cost	6
3	Population	Benefit	8

There is an explanation of each criterion in the decision support system for selecting new minimarket branch locations.

1. Condition Criteria

In determining the location of a new mini market branch in Bumi Sakinah, it is a strategic location, namely close to busy communities. Because if the location is close to the community and very strategic, it can increase sales turnover at the mini market branch. This criterion includes benefits.

The location condition criteria are measured based on the location conditions of the prospective new mini market branch. The conversion values given are as shown in table 2.

Table 2. Conversion of Location Condition Values

Condition	Value
Very strategic	10
Strategic	8
Quite strategic	6
Less strategic	4

2 Distance Criteria

In determining the choice of location for a new mini market branch, closeness between branches is also required, this is useful for making it easier to distribute goods between branches, so that network connections between branches can be monitored well. This criterion includes costs. In terms of population criteria, it is measured based on the number of resident supporters in the location, the more residents who live in the location, the more priority it will be given. The conversion of population values can be seen in table 3.

Table 3. Conversion of Population Population Values

Population	Value
A very large number	10
Lots	8
more or less	6
not many	4

3. Population Population Criteria

Population population is the number of people living near the prospective mini market branch location. The greater the population of residents living in the area, the more priority it will take. So this criterion is worthy of being set as one of the criteria for measuring the best alternative location for the Bumi Sakinah mini market branch.

In terms of population criteria, it is measured based on the number of resident supporters in the location, the more residents who live in the location, the more priority it will be given. The conversion of population values can be seen in table 4.

Table 4. conversion of resident population values

Population	Value
A very large number	10
Lots	8
more or less	6
not many	4

4.2 System Design

1. Context Diagram

Context Diagram for a decision support system for selecting the location of a new minimarket branch. The Context Diagram model can be seen in Figure 1.

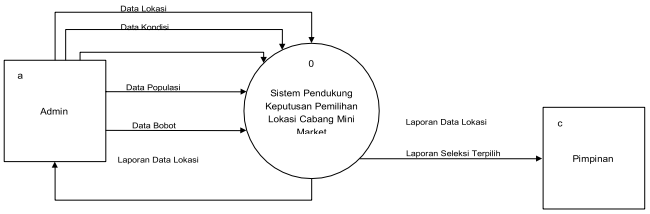

Figure 1. Context Diagram

2. HIPO

The Input Process Output (HIPO) hierarchy is used as a tool for system development and program documentation techniques and its use has several objectives. The HIPO tiered chart is used for levels to provide a clear explanation of the inputs that must be used and the outputs that must be produced by each function at each level. each level of the HIPO diagrams. The HIPO image of the Decision Support System for Selecting the Best Minimarket Branch Locations can be seen in Figure 2.

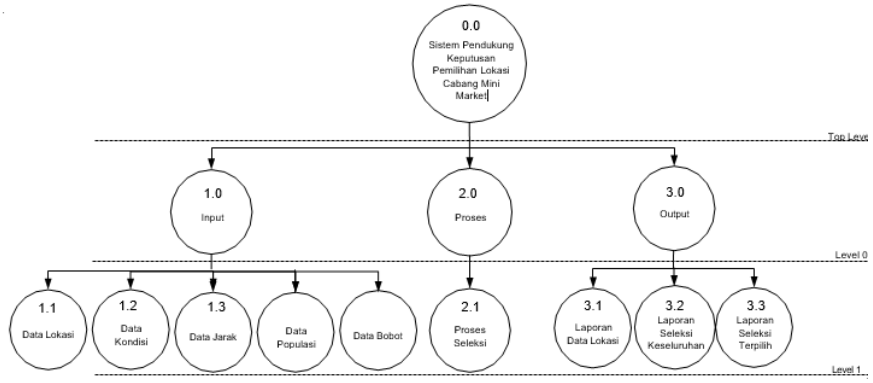

Figure 2. HIPO

3. DAD

Data Flow Diagram (DAD) is a diagram that uses notations to describe the flow of system data, the use of which is very helpful for understanding the system logically, structured and clearly. DAD describes the flow of data to the system, DAD helps to understand the system logically, structured and clearly [12]. The following is DAD level 0 for the Decision Support System for Selecting the Best Minimarket Branch Locations. An overview of DAD Level 0 can be seen in Figure 3.

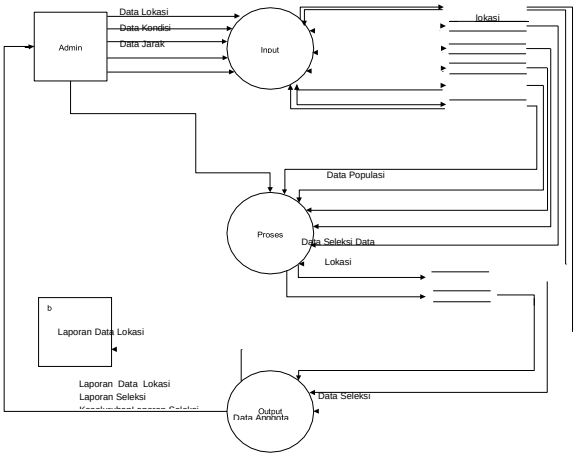

Figure 3. DFD Level 0

4. ERD (Entity Relationship Diagram)

Entity Relationship Diagram is an abstract and conceptual representation of data. Entity-Relationship is a database modeling method that can be used to produce conceptual data schemas for system semantic data type models [13]. The following is the ERD in the Decision Support System for Selecting the Best Minimarket Branch Locations, which can be seen in Figure 4.

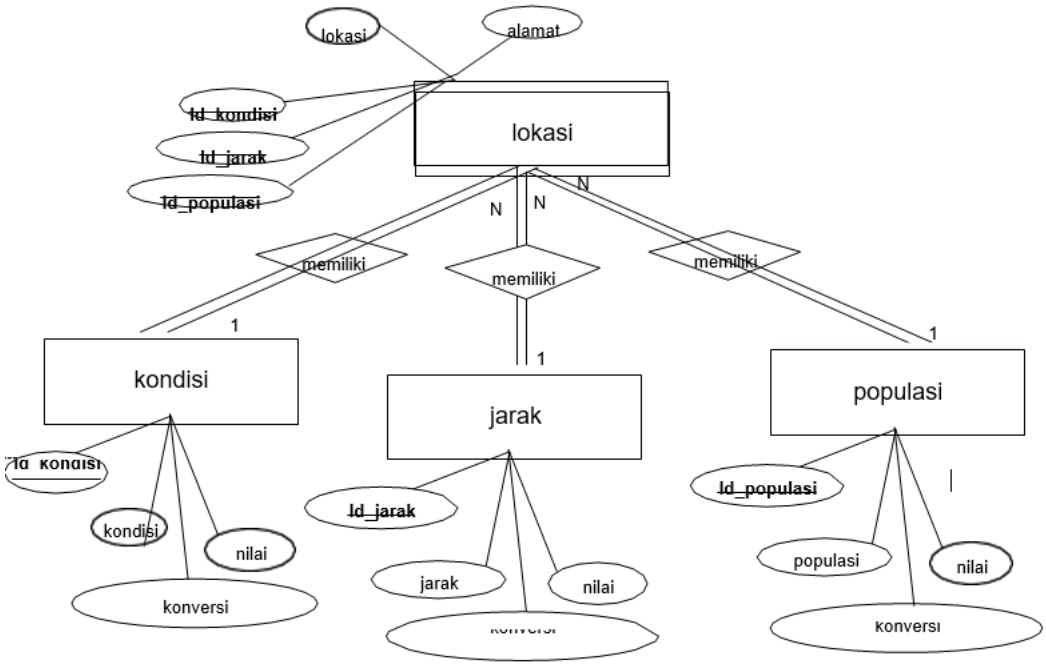

Figure 4. ERD (Entity Relationship Diagram)

Explanation in Figure 4, Entity Relationship Diagram The following table :

1. In the relationships between entities above, there are 4 entities that can carry out relationships, such as: location, condition, distance and population entities. because it has the appropriate Primary key ID.* Entities: objects that have the same characteristics.
2. In the location entity there is an attribute that has a primary key that can perform relationships. These attributes include: location_id, condition_id, distance_id and population_id.
3. In the location entity there is Primary key = location_id, then the location entity, there is Primary key = condition_id, then the distance entity is Primary key = population_id, then the population entity is Primary key = population_id.
4. Then for the location entity, there is also the same Primary key attribute, so that it can be a many to one relationship

4.2 System Implementation

System implementation is the process of creating a system in the form of designing the SPK application for Selection of the Best Minimarket Branch Locations.

1. Application Login
   In carrying out the selection system for selecting new minimarket branch locations, the first step is to log in to the application program as in Figure 5.

Figure 5. Program Login Form

2. Input employee data
   The data input display used to input location data into the application program can be shown in Figure 6.

Figure 6. Location Data Input Form

3. List of Locations
   The data that has been filled in will be stored in the program so that the data can be used for decision making, as shown in Figure 7.

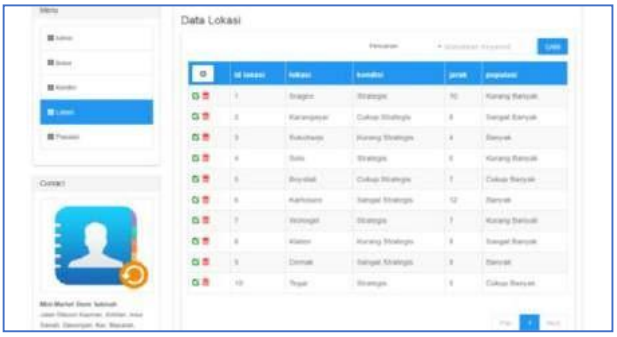

Figure 7. Location Data Input Form

4. Criteria Weight Settings Display

The Criteria weight form display is used to determine the weight value of each criterion. The following displays the criteria weights in the SPK application for Selection of the Best Minimarket Branch Locations, presented in Figure 8.

Figure 8. Criteria Weight Form

5. Location Criteria Display
   Location criteria are used to determine the best minimarket branch locations. In the menu display settings, the location criteria can be seen in Figure 9.

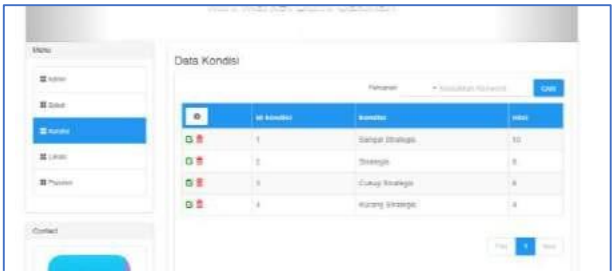

Figure 9. Condition Criteria Form

6. Population Criteria Settings Display
   This criterion was created to provide a conversion value in the system, so that there is a range of decision value levels. In the menu display settings, the population criteria can be seen in Figure 10.

Figure 10. Population Criteria Form

7. Display of Distance Criteria Settings
   For the distance criterion, no value conversion is required, because the value of the distance criterion is the value of the distance input entered into the system because the distance criterion is a type of numeric data that does not require a value conversion process.

8. Algorithm Menu
   In carrying out the selection process for calculating the SAW method algorithm, it can be presented in Figure 11.

Figure 11. Algorithm Calculation Form

9. Report View
   The results of the SKP report displaying the selection of the best minimarket branch locations are made into 3 types, namely the branch location data report, the selected selection data report and the overall selection results report
   a) Branch Location Data Report
      This report is useful for providing data on prospective new minimarket branch locations, as shown in Figure 12.

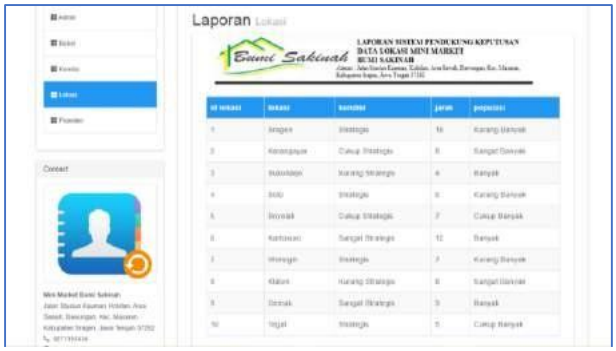

Figure 12. Branch Location Data Report

   b) Overall Selection Data Report
      When viewing the selection data report in the form of the selection calculation process, click the Report menu - then select Overall Selection Process Report, it will appear as shown in Figure 13.

Figure 13. Overall Selection Data Report

c) Selected Selection Results Report
When looking at the selection results report in the form of data, data reports that have passed the selection are "best location". To do this, click the Report menu - then select Report on Selected Selection Results, it will appear as shown in Figure 14.

Figure 14. Selected Selection Results Report

d) System testing
System testing is carried out in 2 test stages, namely functionality testing and validity testing. The recap of the functionality test results can be seen in table 5

Table 5. Functionality Test

No	Jenis Uji	Komponen Sistem yang diuji	Skenario Uji	Hasil yang diharapkan	Hasil yang dihasilkan	Satus Uji	Hasil Pengujian
1	Uji Normal	Form Login Admin	• Masukan username dan password, lalu pilih level admin dan isi kode capca dengan benar	• Tampil halaman menu utama admin	• Muncul pesan "Login Sukses, Selamat Datang admin" • Tampil halaman admin	Normal	Diterima
	Uji Salah	Form Login Admin	• Masukan username dan password, lalu pilih level admin dan isi kode capca dengan salah	• Muncul pesan kesalahan	• Muncul pesan "Code Salah!" • Tidak masuk admin	Normal	Diterima
2	Uji Normal	Form Input Data Admin	• Masukan data admin secara lengkap dan benar	• Data tersimpan dengan baik dan benar	• Muncul pesan "Penyimpanan Berhasil" • Tersimpan dengan baik	Normal	Diterima
	Uji Salah	Form Input Data Admin	• Masukan data admin secara tidak lengkap	• Tidak bisa menyimpan	• Tidak bisa disimpan	Normal	Diterima
3	Uji Normal	Form Input Lokasi	• Masukan data lokasi secara lengkap dan benar	• Data lokasi tersimpan dengan baik dan benar	• Muncul pesan "Penyimpanan Berhasil" • Tersimpan dengan baik	Normal	Diterima
	Uji Salah	Form Input Lokasi	• Masukan data lokasi secara tidak lengkap	• Tidak bisa menyimpan	• Tidak bisa disimpan	Normal	Diterima
4	Uji Normal	Form Input Kriteria Kondisi	• Masukan data kondisi secara lengkap dan benar	• Data kriteria tersimpan dengan baik dan benar	• Muncul pesan "Penyimpanan Berhasil" • Tersimpan dengan baik	Normal	Diterima
	Uji Salah	Form Input Kriteria Kondisi	• Masukan data kondisi secara tidak lengkap	• Tidak bisa menyimpan	• Tidak bisa disimpan	Normal	Diterima
5	Uji Normal	Form Input Kriteria Jarak	• Masukan data jarak secara lengkap dan benar	• Data kriteria tersimpan dengan baik dan benar	• Muncul pesan "Penyimpanan Berhasil" • Tersimpan dengan baik	Normal	Diterima
	Uji Salah	Form Input Kriteria Jarak	• Masukan data jarak secara tidak lengkap	• Tidak bisa menyimpan	• Tidak bisa disimpan	Normal	Diterima
6	Uji Normal	Form Input Kriteria Populasi	• Masukan data populasi secara lengkap dan benar	• Data kriteria tersimpan dengan baik dan benar	• Muncul pesan "Penyimpanan Berhasil" • Tersimpan dengan baik	Normal	Diterima
	Uji Salah	Form Input Kriteria Populasi	• Masukan data populasi secara tidak lengkap	• Tidak bisa menyimpan	• Tidak bisa disimpan	Normal	Diterima
7	Uji Normal	Form Input Bobot	• Masukan data bobot secara lengkap dan benar	• Data bobot tersimpan dengan baik dan benar	• Muncul pesan "Penyimpanan Berhasil" • Tersimpan dengan baik	Normal	Diterima
	Uji Salah	Form Input Bobot	• Masukan data bobot secara tidak lengkap	• Tidak bisa menyimpan	• Tidak bisa disimpan	Normal	Diterima

Apart from testing the system by testing functionality, researchers also tested the system by testing validity. Validity Testing is a system testing process at the end which is also useful for testing the system. In this research there is a validity test. The validity test is comparing the results of manual calculations with computerized results. The following is a manual calculation for the Simple Additive Weighting (SAW) Method: Simple Additive Weighting (SAW) calculation is a mathematical calculation process for

ranking in selecting the best alternative. So it is done based on Formula 2. Based on Formula 2, the Simple Additive Weighting (SAW) Method Calculation Process is as follows:

a) Determine employee data
The first step that must be prepared is to collect data on prospective minimarket branch locations. This can be seen in table 6.

Table 6. Minimarket Location Data

No	ID	Nama	Kondisi	Jarak	Populasi
1	1	Sragen	Strategis	10 km	Kurang Banyak
2	2	Karangayar	Cukup Strategis	8 km	Sangat Banyak
3	3	Sukoharjo	Kurang Strategis	4 km	Banyak
4	4	Solo	Strategis	6 km	Kurang Banyak
5	5	Boyolali	Cukup Strategis	7 km	Cukup Banyak
6	6	Kartosuro	Sangat Strategis	12 km	Banyak
7	7	Wonogiri	Strategis	7 km	Kurang Banyak
8	8	Klaten	Kurang Strategis	8 km	Sangat Banyak
9	9	Demak	Sangat Strategis	9 km	Banyak
10	10	Tegal	Strategis	5 km	Cukup Banyak

b) Value conversion
After the minimarket location data has been collected, in order for the calculation process to be carried out, it is necessary to convert the values according to the criteria, the results can be seen in table 7.

Table 7. Conversion Value Data

No	Alternatif	Kriteria		
		K_1	K_2	K_3
1	A_1	8	10	4
2	A_2	6	8	10
3	A_3	4	4	8
4	A_4	8	6	4
5	A_5	6	7	6
6	A_6	10	12	8
7	A_7	8	7	4
8	A_8	4	8	10
9	A_9	10	9	8
10	A_{10}	8	5	6

c) Normalization Calculations
In implementing the SAW method calculations, the calculation process is as follows:

1) The Location Condition Criteria Value is included in the benefit attribute, because the greater the value, the better.

Sragen : $r11 = \frac{8}{\max\{8;6;4;8;6;10;8;4;10;8\}} = \frac{8}{10} = 0.8$

Karangayar : $r21 = \frac{6}{\max\{8;6;4;8;6;10;8;4;10;8\}} = \frac{6}{10} = 0.6$

Sukoharjo : $r31 = \frac{4}{\max\{8;6;4;8;6;10;8;4;10;8\}} = \frac{4}{10} = 0{,}4$

Solo : $r41 = \frac{8}{\max\{8;6;4;8;6;10;8;4;10;8\}} = \frac{8}{10} = 0{,}8$

Boyolali : $r51 = \frac{6}{\max\{8;6;4;8;6;10;8;4;10;8\}} = \frac{6}{10} = 0.6$

Kartosuro : $r61 = \frac{10}{\max\{8;6;4;8;6;10;8;4;10;8\}} = \frac{10}{10} = 1$

Wonogiri : $r71 = \frac{8}{\max\{8;6;4;8;6;10;8;4;10;8\}} = \frac{8}{10} = 0.8$

Klaten : $r81 = \frac{4}{\max\{8;6;4;8;6;10;8;4;10;8\}} = \frac{4}{10} = 0.4$

Demak : $r91 = \frac{10}{\max\{8;6;4;8;6;10;8;4;10;8\}} = \frac{10}{10} = 1$

Tegal : $r101 = \frac{8}{\max\{8;6;4;8;6;10;8;4;10;8\}} = \frac{8}{10} = 0.8$

2) The distance criterion value is included in the cost attribute, because the smaller the value, the better.

Sragen : $r12 = \frac{\min\{10;8;4;6;7;12;7;8;9;5\}}{10} = \frac{4}{10} = 0{,}4$

Sragen : $r22 = \frac{\min\{10;8;4;6;7;12;7;8;9;5\}}{8} = \frac{4}{8} = 0{,}5$

Sukoharjo : $r32 = \frac{\min\{10;8;4;6;7;12;7;8;9;5\}}{4} = \frac{4}{4} = 1$

Solo : $r42 = \frac{\min\{10;8;4;6;7;12;7;8;9;5\}}{6} = \frac{4}{6} = 0{,}66$

Boyolali : $r52 = \frac{\min\{10;8;4;6;7;12;7;8;9;5\}}{7} = \frac{4}{7} = 0{,}57$

Kartosuro : $r52 = \frac{\min\{10;8;4;6;7;12;7;8;9;5\}}{12} = \frac{4}{12} = 0{,}33$

Wonogiri : $r52 = \frac{\min\{10;8;4;6;7;12;7;8;9;5\}}{7} = \frac{4}{7} = 0{,}57$

Klaten : $r52 = \frac{\min\{10;8;4;6;7;12;7;8;9;5\}}{8} = \frac{4}{8} = 0{,}5$

Demak : $r52 = \frac{\min\{10;8;4;6;7;12;7;8;9;5\}}{9} = \frac{4}{9} = 0{,}44$

Tegal : $r52 = \frac{\min\{10;8;4;6;7;12;7;8;9;5\}}{5} = \frac{4}{5} = 0{,}8$

3) The Population Criteria Value is included in the benefit attribute, because the greater the value, the better.

Sragen : $r13 = \frac{4}{\max\{4;10;8;4;6;8;4;10;8;6\}} = \frac{4}{10} = 0$

Karangayar : $r23 = \frac{10}{\max\{4;10;8;4;6;8;4;10;8;6\}} = \frac{10}{10} = 1$

Sukoharjo : $r33 = \frac{8}{\max\{4;10;8;4;6;8;4;10;8;6\}} = \frac{8}{10} = 0$

Solo : $r43 = \frac{4}{\max\{4;10;8;4;6;8;4;10;8;6\}} = \frac{4}{10} = 0$

Boyolali : $r53 = \frac{6}{\max\{4;10;8;4;6;8;4;10;8;6\}} = \frac{6}{10} = 0$

Kartosuro : $r53 = \frac{8}{\max\{4;10;8;4;6;8;4;10;8;6\}} = \frac{8}{10} = 0$

Wonogiri : $r53 = \frac{4}{\max\{4;10;8;4;6;8;4;10;8;6\}} = \frac{4}{10} = 0$

Klaten : $r53 = \frac{10}{\max\{4;10;8;4;6;8;4;10;8;6\}} = \frac{10}{10} = 1$

Demak : $r53 = \frac{8}{\max\{4;10;8;4;6;8;4;10;8;6\}} = \frac{8}{10} = 0$

Tegal : $r53 = \frac{6}{\max\{4;10;8;4;6;8;4;10;8;6\}} = \frac{6}{10} = 0$

4) Criteria Weighting
Determine the Vector Value S, which can be calculated using formula 3.

$V_1 = (10*0.8)+(6*0.4)+(8*0.4) = 13.6$

$V_2 = (10*0.6)+(6*0.5)+(8*1) = 17$

$V_3 = (10*0.4)+(6*1)+(8*0.8) = 16.4$

$V_4 = (10*0.8)+(6*0.7)+(8*0.4) = 15.2$

$V_5 = (10*0.6)+(6*0.6)+(8*0.6) = 14.2$

$V_6 = (10*1)+(6*0.3)+(8*0.8) = 18.4$

$V_7 = (10*0.8)+(6*0.6)+(8*0.4) = 14.6$

$V_8 = (10*0.4)+(6*0.5)+(8*1) = 15$

$V_9 = (10*1)+(6*0.4)+(8*0.8) = \mathbf{19.1}$

$V_{10} = (10*0.8)+(6*0.8)+(8*0.6) = 17.6$

Based on the SAW method calculation process, the best alternative ranking results can be obtained as shown in table 8.

Table 8. SAW Method Calculation Results

No	ID	Nama Kota	Hasil	Rank
1	M01	Sragen	13,6	10
2	M02	Karangayar	17,0	4
3	M03	Sukoharjo	16,4	5
4	M04	Solo	15,2	6
5	M05	Boyolali	14,2	9
6	M06	Kartosuro	18,4	2
7	M07	Wonogiri	14,6	8
8	M08	Klaten	15,0	7
9	M09	Demak	19,1	1
10	M10	Tegal	17,6	3

As a result of the calculation above, the highest ranking result is V9 so alternative 9 is Demak. was chosen as the best alternative to build a new branch location for the Bumi Sakinah mini market.

From the results of manual calculations using the SAW method, the selected result was the Demak location, so these results were then compared with the results in the application program so that the selection results were displayed as shown in Figure 15.

Figure 15. Selected Selection Results in the Application Program

Based on the results of the validation test comparison, namely comparing manual calculations with the application program, the same results were obtained, thus the system was declared 100% valid, so the system was suitable for implementation in determining the location of the new Bumi Sakinah minimarket branch.

5. Conclusion

Based on the results of the discussions that have been carried out, conclusions have been drawn. The research carried out has been able to fulfill the research objective, namely the formation of a system design in the form of a script and application software for a Decision Support System for Selection of Mini Market Branch Locations Using the Web-Based SAW (Simple Additive Weighting) Method based on predetermined criteria and weights. The system testing carried out in the functionality test showed results that showed the data was accepted or successful and the validity test showed valid results, namely the same between the results of manual calculations (algorithms) and the results of calculations in the application program showing the results of choosing the best Bumi Sakinah mini market branch location. at the Demak location because it has the highest calculated value.

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