GIS Approach for Spatial Data Visualization of Food Service Operator in Jakarta, Indonesia

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Abstract – The purpose of this study is to help the company to improve customer satisfaction about Red Bean restaurant locations. To improve the customer satisfaction in this study used Geographic Information System based on Thiessen polygon, buffer zone, and distribution facility analysis. The conclusions of this research are the company needs to improve restaurant location using Geographic Information System method.

Keywords: Geographical Information System; spatial data; visualization; food service

Introduction

Nowadays the development of the food industry is growing rapidly, especially in restaurants. It makes the restaurant business should be able to analyze the exact location of the restaurant. There are so many new restaurants are seeing the opportunities in this business.

Years	Growth[a]	
	Percent (%)	Billion Rupiah
2011	5,91	174.237,10
2012	5,99	184.665,20
2013	6,16	196.048,70
2014	5,91	206.883,30

[a.] BPS (2015)

Table 1: Restaurant Business Growth based on Gross Domestic Product (GDP)

Based on the above table it can be seen that the restaurant business is more attractive to businesses. With a growing number of competitors, there is fierce competition, so that each restaurant is required to continue to improve its strategic location choice. Then, to analyze a strategic location in order to facilitate customers to access the location of the restaurant used methods of geographic information systems.

Geographic Information System or GIS can be viewed as various tools used to enter, manipulate, analyze, and output spatial data (Heywood, Cornelius, & Carver, 2011). Geographic Information Systems are used to capture, store, analyze, manage and present data and associated attributes which are spatially referenced to the Earth. Geographic Information System is useful for analyzing objects and events on earth and visualize them with real coordinates on the map (Martin, Kumaran, & Joseph, 2012).

To build a service coverage area of a restaurant in geographic information systems, can approach using Thiessen Polygon and Buffer Zone (Almansi, Shariff, & Abdullah, 2015). Each Thiessen polygon contains a discrete point in which each point has the shortest distance to the corresponding point. The point on the frontier has the same distance to the point on both sides (Wang et al., 2014). Area buffers are used to identify objects that are at a certain distance from the object that has an impact on the surrounding environment and determine what objects can be affected in a hypothetical (Skorbilowicz & Skorbilowicz, 2016).

Method

In the data collection, researchers collected data at 12 outlets restaurants Red Bean spread in Jakarta and Tangerang, among others in Central Park Mall, Mall Puri Indah, Pluit Village, Mangga Dua Square, Artha Gading, Poins Square Mall Alam Sutera, Flavor Bliss, Supermall Karawaci, City terrace, Bintaro Plaza, and AEON Mall. The amount of data that is collected as many as 230 customers. To improve customer satisfaction on the location of the restaurant Red Bean to obtain the location of the restaurant location distribution analysis of Red Bean restaurant is located then used the help of software ArcGIS for Desktop 10.2.1.

The data required for these applications include restaurants Red Bean coordinate data obtained from Google Earth. The data layer maps Jakarta and Banten as well as facilities such as banks, hospitals, bus stations, and universities obtained from OpenStreetMap. As well as the respondents' location data obtained using a questionnaire. Here is the distribution of the location of the restaurant Red Bean that has been mapped using ArcGIS software, as can be seen in Figure 1.
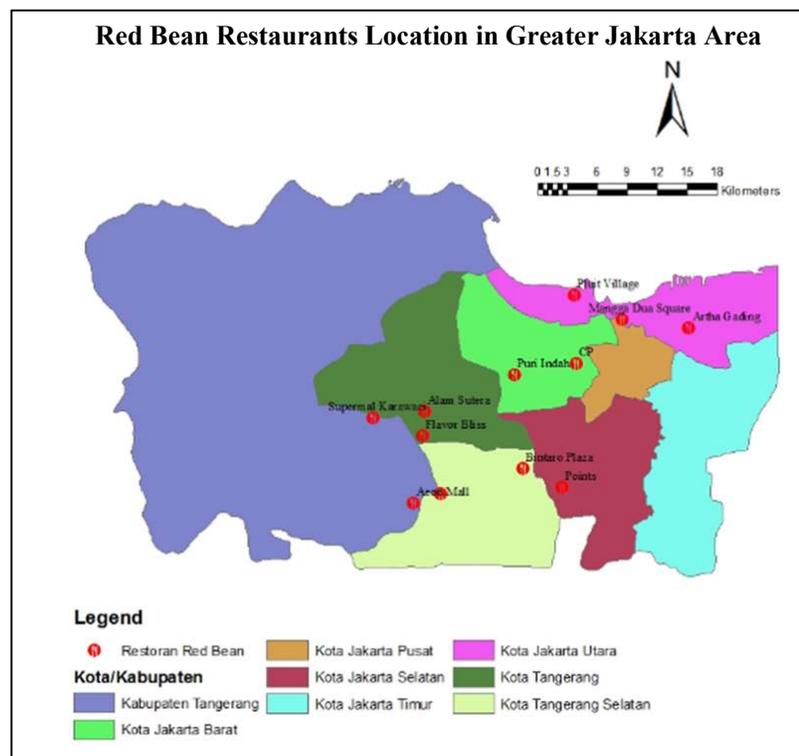

Figure 1: Red Bean Restaurants Location in Greater Jakarta Area

Results and Discussion

Thiessen Polygon Analysis

Thiessen Polygon or also known Voronoi Polygon is a technique used to divide the coverage area of each location of the restaurant into a zone of proximal (Divya and Tali, 2014). The zone showed the entire area locations are in the area close to the point location (Geocoded Restaurant) associated than other areas.
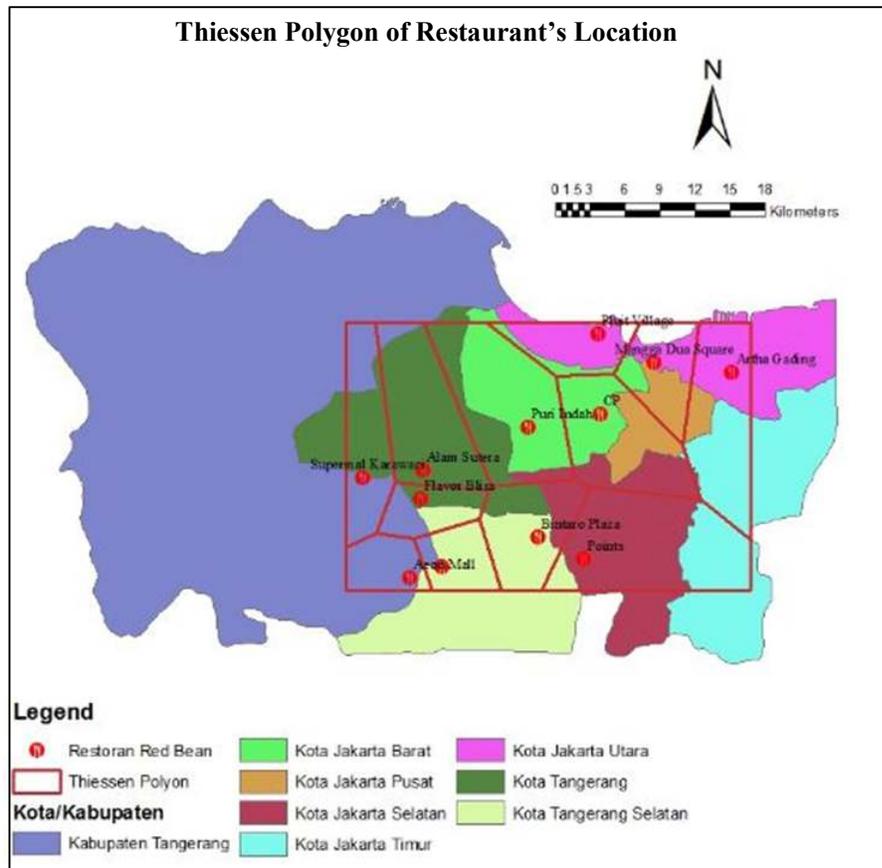

Figure 2: Thiessen Polygon of Restaurant's Location

Figure 2 shows that several restaurants have extensive coverage in large areas such as Puri Indah, Point Square, and Central Park. While others have a vast area of coverage is smaller. Thus, if the company's strategy sets the importance of customer growth, the chances of determining the location is in the area of East Jakarta and Central Jakarta.

OBJECTID *	Name	Shape_Length	Shape_Area	F_AREA
1	Flavor Bliss	0.219238	0.002602	31842516.748083
2	Poin Square	0.42394	0.009981	122142761.649713
3	Artha Gading	0.396473	0.006875	84147717.83338
4	Pluit Village	0.27662	0.003332	40784885.555372
5	Teras Kota	0.20712	0.002612	31966622.080402
6	AEON	0.198508	0.002435	29802481.24424
7	Supermall Karawaci	0.389511	0.005133	62823312.709369
8	Puri Indah	0.398955	0.009016	110354878.884125
9	Alam Sutera	0.375347	0.007065	86475001.053848
10	Bintaro Plaza	0.282256	0.005022	61462297.387348
11	Central Park	0.344109	0.006863	83992328.632035
12	Mangga Dua Square	0.264252	0.003834	46923247.102857

*Figure 3:* Area of Thiessen Polygon based on Spatial Calculation

Buffer Zone Analysis

The buffer is a technique used to provide information on the size of the coverage area with a more specific location (Eray, 2012). In this study is the coverage area of the restaurant Red Bean. This technique is used to determine the exact location of the restaurant is based on the zone stay of customers and facilities located around the restaurant like bus stations, hospitals, universities, and banks.

According to Figure 4 dan Figure 5, we can see the buffer of each restaurant Red Bean with a buffer size of 3 kilometers and 5 kilometers. The distribution of Red Bean restaurant less than the maximum because many restaurants Red Bean in Tangerang have a distance to each other. So that it causes a buffer area restaurants Red Bean coverage overlap one another. The impact is felt due to the buffer area restaurants Red Bean overlap is less than the maximum in attracting consumers as Red Bean has several restaurants within proximity and cause some areas that have the potential consumer not be covered.

Distribution Facility Analysis

The public facility is one of the factors in determining the location of the restaurant is located. The public facilities are located near the site of the restaurant Red Bean has a significant influence on consumer interest. As already mentioned above, about 37% have a destination for shopping in the location or the mall, 18% have a goal to watch at the cinema, and 31% have a goal to eat. While as many as 14% have other purposes which are for church services on-site, meeting with business associates, doing the coursework, foreign language courses, or hang out. This is scattered distributions of a public facility in Jakarta and Tangerang.
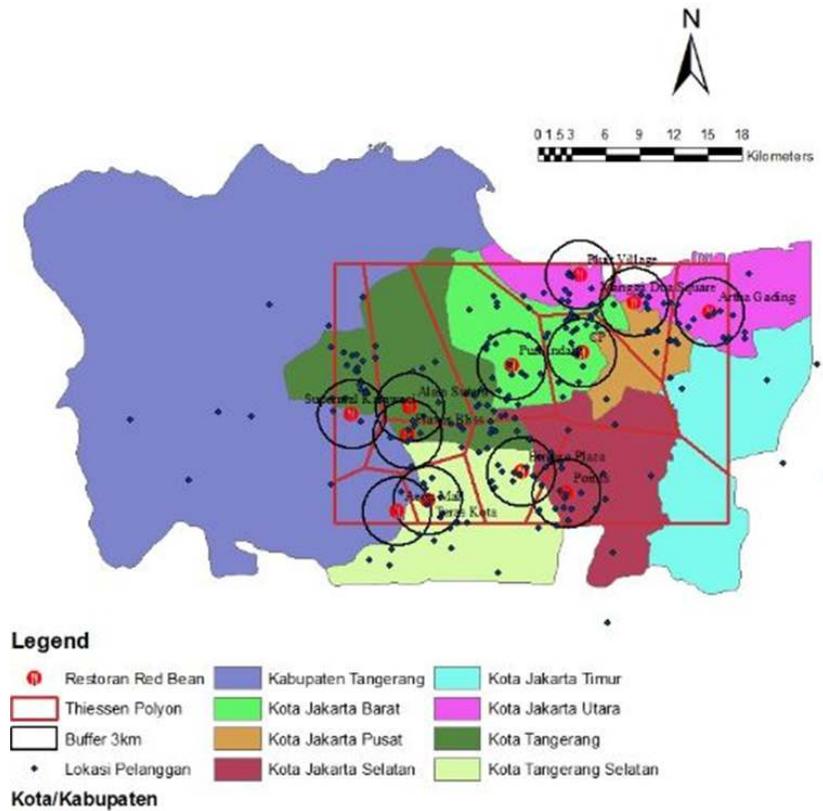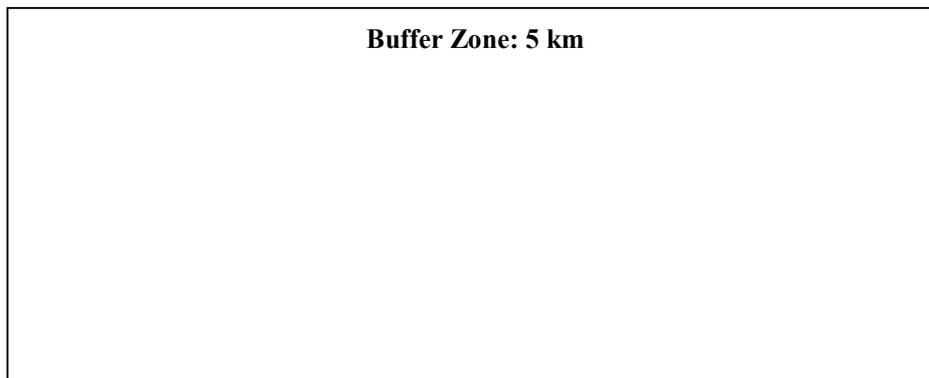
Buffer Zone: 3 km

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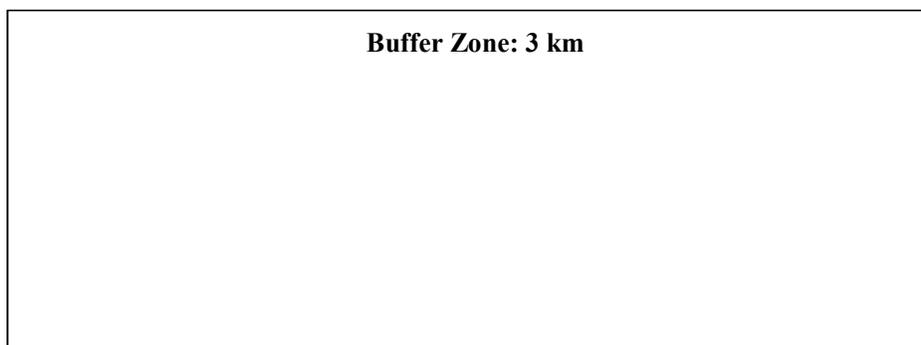
Figure 4: Buffer Area: 3 km

Based on the results of data processing by using ArcGIS, it can be seen the results of the distribution facility located in Jakarta and Tangerang. The results of the distribution of these facilities are some of the factors that influence customers to visit the restaurant. This is done to see if the restaurant Red Bean has been located at strategic locations, of which there are quite a lot of public facilities in the vicinity.

Can be seen in the picture above, several public facilities may affect the customer to visit the restaurants among which banks, bus stations, hospitals, and universities. In most distribution facilities is a visible bank in the area of Central and South Jakarta. However, the distribution of Red Bean too many outlets in Tangerang. In the public hospital facilities, it shows that the distribution of hospitals located in Central Jakarta, South, and East. However, we can see that the distribution of Red Bean outlets are not yet in East Jakarta, where there is a chance to get the customer is also quite a lot.

Then, if we see from the distribution of the bus station, East Jakarta area there are also quite a lot of bus station. In those areas are not served by the Red Bean. If seen from the distribution of universities in South Jakarta, this area already has Red Bean restaurant. While in East Jakarta and Central Jakarta have not yet Red Bean restaurant. Here is an influencing factor to be around the restaurant Red Bean.
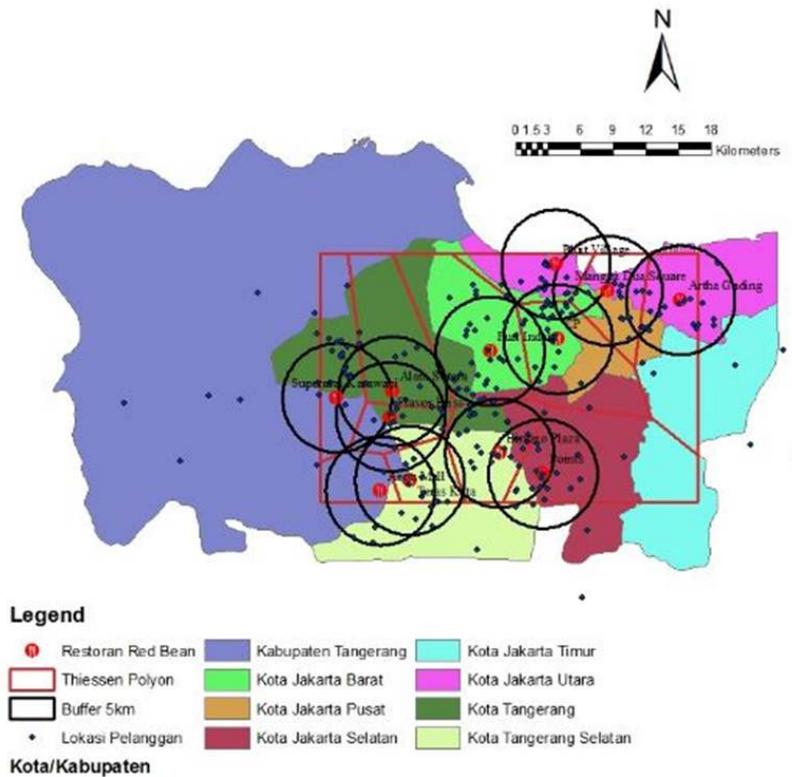
Buffer Zone: 5 km

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Figure 5: Buffer Area: 5 km

Based on the above figures and tables can be viewed Red Bean restaurant located in Tangerang has fewer facilities in scope compared to the buffer zone in the area of Jakarta. For the examples restaurant Red Bean Flavor Bliss, Alam Sutera Mall, Bintaro Plaza and City Terrace does not have university facilities, banks and bus stations are located close to the location of the restaurant. Facilities near the restaurant to be essential for a restaurant to lure consumers into customers came to the restaurant, apart from the quality of services and products offered. PT Red Bean Sukses Indonesia in order to be able to attract all the customers any potential optimally it is necessary to determine the location of the restaurant is located by observing the distance between the location of restaurants and public facilities in the surrounding areas such as universities, banks, hospitals, transportation support such as the bus station, and access to the motorway. From the results above picture can be seen that the restaurant Red Bean has not been able to reach consumers in Central Jakarta, East Jakarta, and consumers who are in South Jakarta optimally although in South Jakarta restaurant Red Bean has a restaurant located in Poins Square.
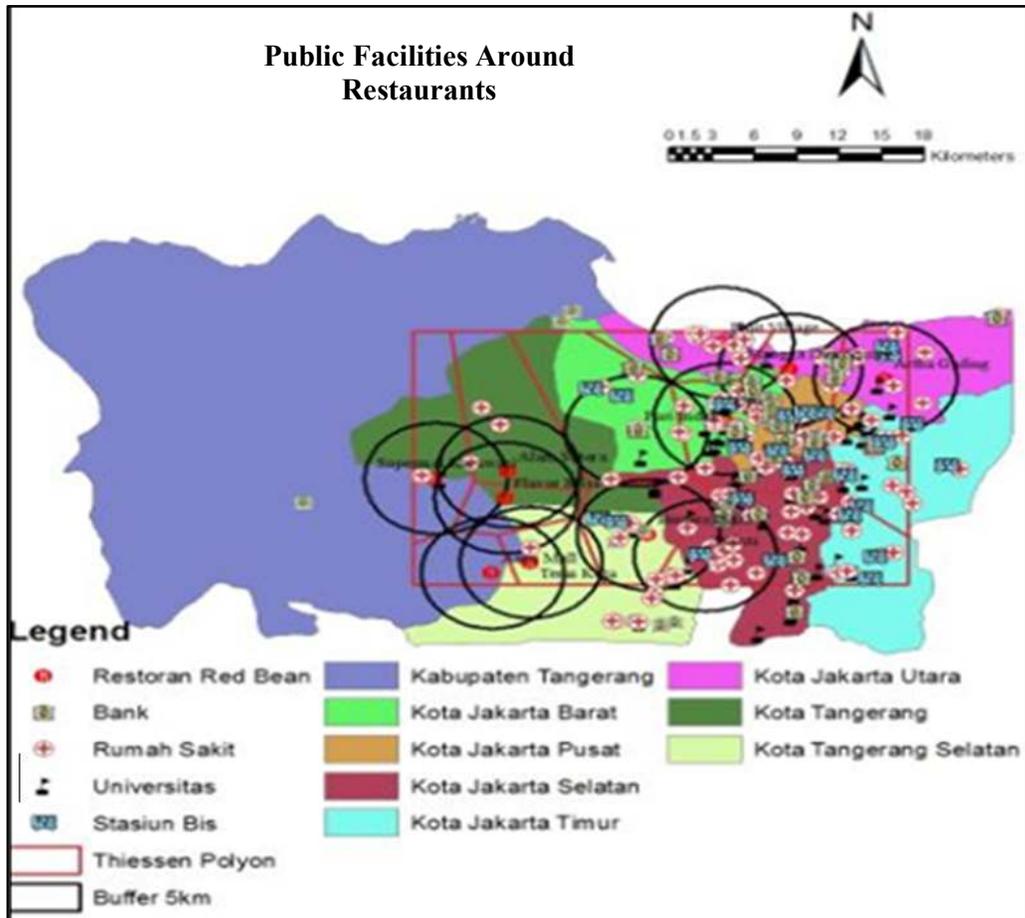
Figure 6: Public Facilities Around Restaurants

In the area of Central Jakarta, East Jakarta, and South Jakarta has some distribution facilities are numerous and comprehensive. Locations that potentially can be recommended as a location for a new restaurant Red Bean thus providing a considerable profit for the company. Also, to extend the reach of consumers, PT Sukses Indonesia Red Bean can implement a delivery system or the message across to consumers.

Conclusion

In the development of Red Bean restaurant location analysis, the company can make the right analysis and effective with the help of Geographic Information Systems software, so companies can reach more customers and get the maximum benefit. How to take advantage of geographic information systems to analyze the strategic location of the restaurant using ArcGIS software is to perform the analysis Thiessen Polygon, Buffer Zone, and distribution facilities of each outlet PT Sukses Indonesia Red Bean. It is also to see the distribution of public facilities spread across Jakarta and Tangerang area can be seen as a potential location of a new restaurant Red Bean.

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