

Spatial characteristic of urban campus in Indonesia

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Abstract. Location becomes one of the principal factors in developing higher education facilities. There is a primary difference between the location characteristic of the university campus and urban campus. The university campus usually locates in the suburbs with public facilities integrated into the campus. Meanwhile, urban campus is in the city or urban area where the public life of the academic community will dispense in public facilities scattered around the campus. Understanding the spatial characteristics of existing urban campuses are expected to provide insight about essential points to consider in determining the appropriate location. This study aims to explore the spatial characteristics of an urban campus in Indonesia with other public facilities. The result of this study is information about the neighborhood relationship between urban campus with other public facilities. The Geographic Information System Approach is implemented to store, manage, and visualize spatial data collected, using QGIS Desktop software. PostgreSQL and PostGIS are used for spatial data analysis to get neighborhoods characteristic around the campus.

Keywords: Spatial analysis, GIS, urban campus, POI

1. Background

The Ministry of Research, Technology and Higher Education of Indonesia continues to pursue valid information for the public, as well as disseminating information related to the list and performance of universities [1]. The community could consider the choice of universities through this condition. Apart from university performance, another important criterion in choosing a university is the location of the campus. The University competes strictly for students and strives to become a university that is not on the 70% list of colleges with under 500 students [2]. Carlson explains in his essays, “For making the most of college, it’s still location, location, location.” He emphasizes the importance factor of location in education, despite online class and MOOC (Massive Open Online Course) already widely provided [3].

Campuses that locate in an urban area should have an understanding of the importance of access to local parks, green spaces, and supplementary activities in adjacent urban areas [4]. The multi-functional building as a campus became a trend in urban society especially in the limited land region [5]. The location of these type of university buildings is separated into different areas/cities and integrated with urban public life [6]. In contrast to the university campus which should be concerned with the design of public life on campus [6–8], then the public life of the academic community will be dispensed in public facilities scattered around the campus. Accordingly, the mobility and activity of the academic community will also affect the mobility of urban communities and the distribution of public facilities. Various studies have been conducted related to this situation. For example, there is a study that examines the effect of spatial location, socioeconomics, and social behavior on travel demand by car in the context of urban university campuses [9].



This study aims to explore the spatial characteristics of an urban campus in Indonesia with other public facilities. The result of this study is information about the neighborhood relationship between urban campus with other public facilities. Understanding the spatial characteristics of existing urban campuses are expected to provide insight about essential points to consider in determining the appropriate location. This paper is organized as follows. Section 2 describes the methodology of research, covering the various data used and the various methods applied. Section 3 represents the study results and discusses the issue. Section 4 concludes the study.

2. Research Methods

The object of this study is an urban campus of higher education. Bina Nusantara University was chosen as the initial study discussed in this paper. Bina Nusantara University is a private university established since 1996 in Jakarta. Currently, Bina Nusantara University has 40 courses spread across several cities in Indonesia. Bina Nusantara University as one of 3,225 universities in Indonesia, has 28,511 students, with a proportion of 0.5% of total students in Indonesia. Figure 1 and Figure 2 show the location of Bina Nusantara University.

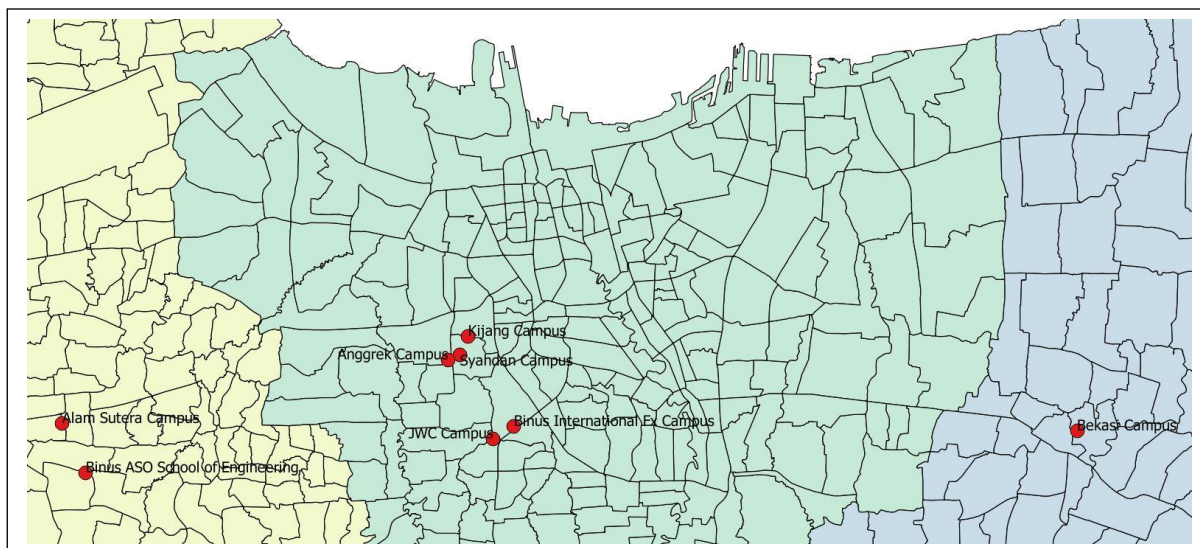


Figure 1. Location of Bina Nusantara University in Greater Jakarta Area

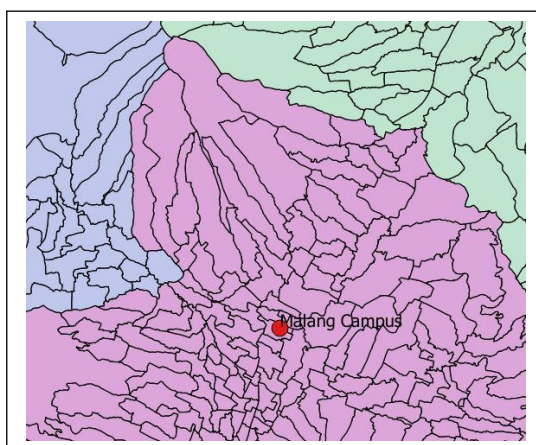


Figure 2. Location of Bina Nusantara University in Malang (East Java)

The spatial data consist of area boundaries, network, and POI (Point-of-Interest) locations are obtained from the "Geospasial untuk Negeri" portal (<http://tanahair.indonesia.go.id/portal-web>) and OpenStreetMap Indonesia (<https://openstreetmap.id/en/data-openstreetmap-indonesia/>). There are 60,663 location data in Indonesia obtained from OpenStreetMap covering various categories of public facilities. QGIS Desktop 2.18.14 software is using for spatial data collecting and visualizing, which is an open source under GNU General Public License (<https://qgis.org/id/site/about/index.html>). PostgreSQL and PostGIS as spatial database systems are used for spatial data analysis to get characteristic of neighborhoods around the campus, by finding POIs within a specific buffer [10]. ST_Distance which is a query function (SQL) is used to search the spatial element at a certain distance. In this study, the specified distance is 500 meters to 5 km.

3. Findings and Discussion

Bina Nusantara University has ten campuses spread across several cities in three provinces as can be seen in Table 1. Five campuses in DKI Jakarta (3 campuses in West Jakarta city and two campuses in Central Jakarta city). Two campuses in Banten (in Tangerang city and South Tangerang city). Two campuses in West Java (in Bekasi city and Bandung city) and one campus in East Java (in Malang city). Based on population data from United Nations [11], Jakarta appertains to megacity category for a population more than 10 million with Tangerang, South Tangerang, and Bekasi as the urban area around Jakarta with a population less than 500 thousand. Meanwhile, the city of Bandung is classified as Medium-sized cities with a population of between 1 to 5 million; and Malang is categorized as cities with a population of between 500 thousand and 1 million.

Table 1. Bina Nusantara University Campus Location

Campus Name		City	Province
Anggrek Campus	(Bnka)	West Jakarta	DKI Jakarta
Syاهدان Campus	(Bnks)	West Jakarta	DKI Jakarta
Kijang Campus	(Bnkk)	West Jakarta	DKI Jakarta
Binus International Fx Campus	(Bnfx)	Central Jakarta	DKI Jakarta
JWC Campus	(Bnjw)	Central Jakarta	DKI Jakarta
Alam Sutera Campus	(Bnsa)	Tangerang	Banten
Binus ASO School of Engineering	(Bnas)	South Tangerang	Banten
Bekasi Campus	(Bnbk)	Bekasi	West Java
Bandung Campus	(Bnbd)	Bandung	West Java
Malang Campus	(Bnml)	Malang	East Java

Spatial data of POIs obtained from OpenStreetMap consists of 111 feature classes. Information regarding POIs located around the campus of Bina Nusantara University was obtained by applying the St_Distance query function of PostgreSQL and PostGIS spatial database system. The amount of POIs located around each campus of Bina Nusantara University for each distance criterion can be seen in Figure 3. In general, there are two groups of patterns that illustrate the number of POIs that escalate when the distance to the campus location is also increased. Patterns from eight campuses in the Greater Jakarta area continue to increase for any additional distance, although the slope begins not to tilted on a 2 km buffer. Meanwhile, for campuses in Bandung and Malang, the increasing number of POIs only occurs from the buffer distance of 100 meters to 1 km. Afterward, the increase tends to be insignificant.

A large number of POIs around the campus location indicates that the location of the campus is at the center of public life. To ensure this presumption, we estimate the kernel density based on POIs distribution using the heatmap feature of QGIS. Figure 4 shows the kernel density estimation of POIs in Indonesia.

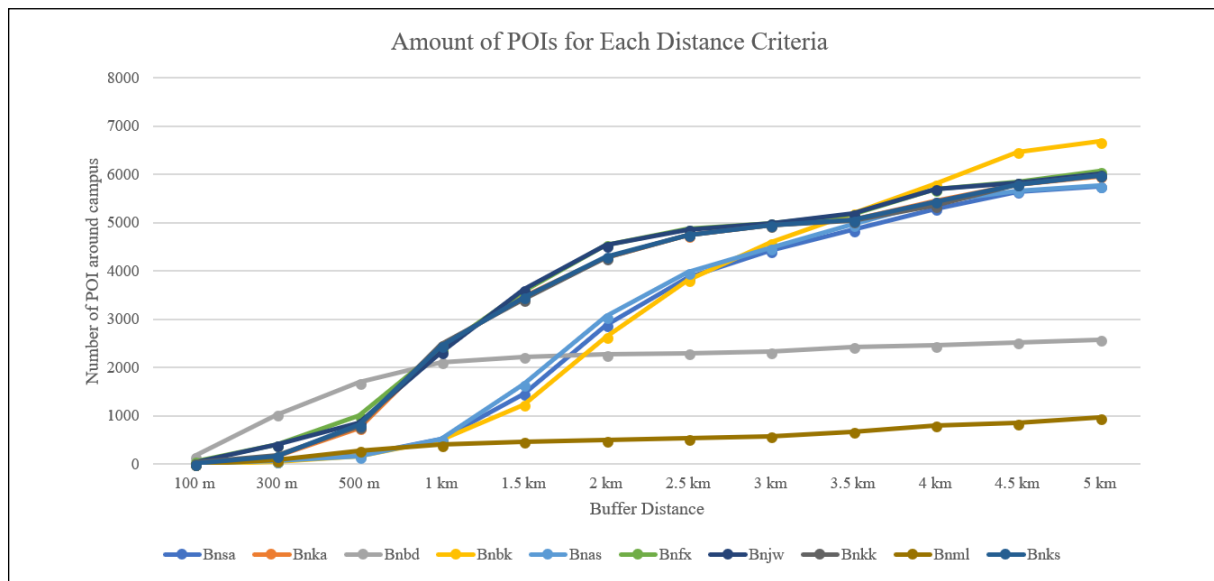


Figure 3. Amount of POIs for Each Distance Criteria

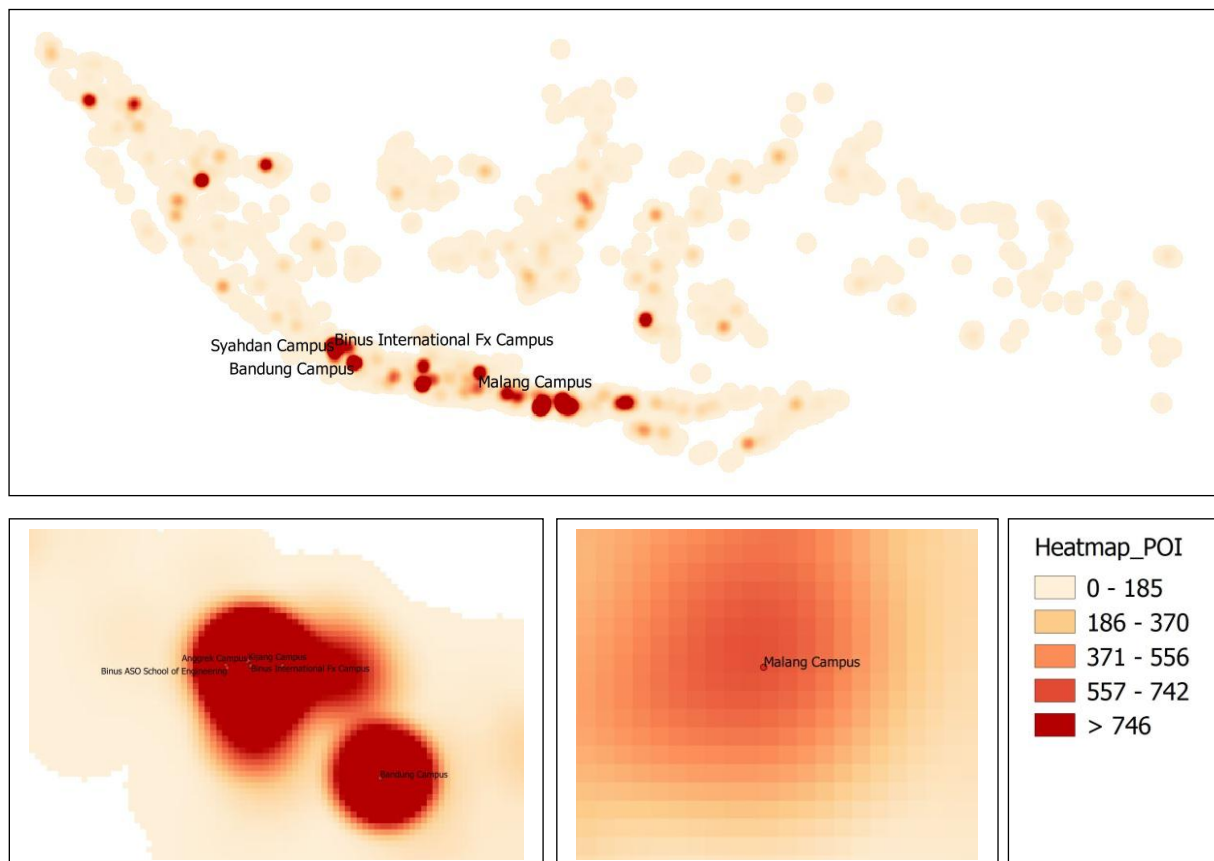


Figure 4. Kernel Density Estimation of POIs in Indonesia

Table 2. Bina Nusantara University Campus Location

Feature Class	Number of POIs in 1 km neighborhood of 10 campus	Percentage to Total POIs
bank	3048	18.9%
restaurant	1780	11.0%
kindergarten	1422	8.8%
fuel	1247	7.7%
hotel	986	6.1%
convenience_store	783	4.9%
cafe	721	4.5%
supermarket	522	3.2%
fast_food	419	2.6%
atm	398	2.5%
school	383	2.4%
bakery	330	2.0%
mall	328	2.0%
mosque	270	1.7%
railway_station	264	1.6%

KDE from POIs in Indonesia shows that the campus location of Bina Nusantara University is at a location with a large number of public facilities. The presence of public facilities in large numbers indicates the existence of consumers or in other words the occurrence of public life. There are 104 public facilities on the perimeter 1 km from Bina Nusantara University campuses. 14% or 15 types of public facilities cover 80% of the total number of public facilities located around the campuses. This phenomenon indicates conformity with the Pareto Principle or 80-20 rule that 80% of public facilities are categorized for less than 20% types of POIs. These public facilities can be seen in Table 2.

4. Conclusion

This study provides information on the neighborhood relationship between urban campus with other public facilities. There are 15 types of public facilities that are found around the urban campus. This study becomes feasible to perform alongside with the development of spatial database systems and geographic information systems that can manage, analyze and visualize large amounts of spatial data.

This study of spatial characteristics needs further research to provide arguments for conformity with public behavior based on empirical studies of the academic community. Suitability with the spatial planning of urban areas also needs to be assessed. Including the academic community needs of green areas.

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