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ZONING DETERMINATION ANALYSIS OF NEW STUDENT ADMISSIONS USING N-DIMENSIONAL EUCLIDEAN DISTANCE

Satrio Muhammad Alif[1], Nisya Kartika[2], Andri Hernandi[3]

[1]Teknik Geomatika, Institut Teknologi Sumatera, Lampung
[2]Teknik Geomatika, Institut Teknologi Sumatera, Lampung
[3]Teknik Geodesi dan Geomatika, Institut Teknologi Bandung, Jawa Barat
[1]satrio.muhammad@gt.itera.ac.id, [2]nisya1kartika@gmail.com, [3]andri@gd.itb.ac.id

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ABSTRACT

The zoning is one of the ways in the New Student Admissions (PPDB) system in Bandar Lampung City. The implementation of PPDB has shortcomings such as lack of capacity and unequal public high schools in the city of Bandar Lampung. Diverse topography makes zoning determination in Bandar Lampung City requires elevation. This study aims to determine the zone of PPDB of Public High School (SMAN) in Bandar Lampung City using Euclidean N-dimensional Distance to get the lack of capacity of each SMAN. This research is a quantitative research using descriptive research method with a sample of the assumption point of residence (APR) in the city of Bandar Lampung which has an interval of 10 meters. Each APR is used in calculating the distance to each SMAN to obtain SMAN zoning with the principle of minimum three-dimensional distance. The population of each zone is calculated from the proportion of the zone in each district and the population of each sub-district involved. The population is linked with the capacity of the school to get information on the lack of capacity of each SMAN. Zone 6, which contains SMAN 6, is the widest zone in the city of Bandar Lampung. There is no SMAN that is not lacking in capacity with the scenario that 75% of the population continues to high school. The districts that most need to increase their capacity are Kedaton, Way Halim, Sukabumi Panjang, Enggal, and Tanjung Karang Pusat districts.
Keywords: *Minimum Distance, Capacity, New Student Admissions, Zonation, Public High School*

INTRODUCTION

New Student Admission (PPDB) for State Senior High Schools (SMAN) in Bandar Lampung uses the zoning, achievement, and transfer of parent/guardian duties based on Permendikbud Number 20 of 2019 (Republic of Indonesia, 2019). The zoning method, which is the method that gets the largest portion of the capacity compared to other admissions, is a complete, integrated, and systemic policy series from our efforts to restore the education sector, especially in the school system (Ministry of Education and Culture, 2020). PPDB which is a system that regulates the requirements and implementation of student admissions for kindergarten, elementary and junior high school levels which is carried out at the beginning of the new school year begins to use the zoning method for equal distribution of education in Indonesia. The use of the zoning method

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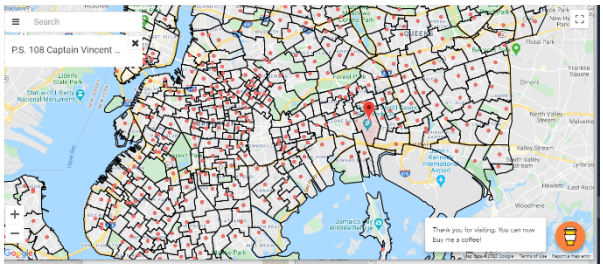
complements the previous PPDB system which prioritizes academic or non-academic achievements as well as the National Examination scores achieved by students. The zoning division of each school is left to the Regional Government (Pemda) related to the geographical factors of an area (Indonesian Information Portal, 2020).

The zoning method for PPDB has problems when applied in Indonesia and abroad. The implementation of the zoning method for PPDB in Sintang Regency, West Kalimantan provides an opportunity for the implementation of equal distribution of education but is still constrained due to geographical conditions and lack of infrastructure and there are still some sub-districts that are not ready with the implementation of the zoning system, and have not been implemented optimally because the compulsory education program is only reach 6 years (Aristo and Meo, 2020).

The implementation of the zoning method for PPDB in Bandung City shows that the zoning method has not been able to eliminate the dichotomy of favorite and unfavorable schools and the unpreparedness of the local government in providing quality educational facilities and infrastructure in all schools (Purwanti et al., 2019). The implementation of the zoning method for PPDB in Banyumanik District, Semarang City shows that the school's capacity is not sufficient for the entire school-age population (Dewi, et al., 2020). The implementation of the zoning method for PPDB in Gresik Regency shows obstacles in the form of a lack of understanding of student guardians on socializing the zoning system due to the different educational backgrounds of parents (Pangaribuan and Hariyati, 2019).

The negative impacts of the zoning method include reducing the quality of outstanding students because students who excel can study with students who are not (Andina, 2017). In other countries that apply the zoning route for schools, obstacles such as lack of infrastructure do not occur because the distribution of schools is even and sufficient for each region such as in Australia and is shown in Figure 1 (Mangomap, 2020).



Source: *https://mangomap.com/schoolcatchment/maps*
Figure 1. School zoning system in Australia

The implementation of the zoning method for PPDB in Bandar Lampung City which has been running since 2018 also has problems. One of these obstacles is the inaccuracy of the mapping system for the location of prospective students' residences, as happened at SMPN 1 Bandar Lampung (ANTARA, 2020). Another obstacle that can arise is that SMAN in Bandar Lampung City is not evenly distributed (Ichwanuddin et al., 2015) while the city continues to grow (Alif and Silaen, 2020). In addition, the zoning method that uses the principle of minimum flat distance without considering elevation can result in zoning that is not appropriate to be applied in Bandar Lampung City which has various elevations from 0 to 500 meters from sea level (Prawiradisastra, 2014) so it is necessary to consider elevation using N-dimensional Euclidean Distance in the zoning process. This study aims to analyze the PPDB zoning of SMAN in Bandar Lampung City using N-dimensional Euclidean Distance which considers elevation to get the capacity of each SMAN.

RESEARCH METHOD

This research is a quantitative research using descriptive research method with samples in the form of assumption point of residence (APR) in Bandar Lampung City which has an interval of 10 meters. The total number of APR used are 1,800,000 points and the processing uses programming software. The elevation of the APR uses elevation data from DEMNAS (Geospatial Information Agency, 2020). SMAN data used in this study are all SMAN in Bandar Lampung City with a total of 17 SMAN. The APR is defined evenly with intervals of 10 meters in the research area so that there are no vacancies during the zoning process.

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The calculation of the three-dimensional distance between the APR and the SMAN points is carried out for APR grouping based on the nearest SMAN. The distance calculation is carried out from each APR to each SMAN so that there are 30,600,000 distance calculations. The minimum distance from APR is the minimum value of the distance from APR to all SMANs. The nearest high school from each APR becomes an additional attribute of the APR. APR with the same nearest APR is grouped into zoning of the related APR. Calculation of three-dimensional distance using N-dimensional Euclidean Distance as shown in Equation 1 (Johnson and Wichern, 2002).

$$D_{TS} = \sqrt{(X_T - X_S)^2 + (Y_T - Y_S)^2 + (Z_T - Z_S)^2} \quad (1)$$

Where X_T is the x-coordinate of APR, Y_T is the y-coordinate of APR, Z_T is the z-coordinate of APR, X_S is the x-coordinate of SMAN, Y_S is the y-coordinate of SMAN, Z_S is the z-coordinate of SMAN, and D_{TS} is the distance between APR and SMAN.

The results of the zoning of each SMAN are calculated for the population of SMAN entry age to get the lack of capacity of each SMAN. The flow chart of this research is shown in **Figure 2**. The population calculation for each zone is based on the percentage of the zone from the sub-districts involved and the population of senior high school age in that sub-district. The population of each sub-district for ages 15-19 was obtained from the Lampung Province BPS (Central Bureau of Statistics, 2018). The population is divided by five to get the assumption of population age entering SMAN because BPS does not provide population data for each age. The population of each zone is compared with the capacity of SMAN obtained from news sites (Tribun Lampung, 2020).

Furthermore, three scenarios were carried out to determine the capacity requirements related to the percentage of SMAN entry age who continued to SMAN because not all residents will continue to study at SMAN by studying at private high school, vocational school, or not continuing their studies. The scenario used is that 75% of the population continues to SMAN, 50% of the population continues to SMAN, and 25% of the population continues to SMAN.

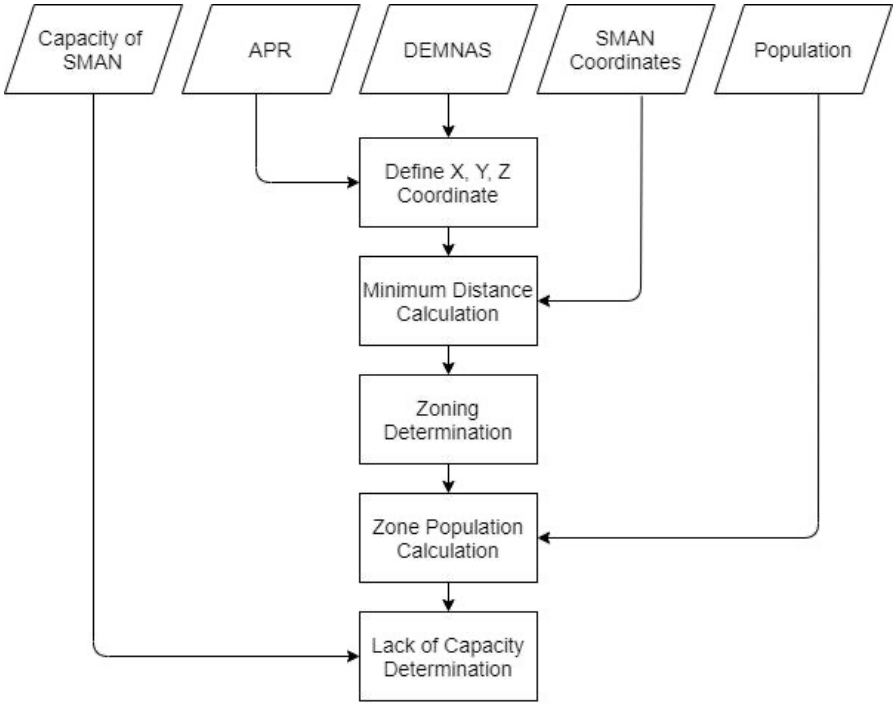

Figure 2. Research Flowchart

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RESULT AND DISCUSSION

The zoning of SMAN has a diverse population of SMAN entry age and area as shown in **Figure 3**. Zone one has an area of 6,301 km^2 with a total population of 7293 people entering SMAN. Zone two has an area of 3,561 km^2 with a total population of 3770 people entering SMAN. Zone three has an area of 11,695 km^2 with a total population of 7558 people entering SMAN. Zone four has an area of 3,529 km^2 with a total population of 3797 people entering SMAN. Zone five has an area of 14,113 km^2 with a total population of 9216 people entering SMAN. Zone six has an area of 18,858 km^2 with a total population of 7669 people entering SMAN. Zone seven has an area of 22,507 km^2 with a total population of 3233 people entering SMAN. Zone eight has an area of 4,001 km^2 with a total population of 9864 people entering SMAN. Zone nine has an area of 13,072 km^2 with a total population of 9900 people entering SMAN. Zone ten has an area of 6.572 km^2 with a total population of 4590 people entering SMAN. Zone eleven has an area of 11,074 km^2 with a total population of 3923 people entering SMAN age. Zone twelve has an area of 11,651 km^2 with a total population of 4401 people entering SMAN. Zone thirteen has an area of 8,933 km^2 with a total population of 3687 people entering SMAN. Zone fourteen has an area of 8,585 km^2 with a total population of 3087 people entering SMAN. Zone fifteen has an area of 10,128 km^2 with a total population of 5419 people entering SMAN. Zone sixteen has an area of 9,054 km^2 with a total population of 4624 people entering SMAN. Zone seventeen has an area of 15,724 km^2 with a total population of 6976 people entering SMAN.

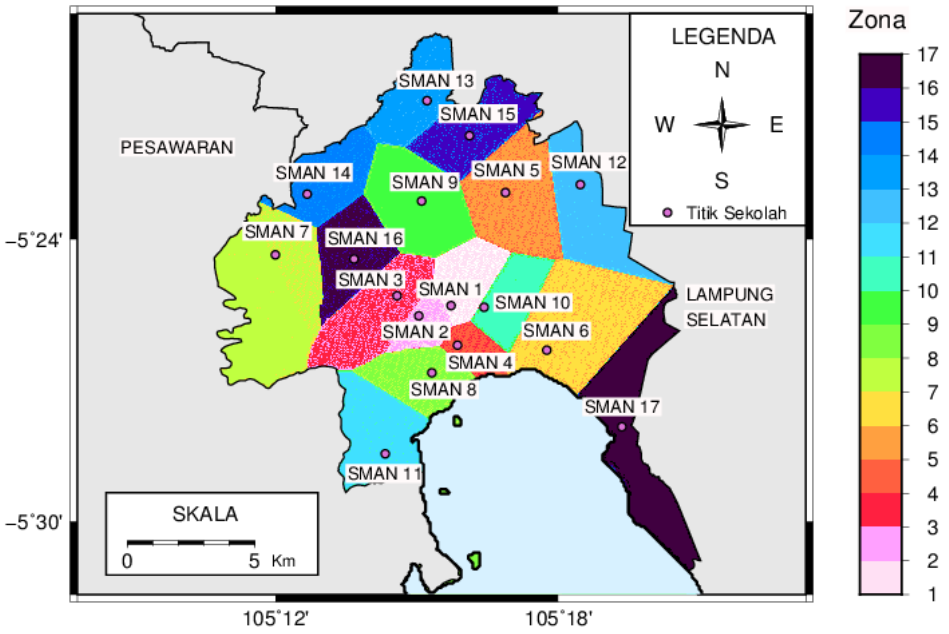

Figure 3. Zoning of SMAN in Bandar Lampung

Zones with larger area indicate a lack of SMAN in the related zone. The zones with the largest area, namely zones six, seven, and seventeen are located on the west and east sides and Bandar Lampung City which is part of Kemiling, Tanjung Karang Barat, Sukabumi, and Panjang sub-districts. Zone seven also shows the influence of elevation plays a role in determining zoning because zone seven is the area with the most diverse elevations in Bandar Lampung City. However, zone seven is one of the zones with the lowest population from the research because the area is dominated by forest. The zone with the highest population is zone eight which is part of Teluk Betung Selatan District.

Lack of SMAN capacity results for the three scenarios are shown in **Table 1**. The numbers from these results are population data of the age of entering SMAN in units of human and sorted from the zone with the greatest deficiency. The zone with the largest lack of capacity is zone 9 which is part of the Kedaton District. This is because Kedaton District has a

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fairly large population but there is only one SMAN. In the scenario of 75% of the population continuing to SMAN, there is no single zone or SMAN that does not lack capacity. It makes residents who want to continue their studies, can only continue to a private vocational high school or high school.

Tabel 1. Lack of capacity for SMAN in three scenarios

Zone	Scenario		
	25%	**50%**	**75%**
9	119	612	1106
5	133	594	1054
17	105	554	902
1	101	465	830
6	59	443	826
3	4	382	760
15	0	218	489
16	0	174	406
11	0	176	372
10	0	119	349
4	0	65	255
12	0	80	300
8	0	4	204
2	0	0	158
13	0	0	121
7	0	0	111
14	0	0	31

SOURCE: DATA ANALYSIS (2021)

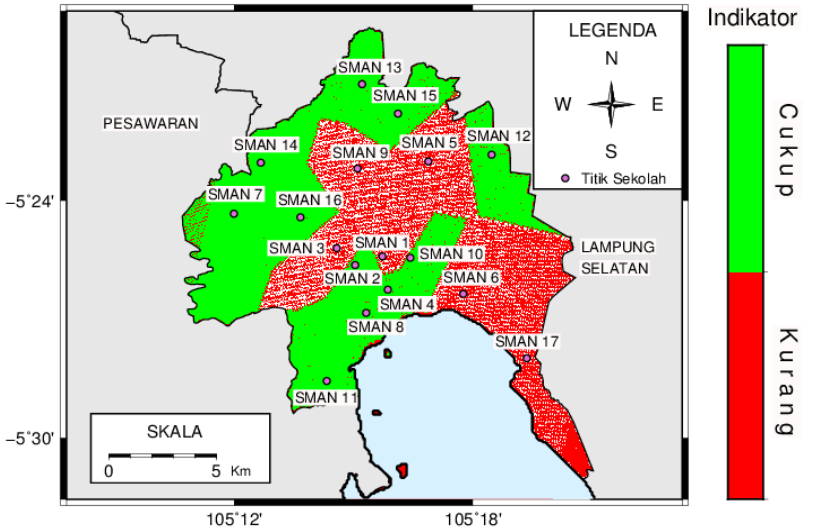

Figure 4. Map of the adequacy of the capacity of each SMAN in Bandar Lampung City with a scenario of 25% of the population continuing to SMAN.

The urgency of increasing the capacity of SMAN to fulfill the zoning method in the PPDB in Bandar Lampung City can be seen in the calculation of the capacity shortage in the scenario of 25% and 50% of the population continuing to SMAN. In addition to increasing the capacity, a solution that can increase significantly but is expensive in its

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implementation is the construction of a high school in the zone that is categorized as less capacity.

Zones 1, 3, 5, 6, 9, 17 are the zones that most urgent zones to increase the capacity because even in the scenario of 25% of the population continuing to SMAN, the SMAN in that zone cannot accommodate 25% of the population as shown in Figure 4. This zone is part of the Kedaton, Way Halim, Sukabumi Panjang, Enggal, and Tanjung Karang Pusat sub-districts. Zones 4, 8, 10, 11, 12, 15, 16 are zones that need additional capacity but with lower urgency than zones 1, 3, 5, 6, 9, 17. This is because in the scenario 25% of the population continues to SMAN, the zone can still accommodate, but cannot accommodate 50% of the population who will continue to SMAN. The zone is part of the Districts of Teluk Betung Selatan, Teluk Betung Timur, Teluk Betung Utara, Kedamaian, Sukarame, Tanjung Senang, and Tanjung Karang Barat. The sub-districts with the lowest urgency for additional capacity are Kemiling and Rajabasa sub-districts because in the scenario 50% of the population continues to SMAN, the zone that includes the sub-district can still accommodate.

CONCLUSIONS

The PPDB zoning of SMAN in Bandar Lampung City which was determined using the N-dimensional Euclidean Distance showed that the lack of capacity occurred in all SMANs with the scenario of 75% of the population continuing to SMAN. This makes residents who want to continue their studies, can only continue to a private vocational high school or high school. With a lower scenario, the Districts of Kedaton, Way Halim, Sukabumi Panjang, Enggal, and Tanjung Karang Pusat are the districts that urgently need additional capacity.

RECOMMENDATIONS

Increasing the capacity and/or construction high school in most urgent zones should be conducted by stakeholders so that zoning method in PPDB can be implemented in Bandar Lampung. The method of this research can also be done for zoning of private school, junior high school, and elementary school to determine lack of capacity of the school. The research will evaluate the adequacy of capacity in implementing zoning method in PPDB.

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