

SPATIAL DISTRIBUTION OF RESTAURANT POPULARITY INDEX BASED ON CONSUMER REVIEW

*Dewi Susiloningtyas, Alexander Tio, Supriatna and Iqbal Putut Ash Shidiq

Faculty of Mathematics and Natural Sciences, University of Indonesia, Indonesia

*Corresponding Author, Received: 14 June 2019, Revised: 21 Nov. 2019, Accepted: 18 Feb. 2020

ABSTRACT: There has been a remarkable surge nowadays, especially in the usage of social media. People in urban areas are using social media to choose the restaurant they want to visit. This is becoming a new phenomenon that changes people's lifestyles and behavior in urban areas. That is including how people receive information from word of mouth (WoM) recommendation for a restaurant and becoming electronic-word of mouth information. Consumer review websites (CRW) are the e-word of mouth (e-WoM) information that uses people's information as the main database for restaurant recommendation. Zomato is one of the CRW that have around 4032 databases for DKI Jakarta province, and that includes the restaurant's popularity index. This study divides three levels of the restaurant's popularity into high, average, and low popularity. This study is using Nearest Neighbor Analysis (NNA) and Kernel Density Analysis (KDA) to describe the spatial distribution of restaurants based on the popularity index. This study is using distance from POIs, CBD, road class, and land-uses as control variables. The result shows that high, average, and low popularity restaurants are clustering with density of 59 restaurants/km², 29 restaurant/km², and four restaurant/km², respectively. Based on chi-square analysis, high popularity restaurants averagely had a closer distance to the POIs like shopping malls and hotels and the main road (or primary road). Low popularity restaurants more likely located far away from POIs, main roads, and CBD.

Keywords: Spatial distribution, Consumer review website, Popularity index, Restaurant, Spatial analysis

1. INTRODUCTION

The social media has transformed nowadays. It brought more users and had much impact on the surge of electronic word of mouth or e-WoM. The e-WoM has become valuable information during the modern era and changing someone's behavior especially when surfing on the internet [1]. The e-WoM from social media users are affecting people's decision when buying goods or things and when choosing services from the internet. As one of the social media platforms, the consumer review websites (CRW) are using people's opinions on a certain service or product [2]. CRW has been applied in many sectors, especially tourism and catering industries, where it very much relied on consumer's assessment. This platform gave easy access for consumers to connect each other and to give ratings or reviews for products or services based on their experience [3]. People in the city are using more and more consumer review website as their reliable source for choosing what restaurant they want to eat because people's behavior for service or product depends on another online review [4].

Zomato is one of consumer review websites that have restaurant database for Jakarta based on people's ratings and reviews. Zomato also has a foodie index or popularity index for each restaurant in their database. The rating system is process of

subjective scoring from the consumer based on food, service, price, location, and the environment of a certain restaurant [5]. This scoring becomes a popularity index for each restaurant, and based on this research that uses Zomato as main database, score for each restaurant is varying from 1 to 5. The popularity index can be visualized based on their rating and geographic information [6]. The objectives of this study are to map the spatial distribution of restaurant based on the popularity index; and to analyze factor that affecting the most on the spatial distribution.

2. METHODS

This study extracts data from Zomato website. The data extracted already has the location (X and Y) and the necessary attributes like popularity index, types of restaurant and types of food. The geographic information system (GIS) analysis are applied to map and to explain the spatial distribution of restaurant based on the popularity in Jakarta province. A cross-tabulation and statistical analysis are employed to explain which factor is affecting the most.

2.1 Study Area

Jakarta is the capital city of the Republic of Indonesia located on the northwest coast Java.

Jakarta has an area of 662 km² and total population of 10 million people as of 2014. Jakarta also the growth center for economic, cultural, and social in Indonesia. Jakarta divided by five administrative regions, which are West, Center, South, East, and North (Fig.1). Jakarta becoming growth center for food industry and tourism, and also Zomato has the most data for popularity index in Jakarta.



Fig.1 Location of Jakarta province

2.2 Popularity Index

Zomato has a foodie index that becomes popularity index in this research. Each restaurant has its rating and this rating from user will be calculated based on the Zomato algorithm and become popularity index. This popularity index then classified into three different groups based on their rating which is high popularity, average popularity, and low popularity (Table 1).

Table 1 Classification group for popularity index

Group Restaurant	Rating Restaurant	Total Restaurant
High Popularity	4.0 – 5.0	1494
Average Popularity	3.0 – 3.9	1970
Low Popularity	1.0 – 2.9	568

Source: Zomato and data collection, 2019

2.3 Urban Functional Units

Urban functional units are all unit that supports all the activity in the city [7]. This unit typically consists of grocery stores, hospitals, malls, banks, offices, schools, etc. Restaurants that close to urban functional units are more likely to have higher popularity, and restaurants that far from urban functional are more likely to have low popularity [6]. The urban functional units are collected from open street map (OSM) application.

2.3.1 Shopping malls

Shopping malls have an impact on the popularity index based on their distance with restaurants [6]. This research uses 90 point data of shopping malls from all around Jakarta province (Fig 2.). The point data collected from the open street map (OSM) application.

2.3.2 Hotels

Besides shopping malls, hotels also one of the urban functional units that have impact on popularity index [6]. This research gathered 150 point data of hotels all across the region of Jakarta province (Fig.2). The point data also collected from the open street map (OSM) application.

Shopping Malls and Hotels

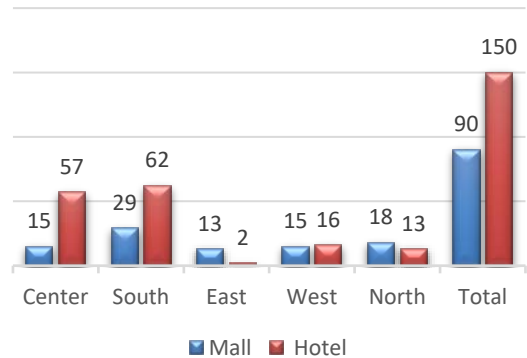


Fig.2 Distribution of shopping malls and hotels in Jakarta province

2.3.3 Central business district

Central business district or CBD is one of the focal points that have economic impact in city. This study uses six main roads, namely Thamrin, Rasuna Said, Mega Kuningan, Gatot Subroto, and Prof. Dr. Satrio to identify the CBD area.

2.4 Accessibility

Accessibility describes the distance between the restaurant and the road. This study uses two classes of road, namely arterial (primary) and collector (secondary) road. The road data gathered from open

street map (OSM) and tanahairindonesia.go.id/portal-web.

2.5 Land-use Data

Land-use data included describing relationship between the restaurant's popularity and the type of land-use where its located. Land-use types included in this research are business, settlement, religion, social-cultural, and other types. Land-use data gathered from tanahairindonesia.go.id/portal-web

2.6 Data Processing and Analysis

2.6.1 Spatial Distribution

Spatial distribution for each restaurant in Jakarta based on popularity index was analyzed using two methods, namely nearest neighbor analysis (NNA) and kernel density analysis (KDA). NNA can describe the type of distribution of each restaurant in Jakarta based on its popularity, whether it is clustering, random, or spreading all across the region of Jakarta province. Then by using KDA this study can confirm the result from NNA analysis and see how each class has a different density that affects each class's spatial distribution. These two methods will strengthen spatial distribution analysis in each class and see what region that has each classification restaurant based on their popularity index. NNA and KDA are applied using ArcGIS software.

2.6.2 Statistical analysis

Before using the statistical method, popularity group was divided into five groups. This is done to see how popularity group for high and low have significant interval rating number (Table 2).

Table 2 Rating interval for five groups of popularity index

Popularity Group	H-Test Popularity Group	Rating
High	Very High	4.5 – 5.0
	High	4.0 – 4.4
Average	Average	3.0 – 3.9
Low	Low	2.6 – 2.9
	Very Low	1.0 – 2.5

Source: Zomato and data processing, 2019

Statistical analysis used in this study is the Kruskal-Wallis test or H-test. The test is to measure distance for each restaurant to the three urban functional units (shopping malls, hotels, and CBD). The H-test is conducted for three groups; high, average, and low using SPSS program [8]. Euclidean distance from GIS proximity analysis is

employed to describe the distance between restaurant and primary or secondary road. Then a cross-tabulation method is used to describe the relationship between the restaurant's location, accessibility, and land-use.

3. RESULTS AND DISCUSSION

3.1 Restaurant's distribution

Distribution for 4032 restaurants in Jakarta based on Zomato is seen in Fig.3 and 4. Most restaurant was located on the south, north, and central Jakarta. The east district of Jakarta province has the least number of restaurants.

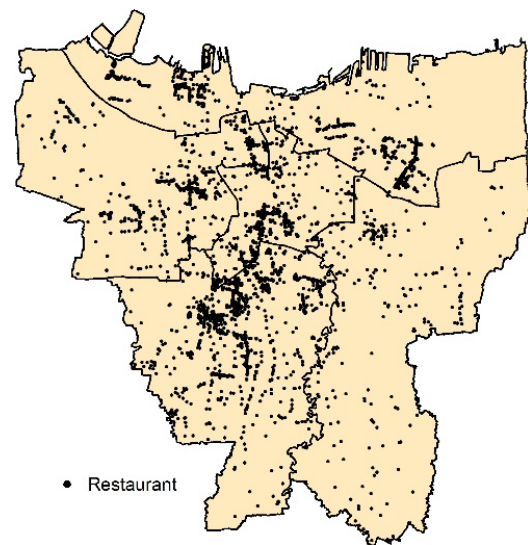


Fig.3 Location of 4032 restaurants in Jakarta

Restaurant's Distribution in Jakarta

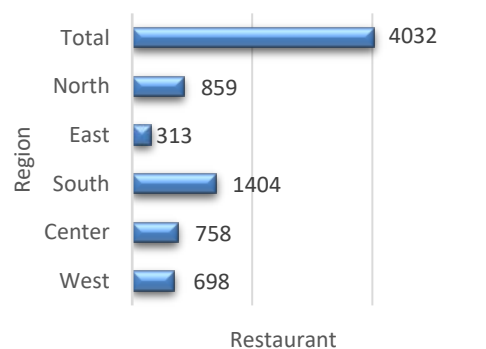


Fig.4 Distribution for 4032 restaurants in Jakarta

3.2 Popularity distribution

Fig.5 shows restaurant's distribution based on popularity index. Most of the high popularity restaurant located in central part of Jakarta, particularly on the south and central districts. The

east district of Jakarta province has the least number of high popularity restaurants.

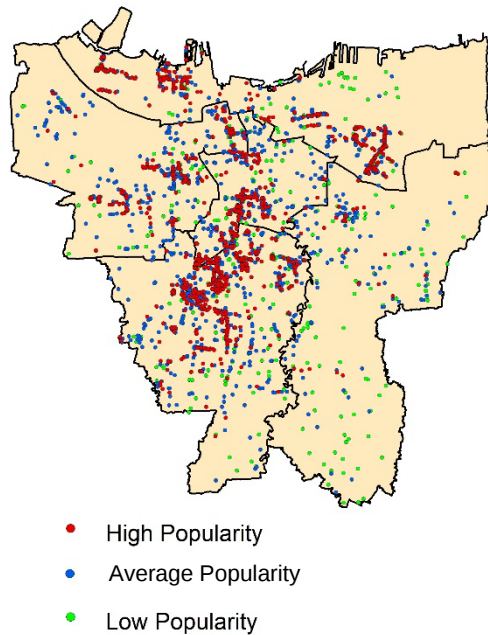


Fig.5 Popularity group of restaurants in Jakarta

3.2.1 High popularity restaurants

High popularity restaurants are dominantly located in the center and south districts of Jakarta. NNA classifies this pattern as cluster (Fig.6). Based on KDA, it is known that high popularity restaurants have high density with up to 59 restaurants per km² (Fig.7). Based on this analysis most of high popularity restaurants were located in the central and south districts with a few in the north and west districts of Jakarta province.

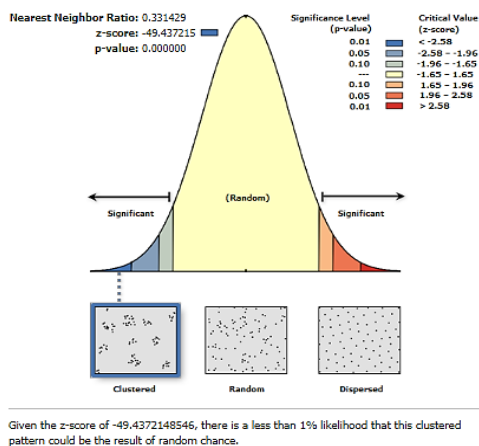


Fig.6 NNA result for high popularity restaurants in Jakarta

3.2.2 Average popularity restaurants

Average popularity restaurants were mostly located

in the center, south, north, west districts, and very few in the east district of Jakarta province. Based on NNA result (Fig.8) it is shown that like the high popularity restaurants, the average popularity restaurants also have cluster patterns. This means that average popularity restaurants were clustered in Jakarta. The KDA confirms the cluster pattern and explains the density of each cluster in a different area. In the north, the densest cluster is up to 19 restaurants per km². Meanwhile the south, center, and west districts are sharing the same density with the densest cluster is up to 28 restaurants per km². The east district is the region with the least density, where the densest cluster is up to 14 restaurants per km² (Fig.9).

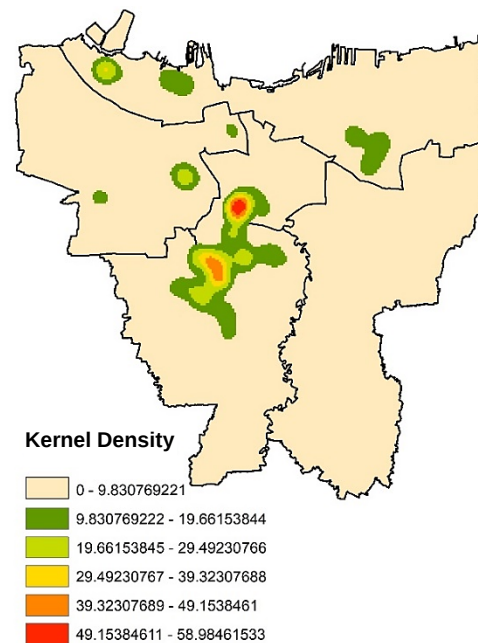


Fig.7 KDA result for high popularity restaurants in Jakarta

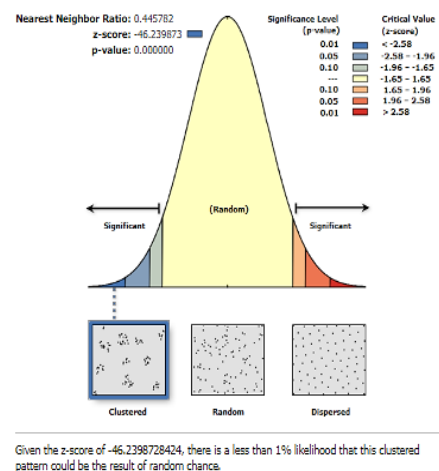


Fig.8 NNA result for average popularity restaurants in Jakarta

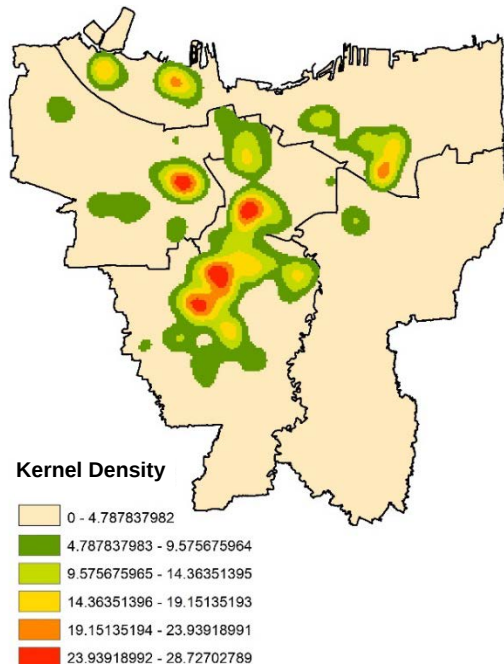


Fig.9 KDA result for average popularity restaurants in Jakarta

3.2.2 Low popularity restaurants

Low popularity restaurants were spread across all of the regions in Jakarta province. Based on NNA result, it is shown that low popularity restaurants are clustering in Jakarta (Fig.10). Although the NNA shows a clustered type of pattern, the KDA shows very low density, with densest cluster has up to four restaurants per km² (Fig.11).

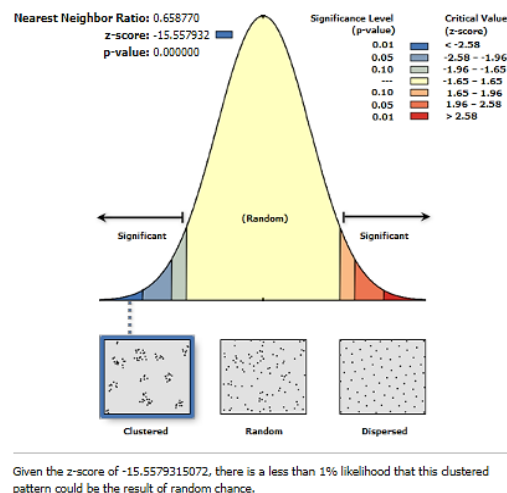


Fig.10 NNA result for low popularity restaurants in Jakarta

3.3 Factors Affecting Popularity Index

The factors that affect the popularity index are the distance between restaurant's location and urban

functional unit, accessibility, and land use. The urban functional unit includes shopping malls, hotels, and CBD. The H-test or the Kruskal-Wallis test is applied to know whether distances are related to the level of popularity. From the significance value, it is concluded that distance for each restaurant to the three urban functional units was not the same or there is connection/relation between the restaurant's popularity with their distance to urban functional unit (Table 3).

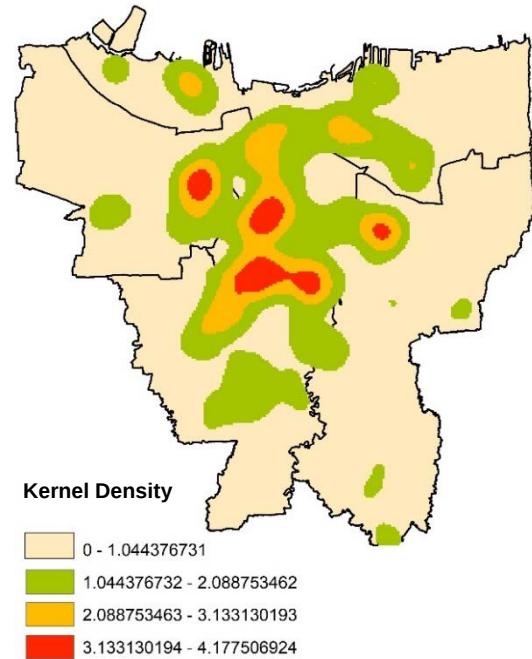


Fig.11 KDA result for low popularity restaurants in Jakarta

Table 3 H-Test or Kruskal-Wallis test between restaurant's popularity index with urban functional units

Null hypothesis	Test	Sig.	Decision
The distribution of the Shopping Mall is the same across categories of Popularity	Kruskal-Wallis test	.000	Reject the null hypothesis
The distribution of the Hotel is the same across categories of Popularity	Kruskal-Wallis test	.000	Reject the null hypothesis
The distribution of the CBD is the same across categories of Popularity	Kruskal-Wallis test	.000	Reject the null hypothesis

Source: Data processing, 2019

The connections between these variables are known. The restaurants that are closer to the urban functional will have higher popularity. If its location is far from the urban functional unit, the restaurants are likely to have lower popularity (Fig.12). The distance only significant in the very high, high, and average groups, while the distance is not significant in the low and very low groups.

Kruskal-Wallis Test

Ranks			
	Popularitas	N	Mean Rank
Mall	Very High	212	1637.96
	High	1282	1794.43
	Average	1970	2123.73
	Low	514	2295.09
	Very Low	54	2211.19
	Total	4032	
Hotel	Very High	212	1377.39
	High	1282	1752.63
	Average	1970	2115.33
	Low	514	2507.58
	Very Low	54	2510.23
	Total	4032	
CBDline	Very High	212	1533.45
	High	1282	1854.42
	Average	1970	2083.55
	Low	514	2333.29
	Very Low	54	2299.49
	Total	4032	

Fig.12 H-Test ranks based on distance (in meter)

Accessibility for each restaurant can have an impact on how popular a certain restaurant is. This study used distance between restaurant's location and primary-secondary roads. This study examined whether the distance is affecting the restaurant's popularity (Table 4). The result shows that high popularity restaurants are mostly closer to the primary road and low popularity restaurants are closer to the secondary road.

Table 4 Accessibility for each popularity group

Popularity	Primary (Arterial)	Secondary (Collector)	Mean Distance to Arterial (meter)	Mean Distance to Collector (meter)
High	909	585	178.82	471.71
Average	982	988	505.08	413.87
Low	283	285	583.95	413.67

Source: Data processing, 2019

Table 5 shows that most of the restaurants are located in business area. From the table it is shown that high, average, and low popularity might have the same pattern. It is firstly assumed that high popularity restaurant will mostly located in business area, whereas the table shows that popularity is not having a direct relation with land-use type.

Table 5 Cross-tabulation between land-use type and restaurant's popularity index

Popularity	Business	Settlement	Religion	Social Cultural	Other
High	1237	209	5	21	22
Average	1456	349	5	41	51
Low	394	140	2	11	21

Source: Data processing, 2019

4. CONCLUSION

This study concludes that high, average, low popularity restaurants are clustering in Jakarta. The densest cluster in high, average, and low popularity groups has up to 59 restaurants/km², 28 restaurants/km², and four restaurants/km², respectively. The high popularity restaurants are mostly located in the south, center, and west districts of Jakarta province. It is known that urban functional units and accessibility are the factors that influencing restaurant's popularity. The closer the distances to these factors the higher popularity the restaurant will have.

5. ACKNOWLEDGEMENTS

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