Savings And Loan Information System At KSU Madu Kencana Using AHP-WP Method

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Abstract

Information technology has become a major driver of significant global development, changing the way we work, communicate, and access information. Koperasi Serba Usaha (KSU) Madu Kencana is a community-based financial institution with a savings and loan system that requires an information system that can support its operations to be faster, more precise, accurate, and relevant in improving the quality of service to customers and employee performance. The lag in the information system at KSU Madu Kencana will slow down service and data processing. The AHP method is used to determine the weight, then the WP method is used to determine the best alternative or priority order of alternatives. The results of this study are a savings and loan information system that can be used by KSU Madu Kencana in assessing loan applicants.

***Keywords** : KSU Madu Kencana; AHP method; WP method*

1. INTRODUCTION

Information technology has become a major driver of significant global development, changing the way we work, communicate, and access information. In this digital era, the need for fast and accurate information is becoming increasingly important to improve efficiency and effectiveness in various aspects of life. This includes the business sector, government, and non-profit organizations. Computerized information technology provides convenience in collecting, processing, and storing data, as well as ensuring fast and accurate information dissemination. With computerized information technology, organizations can obtain, collect , process, and store data more efficiently, so that they can meet the needs of information distribution better [1].

In every company, institution, or agency, the existence of a reliable information system is very important to support work productivity and quality of service that is precise, clear, accurate and fast. Information systems help in managing more structured data and simplify the decision-making process. Without the right information system, the decision-making process can be hampered by data inaccuracy and potential misappropriation of information. For the context of cooperatives, information systems can help improve performance and provide good service to customers or members.

Multipurpose Cooperative (KSU) Madu Kencana is a community self-help financial institution with a savings and loan system that requires an information system that can support its operations. KSU Madu Kencana focuses on small and medium enterprises and to become a growing business entity. Therefore, a system is needed that is able to produce fast, precise, accurate, and relevant information. Because KSU Madu Kencana still does not have a system that can produce relevant information, decision making is still done manually, thus increasing the possibility of fraud from both customers and prospective customers.

KSU Madu Kencana has used computer technology to fulfill its main function, which is to manage savings and loan data and determine loans to customers. However, the use of computer technology in KSU Madu Kencana has not been optimal. They do not use information system applications that use databases, only Microsoft Excel. In addition, the creation of financial reports, such as savings and loan reports, member installments, and loan determination. The process of making this report takes a long time because employees have to collect documents again and then summarize them into a report to be submitted to the chairman of the cooperative. The old KSU Madu Kencana system

also cannot determine loan approval which is another weakness. Therefore, a decision-making system is needed to examine each member's loan application in accordance with the terms and procedures that have been determined.

The absence of data processing for determining customer loans can cause significant errors in the decision-making process and increase the possibility of errors in processing this information system . KSU Madu Kencana needs a system that can produce faster , more precise, accurate and relevant information to improve customer service and employee performance so that KSU Madu Kencana can grow. This shows that a more efficient and effective information system is needed to assist cooperative operations.

The decision-making process has many different approaches to use in solving this problem. There are two most common methods used in decision support systems, namely Analytical Hierarchy Process (AHP) and Weighted Product (WP). The Analytical Hierarchy Process (AHP) method is a popular tool for supporting decisions in dealing with planning problems, finding alternative solutions, choosing actions, allocating resources, predicting outcomes, system planning, performance evaluation, optimization, problem solving, and prioritization. These alternatives are ranked using the Weighted Product (WP) approach according to predetermined parameters [2]. For saving and loan decision making at KSU Madu Kencana, a combination of the Analytical Hierarchy Process (AHP) and Weighted Product (WP) methods can help.

There are several previous studies that show that the Analytical Hierarchy Process (AHP) and Weighted Product (WP) methods can help in decision making[3]. Based on the results of previous studies, it can be concluded that the AHP and WP methods can be used in developing an effective decision support system. The combination of these two methods provides flexibility in determining the weight of the criteria and efficiency in ranking alternatives. Through this, it is possible to design and develop a savings and loan information system at KSU Madu Kencana using the AHP-WP method. This system is expected to help KSU Madu Kencana in producing fast, precise, and accurate information and support better decision making to improve the quality of service and overall cooperative performance.

2. RESEARCH METHODS

This research was conducted at KSU Madu Kencana, Srati Village, Kebumen, Central Java. The focus of this research is the savings and loan information system used by KSU Kencana in determining loan approval. In this research process, it is supported by research materials, such as data from KSU Madu Kencana, journals on savings and loan information systems, journals on the *Analytical Hierarchy Process* (AHP) method, journals on the WP method, and books on the PHP Programming Language. In this study, data were collected through several methods, namely literature studies, observations and interviews.

Literature study was conducted by identifying the methods used and studying references from books, journal articles, and previous research related to the research topic. Observations were conducted by conducting direct observations of the activity process at KSU Madu Kencana on December 30, 2022. In addition, interviews were also conducted with employees and the head of KSU Madu Kencana on December 26, 2022 to obtain information needed in the study. This study is also supported by hardware and software for the ongoing research process. *The hardware* consists of an Intel Pentinum Processor, 4.00GB RAM, and 1TB HDD. While *The software* consists of above , System Windows 10, *Microsoft Office 2019* , Google Chrome as operating system *Web Browser* , and Text Editor.

The system is used to facilitate the process of implementing the developed program. System requirements analysis, general and comprehensive system design, system implementation, and system testing are all included in the system design.

2.1 Data Flow Diagram

The logical model of data or process called DFD is used to explain data transformation and storage procedures. The relationship between data and processes in a system is shown by DFD. DFD consists of Level 1 Data Flow Diagram and Level 0 Data Flow Diagram (Context Diagram). Level 0 Data Flow Diagram (Context Diagram) is a component of DFD. In the context diagram, the interaction between external entities, system input, and output is explained. In the context diagram there are also 4

syntheses, namely administrators, employees, cooperative leaders, and public users, who receive input and produce certain outputs.

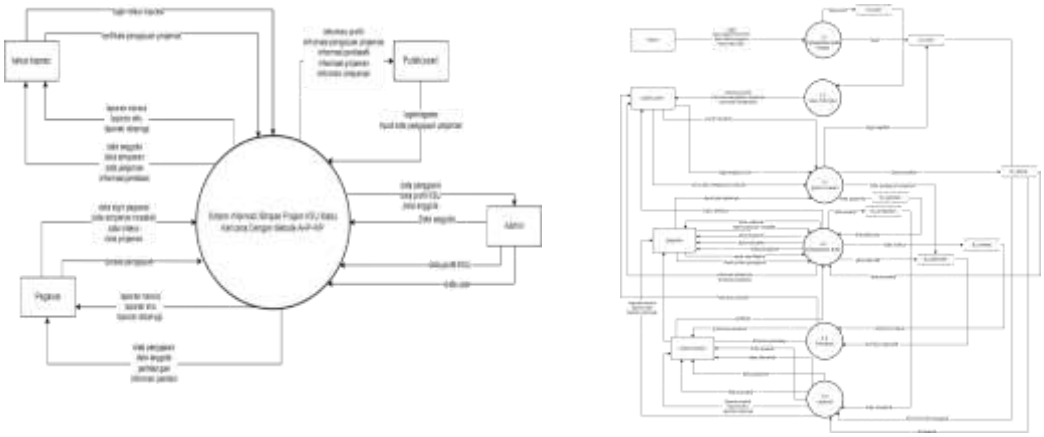

Figure 1. Data Flow Diagram Level 0 Figure 2. *Data Flow Diagram Level 1*

2.2 *Entity Relationship Diagram (ERD)*

To create loan determinant data through the use of entity relationship diagrams. This diagram shows the relationship between visible entities or objects and their attributes. Researchers using the spk_ahp.sql database file in create this website . The following tables are included in the database:

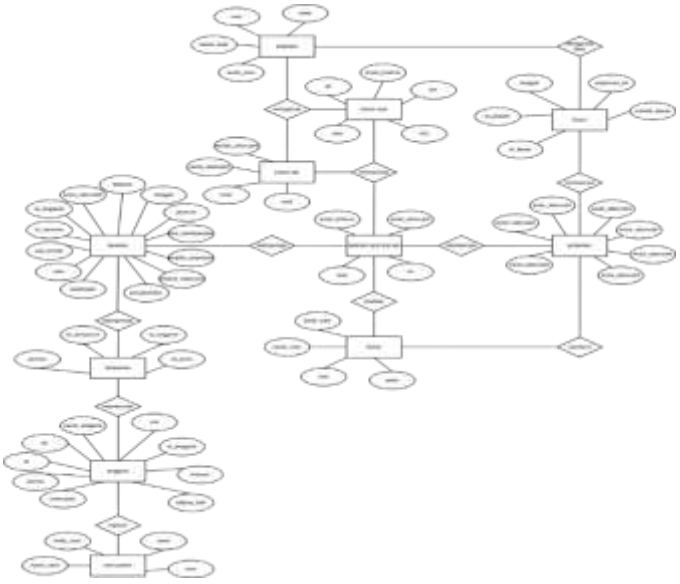

Figure 3. ***Entity Relationship Diagram (ERD)***

2.3 Logical Relation Structure (LRS)

Logical Relation Structure describes how to transform the data model in the ER Diagram in the

physical database.

Figure 4 . ***Logical Relation Structure (LRS)***

2.4 AHP-WP Calculation

AHP is a method used with the aim of prioritizing various existing alternative choices and these choices are complex or multi-criteria.

a. Criteria Table

Table 1. Criteria Table

No	Criteria	Code
1.	Guarantee	C1
2.	Amount of Financing	C2
3.	Installment Period	C3
4.	Installment History	C4
5.	Income	C5
6.	Work	C6
7.	Age	C7
8.	Home Status	C8

Table 2. Comparative Values of Criteria

Criteria	C1	C2	C3	C4	C5	C6	C7	C8
C1	1	2	2	3	4	5	5	7
C2	1/2	1	3	4	3	4	5	5
C3	1/2	1/3	1	2	2	3	4	4
C4	1/3	1/4	1/2	1	3	2	3	3
C5	1/4	1/3	1/2	1/3	1	2	2	3
C6	1/5	1/4	1/3	1/2	1/2	1	2	2
C7	1/5	1/5	1/4	1/3	1/2	1/2	1	2
C8	1/7	1/5	1/4	1/3	1/3	1/2	1/2	1

A hierarchical weighting factor matrix can be generated to perform a comparison of the results of the paired criteria. Next, determine the eigenvectors of the matrix using table 1 as a guide. Then, the priority value of each criterion is processed by dividing the total in each row of the matrix at the calculation stage. Next, the consistency ratio of the comparison matrix is calculated as follows:

λ Max value = (0.289 x 3.126) + (0.244 x 4.567) + (0.145 x 7.833) + (0.11 x 11.5) + (0.078 x 14.33) + (0.057 x 18) + (0.044 x 22.5) + (0.033 x 27)

= 0.903414 + 1.114348 + 1.135785 + 1.265 + 1.11774 + 1.026 + 0.99 + 0.891

= 8.436376

Because the matrix has 8 dimensions (consisting of 8 criteria), the Consistency Index value obtained is:

CI = (λ max– n) / (n − 1)

= (8.436376 – 8) / (8 – 1)

= 0.062339

For n = 8, RI = 1.41 then:

CR = CI / RI

= 0.062339 / 1.41

= 0.044212 < 0.1 (Consistent)

The pairwise comparison matrix on a criterion is consistent if the CR value < 0.1. On the other hand, if the CR value ≥ 0.1 the pairwise comparison matrix based on the criterion will not be consistent, thus requiring another round of value filling.

Table 3. Normalization of All Criteria Matrix

Criteria	C1	C2	C3	C4	C5	C6	C7	C8
C1	1	2	2	3	4	5	5	7
C2	0.5	1	3	4	3	4	5	5
C3	0.5	0.333	1	2	2	3	4	4
C4	0.333	0.25	0.5	1	3	2	3	3
C5	0.25	0.333	0.5	0.333	1	2	2	3
C6	0.2	0.25	0.333	0.5	0.5	1	2	2
C7	0.2	0.2	0.25	0.333	0.5	0.5	1	2
C8	0.143	0.2	0.25	0.333	0.333	0.5	0.5	1
Amount	3.126	4,567	7,833	11.5	14,333	18	22.5	27

b. Table of Criteria weight values

Table 4. Criteria weight values

Criteria	**Criteria**	**Weight Value**
C1	Guarantee	0.289004
C2	Amount of Financing	0.243582
C3	Installment Period	0.145829
C4	Installment History	0.109627

C5	Income	0.078332
C6	Work	0.057269
C7	Age	0.043731
C8	Home Status	0.032586
Total (Σ w)		1

Using the *Weighted Product* (WP) technique without weight calculation and pairwise comparison, the loan application screening system is tested. The *Analytical Hierarchy Process* (AHP) approach is used to determine the priority weights of the criteria. The priority weights from AHP are used to rank alternatives using the WP approach.

c. WP Analysis Table

Table 5. WP Analysis Table

Criteria	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**
interest	0.289	0.2436	0.1458	0.1096	0.0783	0.0573	0.0437	0.0326
Weight	0.2890	0.2436	0.1458	0.1096	0.0783	0.0573	0.0437	0.0326
Rank	0.2890	-0.2436	0.1458	0.1096	0.0783	0.0573	0.0437	0.0326

It is a method for multi-criteria decision making which functions to determine priorities to take into account the weight of each criterion.

d. Alternative Table

Table 6. Alternative Table

No	**Alternative**	**Code**
1.	Angga	A1
2.	Bagasse	A2
3.	Purnomo	A3
4.	Indra	A4
5.	Seuful	A5
6.	Bayu	A6
7.	Bambang	A7

e. Assessment of Alternatives against Criteria

Each relevant criterion is assessed alternatively when determining the assessment of alternative loan financing . At the initial weight W = (0.289004, 0.243582, 0.145829, 0.109627, 0.078332, 0.057269, 0.043731, 0.032586). Then , calculate the Vector S to get the value of each option. The vector of each option is calculated using the calculation results shown in the table and the sorting process is carried out. The value of the Vector V used in the ranking and ranking procedure is the result of dividing the value of the Vector S by the total value of the Vector S. In the Vector V table is based on the calculation process in the equation. So, the ranking results of the options offered when choosing a loan.

Table 7. Assessment of Alternatives against Criteria

A	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**
A1	4	3	3	2	4	3	2	3
A2	3	2	4	3	2	4	4	2

A3	3	4	2	2	3	2	3	4
A4	2	4	3	3	4	3	2	3
A5	3	2	4	3	2	3	2	3
A6	2	3	2	2	4	4	3	2
A7	4	2	3	4	3	2	2	4

1) Interface Design

The interface design shows the design of the application display with elements such as colors, images, menus, icons, and text. This will help sharpen the appearance of the website so that users can understand it more easily.

a. User Interface Design For Public Users

1) Add Application Interface Design: add application page for users (public) to add new applications with a form containing loan information.

Figure 5. Add Submission Interface Design

b. Interface Design for Employees

1) Criteria Data Page Interface Design: displays employee criteria in table format.

Figure 6. Data Page Interface Design

2) Design : the crips value page displays employee input crips data. The cooperative chairman can only view without changing crips data. Additional features, such as changing and deleting crips data.

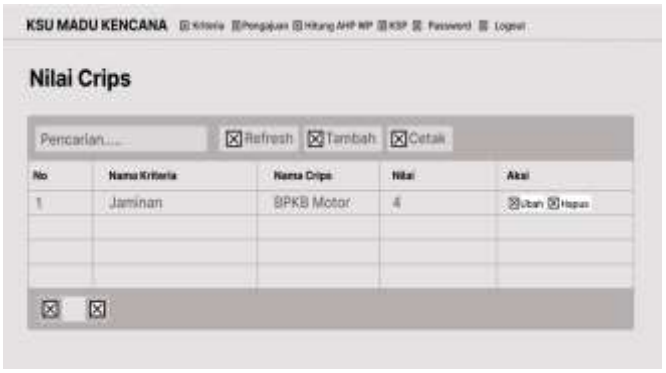

Figure 7. Crips Value Page Interface Design

3) Criteria Weight Value Page Interface Design : is a page for providing weight values for each criterion with automatic calculations in a data table display.

Figure 8. Criteria Weight Value Page Interface Design

4) AHP WP Calculation Page Interface Design: displays the results of AHP and WP calculations and displays a report on borrower data that meets or does not meet the requirements in a table.

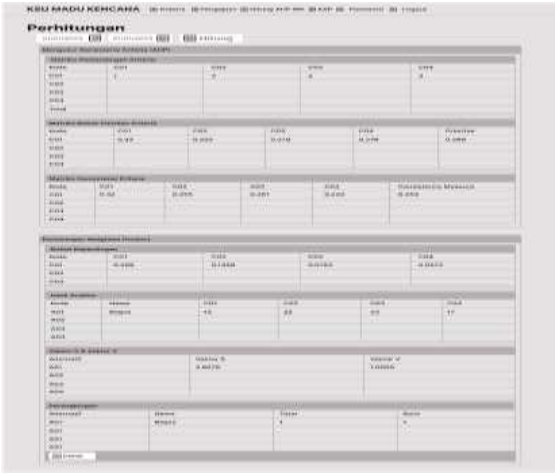

Figure 9. AHP WP Calculation Page Interface Design

3. RESULTS AND DISCUSSION

3.1 System Implementation

Implementation and system testing are carried out to complete the design based on system analysis and design . The goal is to conduct a trial of the output that is in accordance with the expected goals. The system display displays all features of the KSU Madu Kencana Savings and Loan Information System with the AHP-WP Method.

1. Public User Pages
   a. The Submission page is a place to manage submission data in the system, displaying a table with information on date, member name, file, submission requirement, wp score,

status, and action. The submit menu is used to add new submissions with a note of paid off or rejected loans. Users can view the details of the submission data by pressing the detail button in the action column.

Figure 10. Submission Page

2. Employee Page Implementation
   a. The criteria page is used to manage criteria data by displaying codes, names, attributes, and actions. There are add, print, change, and delete menus to manage criteria data.

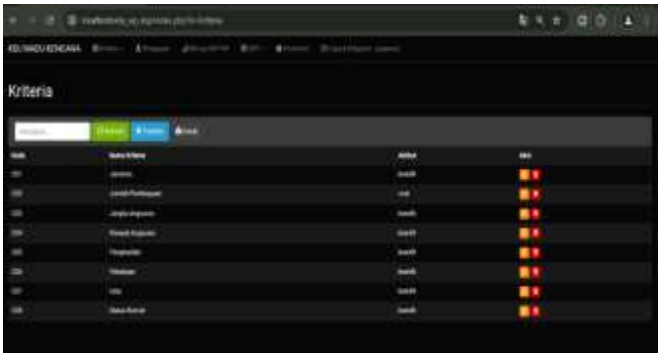

Figure 11. User Data Page

   b. The crips value page makes it easy to manage crips value data with a table that displays the criteria name, name, criups, value, and action. There is an add menu to add data, a print menu to print, and a change/delete button to edit/delete data.

Figure 12 Crips Value Page

c. The criteria weight value page provides weighting for each criterion with the highest weighting of 1 and the lowest of 9. The form is used to weight the criteria by employees.

Figure 13 Criteria Weight Value Page

d. The calculation page displays the comparison value of criteria and alternatives, employees and cooperative leaders can see the value of loan applicants. The first table shows the comparison matrix of criteria, the second table priority weights, the third table consistency, the fourth table importance weights, the fifth table analysis results, the sixth table calculation of s and v vectors, and the last table ranking.

Figure 14 Calculation Page

3.2 System Test Results

a. Black Box *Test*

Black box test was conducted by the thesis supervisor for the Savings and Loan Information System at KSU Madu Kencana using the AHP-WP method. The results showed that the system functioned well without syntax errors.

b. Alpha *Testing*

Alpha testing was carried out by respondents to evaluate the Savings and Loan Information System at KSU Madu Kencana using the AHP-WP method. Respondents ran the program, saw the evaluation results and filled out a questionnaire as a response to system performance. The results of the trial on the system display showed that out of 37 respondents, 70.3% of respondents gave a very interesting rating and 29.7% gave an interesting rating. Next, the results of the trial on the benefits for system users resulted in

67.6% of respondents rating it very useful and 29.7% giving a useful rating.

The results of the trial on the ease of the system for users showed that 67.6% of respondents gave a very easy score and 32.4% gave an easy score. Then the results of the trial on the system assessment output where 73% of respondents gave a very accurate score and 27% gave an accurate score. The results of the trial on application performance showed that 78.4% gave a very good score and 21.6% gave a good score. The results of the trial on the completeness of the system showed that 78.4% of respondents gave a very complete score and 18.9% gave a complete score.

3.3 Discussion

This system certainly has its advantages and disadvantages, so the advantages of the system are web-based applications, the system has 4 levels of entities , namely users (public), admins, employees and cooperative leaders, the system uses the AHP-WP method which can make it easier to determine loan applicants, users (public) can see the final value of the calculation, and users (public) can apply for loans online. This system also has disadvantages, namely loan disbursement cannot be done online, loan payments cannot be made online, additional savings cannot be made online, and savings withdrawals cannot be done online.

4. CONCLUSION

Loan Information System at KSU Madu Kencana which has been carried out, the following conclusions can be drawn:

- The research has been able to produce a Savings and Loan Information System that can be used by KSU Madu Kencana in assessing loan applicants.
- The Savings and Loan Information System application is able to run well and calculate the assessment of loan applicants easily and quickly.
- The results of the system test show that the system can run according to the designed function. The system display with a value of 70.3% is very attractive, the benefits of the system for users with a value of 67.6% are very useful, the ease of use of the system with a value of 67.6% is very easy, the calculation output from the system with a value of 73% is very precise, the system performance with a value of 78.4% is very good and the completeness of the system with a value of 78.4 is very complete.
- The system can run well according to the existing design and output. As an indicator for assessing loan applicants.

5. SUGGESTION

Based on the research results and conclusions outlined above, there are several suggestions that can be given. The suggestions given are as follows:

- This system is expected to use validation automatically to the telephone number when registering.
- This system is expected to attract online savings.
- This system is expected to be able to search for loans online.
- This system is expected to be able to make loan payments online.

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