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Decision Support System to assess customer satisfaction using Analytical Hierarchy Process

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ABSTRACT

Transportation is an important aspect of mobility or global movement and activities. As public transportation that can be accessed online by the public, Gojek and Grab types of transportation provide transportation services and are growing rapidly. At the time of Covid 19 around 2020, online transportation was very important and much sought after. More and more online transportation companies are appearing, especially in Tegal City, so that there are more service offerings that consumers can use. User or consumer satisfaction measurements were carried out using Fuzzy Logic Method Analytical Hierarchy Process (AHP) on 200 consumers who used Gojek or Grab or other online transportation for 3 to 4 months in 2022 in Tegal City. The results obtained by customers or consumers were satisfied with Gojek transportation at 45%, with male consumers at 67%, and Grab at 37%, with male consumers at 65%, followed by other online transportation (X and Y). These results can be used as an option for consumers who expect the best service.

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Introduction

Transportation is an important aspect of mobility or movement and global connectivity (Krauss dkk., 2022). The role of transportation in people's daily lives is very important, including the role of transportation in the economy and trade (Gkiotsalitis & Cats, 2021). Technological developments in transportation influence how to move from one place to another, influencing the shift from conventional transportation services to online transportation (Rachmat Suryadithia dkk., 2021). Online transportation is a transportation system that utilizes digital platforms and mobile device applications to connect drivers with passengers who need transportation services, using the driver's transportation equipment (Nasution dkk., 2020). So this online transportation can make things easier for consumers and provide benefits and efficiency (Fauzi, 2018).

Good public transportation must meet three basic criteria, namely comfort (Solecka & Kiciński, 2022). This aspect can be felt by passengers if facilities such as air conditioning are closed from polluting motor vehicle fumes on the roads, then safety is always paid attention to when boarding and disembarking passengers, then the aspect of ensuring speed and accuracy in arriving at the destination (Yannis dkk., 2020).

As public transportation that can be accessed by the public (Shen dkk., 2018), Gojek and Grab are online applications that provide transportation services and are growing rapidly in Indonesia (Anggraeni, 2021), which is then followed by several other similar applications such as Maxime which offer various advantages so that competition is increasingly competitive (Sardjono & Retnowardhani, 2019). Especially during the recent Covid-19, online transportation such as Grab and Gojek was sought after and used by people as a means of transporting people and goods(Yudhiantoro & Karyono, 2020) . Grab and Gojek are two online transportation companies based in Southeast Asia that are popular and both offer various transportation services via mobile applications (Hamzah dkk., 2021). These two companies compete intensively, especially in terms of prices and promotions, so that users have a wide choice of safe, comfortable and varied online transportation services (Gray, 2020).

User preferences in choosing between Grab and Gojek may vary depending on individual needs, experience and priorities, including service quality, price, availability, safety, speed and efficiency, sustainability initiatives, loyalty programs and promotions as well as geographic location and user service (Voccia dkk., 2019).

Fuzzy Logic AHP is an effective system to assist complex decision making by using decision making rules, analytical models, comprehensive databases and knowledge from the decision making itself (Kimchi dkk., 2009). Another method used for Fuzzy Logic method is Simple Additive Weighting (Habibi dkk., 2023). The main input of the Analytical Hierarchy Process method is human perception, while Simple Additive Weighting uses the sum of the weighted numbers from the ratings for each alternative (Kurniawati dkk., 2021). The advantage of the Analytical Hierarchy Process method compared to other methods is that the Analytical Hierarchy Process method was created for decision making by combining qualitative and quantitative factors from complex problems and can resolve problems from various conflicting factors (Duleba, 2019).

Another method that has been used in assessing customer satisfaction before is using the SAW method. This method has the advantage of being relatively easy to understand and imply in assessing customer satisfaction, as well as being more flexible, but this method also has weaknesses, namely weight imbalance and inconsistency. Based on the background above, this research uses the AHP method, because this method can overcome dependencies between criteria that are difficult to handle by the SAW method, and the resulting weighted comparison assessments are more consistent and more accurate. This research will create a model of a Fuzzy Logic method using the Analytical Hierarchy Process method so that it can help online transportation determine the level of consumer satisfaction and help consumers identify the best online transportation.

Method

The Analytical Hierarchy Process method is one of the decision making systems included in Multi Criteria Decision Making by providing choices, rankings, descriptions, grouping classifications and to sort alternatives from the most preferred to the least preferred options, so that it can solve problems that arise. complex with quite a lot of criteria taken (Anderluh dkk., 2020). The stages can be seen in Figure 1.

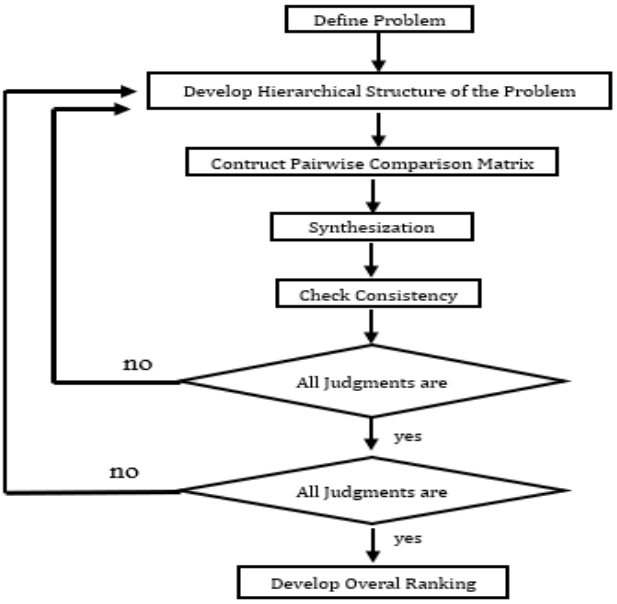

Figure 1. Outline of AHP Method Applied

The first step in conducting research using the Analytical Hierarchy Process method, starting with finding the problem to be researched, in this case, is wanting to know customer satisfaction with Grab and Gojek services (Duleba dkk., 2021). Once determined, then develop a hierarchical structure for the above problems. Then, create a pairwise comparison matrix of the problem, so that it appears in the assessment, then carry out an initial synthesis of the assessment that has been carried out by deciding on the initial hypothesis. The next step, namely by checking the consistency of other customers' assessments, whether their opinions remain the same as the existing ones and whether they are in accordance with the initial hypothesis. If the resulting assessment is appropriate then checking again with the aim of ensuring whether it is in accordance with the second assessment, but if the results are not appropriate then the research is repeated. Returning to the development stage of the hierarchical structure of the problem, if the results are appropriate then the overall ranking can be obtained used for the final conclusion, but if it is not appropriate then the steps that must be taken are to return to developing a hierarchical structure of the problem and so on (Saripudin, 2021).

The Analytical Hierarchy Process method was developed by Dr. Thomas L Saaty of the Wharton School of Business in the 1970s (Sarjono, 2023). This method can solve complex problems where the aspects or criteria taken are quite complex (Sianipar dkk., 2020). The use of Analytical Hierarchy Process in various fields has increased quite significantly, this is because Analytical Hierarchy Process can produce solutions to various conflicting factors (Badi dkk., 2019). Analytical Hierarchy Process can be applied in the fields of agriculture, sociology, industry and so on (Ustaoglu dkk., 2021).

The basic principles for solving problems using the Analytical Hierarchy Process method are decomposition, comparative, judgment, synthesis of priority and logical consistency (Pant dkk., 2022). The principle of decomposition is the action of solving a complete problem into its elements, with levels in the form of goals, criteria and alternatives (Hoseini dkk., 2021). The principle of comparative judgment is an assessment of the relative importance of two elements at a certain level in relation to the level above it. Assessment is the core of the Analytical Hierarchy Process method, because it influences the priority of elements. The assessment results are presented in the form of a matrix called the pairwise comparison matrix. The scale used is used to express the Saaty scale preferences. After the pairwise comparison matrix is obtained, then the Eigen vector is searched to get local priority based on the principle of synthesis of priority. The principle of logical consistency states that consistency has two meanings, firstly, objects are grouped according to their uniformity and relevance, with the level of

relationship between objects being based on certain criteria. The decomposition of Analytical Hierarchy Process can be seen in Figure 2.

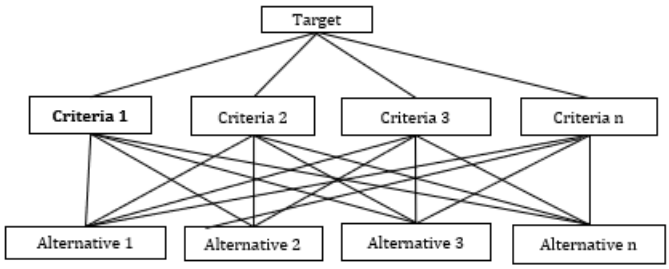

Figure 2. Decomposition on AHP

Comparative assessment data collection is obtained by using questionnaires or carrying out individual comparison assessments with considerations in accordance with predetermined provisions. The next step is to check the consistency of the hierarchy, for example A is a pairwise comparison matrix and w is a weight vector, then the consistency of the weight vector w can be tested by formula 1.

$$t = \frac{1}{n}\sum_{i}^{n} = 1 \left(\frac{element\ no-i\ at\ (A)(w^T)}{element\ no-i\ at\ (w^T)}\right) \quad (1)$$

Formula 1 is the consistency of the weight vector. Then calculate the consistency index with formula 2

$$CI = \frac{\lambda_{maks}-n}{n-1} \quad (2)$$

Where λ_{maks} = eigenvalue maksimum, n = skala matrix.
The comparison between CI and RI for a matrix is defined as the Consistency Ratio (CR). The random RI index is the average CI value that is chosen randomly, then calculate the consistency ratio with formula 3

$$CR = \frac{CI}{RI} \quad (3)$$

Where, CR = Consistency Ratio, CI = Consistency Index and RI = Random Index. if the CR value $\leq$ 10% then the matrix is consistent.

Table 1. Random Index (RI) Value

No	RI
1	0.0
2	0.0
3	0.58
4	0.90
5	1.12
6	1.24
7	1.32
8	1.41
9	1.45
10	1.49

Results and Discussions

Making a questionnaire using predetermined indicators. The scoring method for data collection is a) Strongly Disagree (DN) is worth 1, b) Disagree (NA) is worth 2, c) neutral (N) is worth 3, d) agree (A) is worth 4 and e Strongly disagree (SA) has a value of 5. Questionnaire form as in Tabel 2.

Table 2. Questionnaire

Type	No.	Statement	Category				
			DN	NA	N	A	SA
Servive Quality	1	Transport using Gojek/Grab/X/Y quickly to reach your desired destination location					
	2	Pickup from Gojek/Grab/X/Y drivers is fast					
	3	Gojek/Grab/X/Y drivers respond very quickly to customer service requests					
	4	Gojek/Grab/X/Y drivers always behave well and are polite to wardscustomers					
Emotional	1	I am satisfied with the Gojek/Grab/ X/Y service					
	2	I felt satisfied so I was interested in using the Gojek application servi ces Grab X/Y re turns to support daily activities					
	3	I am satisfied with the ease of orde ring Gojek/ Grab/ X/Y so I recom mend this service to friends					
Convenience	1	Using the Gojek/Grab/ X/Y appli cation makes activities easier					
	2	Using the Gojek/Grab/ X/Y appli cation makes activities completed more quickly					
	3	Shopping becomes easier by using the Go/ Grabshop and Go/Grab Mart menus on the Gojek/Grab/X/Y application					
	4	The Gojek/Grab/X/Y application is flexible because it can be done at any time					
	5	Sending packages is faster by using the Gosend/ Grabsend me nu on the Gojek/ Grab/ X/ Y application					
	6	Using the Gojek/Grab/ X/Y application makes your activities more efficient					
	7	The Gojek/Grab/X/Y application is easy to understand					
	8	It doesn't take much effort to use the Gojek/ Grab/X/Y application					
	9	The Gojek/Grab/ X/ Y application is easy to use					
	10	I was immediately able to use the Gojek/Grab/X/Y application pro perly the first time I ordered Gojek/Grab/X/Y via the application					
	11	Using the Gojek/Grab/ X/Y application makes activities easier acco rding to your wishes to order types of services from Gojek/Grab/X/Y					
	12	By ordering Gojek/Grab/ X/Y services, all activities become easier					

In this test, testing was carried out on 200 customers and correspondents from Gojek and Grab over a period of approximately 3 to 4 months. In the Central Java region, especially Tegal City. Meanwhile, the technique uses a ranking scale by comparing two or more objects to choose which one is the best. The AHP method always uses a paired comparison scale and tests its consistency using the Consistency Ratio (CR). So this CR will indicate the level of consistency of the respondent by comparing pairs, so that ultimately it will indicate the quality of the decision or choice of the respondent. The value of this questionnaire will range, a large CR questionnaire value (CR$\geq$ 10%) indicates that the respondent must seriously consider evaluating or reassessing their responses during the pairwise comparisons carried out. Meanwhile, a CR value that is lower (CR $\leq$ 10% indicates that the respondent's answers are more consistent.

The measurement model analysis tests the validity and rehabilitation of the constructs used which state they are reflexive indicators. The criteria are validity which is measured using convergent validity and reliability. Measured by Croanbach's Alpha > 0.60. It can be seen from the correlation between the indicator scores and the construction scores. An individual indicator is considered valid if it has a value above 0.227, from the test results obtained or obtained with the data collected it is valid. To test the validity of the data collected, it can be concluded that the Cronbach Alpha value is greater than 0.60, so it can be concluded that the results of the data obtained and collected are quite reliable. Respondent of characteritic show as Table 3 .

Table 3. Respondent of characteristic

Characteristics	Type	Total	Percentage
Gender	Male	122	61%
	Female	77	39%
Income	< Rp 2000.000	136	68%
	Rp 2000.000	50	25%
Age	17-24 old	150	75%
	25-34 old	39	20%
	35-44 old	3	2%
	45-54 old	6	3%
	>54 old	1	1%
Education	SD-SMP	8	4%
	SMA	68	34%
	D3	11	6%
	S1	110	55%
	S2/S3	2	1%
Work	Students	119	60%
	Employees	43	22%
	Self-employed	11	6%
	Freelancer	13	7%
	Doesn't work	13	7%
Operating System (OS)	Android	161	81%
	iOS	38	19%
Payment	Cash	189	95%
	Gopay	10	5%

Source: data processed from the results of the 2022 questionnaire.

The results of this research can be generally seen in the figure 3. regarding the Online Transportation Selection Decision Support System model

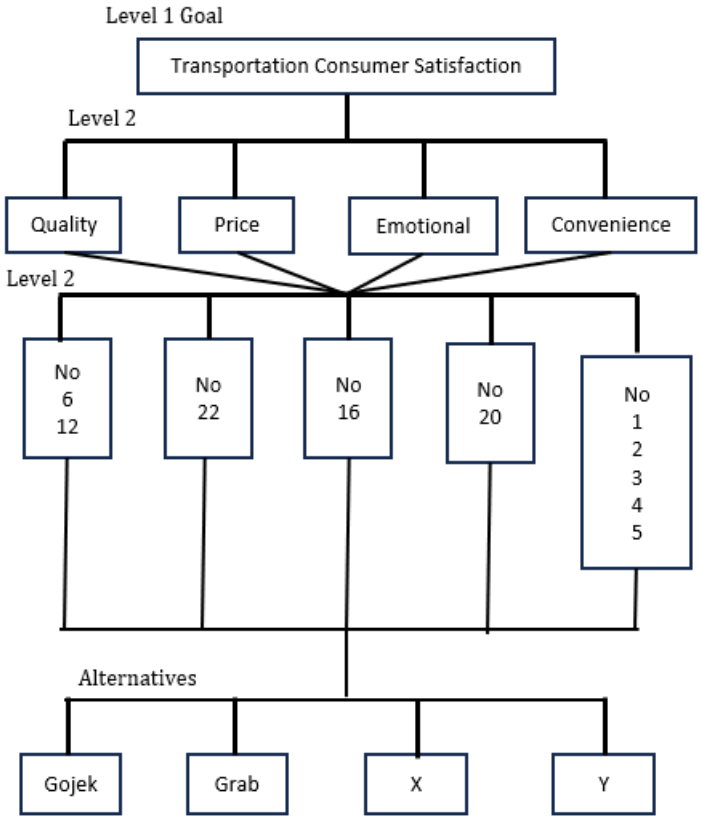

Figure 3. DSS Model for Online Transportation Selection

From Figure 3 above, you can see the steps in analyzing the questionnaire obtained. The first step is to look at what transportation options are often used by customers or consumers of online transportation, including Grab, Gojek, or X or Y transportation. Then determine what factors can be assessed by customer satisfaction, such as quality, price, emotions and convenience. After obtaining the results of the questionnaire, it can be seen that the highest percentage of quality results is customer number 15, 6, 11, then price number 25, emotional number 20 and convenience number 1,2,3,4, and 5. From the results of the questionnaire the most results were obtained for Gojek's type of online transportation is then followed by Grab and other online transportation. The results obtained by customers or consumers were satisfied with Gojek transportation at 45%, with male consumers at 67%, and Grab at 37%, with male consumers at 65%, followed by other online transportation (X and Y). These results can be used as an option for consumers who expect the best service.

Conclusions

Research using the AHP Decision Support System can be used to measure the results of online transportation customers or consumers. Customer assessments obtained from 200 correspondents showed that the highest customer satisfaction was with the Gojek type of online transportation, followed by the Grab type, then X and Y types. The results obtained by customers or consumers were 45% satisfied with Gojek transportation, male consumers were 67% , and Grab by 37%. , with male consumers at 65%, followed by other online transportation (X and Y). These results can be used as an option for consumers who expect the best service and are expected to help consumers find out which transportation is the best. For service companies, it can be used to improve their transportation facilities to be even better. Suggestions for further research are to develop more effective variations of the questionnaire so that the results of further research can be more focused.

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