DETERMINING THE PRIORITY OF TRANSPORT STATION CONSTRUCTION SITE USING AHP METHODS

[1]Dwi Setiyo Raharjo, [2]Sri Hartati

[1]Program Magister Ilmu Komputer, Jl.Sekip Utara, Bulaksumur, Yogyakarta 55281 Indonesia

[2]Jurusan Ilmu Komputer dan Elektronika, FMIPA UGM, Yogyakarta

e-mail: [1]adi_ne1@yahoo.co.id, [2]shartati@ugm.ac.id

ABSTRACT

Construction of the transport station as a node connecting the major transport systems become an obligation of government to increase the pace of development and the achievement of the area. Build the station requires careful consideration and planning, especially with regard to the rate of population movements. The main concept in determining the priority of some transport station construction site available is the choice of location were deemed urgent to be carried out construction of the transport station. Determining the level of urgency and also refers to the criteria and factors supporting of several locations that have been provided to meet the needs of society in order to facilitate the flow of people. So it has been done by the government of Situbondo to the attainment of the index of people's satisfaction with government performance, the prioritization of transport station construction site developed using Analytical Hierarchy Process (AHP) as a decision support. With Analytical Hierarchy Process (AHP) to help facilitate Situbondo regency government in making the determination of development priorities based on problem solving into a hierarchical structure that contains of objectives, criteria, sub-criteria and alternatives.

Keywords: *Transport Station, Government, Analytical Hierarchy Process, Priority*

1. INTRODUCTION

Determining priority level of some of the alternatives offered is one of the obstacles in order to get maximum results in making a decision. It is also a problem that governments face when trying to Situbondo district determined the priority areas in the development of transport station of the few places that have been provided. As part of the manifestation of a long-term development plan which focuses on the availability of access within the scope of the transportation system. Definition of the transport's station itself according Station Development Technical Guidelines issued by the Directorate General of Land Transportation 1993 is :

1. Points node in the road transport network system where the breaking current is the principal transport infrastructure that serves as a public service, in the form of a raise and lower the public transport of passengers or goods, loading and unloading goods, the movement of passengers or goods both intra and extra modal transportation that occurs as a result of the current movement of people and goods as well as the demands of efficiency of transportation,
2. Place the control, supervision, regulation and operation of the traffic and public transport,
3. transport infrastructure that is part of the transport system to ease the flow of passengers and goods transportation.
4. The spatial element that has an important role for the efficiency of the life of the region / city and the environment.

Based on the above definition it is necessary to Situbondo district government is making a study in determining the development priorities of several locations available. In a study to resolve the issue, the Analytical Hierarchy Process (AHP) be a priority choice in making the determination of the station construction site. The use of Analytical Hierarchy Process (AHP) because the method is a method that became the framework for an effective decision-making in solving complex problems by simplifying and accelerating the decision-making process [4]. Steps taken in this method is to perform a problem-

solving into its parts and variables and put them together in a hierarchical arrangement. By giving the numeric value in the previous variables subjective worth is measured from the highest priority level and have an influence on the result of solving the problem. Development of Analytical Hierarchy Process (AHP) is performed by Thomas L. Saaty. Where according to [12], AHP helps solve complex problems by structuring a hierarchy of criteria, the competent authorities, with interesting results and a variety of considerations in order to develop a weight or priority.

In accordance with the above background, it outlines some where in the formulation of the problem is determining the factors that will be grouped into consideration the criteria and sub-criteria and the existence of sites is to be used in the application of Analytical Hierarchy Process (AHP).

The scope of the discussion contained in the study are:

1. Making Decision Support System prioritization transport station construction site by using Analytical Hierarchy Process (AHP).
2. The variables used and get a numeric value based on the consideration of subjectivity are all factors that describe the state of the environment around the location where transport station was about to be established.

Goals to be achieved in this research is to help decision-makers as a material consideration in determining priority freight station construction site in the district of Situbondo.

Associated with the use of AHP method in the determination of a priority, as has been done previously by Endang Wahyuningsih [17] through research on the selection of employees who excel in Margaria group. This study took the three main criteria as indicators in assessing employees. The criteria are divided into three weight ratings, with 40% for the Work Productivity, 30% for Work Attitude and 30% for Managerial. This research could be a reference because using AHP in the development of the system. In this study are expected decision support systems can be applied to various other companies to assess the ability of employees to measure their employees in order to improve overall performance.

Then use the AHP method is also used in the study was built by Syahrizal Pahlavi [10] by taking a case study at SMK 1 Sampit District to be a reference both in the literature. In this study Pahlavi using three main criteria being variable major assessment of the achievements of teachers who are in the neighborhood SMK 1 Sampit, where there are four sub criteria on the variable ratio further in order to obtain the accuracy of the results of the assessment of teachers who excel through approach AHP. the purpose of this study is expected to be the motivation of the other teachers to improve performance, especially in improving the quality of teaching that is capable well accepted by the students [4].

From a review of the use of AHP to determine the weight of a variable that has a level of influence on solving the problems facing into the basic use AHP method to solve the problem of determining the priority of the few locations available to build transport station in Situbondo.

2. RESEARCH METHODS

AHP Methodology is a hierarchy which starts from the main input in the form of human perception. With the formulation of a hierarchy, the complexity of the problems and unstructured will be resolved in their groups first and then recreated a hierarchical arrangement. Owned approach of the AHP model is a model decision that is individualized with a collective approach at the time of the decision making process.

According to Thomas L.Saaty, which became the center of gravity in problem solving is done by using AHP is based on the level of complexity refers to the number of criteria that have influence in decision-making that quite a lot. In addition the level of complexity is due not clearly structured problems, uncertainty perception of decision makers who make the inconsistency in determining the numerical value of perception incurred primarily expressed on the basis of intuition and experience or uncertainty of the availability of data has an accuracy for solving the problem.

AHP itself has advantages such as:

1. It has a hierarchical structure, as a consequence of the selected criteria, until the sub-sub-criteria most in
2. Tolerance limits inconsistencies validity of various criteria and the alternative chosen by the decision maker are also taken into account in the method of AHP.
3. Taking into account the durability or resistance output sensitivity analysis decision makers.

Some basic principles that need to be understood before using dispute resolution METRODE AHP begins with:

a. decomposition
a problem that is seen as one whole. then do the decomposition or splitting into its constituent elements. from the solution is then arranged in a hierarchical form as shown in Figure 1.

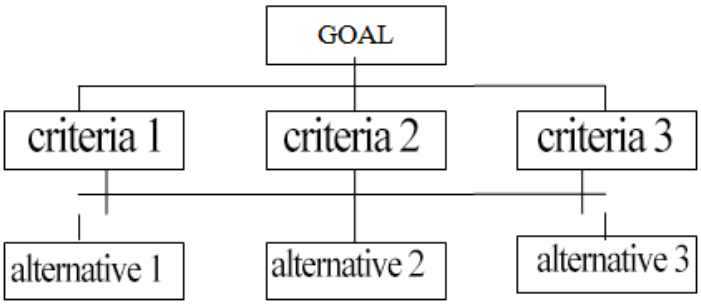

Figure 1 Structure of AHP Hierarchy

b. prioritization (Synthesis of Priority) of each pair wise comparison matrices will get local priorities. but because the pair wise comparison there at every level, to get a global priority needs to be done synthesis of local priorities.
c. make a logical consistency which is important to know how well the consistency is there. This is done by grouping the objects based on the similarity elevated level and the level of relationships between objects based on specific criteria. Decisions arising under consideration with a low consistency becomes something to be avoided. It is necessary for the following steps:
a. Multiply each value in the first column with the relative priority of the first element, the value in the second column with the relative priority of the second element, and so on.
b. Sum of each row.
c. The results from the sum of the line divided by the relative priority elements are concerned.
d. Total the results of the above with the number of existing elements, the result is called λ max.
Consistency Index (CI), Equation consistency can be seen in equation 1:

CI = (λmax – n) /n-1 ……. ….(1)

Where n = the number of number of elements

Then calculate Consistency Ratio (CR), using equation 2:

CR= CI/RI ……..…….. (2)

Where CR = Consistency Ratio
CI = Consistency Index
RI = Index Random Consistency

The Random index can be seen in Table 1.

Table 1 Table Random Index

N matrik	Random Indeks
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

e. Check the consistency of the hierarchy. If the value is more than 10%, then the judgment must be corrected data assessment. However, if the ratio Consistency (CI / RI) is less than or equal to 0.1, the final result can be declared righteous

METHOD

The method used in the resolution of related problems are:

1. Observation
   Performed by seeing and observing directly the location that has been determined by the government in development planning Situbondo Station Equipment, accompanied by data on which to base the choice of location is sourced from related parties.
2. Studies Library
   Through the use of the books and journals related to the issues to be solved
3. Research
   experiment with doing the programming of the data that has been obtained through a process for producing solutions to problems faced.

ANALYSIS

factors associated with the location to be carried out construction of transport stations are grouped into the criteria and sub-criteria based on uniformity and proximity effect. Then assigned a weighting that becomes material in the calculation and further processed by AHP method. The criteria and sub-criteria are:

1. Land
   in soil criteria that describe the condition of the physical and geographical circumstances form of terrain or soil around the site was going to do the construction of transport stations. on these criteria there are sub-criteria related to, among others

a. Height
   an overview of the condition of the station construction site against the height measured from sea level.

b. nature of Soil
   The depiction of the nature of soil based on soil types constituent particles that become variables to determine the location that has the priority to the implementation of the construction of transport stations.

c. Land contour
   Contour lines in order to determine the condition of the high similarity of the plains area specified in location freight station that will be built.

d. Soil texture
   is used to indicate the level of rough / the soft soil conditions and a depiction of a relative comparison of sand, silt and clay or groups of particles with a size smaller than gravel (diameter less than 2 mm) [4] on a location which would be built freight station

2. Population
   the criteria to form demographic circumstances around the site that will be built freight station. demographic circumstances be factors taken into account regarding the benefits that will be acceptable to the surrounding population if there is a transport locations around their neighborhood. As for the sub-criteria of population criteria are:

a. Productive age population
   Describing the existence ratio of the number of productive people's age with a total population around the locations that became the place to be built station associated with movement of the population in the surrounding area are dominated by those of childbearing age.

b. Population density
   Refers to the population density around the locations to be used as a transport station construction site.

c. Population Economics
   Economic level of the population into sub-criteria related to the resident welfare of communities around the construction site freight station.

d. Residents culture.

Culture of the population into sub-criteria related to the utilization of transport stations and influence on the lives of people who tend to be active or not in the vicinity of where the determination of the construction of transport stations.

3. Land Use

The criteria used land use considerations about the state of the level of use and land use by the community [1] around the location of the station that will be built. The sub-criteria are included in this criterion among others

a. Settlement.

consideration of the level of the existence of settlements around the location being the construction of transport stations in order to analyze the impacts and consequences as well as the benefits of the construction of the station in the area.

b. Agriculture

with regard to the comparison between multiple use of land in agriculture in the region primarily to the overall number of locations administrative's development objectives freight station.

c. Ponds / Fisherman

this variable to determine whether it has the proximity to the area where the locations that will be built is a region close to the pond or to the population related to the availability of facilities and infrastructure needs in the distribution of marine products or the farming industry.

d. Industry

The use of sub-criteria in order to get an idea of whether a location to be used as a transport station development is an area that has a high enough level where industry.

4. Infrastructures

the infrastructure criteria definition refers to itself as a station node of major transportation systems and places where people have access to come and start the journey as well as the need for people to use the freight station. Subcriteria are included in this criterion are:

a. School

variables describing the existence of schools or educational institutions who are focused on the areas of its distribution around the site is an alternative construction of transport stations.

b. Office complex

Existence office results of the analysis on the utilization of the freight station building to accommodate the movement of employees from offices located in the vicinity.

c. Trading center

The trade center is located in the environment into consideration of the construction of the freight station is expected to be a means easier for businesses and consumers in supporting the activities in the surrounding areas.

d. Access Road

Ease of access to support in the form of presence around the neighborhood into consideration of the construction of transport stations in order to facilitate the movement of vehicles became the main supporting the existence of the freight station [2].

The result of the grouping criteria and sub-criteria of the above elements are described in the order of hierarchy as seen in Figure 2.

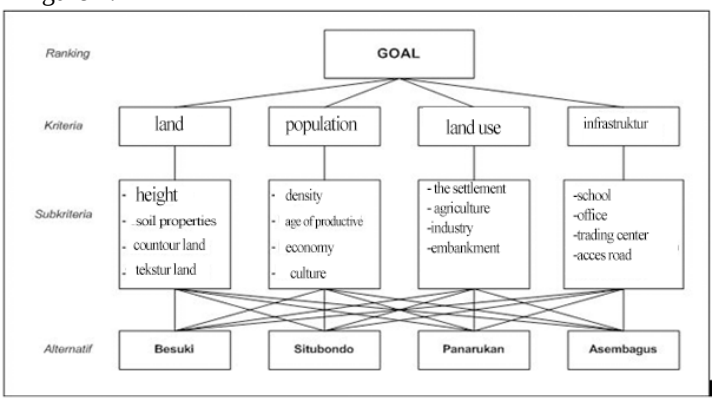

Figure 2 Structure Hierarchy AHP Station Development

3. RESULTS AND DISCUSSION

Is testing through the use of tools that are built by using AHP to help find an option on the priorities of the development of transport station in the district of Situbondo through test plans as described in Table 2 and input criteria in Table 3.

Table 2 Test Plan Data

NO	Test Case	Expected results
1	Input criteria	data about the comparison between the variables being the criterion in the process of calculation
2	Input sub criteria	data about the comparison between the variables being the criterion in the process of calculation
3	Input alternative	data about the location of alternative development that offered

Table 3 Value input variable criteria

Criteria	comparison criteria	The value	description
Land	Population	2	the middle (just as important)
Land	utilization of land	2	the middle (just as important)
land	infrastructure	7	more powerful is important
Population	utilization of land	3	quite important
population	infrastructure	7	more powerful is important
utilization of land	infrastructure	3	quite important

Figure 3 The test results with variable input criteria

Then do the input sub-criteria on Land as criteria described in Table 4 continued input sub-criteria for the Land Use criteria in Table 5 and then input sub-criteria for the population criterion in Table 6 to the input sub-criteria as described in Table 7 for the infrastructure criteria.

Table 4 Rated input variable sub-criteria Land

Kriteria	comparison criteria	the value of the	Description
the height of the	soil properties	2	mid (qually important)
the height of the	contour	2	mid (qually important)
the height of the	tesktur	7	more powerful is important
soil properties	contour	3	quite important
soil properties	tesktur	7	more powerful is important
contour	tesktur	3	quite important

Table 5 Value input variable subcriteria Land Use

Kriteria	comparison criteria	the value of the	Description
the settlement	Agriculture	1/7	not more strongly critical
the settlement	industry	1/3	not important enough
the settlement	embankment	1/9	not absolutely more important
Agriculture	industry	2	mid (qually important)
Agriculture	embankment	1/2	mid (not the same important)
industry	embankment	1/9	not absolutely more important

Table 6 Rated input variable subcriteria Population

Kriteria	comparison criteria	the value of the	Description
population density	the population of productive age	2	mid (qually important)
population density	economy	2	mid (qually important)
population density	culture of population	3	quite important
the population of productive age	economy	3	quite important
the population of productive age	culture of population	1/2	mid (not the same important)
economy	culture of population	1/3	not important enough

Table 7 Rated input variable subcriteria Infrastructure

Kriteria	comparison criteria	the value of the	Description
school	Office space	7	more powerful is important
school	trade	3	quite important
school	access road	1/3	not important enough
Office space	trade	¼	mid (not important enough)
Office space	access road	1/9	not absolutely more important
trade	access road	1/6	mid (not important)

Table 8 Rated alternative input variable

Kriteria	comparison criteria	the value of the	Description
Besuki	Panarukan	2	mid (qually important)
Besuki	Situbondo	3	quite important
Besuki	Asembagus	2	mid (qually important)
Panarukan	Situbondo	2	mid (qually important)
Panarukan	Asembagus	2	mid (qually important)
Situbondo	Asembagus	2	mid (qually important)

From the test results obtained system results as shown in Table 9 and Figure 4.

Table 9 Testing System

SubKriteria	value of subkriteria	Alternatif1	Alternatif2	Alternatif3	Alternatif4
		Besuki	Panarukan	Situbondo	Asembagus
land	0,42902	value of alternative 1	value of alternative 2	value of alternative 3	value of alternative 4
height	0,31992	0,31992	0,35838	0,18097	0,14073
soil propeties	0,35838	0,41896	0,26442	0,17686	0,13977
contour	0,18097	0,33532	0,28671	0,24157	0,13641
texsture	0,14073	0,32900	0,32900	0,20022	0,14178
total number		**1,40320**	**1,23851**	**0,79962**	**0,55869**
population	0,30315	value of alternative 1	value of alternative 2	value of alternative 3	value of alternative 4
density	0,35623	0,41630	0,23575	0,19823	0,14971
age of productive	0,32498	0,41948	0,24805	0,19545	0,13701
economy	0,19374	0,32900	0,32900	0,20022	0,14178
culture	0,12506	0,42604	0,22601	0,20815	0,13979
total number		**1,59082**	**1,03881**	**0,80205**	**0,56829**
land use	0,17028	value of alternative 1	value of alternative 2	value of alternative 3	value of alternative 4
the settlement	0,41948	0,32900	0,32900	0,20022	0,14178
Agriculture	0,24805	0,41680	0,26948	0,19278	0,12094
industry	0,19545	0,38384	0,29988	0,19056	0,12572
embankment	0,13701	0,37879	0,30203	0,18163	0,13755
total number		**1,50843**	**1,20039**	**0,76519**	**0,52599**
infrastructure	0,09755	value of alternative 1	value of alternative 2	value of alternative 3	value of alternative 4
school	0,33593	0,41896	0,26442	0,17686	0,13977
office	0,37541	0,41680	0,26948	0,19278	0,12094
trade	0,18984	0,39000	0,32900	0,20022	0,14178
access road	0,09882	0,33532	0,28671	0,24157	0,13641
total number		**1,56108**	**1,14961**	**0,81143**	**0,53890**
the total number of		6,06353	4,62732	3,17829	2,19187
ranking		**1**	**2**	**3**	**4**

Subkriteria	Nilai SUbkriteria	Alternatif 1	Alternatif 2	Alternatif 3	Alternatif 4
		Besuki	Panarukan	Situbondo	Asembagus
Tanah	0,42902	Nilai Alternatif 1	Nilai Alternatif 2	Nilai Alternatif 3	Nilai Alternatif 4
ketinggian	0,31992	0,31992	0,35838	0,18097	0,14073
Sifat tanah	0,35838	0,41896	0,26442	0,17686	0,13977
Kontur	0,18097	0,33532	0,28671	0,24157	0,13641
Textur	0,14073	0,32900	0,32900	0,20022	0,14178
Jumlah		Text2	Text2	Text2	Text2
Penduduk	0,30315	Nilai Alternatif 1	Nilai Alternatif 2	Nilai Alternatif 3	Nilai Alternatif 4
Kepadatan	0,35623	0,41630	0,23575	0,19823	0,14971
Usia Produktif	0,32498	0,41948	0,24805	0,19545	0,13701
Ekonomi	0,19374	0,32900	0,32900	0,20022	0,14178
kultur	0,12506	0,42604	0,22601	0,20815	0,13979
Jumlah		Text2	Text2	Text2	Text2
Pemanfaatan lahan	0,17028	Nilai Alternatif 1	Nilai Alternatif 2	Nilai Alternatif 3	Nilai Alternatif 4
Pemukiman	0,41948	0,32900	0,32900	0,20022	0,14178
Pertanian	0,24805	0,41680	0,26948	0,19278	0,12094
Industri	0,19545	0,38384	0,29988	0,19056	0,12572
Tambak	0,13701	0,37879	0,30203	0,18163	0,13755
Jumlah		Text2	Text2	Text2	Text2
Infrastruktur	0,09755	Nilai Alternatif 1	Nilai Alternatif 2	Nilai Alternatif 3	Nilai Alternatif 4
Sekolah	0,33593	0,41896	0,26442	0,17686	0,13977
Perkantoran	0,37541	0,41680	0,26948	0,19278	0,12094
Perdagangan	0,18984	0,32900	0,32900	0,20022	0,14178
Akses Jalan	0,09882	0,33532	0,28671	0,24157	0,13641
Jumlah		Text2	Text2	Text2	Text2
Total Jumlah		Text13	Text13	Text13	Text13
Ranking		Text14	Text14	Text14	Text14

Figure 4 System test results

4. CONCLUSION

Differences in the level of weighting votes in making comparisons among criteria, sub-criteria and alternatives linguistic influence on the value of the final results obtained priority of alternatives offered.

5. SUGGESTION

For researchers who want to develop the system of determination of development priorities on transport stations can expand it by adding more variables in accordance with the conditions you have, it is hoped the final results obtained more accurate.

REFERENCES

[1]Departemen Pekerjaan Umum, 2006, *Pedoman Konstruksi dan Bangunan : Pekerjaan Tanah Dasar*, No.003-1/BM/2006, Direktorat Jenderal Bina Marga.

[2]Departemen Pekerjaan Umum, 2009 *Pedoman Kontruksi dan Bangunan : Perencanaan dan Pelaksanaan Perkuatan tanah dengan Geosintetik* No. 003/BM/2009, DirJend Bina Marga.

[3]Edward W.N. Bernroider &Johann Mitlohner, 2005 ,*Characteristics of the Multiple Attribute Decision Making Methodology in Enterprise Resource Planning Software Decisions*.

[4] Herulambang, Wiwiet, 2016, Modeling The Effect Of Fertilization On Growth Pattern Of Brassica Rapa Using Backpropagation Neural Network, *JEECS (Journal Of Electrical Engineering And Computer Sciences) Vol 1 Number 1, 2016*, Surabaya, Indonesia.

[5]Pahlevi, Syahrizal. 2010. *Sistem Pendukung Keputusan Pemilihan Guru Berprestasi*, Tesis Magister Ilmu Komputer, UGM.

[6]Paul, R.E dan Whyte,W.S, 1985. *Basic Metric Surveying : Third Edition*, Spoon Press, New York.

[7]Saaty. T.L, 1990. *The analytic Hierarchy Process*, McGraw-Hill, New York.

[8]Saaty. T.L,1993. Sen, P., 1994. A General Multi-Level Evaluation Process for Hybrid MADM. *IEEE.Transaction*, Vol. 24, No. 10, p. 688-695.

[9]Saaty. T.L, 2008. *Decision making with the analytic hierarchy process*, In.J Services Sciences,Vol.I, No.1,2008.

[10] Silberschartz, *Database System Consepts*, 4TH Edition, Mc Graw Hill, New York

[11]Turban, Efraim, dan Aronson,J.E, 2001 , *Decision Support System and Intelligent System*, Sixth Edition,PrenticeHall,NewJersey