Decision Support System in Service Satisfaction Assessment Using *Weighted Product* (WP) Method At the New Equator Shop

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Abstract *-In the era of increasingly fierce retail business competition, customer satisfaction is the key to success, but Toko New Khatulistiwa faces challenges in evaluating service satisfaction in a structured manner because it still relies on subjective manual methods. The main problem faced by the store is the absence of a structured customer satisfaction evaluation method, so that the assessment process becomes subjective and less accurate. This research aims to develop a decision support system (SPK) to assess customer service satisfaction at Toko New Khatulistiwa objectively and measurably. This research uses the Weighted Product (WP) method to perform calculations based on predetermined criteria, namely service quality, service speed, staff friendliness, place comfort, and price satisfaction. The system is built using PHP programming language and runs on a local server. The results showed that the WP method can produce accurate alternative rankings and help stores identify aspects of service that need to be improved. The implementation of this system is expected to improve service quality and customer loyalty.*

Keywords: Decision Support System, Customer Satisfaction, Weighted Product, Retail Store, Evaluation of Services.

I. INTRODUCTION

Service is a key factor in determining the success of a business, especially in the retail sector. Good service not only creates a positive shopping experience but also increases customer satisfaction. This depends on how well customer expectations are met by the service provided. In an era of increasingly competitive business, retailers must ensure that the service provided meets customer expectations to maintain their loyalty. However, in this modern era of increasingly fierce competition, many retail businesses have emerged, including cosmetics stores, including Toko New Khatulistiwa, which also face challenges in maintaining and improving customer satisfaction.

One of the main challenges facing the New Khatulistiwa Store is the lack of a structured service satisfaction evaluation system. Currently, customer satisfaction assessments are conducted manually through simple, subjective conversations or Google ratings, with no specific methodology implemented at the store. This results in biased data that doesn't reflect the true situation. Furthermore, it's difficult for the store to identify the key factors influencing customer satisfaction. Without accurate data, decisions to improve service quality are often misplaced. For example, a store might focus on improving staff friendliness when the main issue customers experience is the length of service time.

To address this issue, a Decision Support System (DSS) is needed to assist the New Khatulistiwa Store in assessing service satisfaction objectively and measurably. A DSS is an interactive system that facilitates decision-making through the use of data and decision models to solve semi-structured and unstructured problems (Nurut, 2020). Using a DSS, the store can process customer satisfaction data based on various relevant criteria, resulting in accurate information to support strategic decision-making.

In developing this DSS, the *Weighted Product* (WP) method was chosen as the basis for its calculations. WP is a popular multi-criteria analysis decision and is a multi-criteria decision-making method (Basri, 2017). The selection of the *Weighted Product* (WP) method was also based on its ability to provide optimal solutions in the ranking system. This method was also chosen based on its relatively low computational complexity, resulting in a relatively short calculation time. This method allows stores to consider various important factors in service. The final result is a ranking of alternatives that can help stores identify which service aspects need to be improved. The WP method was chosen for

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several reasons. First, this method is able to process data objectively by considering the weight of each criterion, resulting in a more accurate assessment. Second, WP allows stores to effectively compare alternatives even when there are many different criteria. Third, the calculation process is simple, making it easy to implement in store environments that may have limited resources.

By implementing a WP-based SPK (Decision Making Decision Support System), Toko New Khatulistiwa can conduct customer satisfaction evaluations more systematically and measurably. This system will help the store identify previously unseen service weaknesses and provide more targeted recommendations for improvement. Ultimately, this step is expected to increase customer satisfaction, strengthen customer loyalty, and provide a stronger competitive edge for Toko New Khatulistiwa in a competitive market. Based on the description above, determining the best employees requires an appropriate decision support system to determine them based on predetermined criteria and weighting.

II. LITERATURE REVIEW

A. Satisfaction

Satisfaction is a model that describes the process of creating customer satisfaction or dissatisfaction; it is the effect of comparing consumer expectations before purchasing and actual consumer performance (Ananda et al., 2022). Customer satisfaction depends on the product's performance to the buyer. If the product does not meet expectations, the customer is dissatisfied. If the product meets expectations, the customer is satisfied (Hari, 2020).

B. Service

Customer service , in general, is any activity intended or aimed at providing customer satisfaction. Through this service, customers' desires and needs can be met. The Great Dictionary of the Indonesian Language (KBBI) defines service as an effort to meet the needs of others, while to serve is to help prepare (help someone with what they need). Essentially, service is a series of activities that constitute a process. As a service process that occurs routinely and continuously, it encompasses the entire life of people in society, the process of fulfilling needs through the activities of others (Apriliana, 2022).

C. Decision Support System

Decisions are the result of a complex cognitive process in which individuals evaluate available options to achieve a specific goal or solve a problem. Good decisions tend to produce significant positive effects, while poor decisions can lead to detrimental consequences (Yuwan, 2024). A decision support system is a concept designed to facilitate the decision-making process within a management process. Decision support systems can also be used as a tool to generate alternative decisions that can be used by decision-makers. Decision support systems are also used to support decision-making in corporate organizations or educational institutions (Musli, 2021).

D. WP Method (*Weighted Product*)

Weighted Product (WP) method is a simple multiplication method for linking attribute ratings, where each attribute must be raised to the power of its weight (Nurhadi, 2020). Numerous practitioners and researchers have helped expand and improve the WP method in various fields, such as engineering, management, economics, and social sciences. The use of computer technology and specialized software that allows for more complex and faster calculations has been a major advancement in the development of the Weighted Product method. The use of computers has enabled the application of the Weighted Product method on a larger scale and with higher complexity, making it more relevant in modern decision-making.

Weighted Product (WP) supports decisions based on the concept that the best alternative not only has the shortest distance from the positive ideal solution but also has the longest distance from the negative ideal solution. The Weighted Product (WP) method is capable of selecting the best alternative from a number of alternatives and excels in weighting techniques. The WP method uses multiplication to connect attribute ratings, raising each attribute's rating to a power with a weighting (Beyamin, 2020).

The Weighted Product (WP) method is a decision-making method that is efficient in its calculation process. This method is widely used in solving problems because it requires less time and is effective, by using multiplication between predetermined criterion values, where the value

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of each criterion must first be raised to the power of the criterion weight that has been determined at the beginning. The Weighted Product (WP) method uses multiplication to connect attribute ratings, where the rating of each attribute must first be raised to the power of the weight of the attribute in question. This process is the same as the normalization process. The WP method is similar to the Weighted Sum (WS) method. Only the Weighted Product (WP) has multiplication in its mathematical calculations. The WP method is also called dimensional analysis because its mathematical structure eliminates units of measurement (Chairul, 2021). The steps for solving using the WP method are as follows (Mahendra, et al., 2024):

1. Defining criteria and alternatives, the WP method uses criteria to assess and compare alternatives.
2. Determining criteria weights is a crucial step in using the WP method. Criteria weights reflect their level of importance and significantly influence the final decision-making outcome. Appropriate weights will yield accurate and consistent values consistent with the decision-making objectives.
3. Data normalization: Values from different scales are transformed through a mathematical process known as data normalization. The primary purpose of data normalization is to eliminate scale differences between variables or criteria in a decision matrix so they can be compared accurately and fairly. For example, to determine the normalization of criterion weights, you can use the formula:

$$W_j = \frac{W_j}{\sum W_j}$$

Information :
W_j= Weight value of the jth criterion
$\sum W_j$= Total criteria weight

4. Determine the value of the vector S. For each alternative, calculate the value of the vector S using the following formula:

$$S_i = \prod_{j=1}^{n} X_{ij}^{\ wj}$$

Information :
S = States the alternative preferences which are analogous to
the Vector S
x = State the criteria value
w = State the weight of the criteria
i = Declare alternative
j = State the criteria
n = States the number of criteria

5. The results of these multiplications are added together to produce the vector value V for each alternative. The vector value V can be calculated using the formula:

$$V_i = \frac{\prod_{j=1}^{n} X_{ij}^{\ wj}}{\prod_{j=1}^{n} (X_{ij}^{\ *})}$$

Information :
V = States the alternative preferences which are analogous to the vector V
x = State the criteria value
w = State the weight of the criteria
i = Declare alternative
j = State the criteria
n = States the number of criteria

6. Find alternative values by doing the same steps as in step one, only using the highest value for each highest attribute.
7. Divide the V value for each alternative by the standard value.
8. Searching for ideal alternative values, namely by ranking the values of the vector V and making conclusions as the final stage.

III. RESEARCH METHODOLOGY

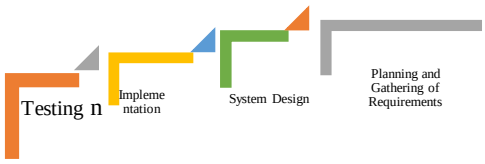

Figure 1 ***Water Fall Method***

E. *System* Testing

At this stage, testing is conducted on the system that has been built or created to determine whether there are still problems in the system and whether it has met the expected desires in solving the research problem. In this testing, system processing tests will be carried out, namely testing the data *input process, testing* the displayed data *output process, testing the data editing process, and testing the data deletion* process in the system to then determine whether the system has not experienced *errors* or problems during the system coding stage. Black

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box testing is conducted to ensure that the decision support system in assessing service satisfaction at the New Khatulistiwa Store functions as expected. This testing focuses on input validation, data processing, and output without looking at the internal structure of the program code. Testing is carried out by examining each main feature, including customer satisfaction data input, the calculation process using the Weighted Product (WP) method, and the display of decision results. Several test scenarios are implemented, such as entering valid customer data, trying input with blank values, and testing whether the calculation results are in accordance with the WP formula.

Here is the evidence of the expected test results:

1. Valid Input Test Results
   1) Input: Customer data with complete satisfaction scores.
   2) Output: The system successfully saved and processed the data correctly.
2. Empty Input Test Results
   1) Input: The form is blank or not all criteria are filled.
   2) Output: The system provides an error notification that the data must be filled in.
3. WP Calculation Test Results
   1) Input: Data with predetermined weights.
   2) Output: The calculation results are in accordance with the Weighted Product method formula.
   4. Decision Display Test Results
   1) Input: Satisfaction data of several customers.
   2) Output: The system successfully displays customer ratings based on the calculation results.

IV. RESULTS AND DISCUSSION

A. Research result

The results of this research are the creation of a customer satisfaction assessment system using the WP method. This program was created using the PHP (*Hypertext Processor*) programming language , Bootstrap , and also a MySQL database. This program can be run on a laptop or PC using *a browser* or *search engine program* by installing other programs such as Xampp as a storage program. Data. The data entered into this program consists of customer data and questionnaire results. This data will be assessed and processed by the system using calculations from the WP method, resulting in a decision regarding customer satisfaction levels. To run this program, the admin must To use this program, you can turn on or activate the XAMPP program , namely *the Apache server* and MySQL , then type the address, namely localhost/folder name . When this program is run or activated, it will appear on the *desktop screen* of your computer or laptop. Users of this program will see a login page as the system's home page.

1. Login Page

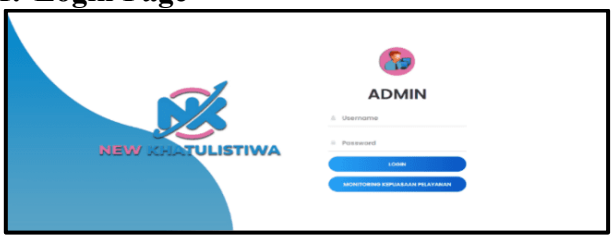

Figure 2. Login Page

This page displays the name of the New Khatulistiwa Store on the left side of the system page. On the right side is a login form with two input fields: a username and a password, with the password displayed in a hidden format. At the bottom, there's a login button to access the system. A service satisfaction monitoring button takes you to a page that monitors customer satisfaction levels.

2. Home Page

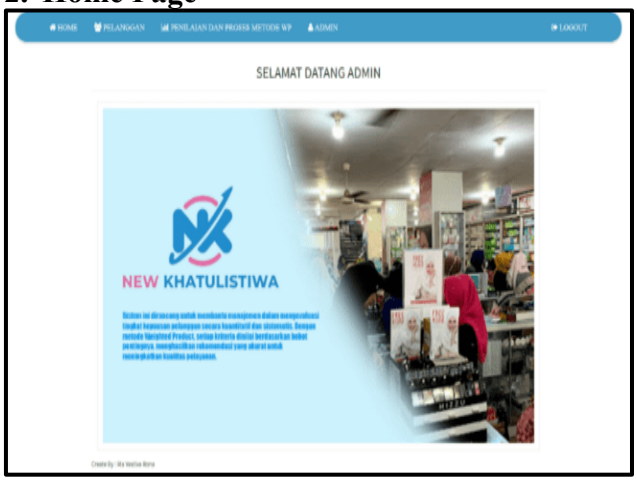

Figure 3. Home Page

This page has a menu at the top, consisting of Home, Customers, WP Method, and Logout on the far right. Each menu item leads to its respective page. The Home menu takes you to the home page, the Customers menu takes you to the customer data page, and the WP Method menu takes you to the WP method processing page. The bottom section contains an image banner and logo, as well as a text content area with paragraphs of information to be displayed . The bottom section also contains an explanation of the creator's name .

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3. Admin Menu Page

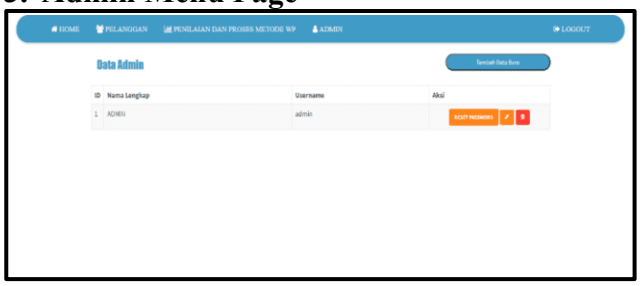

Figure 4. Admin Menu Page

This page contains a table of admin data, including the number, admin name , and username, along with the action buttons, which include delete and edit. There's also an add new data button to access the new data input page.

4. Admin Input Page

Figure 5. Admin Input Page

On this page there is data input consisting of Admin Name to add admin name data, *Username* to add admin *username data* and *Password* to add admin *password data* and there is also a save data button to process the data to be processed.

5. Customer Data Menu Page

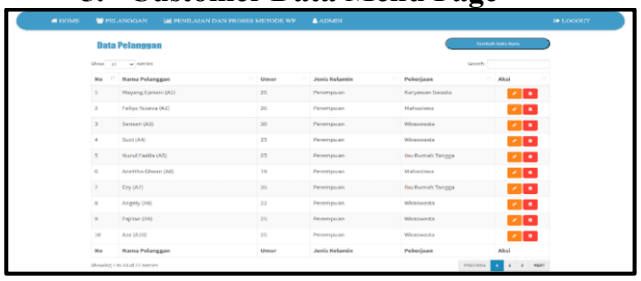

Figure 6. Customer Data Menu Page

This page contains the title "Customer Data" and a table containing customer data. The table has columns such as "No," " Customer Name" to display the customer's name , "Age" to display the customer's age, "Gender" to display the gender, "Occupation" to display the job data, and "Action." In the "Action" column, there are "Edit" and "Delete" options to modify and delete customer data. At the top right of the table, there is an "INPUT" button to enter the new data input page to add new customer information, which will then appear in the customer data table.

6. Customer Data Input Page

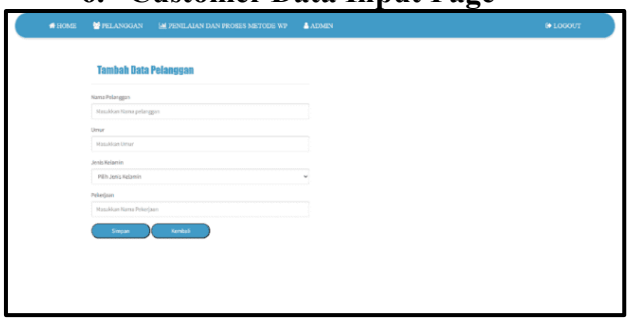

Figure 7. Customer Data Input Page

This page contains several data inputs consisting of Customer Name to add customer name data, Gender to add customer gender data, Age to add customer age data, Occupation to add customer occupation data. Then at the bottom there is a save button to save the data. When the button is clicked, *a dialog box* will appear to state whether the data was successfully added or not to the system database.

7. Assessment Data Input Page

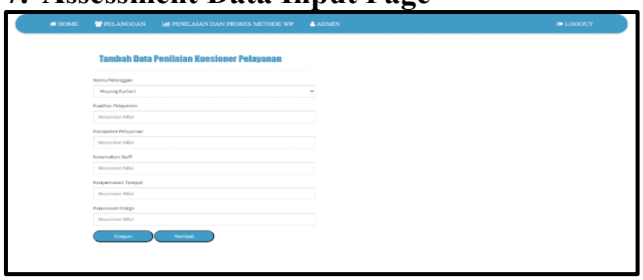

Figure 8. Assessment Data Input Page

On this page there is data input in the form of Customer Name to add customer name data, Service Quality Value to add employee service quality criteria value data, Service Speed Value to add employee service speed criteria value data, Staff Friendliness Value to add employee friendly attitude value data, Place Comfort Value to add store comfort criteria value data and Price Satisfaction Value to add given price criteria value data. In the bottom right corner there is a save button to save data into the database.

8. Criteria Weight Input Page

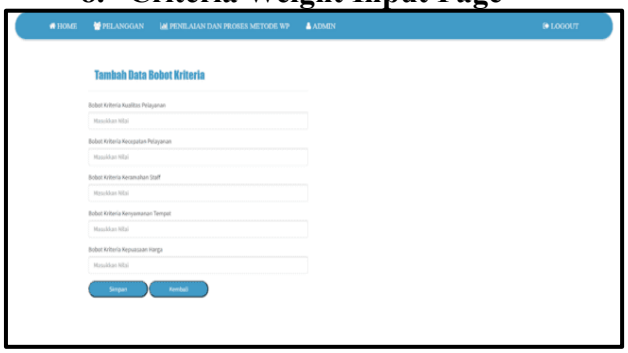

Figure 9. Criteria Weight Input Page

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On this page there is data input in the form of Service Quality Weighted Value to add data on the weighted value of employee service quality criteria, Service Speed Weighted Value to add data on the weighted value of employee service speed criteria, Staff Friendliness Weighted Value to add data on the weighted value of employee friendly attitude, Place Comfort Weighted Value to add data on the weighted value of store comfort criteria and Price Satisfaction Weighted Value to add data on the weighted value of the given price criteria. In the bottom right corner there is a save button to save the data into the database.

9. WP Method Assessment and Process Data Page

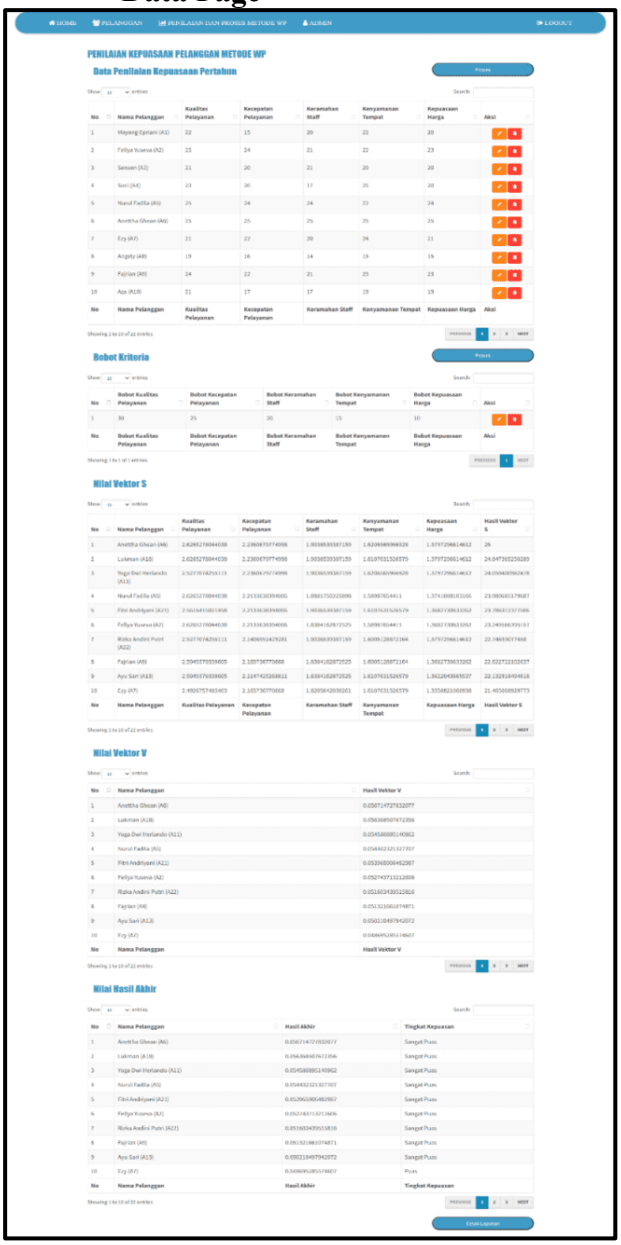

Figure 10. Assessment Data Page

On this page, there are several tables that represent the stages of the WP method process. These tables are as follows: First, the Assessment Data table, which consists of No., Name, Service Quality Criteria Value, Service Speed Criteria Value, Staff Friendliness Criteria Value, Place Comfort Criteria Value, Price Satisfaction Criteria Value, and Actions consisting of Change and Delete. At the top, there is an Add New Data button to add new value data. Then, the Process WP button to process the calculation of the WP method.

Second, the Criteria Weight table, which contains the weight values for each criterion, is a table of criteria weight data previously inputted on the criteria weight data input page. This table contains the weight values for Service Quality Criteria, Service Speed Criteria, Staff Friendliness Criteria, Place Comfort Criteria, and Price Satisfaction Criteria.

The second table is the S Vector Value table which consists of No., Name, S Vector Value for Service Quality Criteria, Service Speed Criteria, Staff Friendliness Criteria, Place Comfort Criteria, and Price Satisfaction Criteria.

The third table is the V Vector Value table which consists of No., Name, and V Vector Value.

The final table is the Final Results table, which includes the number, name, final result of the entire WP method process, and service satisfaction level. At the very bottom, there's a PRINT REPORT button to print the data.

10. Report Page Menu

Figure 11. Report Page

On the page there is the name of the New Khatulistiwa Store along with its address and a table of customer satisfaction assessment results based on the results of the WP method process. The table consists of a number, the name of the customer who became the respondent to display the customer name data and the final result to display the results of the calculation process of

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the WP Method that has been carried out on the WP process stages page and information on the level of customer satisfaction to measure how much customer satisfaction with the service. At the bottom there is a place for the signature of the owner of the New Khatulistiwa Store .

11. Service Satisfaction Level Monitoring Page

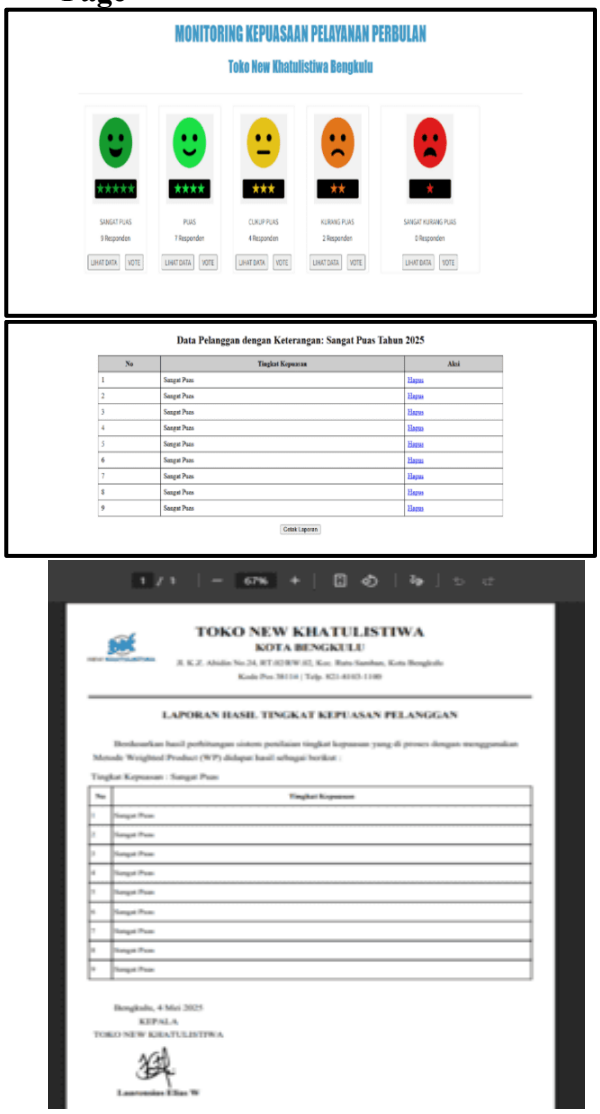

Figure 12. Service Satisfaction Level Monitoring Page

At the top of the page is a title stating the main purpose of this page, which is to monitor customer voices or opinions regarding store services. There are five satisfaction level options presented in the form of horizontally aligned boxes. Each box has a symbolic image at the top, followed by a satisfaction level label: Very Satisfied, Satisfied, Quite Satisfied, Less Satisfied, and Unsatisfied, then there is a value and a view data button. The page will display a customer data table consisting of number, name, age, gender, occupation and level of authority. At the very bottom of the table is a print report button that is useful for entering the print monitoring report page, the same as the report on the WP method process page.

System Testing

At this stage, the system is tested using *black box testing* . Testing is performed to determine whether the program is running properly and without errors or other problems. For more details on *black box testing* , see the table below.

Table 1 *Black Box* Testing

No	Feature Name	Tested Input	Testing Steps	Expected results	Test Results	Mark
1	Admin Login	Username and Password correct/wrong	Enter username and password, click login button	The system displays the home page if correct, an error message if incorrect.	Succeed	100%
2	Admin Data Input	Name, Username, Password	Fill in the admin form then click the save button	Admin data is saved and displayed in the admin table	Succeed	100%
3	Edit Admin Data	Click the edit button, change the data	Change the existing admin data then save	Admin data successfully updated	Succeed	100%
4	Delete Admin Data	Click the delete button on the admin data	Delete admin data from table	Admin data deleted from the system	Succeed	100%
5	Customer Data Input	Name, Gender, Age, Occupation	Fill in the customer form then click the save button	Customer data is saved and appears in the customer table.	Succeed	100%
6	Edit/Delete Custo	Click the change/de	Change or delete existing	Data successfully updated	Succeed	100%

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	mer Data	lete butto n	custome r data	or deleted		
7	Input Assess ment Values	Cust omer name , score s for 5 criter ia	Fill in the assessm ent form then click the save button	Assessm ent data is saved and displaye d in the assessm ent data table.	Succe ed	10 0%
8	Input Criteri a Weigh t	Weig hted value s for 5 criter ia	Fill in the weight then click the save button	Weight data is stored and used in the WP process	Succe ed	10 0%
9	WP Metho d Proces s	Click the "Proc ess WP" butto n	The system calculat es the S and V values, produci ng the final result.	Table shows: Vector S values, Vector V, and final results of satisfacti on level.	Succe ed	10 0%
1 0	Print Report	Click the "PRI NT REP ORT " butto n	The system prints the report results	Printed reports in print-ready format (PDF/pri nt)	Succe ed	10 0%
1 1	Custo mer Satisfa ction Monit oring	Selec tion of ratin gs by custo mers	Additio n of data from the results of the WP method calculati on process	The number of votes for that option increase d	Succe ed	10 0%

Based on the results of testing using the *black box testing method* , all features in the system were declared to function properly and in accordance with user needs. Each input provided produced the expected output, and no errors or failures were found during the testing process. Testing was carried out on 11 main features of the system, including the login process, admin and customer data management, assessment input, WP method processing, to report printing and monitoring customer satisfaction levels. All of these features successfully passed the test with a "Success" status, indicating that the system has met the functionality criteria and is ready for operational use. Thus, this system can be said to be feasible to be implemented in supporting the process of evaluating customer satisfaction levels at the New Khatulistiwa Store effectively and efficiently.

V. CLOSING

A. Conclusion

Based on the results and discussion of research related to this research, various things can be concluded, including the following:

1. This research successfully designed and built a service satisfaction assessment system to help the New Khatulistiwa Shop in knowing how to evaluate customer satisfaction objectively.
2. The use of the WP method in a decision support system allows for objective and structured customer satisfaction assessments. WP assigns weights to each service criterion so that the results obtained are more accurate and reliable. It was concluded that the level of respondent satisfaction was generally in the very satisfied to satisfied category. Alternative A6 ranked first with the highest final score of 0.056715, indicating that the service provided was very satisfactory. There were nine alternatives that fell into the very satisfied category, namely A6, A18, A11, A5, A21, A2, A22, A9, and A13. In addition, there were seven alternatives that obtained the satisfied category, namely A7, A19, A4, A3, A12, A1, and A10. Meanwhile, four other alternatives were in the quite satisfied category, namely A20, A8, A14, and A17. However, there were two alternatives that obtained the lowest level of satisfaction and fell into the less satisfied category, namely A15 and A16.
3. The results of the system testing of the program show that this program can be used as a media to assist the New Khatulistiwa Shop .

B. Suggestion

After seeing the results achieved in this final assignment, there are several suggestions that need to be conveyed, including :

1. the New Khatulistiwa Store will continue to use this program in the future.
2. Developers who want to develop this program can provide new content to be improvements to this program in the future.

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3. The research could be expanded by analyzing customer satisfaction trends over time. The system could be developed to store historical assessment data and generate trend reports, helping Toko New Khatulistiwa identify areas for continuous improvement.

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