JUSIKOM PRIMA (Jurnal Sistem Informasi dan Ilmu Komputer Prima)
Vol. 6 No. 1, Agustus 2022 E-ISSN : 2580-2879

Implementation of A*nalytical Hierarchy Process* (AHP) Method In Determining Expedition Services at *the Market Place*

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ABSTRACT-. The delivery of goods is an important part, where the seller's efforts in sending the order package reach the consumer and become a satisfaction for consumers to be able to reason again. Decision-making is often faced with a number of confusing choices, especially in the selection of expedition services. The selection of acquisition services is the main point in supporting business processes. The purpose of this study provides more important criteria for determining alternative expedition services. This research used the *Analytical Hierarchy Process* (AHP) Method. Pairwise comparison questionnaires are given to obtain the degree of importance of the criteria. Price Criteria are the highest criteria in this study compared to location criteria, services and responses. Meanwhile, the response criteria that have sub criteria for claiming goods are more important than the sub criteria for ordering and tracking goods while the service criteria where in the sub criteria for losing goods are a more important condition than damage to goods, speed of delivery criteria . These criteria are used to determine the best choice of expedition services so that from the calculation results of the three alternatives obtained the top ranking with a value of 0.546933.

Keywords : AHP, Expedition Services, Market Place

1. INTRODUCTION

Since the Covid-19 pandemic, *the market place* has become an alternative opportunity for business actors to be able to survive and compete in doing business. Decision makers are often faced with complexities in the scope of decision-making with a lot of data[1]. The quality of service is closely related to customer satisfaction [2]. One of the reasons for customer satisfaction in online shopping is that it does not experience obstacles when sending order packages, for that online business people must be able to choose and determine exactly the expedition service to be used [3]. The delivery of goods is an important part. where the seller's efforts in sending the order package reach the consumer and become a satisfaction for consumers to be able to return. Logistics activities have an important role in business and trade processes where the process of distributing products reaches consumers[4]. The selection of expedition services is the main point in supporting the delivery of goods ordered by consumers. The research was carried out at the Saburohojo Shop, an accessories business for motorized vehicles located on jl. Raya Hankam No. 54 Pondok gede. The selection of expedition services is carried out based on the location closest to the place of business. Basically, every *market place* already provides a choice of various expedition services, but online business people who are just starting to market their products on *the market place* sometimes don't know much about what is the right choice to use expedition services. There are three alternative options, namely Sicepat, JNE and J&T.

The AHP method is a decision support model developed by Thomas L. Saaty. [5]. AHP through the design of procedures comes down to a scale of preference among various options to capture the perceptions of people who are very closely related to a particular problem [6].

AHP divides problem solving by several levels of hierarchy. The hierarchy defines several levels of that's levels :goals , criteria and alternatives [7].

AHP can solve problems and provide solutions, including: [8]

1. Determine the choice of priority
2. Generating alternatives
3. Determine the best alternative
4. Meet the various requirements
5. Allocate resources
6. Predict results and risks
7. Measuring performance
8. Designing the system
9. Ensuring system stability
10. Optimizing
11. Provide alternative solutions
12. Solving problems

2. RESEARCH CONTENT

The problem with the store is the delivery of orders for goods with various considerations of the services provided, costs, location of expedition services available around the store. in addition, the reaction or response given regarding orders, claims and checking the position of the order is a consideration in choosing an expedition service in the process of shipping goods.

Quantitative descriptive research is applied to this research, where researchers carry out a series of statistical and mathematical calculation activities to carry out tests and hypotheses. Data obtained from interviews and questionnaire filling through the *Analytical Hierarchy Process* (AHP) approach.

2.1 *Analytical Hierarchy Process* (AHP)

The AHP method can solve unstructured problems, assign numerical values to the relative importance that is subjectively considered in each variable, which is arranged in a hierarchy and integrates elemental fish to be able to be assessed in determining priorities in a condition [9]

The basic principles that need to be understood in solving problems with the AHP method , the following basic principles of the research carried out in [10] are:

1.Creating a Hierarchy is a decision-making activity based on problem solving that is divided into level criteria and alternatives.

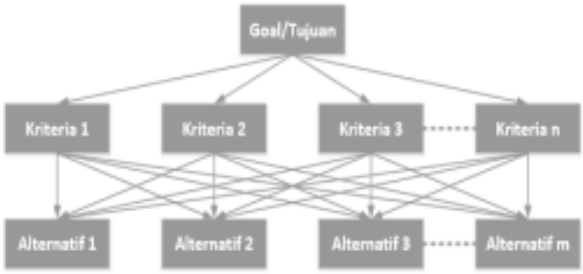

Figure 1. AHP level tiers

Goals or objectives are the final achievements of activities an research, namely giving priority to more important choices. . The selection of those criteria and alternatives is based on the relevant needs that are interconnected .

2. 2. Assessment of criteria and alternatives

In expressing opinions, it is carried out by comparing criteria and alternatives in the form of choice values 1 to 9. The analysis is aimed at table 1 which shows the values and definitions of qualitative opinions. Axioma applies the nature of the assessment of the importance of two reciprocal elements meaning that when the i element is rated 5 x more important than the j value, then the value of the element j is 1/5 times the importance of the value of the element i. In addition, for the value of the element i and j will be worth 1 for the same purpose. Ratio of paired comparison values based on Saaty (Saaty, 1994) in the study [11]

Table 1. Value comparison ratio

importance	information
1	Element couples have common interests
3	One of the elements is slightly more important than the other elements
5	one element is more important than the other element
7	obviously more absolute importance than any other element
9	Absolute importance over other elements
2,4,6,8	The equilibrium of adjacent values between two elements
Opposite	For the value of the selected element i will get a comparison of the inverse value of the element j value

2.3. Choosing Priorities

Doing pairwise comparisons needs to be done on each criterion and alternative. Weight and priority values are generated from the price of all relative values. The Weight and priority values are calculated by calculating the comparison matrix through the application of Ms. Excel.

2.4. Logical Consistency

Is a grouping of certain criteria of objects based on relevance and conformity and degree of connectedness. In decision making, consistency is important to know. This can be done through the calculation *of the Consistence Index* (CI) using the formula:

$$CI = \frac{(\lambda \max - n)}{(n-1)} \quad \text{.....} \quad (1)$$

where n = multiplicity of elements

Consistency Ratio Calculation (*Consistency Ratio* = CR)

$$CR = \frac{CI}{CR} \quad \text{.....} \quad (2)$$

RI = Value obtained from the *Random Consistency Index* table at a specified n

Table 2. Random list of consistency indexes

Matrix Size	IR Value
1,2	0,00
3	0,58
4	0,90
5	1,12
6	1,24
7	1,32
8	1,41
9	1,45
10	1,49
11	1,51
12	1,48
13	1,56
14	1,57
15	1,59

2.5 Selecting Members

In this study, experts consisting of shop owners and warehouse admin staff were asked to give an assessment. the two people have an important role in making decisions to determine expedition services so that they understand and understand the performance of the delivery service. Experts compare each element of each level in pairs to get the importance level value

2.6 Diagram of Research Activities

Guidelines in conducting the research process are a framework that is systematically designed to facilitate research activities. The research diagram can be seen in figure 2.

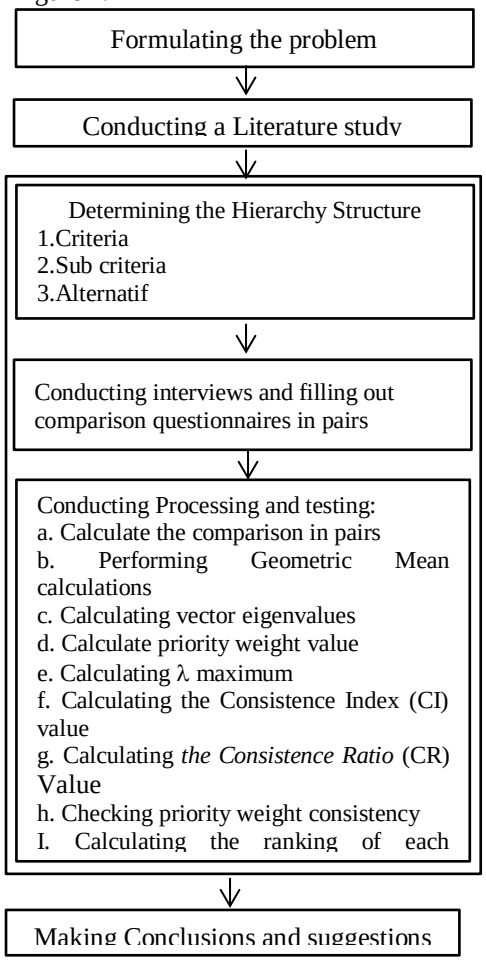

Figure 2 Stages of Research Activities

2.6.1. Formulating the Problem

The formulation of the problem is necessary to dispel doubts in search of answers to a problem. Reference in the form of relevant concepts and theories are used to support the empirical facts of the research, where the previous research related to the research to be made. The use of analytical methods and the conclusions of conclusions becomes base on formulating problems.

2. 6.2 Defining the Hierarchy

The hierarchical structure is formed by dividing problems by level of level into separate and interconnected elements in the decision-making process.

2.6.3. Conducting interviews and filling out comparison questionnaires in pairs.

The owner and warehouse admins are used as data sources. After determining the criteria and alternatives. Next, compile easy-to-understand questions to provide comparisons and weighting of values on each pair of criteria through a number of questions on the questionnaire.

2.6.4. Perform Data Calculations

This activity aims to calculate data and conduct testing with the *Analytical Hierarchy Process* (AHP) method. Steps by doing calculation :

a. value in pairs
b. Geometric Value of Mean
c. *Vector Eigenvalues*
d. priority weighting value
e. λ Maximum
f Value of *Consistence Index* (CI)
g. Value of *Consistence Ratio* (CR)
h .Priority weight consistency checking
I. Order or ranking of each alternative

2.65 Making conclusions and suggestions

Conclusions are made to provide answers to the problems that arise, the shortcomings that exist in this study can be used as suggestions to be developed in the next research.

Suborohajo Store Makes deliveries using three expedition services, namely: Sicepat, JNE and J&T alternately. From a series of expedition service activities, a hierarchical arrangement is obtained as figure 3

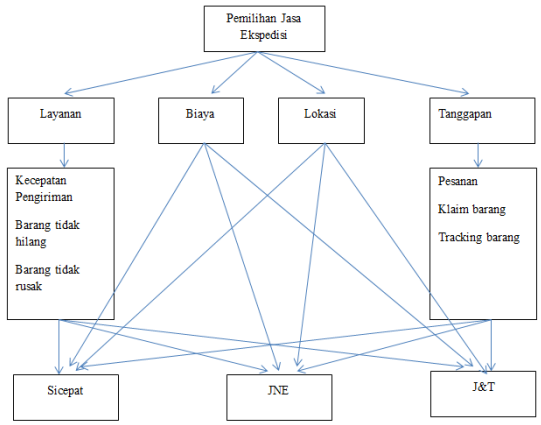

Figure 3 Expedition Service Selection Hierarchy

Pairwise comparison data from experts for criteria are shown in Table 3. By conducting comparisons in pairs through interviews and filling out questionnaires to experts.

Table 3.Pairwise comparison data Criteria

	Cost	Location	Service	Responses
Cost	1,00	3,00	3,00	5,00
Location	0,33	1,00	0,50	0,50
Service	0,33	2,00	1,00	2,00
Responses	0,20	2,00	0,50	1,00
Sum	1,87	8,00	5,00	8,50

Table 4. Eigen values of pairwise comparison

Eigen values				sum	Priority
0,53	0,375	0,6	0,59	2,09	0,525
0,17	0,125	0,1	0,06	0,46	0,116
0,178	0,25	0,2	0,24	0,86	0,216
0,11	0,25	0,1	0,12	0,57	0,144

Priority value indicates the level of importance where the cost has the highest value so that it becomes the main consideration in choosing an expedition. Next, calculate the Consistence Ratio (CR) with the following stages:
Determining the Maximum, calculating the accumulation of each criterion with priority then a value of 4.206 is obtained. λ
Calculating *the Consistence Index* and *Consistence Ratio* using the formula :

$$\mathrm{CI} = \frac{(\lambda \max - n)}{(\mathrm{n} - 1)}$$

$$\mathrm{CI} = \frac{(4{,}206 - 4)}{(4 - 1)} = 0{,}06$$

$$\mathrm{CR} = \frac{\mathrm{CI}}{\mathrm{RI}} = \frac{0{,}06}{0{,}9} = 0{,}076$$

The data obtained from ci and CR calculations is less than 0.1 so it can be said to be valid and consistent.

Table 5 Comparison Data paired sub criteria Service

Service	Delivery speed	Items not lost	undamaged goods
delivery speed	1,00	0,14	0,33
Items not lost	7,00	1,00	3,00
undamaged goods	3,00	0,33	1,00
Sum	11,00	1,48	4,33

Table 6. Service sub criteria vector eigen data

Eigen vector			Sum	Priority
0,091	0,097	0,077	0,265	0,088
0,636	0,677	0,692	2,006	0,669
0,273	0,226	0,231	0,729	0,243

$$\mathrm{CI} = \frac{(\lambda \max - n)}{(\mathrm{n} - 1)}$$

$$\mathrm{CI} = \frac{(3{,}011 - 3)}{(3 - 1)} = 0{,}005$$

$$\mathrm{CR} = \frac{\mathrm{CI}}{\mathrm{RI}} = \frac{0{,}05}{0{,}58} = 0{,}009$$

CR value of 0.009 below 0.1 then valid and consistent

Table 7 Comparison Data paired sub criteria Responses

Response	Order	Goods Claim	Items Tracking
Order	1,00	0,20	2,00
Claim the goods	5,00	1,00	5,00
Items Tracking	0,33	0,20	1,00
Sum	6,33	1,40	8,00

Table 8 Eigin data vector sub criteria Response

Eigen vector			Sum	Priority
0,158	0,143	0,250	0,551	0,184
0,789	0,714	0,625	2,129	0,710
0,053	0,143	0,125	0,320	0,107

$$\mathrm{CI} = \frac{(\lambda \max - n)}{(\mathrm{n} - 1)}$$
$$\mathrm{CI} = \frac{(3{,}010 - 3)}{(3 - 1)} = 0{,}005$$
$$\mathrm{CR} = \frac{\mathrm{CI}}{\mathrm{RI}} = \frac{0{,}05}{0{,}58} = 0{,}009$$

Both CR values have a value of less than 0.1 then the sub criteria are declared valid

Table 9 Local and Global Weight Data on each criterion and sub-criteria

Criteria and Sub criteria	Local	Global
Service	0,216	
delivery speed	0,088	0,019052
Items not lost	0,669	0,144439
Undamaged items	0,243	0,05251
Cost	0,525	
Location	0,166	
Responses	0,144	
order	0,184	0,026436
Claim the goods	0,710	0,10218
Item tracking	0,107	0,015383

Through the assessment of six paired matrices for each criterion and sub-criteria given to the expert, the weighting results used to calculate the ranking of expedition services were obtained.

Table 10 Expedition Services Ranking Results

	Sicepat	JNE	J&T
Service	0,105926	0,042679	0,067361
Cost	0,327029	0,125668	0,072039
Location	0,038583	0,060652	0,016363
Responses	0,075395	0,047961	0,020342
Result	0,546933	0,276960	0,176105

From the calculation results, expedition SiCepat got the highest score with a value of 0.546933, JNE= 0.276960, J&T = 0.176105

CONCLUSION

The level of importance of the criteria and sub-criteria becomes a reference to be able to determine the choice of the best expedition service. Cost criteria has a higher level of importance compared to the criteria of the Service, location and response. The sub-criteria of goods are not lost and the response to the claim of goods has a higher level of importance in the service criteria and response so that it can be concluded that the SiCepat expedition service is the best with a value of 0.546933. Then followed by JNE =0.27696 and J&T =0.176106

3. CLOSING

These of different methods for future research and the selection of Criteria and sub criteria can complement the deficiency that exist in this study.

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