JUSTEK : JURNAL SAINS DAN TEKNOLOGI
http://journal.ummat.ac.id/index.php/justek
ISSN 2620-5475
Vol. 9, No. 3, September 2026, pp. 397-406

A Decision Support System for Recommending Authentic Sweet Tuak Using the AHP (Analytical Hierarchy Process) Method

Widia Wati[1], Sunardi[2*], Helmy Amalia Ariesta[3], Dedy Sofian MZ[4]
[1,2,3]Information Systems Program, Faculty of Engineering, Nahdlatul Ulama University of West Nusa Tenggara, Indonesia
soenardhi.75@gmail.com

ARTICLE INFO

Article History:

Received : 31-07-2026
Revised : 12-09-2026
Accepted : 14-09-2026
Online : 17-09-2026

Keywords:
Decision Support System;
Sweet Palm Wine;
Analytical Hierarchy Process (AHP);
Ranking.

ABSTRACT

Technological development has shifted the assessment of food and beverage quality from a subjective process toward a more systematic and objective one. Tuak manis, a traditional sweet palm-sap beverage from Tamansari Village, West Lombok, Indonesia, is still evaluated subjectively, resulting in inconsistent quality judgements among producers. This study aims to design a web-based Decision Support System (DSS) that objectively assesses and ranks the quality of original tuak manis using the Analytical Hierarchy Process (AHP) method. Primary data were collected through observation, interviews, and questionnaires distributed to farmers, sellers, and consumers in Tamansari Village, while the system was developed using the Waterfall model, covering requirement analysis, design, implementation, verification, and maintenance. Four evaluation criteria were used, namely taste, color, aroma, and clarity, weighted through pairwise comparison and tested for consistency (CI = 0.063; CR = 0.070 ≤ 0.1), confirming that the judgements were logically consistent. The calculation results show that taste obtained the highest weight (0.477), followed by color (0.226), aroma (0.189), and clarity (0.108). Based on the overall AHP score, Alternative 1 achieved the highest final score (0.367), followed by Alternative 3 (0.273), Alternative 2 (0.261), and Alternative 4 (0.098). Black Box Testing confirmed that all system functions operated as expected, and a user satisfaction survey involving 15 respondents recorded an average satisfaction rate of 89.56%, categorized as very good. These findings indicate that the AHP-based DSS is capable of producing objective, consistent, and reliable quality rankings, and is feasible for use as a decision-support tool for both consumers and producers of original tuak manis.

A. INTRODUCTION

Technological advancements have driven significant changes in the food and beverage quality assessment process, shifting from a subjective approach to a more systematic and measurable one. The concepts of Food Industry 4.0 through 5.0 emphasize the use of digital technology and data analysis as alternatives to conventional assessment methods, so that the quality of food products including traditional food products can be evaluated more accurately and consistently (Hassoun et al., 2025).

Indonesia boasts a wealth of traditional beverages that are part of its cultural heritage and have the potential to be developed into products with economic and tourism value (Vitantri et al., 2025); (Syahdisa et al., 2024). One of these is sweet tuak, a beverage made from the sap of the sugar palm that is processed using traditional methods and plays an important role in the social and cultural life of the community, particularly in Tamansari Village, Gunungsari Subdistrict, West Lombok Regency. In addition to being a traditional beverage, sweet tuak is also known to contain nutrients that make it a beneficial source of energy (ARRAZZAQ MUHAMMAD, 2018), with phytochemical compounds, as well as alcohol and vitamin C levels that vary by manufacturer depending on the sap collection and storage processes (Putri et al., 2024); (Alami et al., 2023). In this region, sweet tuak is used in various traditional ceremonies and to welcome guests however, product quality varies among producers due to differences in tapping techniques, processing methods, equipment cleanliness, and storage practices, so quality assessment is still conducted subjectively based on experience and word of mouth recommendations.

This variation is not limited to sensory attributes alone. The exact number of active tuak manis producers in Tamansari Village has not been formally recorded in the available secondary data and would require confirmation through the Tamansari Village Government or the Gunungsari Subdistrict Agricultural Extension Center (BPP); however, field observation identified several producers who regularly supply the local market. Notably, pricing among these producers is relatively uniform regardless of quality differences, with a small ("narmada") bottle generally sold at around IDR 5,000 and a large bottle at around IDR 10,000. Because price is not an indicator of product quality, consumers cannot rely on price to identify better-quality tuak manis, which further reinforces the subjectivity of the current selection process and highlights the need for an objective, criteria-based method to differentiate quality among producers.

This situation underscores the need for a more objective and structured evaluation approach. The Analytical Hierarchy Process (AHP) is a multi-criteria method that breaks down complex problems into a hierarchical structure and calculates the relative weights of criteria through pairwise comparisons as a result, it is widely used in Decision Support Systems (DSS) to produce more objective and rational decisions (Alfian Denny, 2019); (Rohmat & Kusrini, 2021); (Yanto Musli, 2021). Research trends indicate that the application of AHP in decision support systems in Indonesia continues to grow across various fields (Suryana et al., 2021). The application of AHP has proven effective in various cases of product quality assessment, such as the selection of high quality coffee beans (Alfian Denny, 2019), rice quality assessment (Rismayani et al., 2024), supplier selection in the food and beverage and pharmaceutical industries (Mahdiania & Hasibuan, 2024); (Nurjanah & Muharni, 2023), determining the popular beverage menu (Said Zulfikar, 2021), selection of culinary restaurants using a combination of the AHP and SAW Methods (Cahaya et al., 2025), promotion of employee job grades using a combination of AHP and TOPSIS (Marsiani, 2023), until the priorities for campus coffee shop attributes are determined (Thuannadee, 2024) and the selection of the best college graduates (Telaumbanua & Siregar, 2025).

Although the application of AHP in food product evaluation has been extensively studied, most existing studies focus on products with standardized or measurable grading systems, such as coffee bean defect classification (Alfian Denny, 2019), rice quality assessment (Rismayani et al., 2024), or supplier selection in the food and pharmaceutical industries (Nurjanah & Muharni, 2023); (Mahdiania & Hasibuan, 2024). In contrast, an evaluation model that specifically addresses the quality of

traditional, home-produced beverages where quality is judged almost entirely through human sensory perception (taste, color, aroma, and clarity) rather than standardized physical or chemical measurements remains largely undeveloped. This gap is particularly evident for authentic sweet tuak, for which no decision support system based on sensory criteria has been established. Therefore, this study aims to develop a web-based decision support system using the AHP method to provide recommendations for the best authentic sweet tuak in Tamansari Village in an objective, structured, and consistent manner, while also supporting product quality improvement and the development of culinary tourism potential based on local wisdom.

B. METHODS

This study was conducted in Tamansari Village, Gunungsari Subdistrict, West Lombok Regency, West Nusa Tenggara, which was selected because it is one of the main production centers for authentic sweet tuak, where production is still managed traditionally by local farmers.

Primary data were obtained through direct observation at tapping and processing sites, interviews with farmers, sellers, and consumers, as well as a questionnaire assessing the quality criteria of sweet palm wine. Secondary data were obtained from literature reviews and journals related to Decision Support Systems and the AHP method. The research equipment consisted of hardware (a laptop with an Intel Core i5 processor, 8 GB of RAM, and 256 GB of SSD storage) and software (Windows 10, XAMPP as the web server selected for its superior performance compared to MAMP and Laragon for local development (Albert Yakobus Chandra & Putry Wahyu Setyaningsih, 2025), Visual Studio Code as the code editor, MySQL as the database, and Google Chrome as the testing browser). The system interface was developed using HTML and CSS in accordance with modern web development practices (Jain et al., 2024).

The system's workflow and interactions are depicted using the Unified Modeling Language (UML), including use case diagrams and activity diagrams, which are effective for translating functional requirements into system designs (Mollan et al., 2024); (Narulita et al., 2024). To test the consistency of the evaluations in the pairwise comparison matrix, the maximum eigenvalue (λmax) is first calculated through matrix normalization and the calculation of the priority weights (eigenvectors) for each criterion. The λmax value is then used to calculate the Consistency Index (CI) as formulated in Equation (1).

$$CI = (\lambda maks - n) / (n - 1) \quad (1)$$

where λmax is the maximum eigenvalue and n is the number of criteria being compared. The CI value is then compared with the Random Index (RI) to obtain the Consistency Ratio (CR) as defined in Equation (2).

$$CR = CI / RI \quad (2)$$

where RI is the Random Index value, the magnitude of which depends on the number of criteria (n); for n = 4, the RI value used is 0.90. If the CR value is ≤ 0.1, the assessment is deemed consistent and suitable for use in the decision-making process (Rohmat & Kusrini, 2021).

User satisfaction with the system was measured using a 1–5 Likert scale developed by Rensis Likert, by calculating the total score of respondents' answers and then comparing it to the ideal score to obtain a percentage value for the satisfaction level. The system was developed using the Waterfall model, which consists of five phases: requirements analysis, system design using the Unified Modeling Language (UML), implementation using the PHP programming

language with a MySQL database, testing and verification using the Black Box Testing method, and maintenance (Rahmi et al, 2020).

C. RESULT AND DISCUSSION

1. System Interface Implementation

The Decision Support System developed was implemented as a web-based application that administrators can access to manage criteria data and alternative data, as well as to perform comparison and evaluation processes. The Dashboard page, as shown in Figure 1, displays a summary of the number of criteria, the number of alternatives, and general system information, serving as the administrator's main control center before performing calculations.

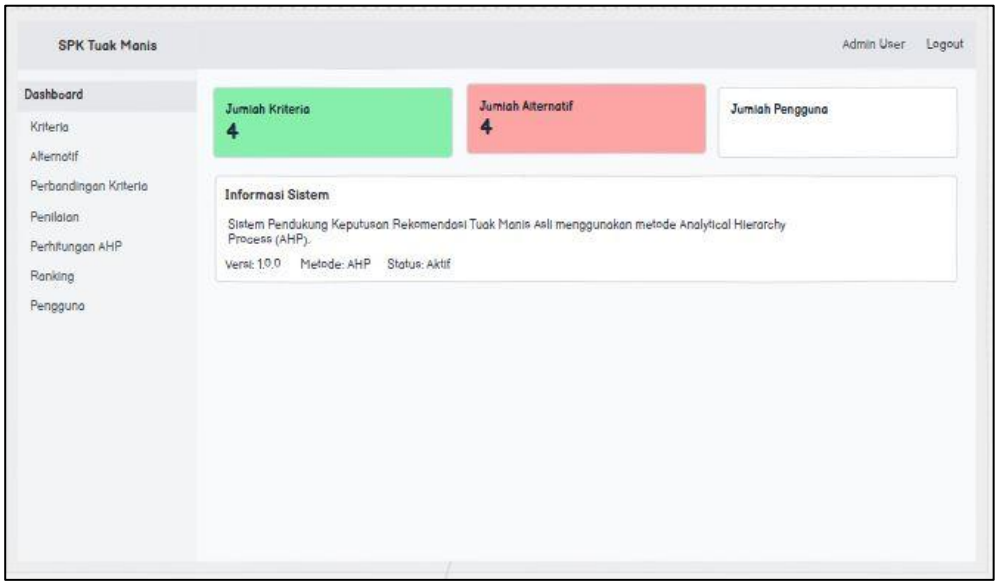


Figure 1. System Dashboard Page

2. Hierarchical Structure of Criteria

The hierarchical structure of the problem is organized into three levels. The first level is the objective, which is to identify the best authentic sweet tuak. The second level consists of the evaluation criteria, which include taste, color, aroma, and clarity. The third level consists of the alternatives, namely four samples of sweet tuak from different farmers (Alternative 1 through Alternative 4) in Tamansari Village.

3. Analytical Hierarchy Process (AHP) Calculation

The process of comparing the importance levels of the criteria is performed by the administrator via the Criteria Comparison Page (Figure 2), which is the core page of the AHP calculation where the administrator enters the values for the pairwise comparison matrix between criteria using the 1–9 Saaty scale.

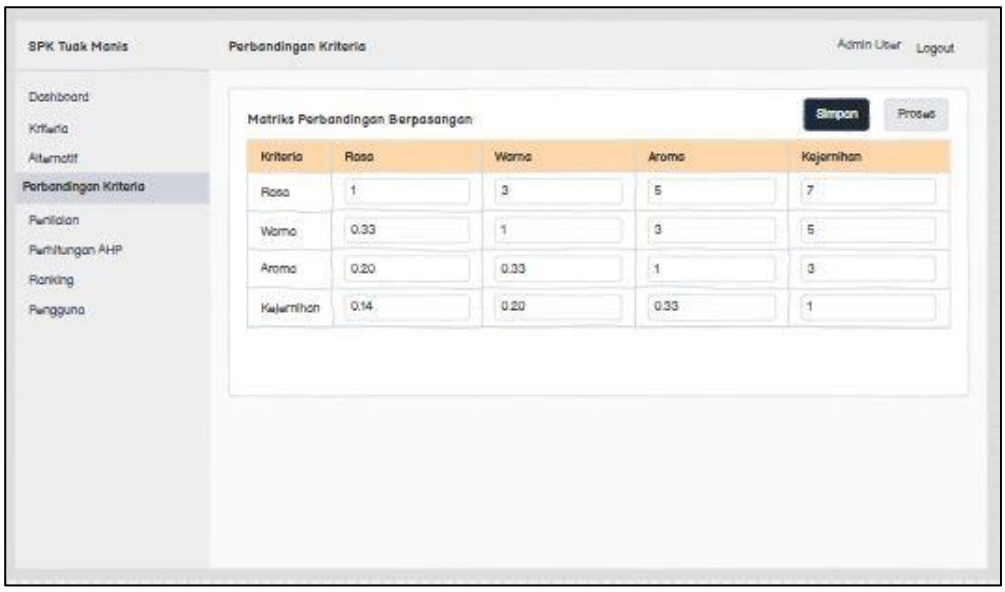


Figure 2. Criteria Comparison Page (Pairwise Comparison)

The results of the data entered on that page form a pairwise comparison matrix, as shown in Table 1.

Table 1. Pairswise Comparison Matrix of Criteria

Criteria	Taste	Color	Scent	Clarity
Taste	1	3	3	3
Color	1/3	1	2	2
Scent	1/3	1/2	1	3
Clarity	1/3	1/2	1/3	1

The matrix was then normalized to obtain the priority weights for each criterion, as shown in Table 2.

Table 2. Normalization Results and Criterion Weights

Criteria	Taste	Color	Scent	Clarity	Weight
Taste	0,500	0,600	0,474	0,333	0,477
Color	0,167	0,200	0,316	0,222	0,226
Scent	0,167	0,100	0,158	0,333	0,189
Clarity	0,167	0,100	0,053	0,111	0,108

The results of the calculations show that the taste criterion received the highest weight (0.477), followed by color (0.226), aroma (0.189), and clarity (0.108). These values indicate that taste is the most dominant factor considered in determining the quality of authentic sweet tuak. Consistency testing of the comparison matrix yielded a Consistency Index (CI) of 0.063 and a Consistency Ratio (CR) of 0.070. Since the CR value is ≤ 0.1, the ratings given are deemed consistent and suitable for use in the next stage of calculation.

4. Best Alternative Rankings

The final results of the AHP calculation are automatically displayed by the system on the Ranking Page (Figure 4), which presents the ranking of the best alternatives based on the final scores calculated by multiplying the criterion weights by the values of each alternative.

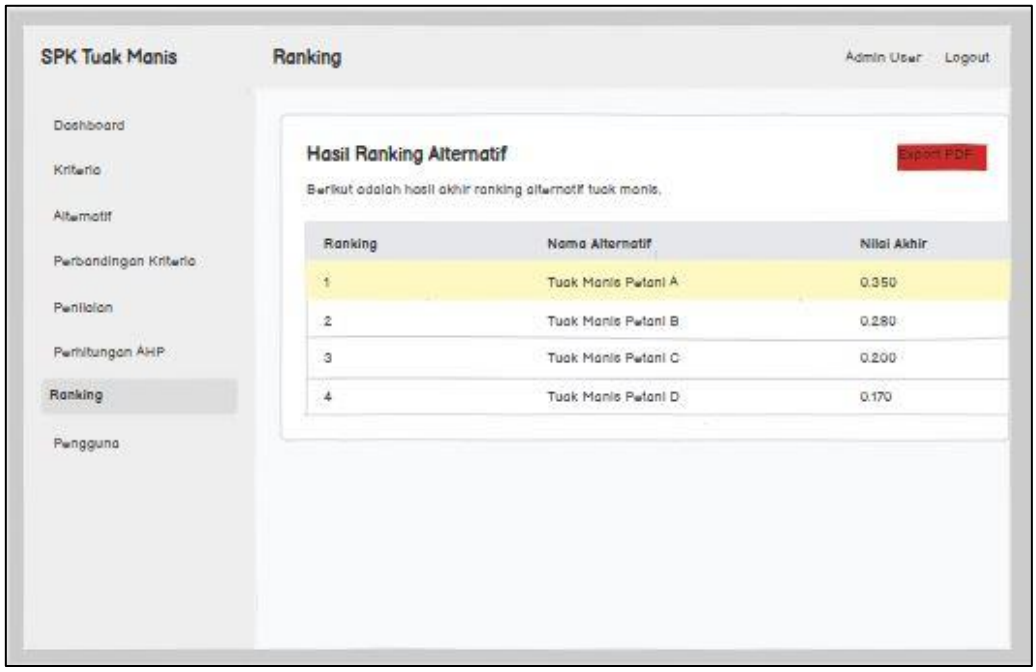


Figure 3. Alternative Ranking Page

The weights of the criteria obtained were then multiplied by the scores of each alternative to produce the final scores, as shown in Table 3. The alternatives are sorted in descending order of final score, with the corresponding rank indicated in the first column, to directly highlight the ranking outcome.

Table 3. Alternative Scores and Rankings

Rank	Alternative	Taste	Color	Scent	Clarity	Final Score
1	Alternative 1	0,152	0,122	0,059	0,035	0,367
2	Alternative 3	0,162	0,035	0,045	0,032	0,273
3	Alternative 2	0,142	0,049	0,050	0,021	0,261
4	Alternative 4	0,022	0,021	0,035	0,021	0,098

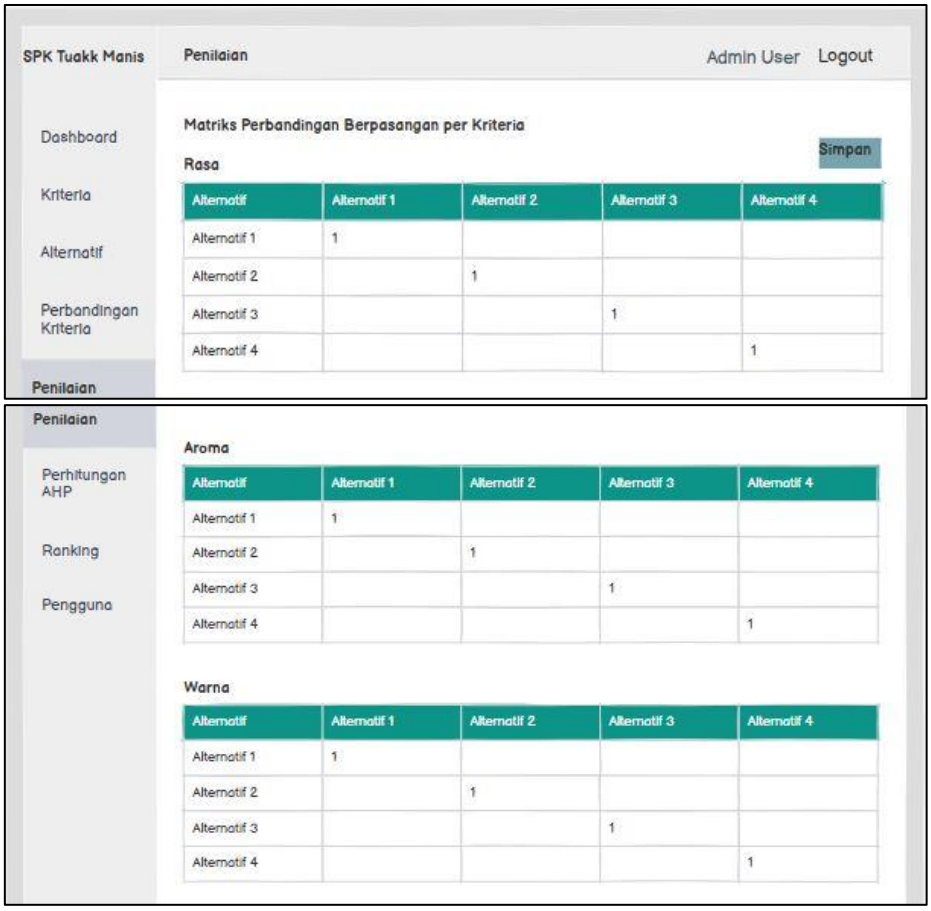
The results of the calculations show that Alternative 1 received the highest final score of 0.367 and is therefore recommended as the authentic sweet tuak of the highest quality, followed by Alternative 3 (0.273), Alternative 2 (0.261), and Alternative 4 (0.098). The superiority of Alternative 1 is primarily due to its higher taste and color scores compared to the other alternatives, in line with the weightings of the taste and color criteria, which dominated the AHP calculation results. These findings are consistent with previous research (Rismayani et al., 2024) and (Andika et al., 2024) which indicates that the AHP method is capable of producing objective and mathematically justifiable rankings of food product quality. The dominance of the taste criterion is also consistent with the finding that consumer perceptions of taste and product quality have a significant effect on purchase intent (Tristanto & Iswati, 2025).

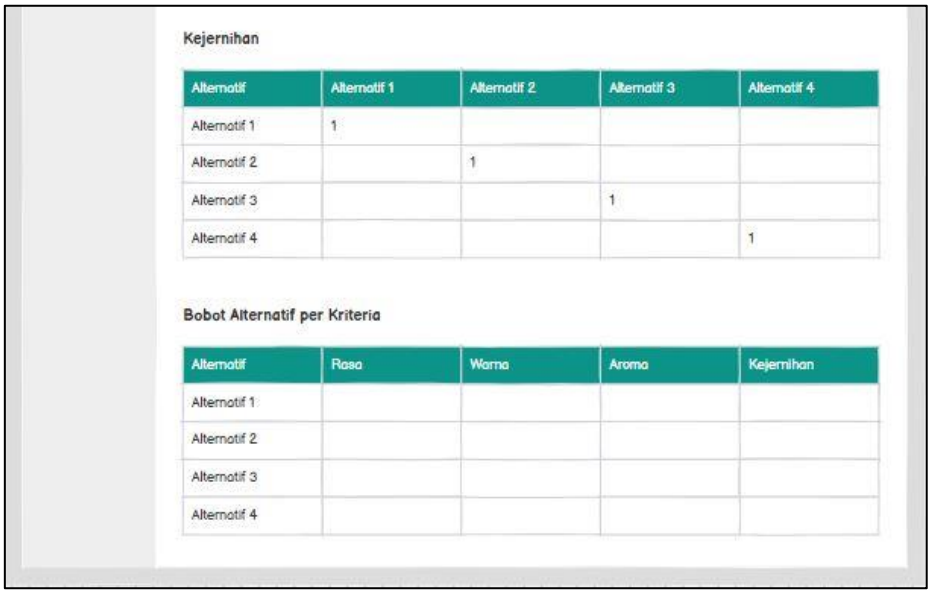
This priority order of criteria also reflects consumer preference patterns in practice: taste is typically the primary attribute consumers rely on when judging the quality of sweet tuak by direct tasting, while color and aroma serve as secondary visual and olfactory cues used to confirm freshness and processing quality before purchase, and clarity is generally treated as a supporting indicator rather than a decisive one. This is consistent with the

finding in this study that Alternative 1, which scored highest on taste and color, was also the top-ranked recommendation overall. For small-scale producers, this criteria-based ranking offers a practical benefit: because price among producers in Tamansari Village is largely uniform, farmers cannot differentiate their product through pricing. The AHP-based DSS instead gives them an objective, quantifiable picture of which specific quality attribute (e.g., taste or color) most strongly drives consumer preference, allowing individual farmers with limited resources to focus their process improvements such as tapping technique or storage practices on the criteria that matter most, rather than relying on guesswork or informal feedback.

1. System Testing

The administrator performs the final evaluation of each alternative via the Evaluation Page (Figure 4), which is the page used to compare each alternative based on predetermined criteria before the system automatically calculates the final scores and rankings.





Kejernihan

Alternatif	Alternatif 1	Alternatif 2	Alternatif 3	Alternatif 4
Alternatif 1	1			
Alternatif 2		1		
Alternatif 3			1	
Alternatif 4				1

Bobot Alternatif per Kriteria

Alternatif	Rasa	Warna	Aroma	Kejernihan
Alternatif 1				
Alternatif 2				
Alternatif 3				
Alternatif 4				

Figure 3. Alternative Assessment Page

Functional testing of the system was then conducted using the Black Box Testing method on all modules, including the login page, dashboard, criteria data management, alternative data management, criteria comparison page, and evaluation page. The test results showed that all test scenarios ran "as expected," indicating that the system was functioning properly and was free of significant functional errors.

In addition to functional testing, a user satisfaction survey was conducted among 15 respondents, consisting of farmers, vendors, and consumers of sweet tuak. The survey results showed an average satisfaction rate of 89.56%, which falls into the "very good" category. These results indicate that the developed system is not only functionally valid but is also well received by users as a decision-making tool for selecting high quality authentic sweet tuak.

D. CONCLUSION AND SUGGESTIONS

This study successfully developed a web-based Decision Support System using the Analytical Hierarchy Process (AHP) method to provide recommendations for the best authentic sweet tuak in Tamansari Village, West Lombok Regency. Taste was found to be the most dominant criterion with a weight of 0.477, followed by color, aroma, and clarity. The calculation results showed a CR value of 0.070 (≤ 0.1), indicating consistent evaluation, with Alternative 1 as the top recommendation (score of 0.367). Black Box Testing confirmed that all system functions operated as expected, and the user satisfaction survey recorded a satisfaction rate of 89.56% (rated "very good"). Thus, the developed system has proven capable of producing objective, consistent, and reliable quality assessments of authentic sweet tuak.

Future research is recommended to include quantitative testing parameters such as pH or alcohol content to make the evaluation of criteria more measurable, expand the scope of alternatives and research areas, improve the user interface to make it more responsive on mobile devices, and combine the AHP method with other decision-support methods such as TOPSIS, SAW, or other approaches (Fergina et al., 2023) to improve ranking accuracy.

ACKNOWLEDGEMENT

The author would like to express gratitude to Nahdlatul Ulama University of West Nusa Tenggara, the academic advisor, the government and residents of Tamansari Village in Gunungsari Subdistrict, and all parties who provided permission, data, and support throughout this research.

REFERENCES

Alami, R. R., Nurwanti, R., Yolandari, S., & Munawarti, W. (2023). Test of Alcohol and Vitamin C Levels in Pure Sap of the Aren Tree (Arenga Pinnata) in Baubau City. *Jurnal Promotif Preventif*, *6*(1), 81–89. http://journal.unpacti.ac.id/index.php/JPP

Albert Yakobus Chandra, & Putry Wahyu Setyaningsih. (2025). Benchmarking Local Development Environments: Analyzing the Performance of XAMPP, MAMP, and Laragon. *Bulletin of Computer Science Research*, *5*(3), 193–206. https://doi.org/10.47065/bulletincsr.v5i3.493

Alfian Denny. (2019). Decision Support System Based on the Analytical Hierarchy Process (AHP) Method for Selecting Quality Coffee Beans. *Journal of Information Technology and Computer Science (INTECOMS)*, *4*, 105–112. http://journal.unpacti.ac.id/index.php/JPP

Andika, A., Octavia, C. S., Dewi, F. G., Subaderi, S., & Hariyanto, K. (2024). Improving Food & Beverage Industry Performance With Performance Prism And AHP (Analytical Hierarchy Process) Method In The Era Of Digital Transformation. *The Journal of System Engineering and Technological Innovation*, *3*(02), 278–292. https://doi.org/10.38156/jisti.v3i02.109

Arrazzaq Muhammad. (2018). The Effectiveness of Sweet Tuak as an Energy Drink on Cardiovascular Endurance in Sewo Putra FC Soccer Athletes, Soppeng Regency. *2*. https://www.uam.es/gruposinv/meva/publicaciones jesus/capitulos_espanyol_jesus/2005_motivacion para el aprendizaje Perspectiva alumnos.pdf%0Ahttps://www.researchgate.net/profile/Juan_Aparicio7/publication/253571379_Los_estudios_sobre_el_cambio_conceptual_

Cahaya, A. I., Aprico, F., Apriyanti, D., Nugroho, K., & Ardhianto, E. (2025). *Journal of Computer Networks , Architecture and High Performance Computing AHP – SAW-Based Decision Support System for Culinary Tourism Restaurant Selection in Semarang City Journal of Computer Networks , Architecture and High Performance Computing*. *7*(3), 898–909.

Fergina, A., Insany, G. P., & Elisya, S. A. (2023). *Public E-Report Information System for Community Complaints in Sriwidari Village Using Android-Based CRM. Jurnal CoSciTech (Computer Science and Information Technology), 4(2), 349-358. https://doi.org/10.37859/coscitech.v4i2.4896*Hassoun, A., Jagtap, S., Trollman, H., Garcia-garcia, G., & Duong, L. N. K. (2025). *From Food Industry 4 . 0 to Food Industry 5 . 0 : Identifying technological enablers and potential future applications in the food sector*. *April 2024*, 1–37. https://doi.org/10.1111/1541-4337.70040

Jain, R., Shrivastava, V., Pandey, A., & Sharma, A. (2024). Modern Web Development using CSS & HTML. *International Journal of Emerging Science and Engineering*, *12*(6), 13–16. https://doi.org/10.35940/ijese.g2574.12060524

Mahdiania, D., & Hasibuan, M. S. (2024). Application of a Decision Support System for Supplier Selection Using the Analytical Hierarchy Process (AHP) Method. *Jurnal Teknologi Sistem Informasi Dan Aplikasi*, *7*(1), 411–418. https://doi.org/10.32493/jtsi.v7i1.39286

Marsiani, E. S. (2023). Decision Support System (Dss) To Determine the Increase in Customer Service Representative (Csr) Employee Class Using Ahp and Topsis Methods At Pt. Telkom. *Journal of Information System, Informatics and Computing*, *7*(1), 127. https://doi.org/10.52362/jisicom.v7i1.1100

Narulita, S., Nugroho, A., & Abdillah, M. Z. (2024). *Unified Modeling Language (UML) Diagram for Designing a Research and Community Service Management Information System (SIMLITABMAS). Bridge: Jurnal Publikasi Sistem Informasi dan Telekomunikasi, 2(3), 244-256. https://doi.org/10.62951/bridge.v2i3.174*

Nurjanah, S., & Muharni, S. (2023). Application of the Analytical Hierarchy Process (AHP) Method for Medicine Supplier Selection. Jurnal Informatika, 23(1), 55-66. https://doi.org/10.30873/ji.v23i1.3531

Putri et all. (2024). Phytochemical Analysis of Palm Sap and Palm Wine (Arenga pinnata (Wurmb) Merr.). E-Jurnal Medika Udayana, 10(6), 18. https://doi.org/10.24843/mu.2021.v10.i6.p04

Rahmi et al. (2020). Analysis of Website-Based Information System Development Methods: A Literature Review. Jurnal Interkom: Jurnal Publikasi Ilmiah Bidang Teknologi Informasi Dan Komunikasi, 15(3), 26-40. https://doi.org/10.35969/interkom.v15i3.74

Rismayani, R., SY, H., Herlinda, H., MZ, S. N. N., & Tulwahdah, F. (2024).). Implementation of the Analytical Hierarchy Process in a Decision Support System for Selecting Quality Rice. Komputika: Jurnal Sistem Komputer, 13(1), 93-101. https://doi.org/10.34010/komputika.v13i1.11423

Rohmat, M. A., & Kusrini. (2021). Application of the Analytical Hierarchy Process (AHP) Method in a Decision Support System for Teacher Performance Assessment. Metik Jurnal, 5(1), 55-62. https://doi.org/10.47002/metik.v5i1.217

Said Zulfikar. (2021). The Use of Websites and the Internet in Learning. Journal of Instructional and Development Researches, 1(3), 106-111. https://doi.org/10.53621/jider.v1i3.70

Suryana, I. P. A. P., Pramaita, N., & Sudarma, M. (2021). Research Development on the Application of the Analytical Hierarchy Process in Decision Support Systems and Its Impact of Use in Indonesia. Majalah Ilmiah Teknologi Elektro, 20(2), 232. https://doi.org/10.24843/mite.2021.v20i02.p07

Syahdisa, M. A., Satiadji, A. R., & Dirga, D. M. (2024). Non-Alcoholic Ginger Arak as a Halal Tourism Support Product. Jurnal Gastronomi Indonesia, 12(1), 1-7. https://doi.org/10.52352/jgi.v12i1.1484

Telaumbanua, L. Y., & Siregar, R. A. (2025). Decision Support System for Selecting the Best Graduates of Undergraduate Students Using the Analytical Hierarchy Process (AHP) Method. *International Journal of Informatics and Data Science*, *2*(2), 79–90. https://doi.org/10.64366/ijids.v2i2.28

Thuannadee, S. (2024). Prioritizing on-Campus Coffee Shop Attributes for Quality Improvement: an Ahp Analysis of University Students' Preferences. *International Journal of the Analytic Hierarchy Process*, *16*(3), 1–23. https://doi.org/10.13033/IJAHP.V16I3.1200

Tristanto, S. H., & Iswati, H. (2025). The Influence of Consumer Perception and Promotion on Purchase Intention Through Perceived Value. *Golden Ratio of Marketing and Applied Psychology of Business*, *5*(2), 440–453. https://doi.org/10.52970/grmapb.v5i2.1141

Vitantri, V., Ramadhani, N. T., Hudi, I., Lubis, A. A., Faradiva, A., Nurazila, R., Rahmadanti, A., Pratama, R. S., & Putra, P. H. (2025). Cultural Heritage in a Glass of Laksamana Mengamuk: Traditional Beverage Education in Secondary Schools. Jurnal Pengabdian Masyarakat Bangsa, 3(5), 1830-1841. https://doi.org/10.59837/jpmba.v3i5.2569

Yanto Musli. (n.d.). *Decision Support System Using the AHP Method in Product Selection.*