Analysis of campus locations concerning the nearby point-of-interests and public facilities

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Abstract. University is a place where knowledge is disseminated. The objective of this study is to see the close relationship between campus locations and public facilities in the vicinity. QGIS Desktop software is used to manage, process, and visualize spatial data. PostgreSQL and PostGIS are used for the process of querying data based on specified proximity criteria. The analysis shows that several public facilities are generally found close to a campus location. Fifteen identified class features in one-kilometer proximity, which grouped as transportation facilities, food service facilities, financial facilities, shopping facilities, other educational facilities, accommodation facilities, offices, and worship facilities. As well as indications of spatial interaction between campus locations. All campus locations are in areas with residential land use status. Raster Kernel Density Estimation (KDE) shows campus locations clustered in two main locations, namely the Jakarta Greater Area and in the Greater Bandung Area.

Keywords: Spatial analysis, university, campus location, public facilities

1. Background
University is a place where knowledge is disseminated. Since this is a place, location is very important. Studies using Geographical Information System (GIS) to study university campus locations related to its nearby point-of-interest (POI) are still rare. GIS studies on universities/schools locations mostly focus on finding suitable locations for new schools [1, 2], land use & land cover (LULC) Changes of universities [3], hazard on education areas [4], spatial variance on academic achievement or school performance [5-7], spatial analysis on how universities contribute to regional economy [8], spatial distribution characteristics of education institutions [9-13], spatial analysis of adult lifelong learning [14], developing campus navigation [15], geo-design for universities [16].

Point-of-interest (POI) is very important because it will help universities attract students to study at their campus sites. POIs can support students in their daily life around campus, especially for out-of-town students that live within close vicinity of the campus. There is a tendency for universities to design their campus in order to support academic activities and community life of the academic community [17-19]. Whether a campus design with complete public facilities will increase the satisfaction of the academic community so that it supports universities in achieving better rankings still requires further research.

The objective of this study is to see the close relationship between campus locations and public facilities in the vicinity, the land use planning status, and distance to natural disaster-prone areas.
campus that was the object of this research was limited to universities that have an excellent rank based on the 2018 Indonesian Ministry of Higher Education list, Webometrics list in 2019, and QS Asia List in 2019, with regional boundaries covering the provinces of Jakarta, Banten, and West Java. This paper is organized as follows. Section 2 describes the research methods, describing the various data and methods applied. Section 3 discussed the research results. Section 4 concludes the study.

2. Research Methods
This study used the top 100 Indonesian universities ranking list based on the Indonesian Ministry of Higher Education list, Webometrics list, and QS Asia List as the sample of this research. This study used only universities located in 3 provinces: DKI Jakarta, West Java, and Banten. There are 38 Universities out of the top 100 Indonesian Universities in these three provinces. Most of the 38 universities have more than one campus. The total number of campus sites for the 38 universities is 66 campus sites. This study analyzed the number and variations of POI and discussed whether it affects the university performance based on the ranking lists. Figure 1 shows the analytical procedures conducted in this study.

3. Findings and Discussion
This study covers three provinces, namely Banten, Jakarta, and West Java. The growth of cities in Jakarta that spread to Tangerang (as part of Banten Province) and Bogor, Depok, Bekasi (as part of West Java Province) led to the term Greater Jakarta Area (or Jabodetabek, means Jakarta-Bogor-Depok-Tangerang-Bekasi).

Figure 2 shows the distribution of campus locations as the objects of this study. Figure 2 (a) shows the tendency for campus locations to clustered. Furthermore, this study used the Nearest Neighbor Analysis feature in QGIS to prove that campus locations are clustered. The nearest neighbor index of
the campus dataset is 0.3231, smaller than 1, with a Z-Score of -10.5208, which smaller than zero. The index value and the negative Z-score prove the tendency to cluster from the campus dataset.

There are two main groups of campus locations, according to the graphical analysis approach, namely in the Greater Jakarta Area, as can be seen in Figure 2 (b) and Bandung Greater Area, as can be seen in Figure 2 (c). The density raster shows that in these two areas, the number of campuses averages around 3 to 7.

Figure 2. Coverage Study

PostGIS is used to export data from the shapefile format in GIS, to a format that can be processed in PostgreSQL. The ST_Distance function maps each campus (a total of 66 points) that meet at a certain distance with each point-of-interest (a total of 19,784 points). In one km buffer, there are 6,991 transaction data, which show that at that distance, a campus is close to a maximum distance of 1 km from one of the public facilities in the dataset. With the same explanation, there are 88,560 transaction data at a maximum distance of 5 km, and 195,423 transaction data at a maximum distance of 10 km.

There are 97 feature classes from the point-of-interest layer identified at a distance of 1 km, 111 feature classes at a distance of 5 km, and 121 feature classes at a distance of 10 km. This study determined that a minimum of 50% of the number of campuses being research objects were close to a feature class at a certain distance, to make the analysis easier to understand. According to this determination, there are 15 class features that often close to the campus at a maximum distance of 1 km, 73 class features at a maximum distance of 5 km, and 97 class features at a maximum distance of 10 km. Figure 3 shows these feature classes as well as the average number of POIs on each campus at each distance. Fifteen identified class features, if grouped by function are divided into transportation facilities (bus stops, fuel), food service facilities (restaurants, fast food, cafes, bakeries), financial facilities (banks, atm), shopping facilities (convenience, supermarkets), educational facilities (schools, kindergartens), accommodation facilities (hotels), offices (commercial towers), worship facilities (mosques).

The results of the analysis provide an overview of the spatial characteristics of the universities that are the objects of this study. It can be concluded that, in general, reputable universities within the scope of research have a relatively similar distribution of public facilities. In other words, they tend to have similar academic activities and community life of the academic community around the campus. These findings affect the university in general and society around the campus location. Universities, both those that are included in the list of the best universities and other universities, both university campus and urban campus, can use this knowledge in conducting suitability analysis of campus locations.
society, including investors, can use this knowledge to assess what public services have good growth potential in locations around campus.

![Average Number of Point-of-Interest in 1 km, 5 km, and 10 km Distance from Campus](image)

**Figure 3.** Average Number of point-of-interest in 1 km, 5km, and 10 km Distance from Campus

Campus locations based on land use planning status included in the residential category. As can be seen in Figure 4 and Figure 5, campus locations are generally close to the status of land use plans as government offices, industrial sites, and nature reserve areas. However, several campus points are also close to areas prone to natural disasters, which are between 60% -70% at a distance between 4 km - 10 km.

These findings show the importance of the university to adequately prepare for disaster mitigation to protect the academic community and the sustainability of campus life.

![Greater Jakarta Area Land Use](image)

**Figure 4.** Greater Jakarta Area Land Use
4. Conclusion

This study shows that 15 class features of point-of-interest are within a maximum distance of 1 km, 73 class features at a maximum distance of 5 km, and 97 class features at a maximum distance of 10 km. Transportation facilities (bus stops, fuel), food service facilities (restaurants, fast food, cafes, bakeries), financial facilities (banks, ATM), shopping facilities (convenience, supermarkets), educational facilities (schools, kindergartens), accommodation facilities (hotels), offices (commercial towers), worship facilities (mosques) are the POIs within 1 km distance. This finding indicated that the campus locations of universities that were rated as good based on the Indonesian Ministry of Higher Education list, Webometrics list, and QS Asia List in provinces of Jakarta, Banten, and West Java are in short distance (1 km) with important POIs and public facilities that are necessary for supporting daily lives of students. In terms of land use planning status, it is found that most campus locations in Greater Jakarta and Greater Bandung Area are in the residential category. Several campus points are also close to areas prone to natural disasters, which are between 60% - 70% at a distance between 4 km - 10 km. This finding is expected to be a stimulus for university organizations to prepare for emergency preparedness and adequately prepare for disaster mitigation to protect the academic community and the sustainability of campus life.

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