SYSTEM OF DETERMINATION THE IMPROVEMENT OF PUBLIC ELEMENTARY SCHOOL CLASSROOMS INFRASTRUCTURE IN REGION 3 OF SUKABUMI REGENCY USING GEOGRAPHIC INFORMATION SYSTEM APPROACH

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ABSTRACT

Sukabumi Regency is the second largest region on the island of Java and is located in the province of West Java. Territorially divided into 7 regions to facilitate coordination of government administration and coordination of development. One form of development carried out is in the field of education. The sub-district development plan through the development program deliberation forum starts from the village level. Every year there are schools that qualify to receive assistance. However, school assistance that supports new classrooms or renovations is still the result of all schools in one UPTD education. Another factor that is the goal is the location of schools that are very far from national roads and difficult to access. The regulations used to make decisions in presidential regulation number 123 of 2016. In this study a system was created to determine the schools that became the focus of the needs of classrooms in 3 districts with a geographic information approach. From the results of the tests carried out, it was concluded that the system built could provide information on the location of schools that needed classrooms in each of the Education UPTD located in 3 Sukabumi districts.

Keywords : AHP Method, Geographic Information System, Sukabumi Regency, Classroom, Educational Infrastructure.

1. INTRODUCTION

Sukabumi Regency is a district in the province of West Java. It is one of the largest regions in West Java with an area of 4,162 square kilometers or 11.21% of the area of West Java, including the second largest district on the island of Java after the Banyuwangi regency. In the form of the district of Sukabumi consists of rural, plantation and mountains. While territorially divided into 7 regions due to the vast area that aims to facilitate coordination of government administration and coordination of development. The development process carried out is through a development plan deliberation forum conducted at the sub-district level every year. One of the proposed development plans is the construction of educational infrastructure such as classrooms. The proposal for development in the field of education is carried out by education uptake by proposing schools that require educational infrastructure, namely classrooms at the Musrenbang forum to be further determined whether it is approved or not. For the field of education has been regulated in presidential regulation number 123 of 2016 [1] that for schools that will receive assistance there are 2 criteria, namely general criteria covering school administration and some special criteria that are divided for the addition of new classrooms or renovations. As for the rules of the development plan, it is regulated in the district regulation number 20 of 2013 concerning the system of participatory planning and budgeting in Sukabumi Regency. [2]

The education authorities as the SKPD in charge appointed by the district government of Sukabumi will verify the schools that receive assistance. Verification is done to find out the details of the school's needs. In verifying that, the education office often has problems finding the location of the primary school that will be verified. This is due to the many schools that are far from the main road so that the verification process sometimes only involves parties up to education. The location of schools that are far from the center of government also makes it difficult for schools to report on school conditions. So that school proposals sometimes only involve schools that are close and easily accessible.

Based on the results of interviews with the head of the ciambar sub-district education office that at present to obtain assistance, the party proposes assistance through proposals to the education office and through musrenbang forums at the sub-district level. In determining school proposals, education updo conducts monitoring in the field that looks directly at the physical condition of the school building or from the school's proposal. The monitoring process carried out by the UPTD was

deemed less than optimal because it did not compare all schools that needed improvements in infrastructure so that there was no prioritized sequence for infrastructure improvements. Because every proposal submitted is not all agreed due to budget constraints. Suppose you propose 5 new classrooms but the budget is only available for 3 classrooms, 3 schools that are in need must be determined. Data obtained from the UPTD Education revealed that some public elementary schools have a number of groups that are not comparable to the available classrooms and the number of students in one study group that exceeds the maximum conditions is 28 students in one classroom.

Geographic information system is an information system designed to work with spatially / geographically referenced data. The reason for using GIS is based on its interactive and interesting nature in an effort to increase understanding of the geographical elements found above the earth's surface. Most of the use of GIS is mapping areas in various fields such as health, education and other fields. This geographical information system can provide information on the location of the school that needs class room infrastructure improvement assistance in region 3 districts of Sukabumi and can make it easier for the verification team to find out the location of the school.

From the description above, it is necessary to have a system that can facilitate the reporting process of primary schools that have been constrained by distance so that they can assist policy makers in the decision making process that is more maximal and also simplify the process of finding the recipient schools to be verified. The decision-making method used is AHP to determine public elementary schools recipients of the addition of new classrooms. So, researchers will raise it into the object of research and design a system that can be applied to determine the priority of improving the infrastructure of new classrooms in Sukabumi, especially in region 3 of the Sukabumi Regency with research entitled "System Of Determination The Improvement Of Public Elementary School Classrooms Infrastructure In Region 3 Of Sukabumi Regency Using Geographic Information System Approach."

1.1 Purpose and Objectives

The purpose of this study is to build a system that can determine public elementary schools that will receive assistance in improving the infrastructure of new classrooms in the 3 districts of Sukabumi based on geographic information systems.

The goals to be achieved from this research is :

1. The system built can provide information on the location of primary schools that will receive assistance in the addition of new classrooms infrastructure from each UPTD Education in region 3 districts of Sukabumi.
2. The system can assist UPTD education in determining primary schools that will receive high-class classroom infrastructure assistance.

1.2 Geographic Information System

Geographic information systems are spatial oriented systems. There are various types of definitions of geographic information systems along with the growing and varied geographic information systems. One definition of GIS is an information system that is designed to work with data that is spatially / graphically referenced. In other words, GIS is a database system with special capabilities of geographically referenced data and a set of operations related to the management of the data. The components contained in GIS are software, hardware, data and geographic information, and the latter is management. [3]

Geographic information system has 2 types of data, namely spatial and non-spatial. Spatial data consists of raster and vector data models, raster data is data that is tasked with displaying and storing spatial data content into a matrix form that forms a grid arrangement, while data vectors display, place, and store spatial data with points, lines, and polygons and their attributes commonly referred to as non-spatial data.

1.3 AHP Method (*Analytic Hierarchy Process*)

AHP or analytic hierarchy process is a concept of many criteria based decision making. AHP was first discovered by Thomas L Saaty and has been widely used to solve complex decisions. There are 3 main stages in AHP, namely hierarchy preparation, pairwise comparisons and finally synthesizing decisions. [4] For the preparation of the hierarchy can be seen in Figure 1.

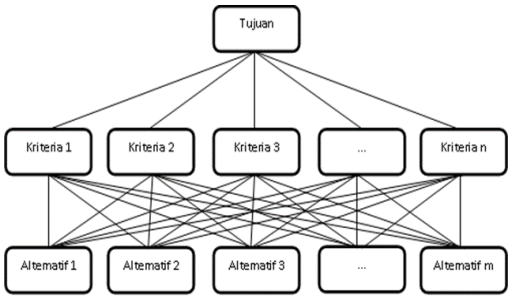


Figure 1 Hierarchy of the AHP Method

In the next step is to do a pairwise comparison or pairwise comparison matrix.

Table 1 Pairwise Comparasion Matrix

Kriteria	A1	A2	A3
A1	1	-	-
A2	-	1	-
A3	-	-	1

To fill in the matrix and perform pairwise comparison calculations can use the pairwise comparison scale in table 2 below :

Table 2 Pairwise Comparasion Scale

Scale	Intensity of Interest	Explanation
1	As important	Both elements have the same relative importance
3	One element is more important than the other	Other considerations are more prominent 1 element than others
5	One element is more important than the other	Stronger considerations that can stand out from others
7	One element is more important than the other	Strong and dominant elements in practice
9	An absolute element is more important than other elements	Proof of element one has the highest level of affirmation
2, 4, 6, 8	Values between two close considerations	Value is needed between 2 considerations

1.4 Legal Basis

The process for improving education infrastructure, especially for classroom infrastructure, has several legal bases as formal legal aspects for the operation of its implementation. Improvement of educational infrastructure is included in the national development plan whose legal basis is regulated in Law number 25 of 2004 concerning the National Development Planning System. [4] National development plans cover various other fields besides education. While at the district level, having its own regulations that are more detailed and in Sukabumi district are regulated in the regional regulation of Sukabumi district number 20 of 2013 concerning Partisifative Development Planning and Budgeting System of Sukabumi District [2] and Perbup number 4 of 2014 concerning the Indicative Ceiling of the District of Sukabumi.. [4]

Another legal basis used in this study is the legal basis for regulations in the scope of education. Regulations concerning standard rules of education facilities and infrastructure are regulated in Minister of Education regulation number 24 of 2007 concerning Standards of Facilities and Infrastructure for Primary Schools / Islamic Primary Schools (SD / MI), Junior High Schools / Tsanawitah Madrasahs (SMP / MTs), and Senior High Schools / Madrasah Aliyah (SMA / MA).[4] As well as Presidential regulation number 123 of 2016 concerning Technical Guidelines for Special Physical Allocation Funds. [1]

In the Presidential Regulation there are rules for the education sector which also discusses the DAK technical guidelines in the field of education for elementary schools to high schools. DAK recipient schools are schools that meet general criteria and specific criteria. The general criteria are more about the administration of the school, and for general criteria include :

1. Prioritized for schools located in 3T (Leading, Outermost, and Disadvantaged) areas for elementary, middle and high school levels;
2. Still operating, has an operational permit, and has a National School Principal Number (NPSN);Masih beroperasional, memiliki izin operasional, dan memiliki Nomor Pokok Sekolah Nasional (NPSN);
3. School buildings are on land that is not problematic / not in dispute and self-owned (Local Government property for public schools, owned by foundations / legal entities for schools managed by the community) as evidenced by certificates or proof of transfer of rights (deed of sale, deed grants, deed of endowments, transfer deeds of rights and / or deeds of rights) authorized by an authorized official or statement of release of customary land rights (specifically Papua / West Papua Province) by the competent authority / other documents in accordance with the regulations region on behalf of Regional Government / Province / Regency / City / Foundation / legal entity;
4. Not having educational facilities and / or infrastructure that meets the standards of educational facilities and / or infrastructure;
5. Having a definite Principal is proven by a decree from an authorized official or an education organizing body, and for schools managed by the community, the principal must not be concurrently supervised by a supervisor / supervisor / supervisor / legal entity;
6. Especially for schools managed by the community must have operational permits and prioritized for schools that have been accredited;
7. Have a School Committee, which is determined by the Decree of the Principal;
8. Have a bank account in the name of the school, not a personal bank account;
9. Do not receive similar assistance from other funding sources (APBN and / or APBD) in the relevant fiscal year;
10. Having a developing potential and in the last three years has a tendency for the number of students to be stable or

increasing, except for schools that experience emergencies and / or disasters such as those affected by riots, fires or natural disasters; and

11. The school has filled out the Basic Education Data in an online data collection system developed by the Directorate General of Primary and Secondary Education on the page http://dapo.dikdasmen.kemdikbud.go.id

Because this study only discusses public elementary schools, number 6 is omitted. While the criteria specifically include :

1. Schools have a growing potential (in the last three years there has been a steady or increasing number of students);
2. Having the number of study groups exceeds the number of classrooms available; and
3. Having a land area of at least 72m2 (illustration 8m x 9m) with the provision of land use does not reduce the ceremonial field or sports field or for schools that have limited land. If you do not have land, the construction of the RKB can be built on the 2nd floor.

2. CONTENTS OF RESEARCH

2.1 Geographic Information System Analysis

At this stage will analyze the data needed in geographic information systems that are built in the form of spatial and non-spatial data. The following is an explanation of spatial and non-spatial data. Spatial data is a type of spatial data that describes the location of a particular object. There are several types of spatial data, namely polygons, points and lines. In this study the spatial data object used is the coordinate point (point) and polygon (area). The following is an explanation of the spatial data used :

1. Polygon

Polygon is used as the first layer to describe the area of each UPTD education located in the 3 districts of Sukabumi. Polygon region 3 of Sukabumi district can be seen in Figure 2.

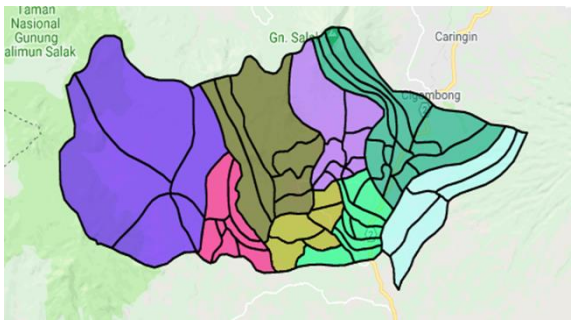


Figure 2 Polygon Region 3

An explanation of the UPTD education polygons in region 3 districts of Sukabumi in figure 2 can be seen in table 3.

Table 3 Polygon explanation

No	UPTD	Polygon color
1	UPTD Pendidikan Kecamatan Bojonggenteng	Light Brown
2	UPTD Pendidikan Kecamatan Ciambar	Mint Green
3	UPTD Pendidikan Kecamatan Cicurug	Dark Green
4	UPTD Pendidikan Kecamatan Cidahu	Purple
5	UPTD Pendidikan Kecamatan Parakansalak	Dark Brown
6	UPTD Pendidikan Kecamatan Parungkuda	Hijau Muda
7	UPTD Pendidikan Kecamatan Kabandungan	Blue
8	UPTD Pendidikan Kecamatan Kalapanunggal	Pink

2. Point

Spatial data points in the form of coordinated data are used to describe the position of public elementary schools in the 3 districts of Sukabumi. To show the coordinates of each school, it is divided into 2 symbol forms. Can be seen in table 4.

Table 4 Elementary School Coordinate Symbol

No	Name	Description	Symbol Form
1	Primary school coordinates	Shows coordinates of primary school	
2	Coordinates of primary school recipients	Showing the coordinates of the primary school proposed to receive assistance	

2.2 Analysis of Input Data

The data used is adjusted to the 3 specific criteria points contained in the DAK technical guidelines for Presidential Regulation number 123 of 2016. It is simplified into criteria for development, difference, and land area. Development represents point 1, namely the potential for developing schools in the last 3 years, the difference represents point 2, namely the difference between study groups and classrooms

where the study group must be more than the available classrooms, and the land represents point 3, namely the available land area.

Data obtained from elementary schools are the number of students and rombel at each grade level, the classrooms that can be used and the available land area. One of the data from SDN 1 Ciambar from the UPTD education in Ciambar sub-district can be seen in table 5.

Table 5 The number of students and students in SDN 1 Ciambar

Class	The Number of Student	Number of Study Groups
1	83	3
2	61	2
3	74	2
4	69	2
5	53	2
6	53	2

And the available land area is 127 M2 and the classrooms that can be used are 8 classrooms. The number of rombel is 13 and the class that can be used is 8 so the difference is 5, while the development is 51.19%. to find out the potential value of developing or school development for 3 years is carried out with the following stages:

1. Add the number of students every 3 years with the following conditions:
   - Number of Years 1 = Class 4 + Class 5 + Class 6
   - Number of Years 2 = Class 3 + Class 4 + Class 5
   - Number of Years 3 = Class 2 + Class 3 + Class 4
   - Number of Years 4 = Class 1 + Class 2 + Class 3
2. Next, to find out the number of students developing each year, the following calculations are carried out:
   - Year Development 1 = Number of Years 2 – Number of Years 1
   - Year Development 2 = Number of Years 3 – Number of Years 2
   - Year Development 3 = Number of Years 4 – Number of Years 3
3. Next, the percentage is calculated with the calculation (development year n / 28) * 100. The number 28 is taken from the maximum number of students in one class room according to Education Minister Regulation number 24 of 2007.
4. The next step is to look for the average of each year of development. The division to search the average uses the amount of potential development. If only 2 years the amount of development is divided into 2.

To be an alternative (in the AHP method each school is an alternative) then after being processed through general criteria and specific criteria, there are 9 alternative data obtained from the initial data totaling 17 alternatives which can be seen in table 6.

Table 6 Alternative Data

School Name	Value		
	Development	Difference	Land
SDN 1 Ciambar	51.19 %	5	127
SDN 2 Ciambar	3.57 %	4	164
SDN Ciambar Kolot	25.00 %	1	508
SDN Cijambu	46.43 %	2	1052
SDN Gobang	32.14 %	1	924
SDN Lemah Putih	14.23 %	2	24
SDN Leuwikeris	35.71 %	1	1196
SDN Nyalindung	1.13 %	1	12668
SDN Warunggombong	89.29 %	2	0

The next step is to assess the weight for each criterion of each alternative. The weighting of each criterion can be seen in table 7 for the assessment of the development criteria weighting, table 8 for the assessment of the difference in weighting criteria, and table 9 for the assessment of the criteria land weight. As well as table 10 for the results of weighting assessments.

Table 7 Assessment of Development Criteria Weight

Persentase Development	Value	Information
0 - 20 %	1	Less
21 - 40 %	2	Enough
41 - 60 %	3	Very Enough
61 - 80%	4	Good
81 - 100% / More	5	Very Good

Table 8 Assessment of Difference Criteria Weight

Diffrence	Value	Information
Selisih 1	1	Very Less
Selisih 2	2	Less
Selisih 3	3	Enough
Selisih 4	4	Very Enough
Selisih 5 or more	5	Enough

Table 9 Assessment of Land Criteria Weight

Land	Value	Information
<= 80 m^2	1	Less
81 - 160 m^2	2	Enough
161 - 240 m^2	3	Very Enough
241 - 320 m^2	4	Good
> 321 m^2	5	Very Good

Table 10 Results of Assessment of Weight of Criteria

Data Sekolah Alternatif	Nilai		
	Development	Diffrence	Lahan
SDN 1 Ciambar	3	5	2
SDN 2 Ciambar	1	4	3
SDN Ciambar Kolot	2	1	5
SDN Cijambu	3	2	5
SDN Gobang	2	1	5
SDN Lemah Putih	1	2	1
SDN Leuwikeris	2	1	5
SDN Nyalindung	1	1	5
SDN Warunggombong	5	2	1

2.3 Determination of Classrooms Infrastructure Improvement using AHP Method

The first step taken in the AHP method is the arrangement of the hierarchy. The hierarchy for the system of determining the improvement of the infrastructure of public primary school classrooms in region 3 of Sukabumi Regency can be seen in Figure 3.

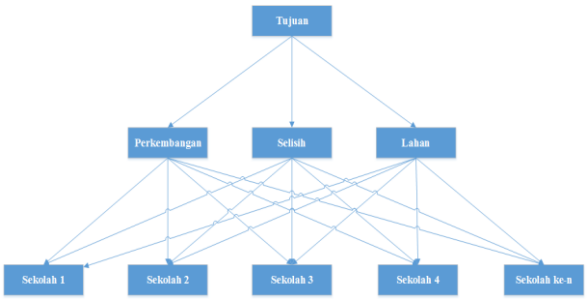


Figure 3 Hierarchy

From Figure 3 it can be seen that the alternative is every public elementary school, the criteria are development, difference and land, and the aim is to determine which schools can receive an increase in classroom infrastructure.

Next is to determine the priority weighting criteria. Can be seen in table 11. For the numbers contained in table 11 can be seen the instructions for determining the value in table 2.

Table 11 Criteria Pair Pairing Matrix

Criteria	Development	Diffrence	Land
Development	1	3	5
Diffrence	1/3	1	3
Land	1/5	1/5	1

The steps to determine the eigenvalue are first, which is to change the value in table 11 into the decimal form and summarize each column. The second step is to divide each value in each matrix with the sum of each column that is the same, the results of the division are rearranged into the matrix form according to the previous one (Xij). The third step sums up each row of each value obtained from the second step and then sums the total of all three (because 3 criteria will make the matrix an order of 3x3). The final step is to divide the number of each row by the number.

After calculating the comparison of paired matrices, you will get the eigenvalues as in table 12.

Table 12 Criteria Weight

Criteria	Eigen Value
Development	0.633
Diffrence	0.260
Land	0.106

After weighting the criteria is known. Next is to compare paired matrices to alternatives. Unlike the criteria that determine the value of the matrix refers to table 2. For alternative values in the matrix in accordance with the calculations that have been previously carried out and found in table 10. The

steps in weighting each alternative criteria are the same as the calculation of criteria. Then the results obtained can be seen in table 13.

Table 13 Alternative Weight Criteria

Alternatif	Eigen Value		
	Development	Diffrence	Land
SDN 1 Ciambar	0.150	0.263	0.063
SDN 2 Ciambar	0.050	0.211	0.094
SDN Ciambar Kolot	0.100	0.053	0.156
SDN Cijambu	0.150	0.105	0.156
SDN Gobang	0.100	0.053	0.156
SDN Lemah Putih	0.050	0.105	0.031
SDN Leuwikeris	0.100	0.053	0.156
SDN Nyalindung	0.050	0.053	0.156
SDN Warunggombong	0.250	0.105	0.031

The final step is to do matrix multiplication between the criteria weight and alternative weights by means of (Alternative Development Values * Value of Development Criteria) + (Alternative Value Difference * Value Difference Criteria) + (Alternative Land Value * Land Criteria Value) = Matrix Value .. For example SDN 1 Ciambar, then do the multiplication between the criteria weight and alternative weights, namely (0.150 * 0.633) + (0.263 * 0.260) + (0.063 * 0.106) = 0.170

The multiplication is carried out for all available alternatives. Then the results of the multiplication can be seen in table 14..

Table 14 Results of Matrix Multiplication

Alternatif	Result
SDN 1 Ciambar	0.170
SDN 2 Ciambar	0.096
SDN Ciambar Kolot	0.094
SDN Cijambu	0.139
SDN Gobang	0.094
SDN Lemah Putih	0.062
SDN Leuwikeris	0.094
SDN Nyalindung	0.062
SDN Warunggombong	0.189

From the results obtained, it is known that warunggombong Elementary School is a school that must be prioritized for improving classrooms infrastructure with the highest value of 0.189 and then SDN 1 Ciambar and SDN Cijambu with grades 0.170 and 0.139.

3. FINAL

3.1 Conclusion

Based on the results of research conducted. So the writer can draw the following conclusions :

1. Geographical information systems can display the school location points proposed by the system as a priority school receiving assistance to improve classroom preservation.
2. The system can determine public primary schools that are prioritized requiring new classrooms from each education uptd in region 3 districts of Sukabumi.

3.2 Suggestion

To improve further research. Especially for improving infrastructure in the education sector. The author proposes several suggestions, namely:

1. The need for further development of information that can be provided in the geographic information system that is built and not only the location information of elementary schools.
2. Improving education does not only cover new classrooms, it can include classrooms or other things according to educational needs. So, there are many more that can be done for a wider space, space or other space.

REFERENCE

[1] PerPres, Peraturan Presiden Nomor 123 Tahun 2016 Tentang Petunjuk Teknis Dana Alokasi Khusus Fisik, Jakarta.

[2] B. Sukabumi, Peraturan Daerah Kabupaten Sukabumi Nomor 20 Tahun 2013 Tentang Sistem Perencanaan dan Penganggaran Pembangunan Partisifatif Kabupaten Sukabumi, Pelabuhan Ratu.

[3] E. Praharsa, SISTEM INFORMASI GEOGRAFIS : Konsep-Konsep Dasar (Persefektif Geodesi &Geomatika) Edisi Revisi, Bandung: Informatika, 2014.

[4] D. r. n. N. Utama, Sistem Penunjang Keputusan :

filosofi, Teori & implementasi, Yogyakarta: Garudhawaca, 2017.

[5] Undang-undang no 25 tahun 2004 tentang SISTEM PERENCANAAN PEMBANGUNAN NASIONAL, JAKARTA.

[6] B. Sukabumi, Peraturan Bupati Sukabumi Nomor 4 Tahun 2014 tentang Pagu Indikatif Kewilayahan Kabupaten Sukabumi, Palabuhan Ratu.

[7] Depdiknas, Peraturan Menteri Pendidikan Nasional Nomor 24 Tahun 2007 tentang Standar Sarana dan Prasarana Untuk Sekolah Dasar/Madrasah Ibtidaiyah (SD/MI), Sekolah Menengah Pertama/Madrasah Tsanawiyah (SMP/MTs), dan Sekolah Menengah Atas/Madrasah Aliyah (SMA/MA), Jakarta.