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Research article

Optimizing Helpdesk Operations: Ticketing System Selection Using the AHP Approach

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Abstract: As time passes, the availability and needs related to technology and information systems are also growing. Many companies continue to improve their efficiency by taking advantage of these developments, one of which is the efficiency of collecting, processing, and monitoring data and information. Thus, this research aims to develop a helpdesk ticketing system application to increase the efficiency of collecting, processing, and monitoring data and information in a company. Currently, there are many helpdesk ticketing system (HTS) applications available. However, this creates confusion and doubt for a company just starting to use the HTS application in determining which one to choose. Analytical Hierarchy Process (AHP) is an appropriate method to help support decision-making in solving this problem. The research aims to make it easier for potential helpdesk ticketing system application users to choose the application that best suits their needs using the Analytical Hierarchy Process method. This research shows that from several alternative helpdesk ticketing system applications, the system provides recommendations for using osTicket with a weight of 0.335

Keywords: Helpdesk Ticketing System, Analytical Hierarchy Process, os Ticket

1. Introduction

The digital transformation that has occurred over the last few decades has marked a revolution in how companies conduct their business. The role of information technology has become more than just a primary necessity; it is the foundation supporting various business aspects within a company. Effectiveness and efficiency are used as benchmarks in maintaining service quality. In this regard, companies can utilize a system that assists them in running their business operations optimally.

This system is known as a helpdesk system. A helpdesk system serves as the heart of information management services in a company. Its ability to manage requests and issues submitted by users plays a vital role in enhancing company image, customer satisfaction, and productivity. A helpdesk ticketing system is a platform used by businesses to provide customer service from various channels within a single integrated panel. Some businesses connect this customer service ticketing system with channels such as websites, live chat, telephone, email, and others. The purpose of using this ticketing software is to ensure that no tickets are overlooked or duplicated, and that they can be resolved more quickly. A helpdesk ticketing system is essentially a customer service management system. It has the capability to identify and categorize incoming customer requests from various channels, which are then converted into tickets. A customer service ticketing system can prioritize, track, and follow up on customer requests within a single platform [1].

Therefore, the presence of a reliable and efficient helpdesk system is crucial in delivering responsive service. An effective helpdesk system does not only process requests quickly but also monitors request trends and patterns to improve overall services. A Decision Support System (DSS) is a computer-based system designed to help decision-makers solve various semi-structured and unstructured problems by using specific models and data [2].

The Analytical Hierarchy Process (AHP) is a functional hierarchy designed to assist decision-makers in reaching conclusions regarding objective problems. The AHP approach serves as a framework and ranking technique for feasible alternatives based on decision-makers' preferences. This is possible because AHP is functionally hierarchical, with human perception as its primary input. Consequently, complex and unstructured problems are broken down into groups and organized hierarchically [3]. Furthermore, the AHP method fundamentally helps overcome complicated problems by creating a hierarchy of criteria and providing assessments based on several considerations to determine priorities [4], [5].

2. Study Literatures

Several studies on the application of the AHP method in selection processes are as follows:

Research has developed a web-based recruitment application using AHP. Researchers weighted criteria and applicants to provide recommendations for appropriate decision-making in selecting new employees. The results of this study indicated that this method can provide accurate decision-making recommendations. The criteria used in this study were work experience, references, interviews, appearance, and physical condition [6].

Furthermore, the development of a Decision Support System for Hotel Selection in Buleleng District using the AHP and TOPSIS methods showed that the system is effective for use in the hotel selection process, with a user response rate of 89% [7].

A consistency index value of 0.05, which means an error value below 5%, is considered valid and can be used when assessing employees' soft skills using the Analytical Hierarchy Process (AHP) method. The results of this study show that AHP can be used to assess employee soft skill competencies down to the values most important to them [8].

Meanwhile, another study used AHP-TOPSIS to provide recommendations for students' thesis defense outcomes. The DSS found an accuracy of 96.2% for 95 student data samples collected between 2014 and 2016 [4]. Other research utilized the AHP-PROMETHEE II method in a desktop-based application using six criteria as benchmarks. AHP was used for weighting, and PROMETHEE II was used for ranking. This study measured the level of accuracy, with findings showing accuracy above 80% [9].

Additionally, another study mentioned that the results of a group decision support system for stock selection using AHP, PROMETHEE, and Borda methods can be used as recommendations for investors to achieve optimal stock selection. The implementation of a group decision support system in stock selection can transform criteria and alternative data so that evaluations of the development of a company's stock alternatives can be made as needed [10].

The AHP method has also been used by researchers to build landslide-prone maps across several risk levels. The analysis resulted in four landslide risk potential zones in the study area: high, medium, low, and very low risk zones [11].

The results of another study recommended using a combined AHP and SAW method to maximize the decision support process for selecting the best singer. The criteria used to evaluate the consistency level of priority weights yielded consistent results in determining the best singer based on all available options. Measurement results showed that the method and the expert team's choices had good accuracy, with a percentage of 84.61%. The study indicated that the combination of AHP and SAW methods can assist in the decision-making process and improve the accuracy of alternative ranking results [12].

The AHP method was also used to determine the best graduates; the criteria mentioned in the study were: GPA, writing, intra/extracurricular activities, and English proficiency. The selection criteria used in decision-making were the result of policies from the Directorate General of Higher Education - Ministry of National Education (DIKTI) [13]. The selection method for undergraduate students using this method refers to individual student performance based on several elements: academic achievement (GPA), scientific work, joint and extracurricular activities, English/foreign language skills, and personality [14][15].

The existence of a responsive helpdesk system is becoming increasingly important. This system is not just about resolving requests quickly, but also about monitoring customer needs and subsequently improving overall service. Therefore, this research aims to select the best helpdesk system that can efficiently and effectively meet company requirements.

The Analytical Hierarchy Process (AHP) method was chosen for this study. AHP is an approach that allows decision-makers to prioritize alternatives based on established criteria using available data. In this context, AHP provides a systematic and objective framework for assessing various available helpdesk systems. Based on numerous previous studies that have successfully applied AHP in selection processes, and considering those successes, the use of AHP in this research is expected to provide accurate recommendations for selecting a helpdesk system that effectively meets the company's needs.

3. Research Method

The research stages used in determining the helpdesk ticketing system application using the AHP method are shown in Figure 1.

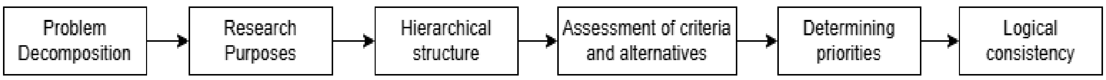

Figure 1. Research stages

Based on Figure 1, this research consists of several stages: problem decomposition, objective setting, building the hierarchical structure, determining criteria and alternative assessments, establishing priorities, and validating logical consistency.

3.1 Problem Decomposition

Based on the previously mentioned problem—specifically the difficulty in selecting a helpdesk ticketing system for a company—this stage establishes five alternatives and five criteria. These criteria serve as the comparative points used to determine which alternative will be selected.

The alternatives used are osTicket, UVdesk, Zammad, Zendesk, and manual. Meanwhile, the criteria consist of usability, pricing, community size, application construction, and omnichannel capabilities.

3.2 Hierarchal Structure

A hierarchical structure is used to facilitate the understanding of complex systems by breaking them down into supporting elements, organizing these elements hierarchically, and then integrating them.

There are three levels of elements used in this system: the goal (determining the most suitable Helpdesk Ticketing System), the criteria (usability, pricing, community size, application construction, and omnichannel capabilities), and the alternatives (osTicket, UVdesk, Zammad, Zendesk, and manual). Each element is organized into a hierarchy, as shown in Figure 2.

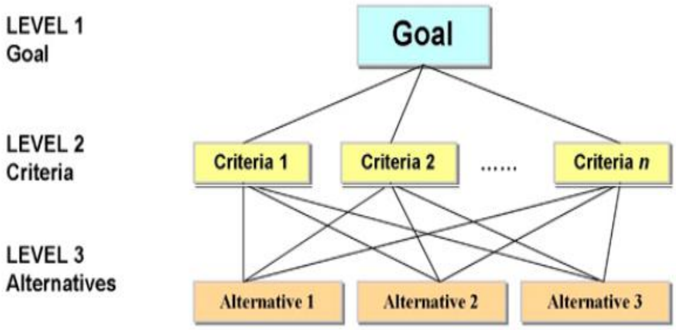

Figure 2. Hierarchical structure chart

3.3 Assessment of Criteria and Alternatives

This rating is measured based on the intensity of interest as in Table-1.

Table **1.** Pairwise comparison scale

Intensity of Interest	Information
1	Both elements are equally important
3	One element is slightly more important than the other element
5	One element is more important than the other elements
7	One element is more important than the other elements
9	One element is absolutely more important than the other elements
2, 4, 6, 8	Values between two adjacent consideration values
Inverse	If activity i gets one number compared to activity i, then i has the opposite value compared to i

Consequently, the company must provide pairwise comparisons for all criteria, followed by assessments for all alternatives under each criterion. This process will result in six 5x5 pairwise comparison matrices. The criteria used in this AHP are as follows:

1. **Usability** Ease of use and user satisfaction are the primary factors in selecting an application.
2. **Pricing** Price is undoubtedly a factor influencing whether an application is preferred or chosen. Open-source applications are often preferred over paid ones.
3. **Community Size** A large community makes it easier to find information regarding the application, including its development and potential troubleshooting. Furthermore, a large community or high popularity indirectly reflects the quality of the application.

4. **Application Construction** Applications built with popular programming languages are more favored and more frequently selected.
5. **Omnichannel Capabilities** Omnichannel is a feature that helps companies connect various communication channels used by customers—such as email, social media, live chat, and telephone—so that the team does not need to switch platforms.

3.4 Determining Priorities

The criteria and alternative assessments previously provided by the company will be further processed to generate weights and priorities. Weights and priorities can be calculated through matrix manipulation or by solving mathematical equations. Thus, this step will yield the priority for each criterion, as well as the priority for each alternative relative to each criterion. These priority results will then be accumulated to provide the overall alternative ranking, identifying which alternative has the highest priority as the solution to the predefined goal.

3.5 Logical Consistency

Logical consistency is the stage for verifying the priority and ranking results obtained. Consistency is validated every time a priority is derived from a pairwise comparison table, both for each criterion and for each alternative under each criterion. Consistency itself has two meanings: first, that similar objects can be grouped based on uniformity and relevance; and second, it concerns the level of relationship between objects based on specific criteria. An acceptable consistency value is less than 0.1. The equations used to determine the consistency value are shown in (1) and (2).

The Consistency Index (CI) value can be obtained using the following formula:

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

Where n is number of elements

The Consistency Ratio (CR) value can be obtained using the following formula:

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

Where CR is Random Index (based on the number of elements)

3.6 Create Alternative Rankings

From the previously obtained priority results—specifically the priority of each criterion and the priority of each alternative relative to each criterion—if they have passed the logical consistency validation stage, the ranking for the alternatives can then be calculated. This ranking value can be determined using equation (3).

$$Value = \sum_{i}^{n} \lambda_{alternatif(i)} \times \lambda_{kriteria(i)} \quad (3)$$

4. Result and Discussion

4.1 Hierarchical Analytics

The hierarchical structure is constructed based on the previously formulated goals, criteria, and alternatives. An analytical hierarchy can facilitate the problem-solving process. The analytical hierarchy structure for this system is shown in Figure 3.

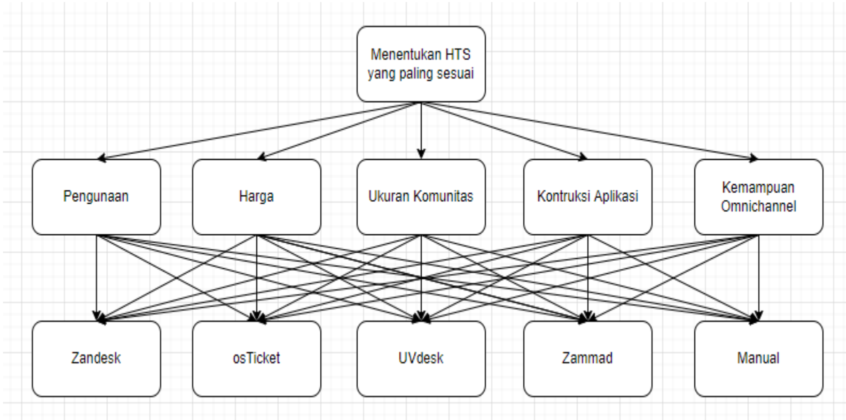

Figure 3. Analytical hierarchical structure of systems

4.2 Assessment of Criteria and Alternatives

The assessment consists of the criteria assessment and the assessment of alternatives relative to criteria 1, 2, 3, 4, and 5.

1) Criteria Assessment

The criteria assessment is obtained by comparing the level of importance of each criterion against the others. The comparisons for the criteria assessment are shown in Table 2. Once the values for the pairwise comparisons are obtained, a pairwise comparison matrix can be constructed, as presented in Table 3.

Tabel 2. Comparison of criteria

Assessment Criteria
Usability is slightly more important than Price
Usability is clearly more important than Community Size
Usability is absolutely more important than App Construction
Usability is clearly more important than Omnichannel Capabilities
Price is more important than Community Size
Price is clearly more important than App Construction
Price is more important than Omnichannel Capabilities
Community Size is more important than App Construction
Community Size is equally important than Omnichannel Capabilities
Omnichannel Capabilities are more important than App Construction

Tabel 3. Criteria Paired Matrix

Pairwise Comparison					
Criteria	C1	C2	C3	C4	C5
C1	1,00	3,00	7,00	7,00	9,00
C2	0,33	1,00	5,00	5,00	7,00
C3	0,14	0,20	1,00	1,00	5,00
C4	0,14	0,20	1,00	1,00	5,00
C5	0,11	0,14	0,20	0,20	1,00
	1,73	4,54	14,20	14,20	27,00

Each of these values holds a specific meaning: **C1** represents usability, **C2** represents pricing, **C3** represents community size, **C4** represents omnichannel capabilities, and **C5** represents application construction. This matrix is used to calculate the **eigenvector**, also referred to as the **priority**.

2) **Assessment of Alternatives for Usability**

The assessment of alternatives against the usability criterion is obtained by comparing the level of importance of each alternative in terms of usability. The comparison for this assessment is shown in Table 4.

Tabel 4. Comparison of alternatives

Assessment
Zendesk is just as good as osTicket
Zendesk is clearly better than UVdesk
Zendesk is slightly better than Zammad
Zendesk is definitely better than Manual
osTicket is definitely better than UVdesk
osTicket is slightly better than Zammad
osTicket is definitely better than Manual
Zammad is definitely better than Manual
Zammad is slightly better than UVdesk
UVdesk is better than Manual

Subsequently, once the pairwise comparison values have been obtained, a pairwise comparison matrix can be constructed, as shown in Table 5.

Table 5. Alternative pairwise comparison matrix

Pairwise Comparison					
Kriteria	A1	A2	A3	A4	A5
A1	1,00	1,00	7,00	3,00	9,00
A2	1,00	1,00	7,00	3,00	9,00
A3	0,14	0,14	1,00	0,33	5,00
A4	0,33	0,33	3,03	1,00	7,00
A5	0,11	0,11	0,20	0,14	1,00
	2,59	2,59	18,23	7,47	31

In this context, A1 represents Zendesk, A2 represents osTicket, A3 represents UVdesk, A4 represents Zammad, and A5 represents manual. This matrix will subsequently be used to calculate the eigenvector, also referred to as the priority.

3) **Assessment of Alternatives for Pricing**

The assessment of alternatives against the pricing criterion is obtained by comparing the level of importance of each alternative in terms of price. The comparisons for this assessment are shown in Table 6.

Table 6. Comparison of alternatives on price

Assessment
Manual is slightly better than osTicket
Manual is clearly better than Zammad
Manual is clearly better than UVdesk
Manual is clearly better than Zendesk
osTicket is slightly better than UVdesk
osTicket is better than Zammad
osTicket is clearly better than Zendesk

UVdesk is better than Zendesk
UVdesk is slightly better than Zammad
Zammad is better than Zendesk

Subsequently, once the pairwise comparison values are obtained, the pairwise comparison matrix can be constructed as shown in Table 7.

Table 7. Alternative pairwise comparison matrix on price

Pairwise Comparison					
Criteria	A1	A2	A3	A4	A5
A1	1,00	0,13	0,20	0,20	0,11
A2	8,00	1,00	3,00	5,00	0,33
A3	5,00	0,33	1,00	3,00	0,20
A4	5,00	0,20	0,33	1,00	0,14
A5	9,09	3,03	5,00	7,14	1,00
	28,09	4,69	9,53	16,34	2

This matrix will be used to calculate the eigenvector, also referred to as the priority. The process continues accordingly, up to the assessment of alternatives against the Application Construction criterion.

4.3 Determining Final Priority (ENV)

Priority values are obtained by calculating the eigenvectors for each element and each criterion. These values are derived from the previously constructed pairwise comparison matrix. The eigenvectors required include the eigenvector for every criterion, as well as the eigenvector for every alternative with respect to a specific criterion.

The results of the eigenvector calculations are as follows:

1. Criteria Eigenvector The eigenvector values for the criteria are shown in Table 8.
2. Alternative Eigenvector for the 'Usage' Criterion The alternative eigenvector values for the usage criterion are shown in Table 9.
3. Alternative Eigenvector for the 'Price' Criterion The alternative eigenvector values for the price criterion are shown in Table 10.
4. Alternative Eigenvector for the 'Community Size' Criterion The alternative eigenvector values for the community size criterion are shown in Table 11.
5. Alternative Eigenvector for the 'Omnichannel Capability' Criterion The alternative eigenvector values for the omnichannel capability criterion are shown in Table 12.
6. Alternative Eigenvector for the 'Application Construction' Criterion The alternative eigenvector values for the application construction criterion are shown in Table 13.

Table 8. Eigenfactor normalization criterion

Criterion	**C1**	**C2**	**C3**	**C4**	**C5**	**Tot**	**Env**
C1	5,00	10,09	37,80	37,80	109,00	199,69	0,52
C2	2,87	5,00	18,73	18,73	67,00	112,34	0,29
C3	1,05	1,74	5,00	5,00	17,69	30,48	0,08
C4	1,05	1,74	5,00	5,00	17,69	30,48	0,08
C5	0,36	0,76	2,89	2,89	5,00	11,90	0,03
		Overall				384,883	1,00

Table 9. Eigen factors of alternative normalization for usage criteria

Criterion	A1	A2	A3	A4	A5	Tot	Env
A1	5,00	5,00	31,89	12,60	83,00	137,49	0,372
A2	5,00	5,00	31,89	12,60	83,00	137,49	0,372
A3	1,09	1,09	5,00	2,23	14,88	24,30	0,066
A4	2,21	2,21	12,13	5,00	35,15	56,70	0,154
A5	0,63	0,63	5,22	1,88	5,00	13,36	0,036
Overall						369,332	1,00

Table 10. Eigen factors of alternative normalization for price criteria

Criterion	A1	A2	A3	A4	A5	Tot	Env
A1	5,00	0,69	1,39	2,41	0,33	9,82	0,028
A2	59,00	5,00	10,92	22,96	2,84	100,71	0,284
A3	29,48	2,50	5,00	10,10	1,48	48,56	0,137
A4	14,54	1,56	2,97	5,00	0,96	25,03	0,071
A5	99,05	7,46	18,62	40,11	5,00	170,25	0,480
Overall						354,368	1,00

Table 11**.** Alternative normalization eigenfactors for community size criteria

Criterion	A1	A2	A3	A4	A5	Tot	Env
A1	5,00	10,07	53,24	30,40	18,96	117,67	0,463
A2	2,98	5,00	30,52	18,41	9,64	66,54	0,262
A3	0,53	1,05	5,00	2,97	1,80	11,35	0,045
A4	1,05	1,98	10,13	5,00	3,26	21,42	0,084
A5	1,68	3,28	19,24	7,70	5,00	36,91	0,145
Overall						253,893	1,00

Table 12. Alternative normalization eigenfactors for omnichannel capability criteria

Criterion	A1	A2	A3	A4	A5	Tot	Env
A1	5	5	31,890	12,596	83	137,487	0,372
A2	5,000	5	31,891	12,596	83	137,487	0,372
A3	1,094	1,094	5	2,231	14,881	24,301	0,066
A4	2,211	2,211	12,127	5	35,152	56,700	0,154
A5	0,632	0,632	5,219	1,88	5,00	13,358	0,036
Overall						369,332	1,00

Table 13. Eigenvector normalization alternative for application construction criteria

Criterion	A1	A2	A3	A4	A5	Tot	Env
A1	5,00	5,00	5,00	13,00	63,00	91,00	0,28
A2	5,00	5,00	5,00	13,00	63,00	91,00	0,28
A3	5,00	5,00	5,00	13,00	63,00	91,00	0,28
A4	2,33	2,33	2,33	5,00	27,00	39,00	0,12
A5	0,70	0,70	0,70	2,11	5,00	9,22	0,03
Overall						321,222	1,00

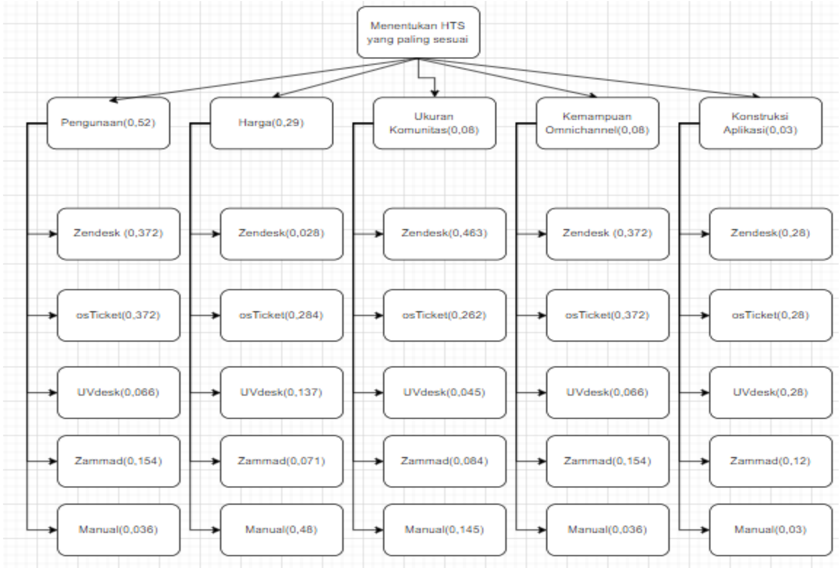

Figure 5. Combined ENV values.

Figure 4 illustrates the combined ENV values derived from the conditions mentioned above. It is important to note that the related tables display the eigenvector values for specific criteria and alternatives. Table 14 highlights the criteria eigenvector values, while Tables 15 through 19 depict the eigenvector values for the various criteria corresponding to the alternatives: Usage, Price, Community Size, Omnichannel Capability, and Application Construction.

When the eigenvector values are combined or aggregated as shown in Figure 4, a comprehensive overview of the values related to the criteria and alternatives is revealed. These combined ENV values reflect the influence and weight of each criterion and alternative within the decision-making process, enabling a more holistic assessment in determining priorities or the best choice within the respective context.

4.4 Determining Ranking

Based on the obtained EVN values, the EVN values for all components can be compiled as follows. By utilizing Equation (3) to calculate the final priority values for ranking, the ranking results are obtained as presented in Table 20.

Tabel-8. Alternative app ranking results

	Ranking	
Alternative	**Priority**	**Rangking**
Zendesk	0,276164832	2
osTicket	0,335082735	1
Uvdesk	0,091641057	5
Zammad	0,12285876	4
Manual	0,174252616	3

5. Conclusion

The Analytic Hierarchy Process (AHP) is a decision-making method that utilizes pairwise comparisons between criteria and available alternatives. AHP serves as an approach to resolve decision-making problems. By leveraging AHP, the decision-making process can be conducted more objectively and transparently. In this case, it was determined that osTicket is the most suitable Helpdesk Ticketing System application for use.

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