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Measuring service capacity of public facilities based on supply aspect (case study: elementary school in Malang City)

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Abstract

Public facilities have various types and functions to support community activities. Provision of public facilities in Indonesia is carried out on the base of population size and spatial approach, which for the development of new facilities used the scale and capacity of services analysis on related facility. This study carried out the capacity of services measurement related to the elementary school in the Malang City based on supply aspect, which mean school locations and numbers. In general, the measurement was done with the administrative boundary as analysis units but grid/cell approach were used to obtain accurate results. Based on the analysis result, service capacity of elementary school in the Malang City defined by the administrative boundary approach was 560.82% but when using grid/cell approach the value defined on 271.95%. It is means that people in Malang City can access elementary school not only in their administrative boundary but also they access school in their neighborhood areas.

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Keywords: public facility; service capacity; elementary school.

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1. Introduction

Public facilities in Indonesia have various types and functions in order to support community activities, such as educational facilities. Adequate provision of educational facilities needed to improve the quality of human resources. Provision of the facilities is carried out in the base of population size and spatial approach, which for the development of new facilities used the scale and capacity of services analysis on related facility.

Procurement education in adequate sufficient is necessary to increase the quality of human resources. This study focused on the service elementary school facilities in because the Indonesian government had *Wajib Belajar 9 Tahun* program whereas people obliged to obtain education services elementary and junior high schools. Until now, provision of elementary school as well as other public facilities some are still based on the number of people which will determine the number of new facility. The government tried to provide elementary school in various areas yet sometimes not supported by adequate planning procedure. The planning process must consider the existing education services by the number and distribution of elementary school in order to analyze the level to access school. Public access to school quite different between areas, especially between the urban and rural area or the centre and fringe areas because the development of facility was generally concentrated on the center. Especially in rural areas, it is often represented have access relatively low to the public school.

Hitherto, the measurement of accessibility on education facilities still not represented in detail because method that used still normative. First, measurement considered only the number of existing schools inside of the administrative unit areas. Then the number comparing with the population numbers to obtain ratio that can used to define new facility number. Second method using service areas or radius of services, which mean this method consider service of facilities not only came from facilities which are located inside of administrative areas but also from outsides.

The weakness for the first is not considered the availability to access the education facilities that are located outside of each area. Meanwhile the community can access the facility independently. It causes each administrative area was served with more facilities (overlapping) on the other hand there are areas was not served on adequate facilities. Likewise with the previous method, on the second method, facilities that are located outside of area were calculated using the administrative boundary. Compared with the first, the second method is more accurate. Weakness on the second method is not considered the land use. This caused the service scale were not effective mainly related as the education facility would not serve the unbuilt areas.

In this research, the weakness of previous methods will be corrected using the cellular/mash approach. To define which method has valuable result then Moran's I was used. Later method perceived have accurate result in order to determine services scale because consider the location of facilities and interaction between community and facility. In mash/cellular approach, the calculation of service area focused on the built-up areas. Hence, author through this research want to give comparison to decide the most accurate method in determining scale services in aim to provide new education facility in Malang City.

2. Methods

The study focuses on Malang City. The city located in East Java Province as second largest city, also known as education city. Area of the city about 110 km^2 and there are about 873.205 peoples live inside of city area. Malang City consist of five districts which are Blimbing District, Kedungkandang District, Klojen District, Lowokwaru District and Sukun District and all the city area is directly adjacent to Malang Regency area. Numerous educational facilities from elementary schools up to universities are located in this city. Regarding the facility, this study focuses on elementary school which is related with national program on education sector "*Wajib Belajar 9 Tahun*". Provision of elementary school is important in order to increase the accessibility level of community. As yet, the number of elementary school in Malang city about 323 units which spread in all five districts.

There are several procedure use in this research. At an early stage, services scale elementary education facilities assessed according to its distribution imaginary sphere on using a circular looking (layer) according to the administrative boundaries. The next step, determined mash/grid in accordance with the admin based on the cellular Approach (CA) concept. The result will be analyzed using Moran's I to examined the links between area on spatial views. Based on author's knowledge, Moran's I analysis used to calcualte spatial bounds, find a spatial model, etc. In

this research, the authors tried Moran's I analysis as a method to comparison in determining scale services. Then overlaid the results of the elementary education services depend on the accuration.

3. Result and Discussions

3.1. Spread Distribution of Elementary School by Existing Number

This method is conventional method which is define the elementary school service based on the number of population and the number of school that are locate inside of each sub district in Malang city. The distribution of education facilities in Malang City are spread across five districts. By number, Kedungkandang district has the highest number of education school. Based on the number of school, services scale of elementary school in Malang city was defined compare with the number of population on each sub district. Result of the calculation from first method served in Table 1.

Table 1. The Scale of Elementary School Services in Malang City Using Existing Unit

Districts	Service Capacity
Blimbing	92.53%
Kedungkandang	119.29%
Klojen	94.80%
Lowokwaru	90.58%
Sukun	95.16%
Average	**98.47%**

Source: Analysis Result, 2015

From **Table 1**, it is known that the average of service capacity 98.47% and it means there about 1.26% of the population will have not serve by elementary school. Only Kedungkandang District has a high service capacity rates up to 119.29%. Other district has lower service capacity rates and it was not met 100% rate. In sub district level, there are several sub districts or villages that has lower rates of service capacity (less than 50%) which are Jodipan, Gadingkasri, Kasin, Tlogomas, and Bandungrejosari sub district. Also, there are several sub districts or villages that has high rates of service capacity which are Blimbing, Tlogowaru, Wonokoyo, Kedungkandang, Kauman, Klojen, Kiduldalem, Tasikmadu, Tunggulwulung, and Pisangcandi sub district. There is no specific pattern to define the service capacity spatially.

3.2. Spread Distribution of Elementary School by Administrative Boundary Catchment (ABC)

Second method conducted examination of the elementary school services in Malang city is based on a imaginary radius of services in accordance with existing distribution of school. Using National Standard, every school has average radius of service around 2 km. The radius of service occurs not only inside of their administrative boundary but also the surrounding administrative units. These results increasing the number of schools that serves on each area not only come from facility inside but also come from surrounding area. For example, existing elementary school in Kotalama sub district is 8 units but using the second method number of elementary school that can be accessed by students reaches 28 units. The result occurs also on every sub district in Malang City. Based on the distribution of elementary school and service catchment by administrative boundary, there is map that is produces as Fig. 1

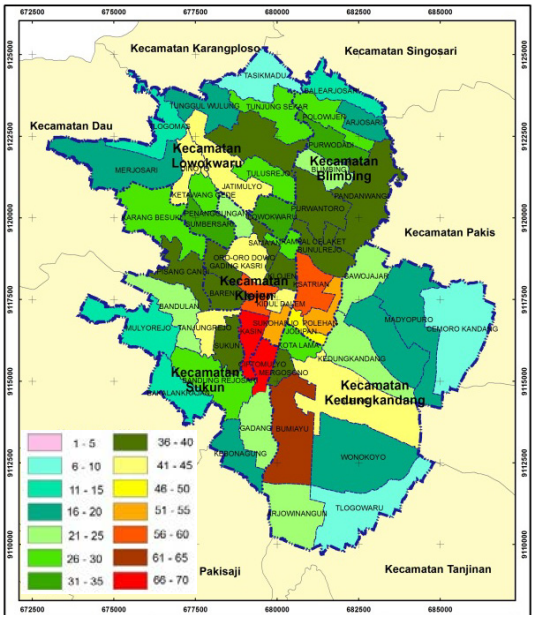

Fig 1. Mapping of Service Capacity Rates based on Administrative Boundary Catchment
Source: Analysis Result, 2015

Using the administrative boundary catchment method, it can be seen that there are 3 sub district or villages served by high number of school (more than 60 units), which are Kasin sub district (Klojen), Ciptomulyo sub district (Sukun) and Bumiayu sub district (Kedungkandang). On the other hand, there are 4 sub districts or villages served by small number of school (less than 10 units) which are Arjowinangun, Cemorokandang and Tlogowaru sub district (Kedungkandang) and Tasikmadu sub district (Lowokwaru). In terms of services scale rates, there is huge differences comparing with the first. The obtained outcomes can be seen on Table 2 as follows.

Table 2. The Scale of Elementary School Services in Malang City Using Administrative Boundary Catchment

Districts	**Service Capacity**
Blimbing	545.26%
Kedungkandang	442.57%
Klojen	931.34%
Lowokwaru	467.85%
Sukun	436.25%
Average	**564.66%**

Source: Analysis Result, 2015

From the Table 2, it can be seen that average service capacity rates using the administrative boundary catchment method in Malang City more than 100% which is 564.66%. It means there is overlap service between elementary schools in this city. It also confirms that service capacity rates using the second method higher than first method. The highest rate of service is Klojen district with rates of elementary school service reaches 931.34%. It is ten times higher than using the first method. Location of Klojen district in the center of city and it make the community on this district can access the facility or school in another district. Moreover, the weakness the method is the determination of services scale catchment not considering the land use aspect regarding un-built areas. The condition is causing the high number of the scale of elementary education services in the Malang city. In the district level, all of sub district has the high rate of service capacity. Several sub districts or villages has capacity rates more than 1.000% which are Kesatrian, Kauman, Klojen, Sukoharjo, Kiduldalem, Kasin, and Samaan sub district.

3.3. Spread Distribution of Elementary School by Mash or Cell Catchment (MCC)

The third method that used in this research is observe services capacity rates with the Cell or Mash Catchment Approach. In the first phase, Malang City area was divided on cell or mash system. Then, the cell or mash adjusted with land use and derived for the later phase only on cell/mash that contain built-up area. This method was used to improve the concept in the previous method that still used empty land on the calculation of services capacity. The result of services scale capacity based on third method can be seen as follows.

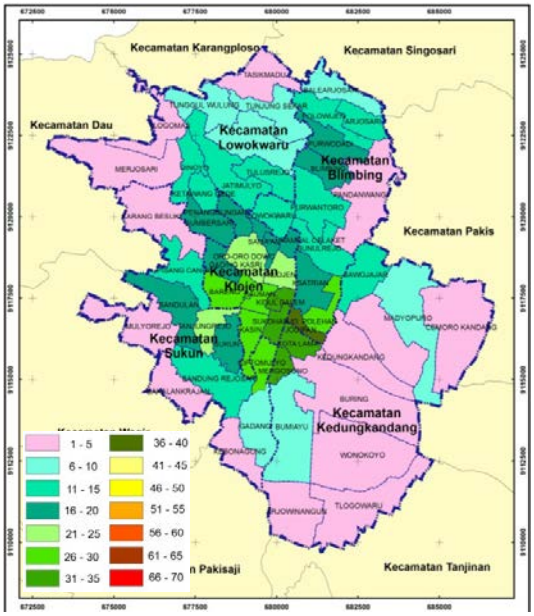

Fig 2. Mapping of Service Capacity Rates based on Mash/Cell Catchment
Source: Analysis Result, 2015

Based on the map result, it is known that 15 of 57 sub district in Malang city served between 1-5 school unit spread across in except in Klojen District. Jodipan sub district is the most served area by elementary school facilities based on this method. The sub district serve about 36 elementary school units. Rate of service capacity that determine with this method can be seen in Table 3.

Table 3. The Scale of Elementary School Services in Malang City Using Mash/Cell Catchment

Districts	Service Capacity
Blimbing	270.48%
Kedungkandang	187.98%
Klojen	569.21%
Lowokwaru	177.65%
Sukun	169.58%
Average	**274.98%**

Source: Analysis Result, 2015

Based on table 3, it is known that average rate of services capacity using the mash/cell catchment method in the Malang City is 274.98% and it lower than using administrative boundary catchment method. But this can perceives has the accurate results. Area with highest rate of service capacity still Klojen District but the rate is lower with 569.21%. Unlike second method, this method also produce high rate of service capacity on almost all sub district but

there is area still has lower service capacity rate (less than 100%) which are Tlogomas, Lesanpuro, Karang Besuki, and Mulyorejo sub district.

This method considered more accurate compared with the earlier by in the concept of CA due regard to autocorrelation (spatial links between regions). In addition, the determination of cell/ mash/grid in this research considered the land use in the measurement of service capacity because it was unbuilt land there is no human activity especially residential activity. Therefore, Moran's I analysis was used to compare the level of accuracy of the three the method of measurement services scale elementary education in Malang City.

3.4. Moran's I Results

As it has been discussed, the use of Moran's I analysis is in order to compare the accuracy of the three methods that is measured the elementary school services capacity that has been done before. Moran's I analysis produced Moran's index that gained from spatial weight with GeoDa software. Moran's I analysis chosen because the characteristic of areas affected by activities on those area/characteristics of around so it is also used as a base assumptions in the measurement of elementary education services scale in this city. The measurement of three method that had been done and it obtained Moran index as follows.

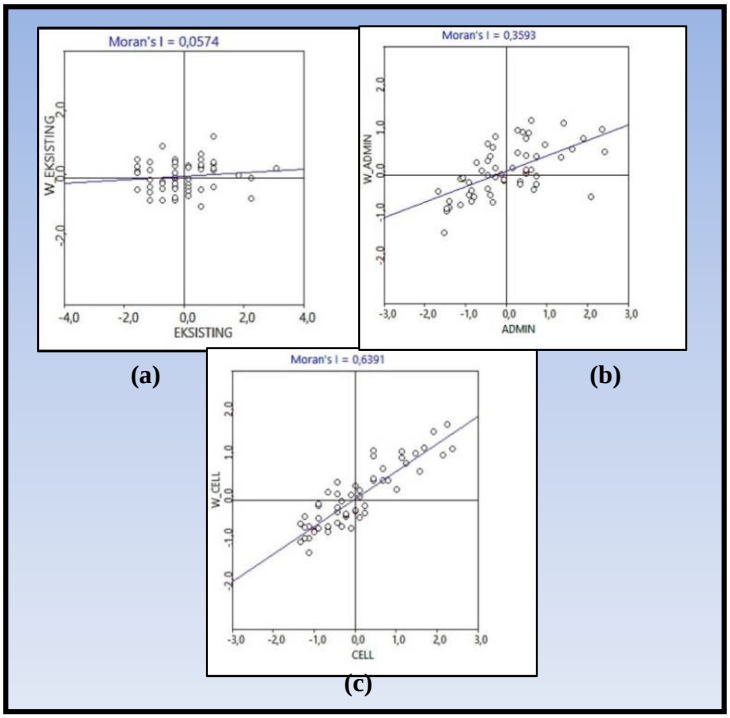

Fig 3. The results of Moran Analysis on elementary school service measurement which are (a) Existing; (b) *Administrative Boundaries Catchment;*(c) *Cellular/Mash Catchment* (CA)

Source: Analysis Result, 2015

Based on the results of analysis, it can be seen that the highest value of Moran's I index was obtained from third method (using cell/mash catchment method) (0,6391). The index value is indicated that spatial autocorrelation from the object studied is in the category of high correlation. These results strengthened by the results of the correlation of each method that presented in Table 4.

Table 4. Comparison of Service Capacity Measurement Method

Variables	Service Scale Based on		
	Existing Catchment	Administrative Boundary Catchment	Cellular/Mash Catchment
Moran's I Index	0,057	0,359	**0,693**
Standart Deviation	**0,47**	2,69	1,53
Correlation	0,35	0,64	**0,72**

Source: Analysis Result, 2015

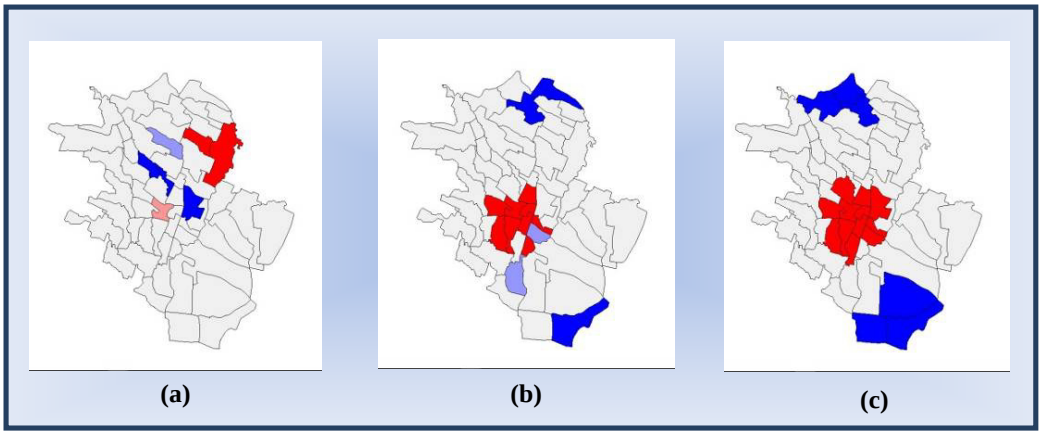

Fig 4. The results of Moran's I Analysis based on Three Methods in Elementary School Service Capacity Measurement based on: (a) Existing; (b) *Administrative Boundaries Catchment;*(c) *Cellular*/*Mash Catchment*

Source: Analysis Result. 2015

Based on Table 4, it can be seen that the highest value of elementary school service is third method (based on cell or mash catchment method. It indicates more normal data distribution compared the other two methods, so it can be described the real condition in the field.

4. Conclusions

Based on research has been done to determine the method which has accurancy to determine elementary school scale services in Malang City is use the third method by using cellular approach. The result is also able to describes the phenomena that happened in the community, which parents when choosing service education facilities can ignore the administrative boundaries of which means the elections influenced by availability of services education in its surrounding areas. Based on the results of Moran's I analysis, it can be said that with the grid/mash approach can be described interaction between areas depend on the access of elementary education facilities is high.

References

Minister of National Education RI (2007). *Minister of National Education RI Policy No. 24, 2007 about Facilities and Infrastructure of Elementary, Junior High Schools and Senior high School Standarts*. Republik Indonesia

National Indonesian Standart 03-1733-2004 about The procedures for planning a residential neighborhood in urban areas.

Puspitasari R & Siusanto I. (2011). *Spatial Analysis Cases of Dengue Fever in Sukoharjo Central Java Uses Moran Index*. Prosiding of Mathematic and Mathematic Education National ConferenceYogyakarta

Statistic Agency Center Malang City (2014). *Malang City in Figure*. Malang City Government

Tarigan, R. (2006), *Regioanal Development Planning*, Revition Edition, Bumi Aksara, Jakarta.