

# Population characteristics and distribution patterns of slum areas in Palembang City: *Getis ord gi\** analysis

Sukmaniar<sup>1</sup>, Andri Kurniawan<sup>2\*</sup>, and Agus Joko Pitoyo<sup>3</sup>

<sup>1</sup>Doctoral Program in Population Study, Postgraduate School, Universitas Gadjah Mada, Indonesia

<sup>2</sup>Population Study Program, Postgraduate School, Universitas Gadjah Mada, Indonesia

<sup>3</sup>Center for Population and Policy Studies, Universitas Gadjah Mada, Indonesia

**Abstract.** The paper aims to describe the population characteristics and the distribution patterns of slums in Palembang City. The research employs a quantitative method with 382 respondents. The data are analyzed using cross-tabulation of IBM SPSS 23 to know the population characteristics. Meanwhile, the distribution patterns of slums are analyzed by observing the sample distribution through the proportional random sampling technique. It is carried out by calculating the number of buildings of each area and noting the coordinates of each sample using GPS essentials application. The data are recorded and inserted into the sample spots on the map, which were then analyzed using the High-Low Clustering Report of Getis Ord General  $G_i^*$ , to see the distribution pattern, especially the cold spot and hot spot, through ArcMap 103 program. The research found that non-migrant married Moslems dominate the population of Palembang city, with the average occupation is labor or manual worker. The slum distribution forms a low cluster pattern, meaning that it has a low value. The value is due to the government's effort to manage the city and the development of the market sector, limiting the slum distribution. Getis Ord  $G_i^*$  analysis revealed that the slum area in the city center and within a dense population is a cold spot (low cluster), while those far from the city center yet are still crowded are hot spots (high cluster).

## 1 Introduction

Slums have become one of the problems due to the increase in population and expansion of urban areas. The advance of economy and technology in the Disruptive Innovation Era does not prevent slums from appearing. The harsh life in the city has urged the people who are unable to compete to move to the city-sides with unclean surroundings, affordable dwelling, and others. Illegal settlements and slums result from the unavailability of the government program for affordable and proper housing in the low economy-level society [1]. Slums appear because of geographical factors; the locations are in the lowlands along the riverbanks, lessening the quality of the environment [2]. The emergence of urban areas is correlated with the formation of new areas caused by the high rate of migration. It is important to note that the population growth in urban areas is influenced by the rate of fertility, mortality, and migration. The high rate of migration cannot be measured due to less accurate data. The increasing number of migration amplifies the number of slums / illegal.

One of the cities having the issue related to slums is Palembang. Most of the areas in the city are located in

the lowland. The Musi River crossing the city center has increased the number of the population and slums. The condition gets worse since the people cannot manage household waste and appropriate sanitation [3]. The slums on the Musi banks also result from society's lack of awareness of the drainage system. Further, the government has not provided the necessary infrastructures [4, 5]. The people, end up living in slums, have thought of living in the urban areas to live the life or fight for the commercial space with all of the aspects based on their capacity [6].

Slums of each area have different characteristics, depending on the geographical and demographic conditions. The spatial distribution patterns can identify the characteristics. The identification can be one of the government's considerations to develop policies to reduce the number of slums. The rapid growth of slums in urban areas can be observed by integrating spatial data. The distribution pattern is a series of illustrations identifying the characteristics. It is one of the approaches to illustrate an informal population [7]. The Geographic Information System (GIS) can represent specific areas, such as flood-prone areas, more efficiently [5]. The mapping approach of slums can describe a more specific context. The distribution

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\* Corresponding author: [andri.kurniawan@ugm.ac.id](mailto:andri.kurniawan@ugm.ac.id)

pattern described on the map can be easily comprehended [8, 30]. In the present study, the slum distribution in Palembang city is explained in a map, providing the information about the pattern, such as uniform, random, or clumped. The pattern can help to identify the characteristics of each slum in the area, allowing the government, the stakeholders, and academics to make decisions regarding the population problems. The pattern identification found in the present study can contribute to the consideration of slums management in Palembang City.

The distribution pattern, particularly the spatial, is a series of illustrations to identify each area's characteristics. The pattern can help to describe the actual conditions of the slums in Palembang City. The pattern defined in the present study is expected to contribute to the government's consideration of establishing policies to reduce the number of slums in the city, which keeps increasing year by year. Therefore, the present study aims to know the population characteristics and the distribution patterns of the slums in Palembang city using Getis Ord  $G_i^*$  analysis.

## 2 Methods

The research employs a quantitative method to observe the slum distribution patterns in Palembang City. The independent variables of the present study included marital status, place of origin, religion, occupation, buildings or the infrastructure of the city, and the government's intervention, while the dependent variable is a slum area. The samples include 382 respondents, especially the families living in a particular building. The demographic characteristics of the population are analyzed using IBM SPSS 23 by conducting cross-tabulation. The distribution patterns are observed by seeing the sample distribution, calculated using the proportional random sampling, which is carried out by calculating the number of buildings of each area and noting the coordinates of each sample using GPS essentials application. The data obtained are inserted into the map of the slums, which are then analyzed statistically using the High-Low Clustering Report of Getis Ord General  $G_i^*$ . It helps to know the patterns of cold spot and hot spot using ArcMap 10.3 application.

## 3 Results and discussion

### 3.1 The demographic characteristics of Slums in Palembang city

#### 3.1.1 Marital status and origin

The population characteristic of slums in Palembang City can be identified from the marital status (married, divorced, widowed). Another characteristic is categorized by migrant or non-migrant. Both characteristics can be investigated through a cross-tabulation, presented in the following table.

**Table 1.** The Percentage of Marital Status and Origin

No	Marital status of the respondents functioning as the head of the household	Place of origin of the respondents functioning as the head of the household		Total
		Migrant	Non-Migrant	
1	Married	33.50	54.98	88.48
2	Divorced	1.32	1.56	2.88
3	Widowed	3.66	4.98	8.64
	Total	38.48	61.52	100.00

The data shows that the population is dominated by married, which is 54.98% (non-migrant) and 33.5 % (migrant). Most residents of the slum areas were married [25, 26]. It is different from other studies, stating that the population is dominated by those living a domestic partnership, followed by unmarried, married, and divorced categories [9, 27]. Furthermore, migrants and non-migrants show the lowest score in the divorced category, which are 1.56 and 1.32 for non-migrants and migrants, respectively. Based on the table, the non-migrant population significantly dominates because most of them living in the slum areas are the dwellers of Palembang City. They were the pioneers who have migrated to the city and been administratively registered as the resident. They have been living in the slum areas from generation to generation. Hence, the number based on marital status is higher in the non-migrant category. In the present study, marital status and origins were correlated with the slum areas. More married couple in the areas will add to the population number, especially when they decided to have more children. Similarly, people who migrated increased the population, making the slum areas more crowded, which were already occupied with the non-migrants.

#### 3.1.2 Religion and origins

Other characteristics to see in the slum areas of Palembang City are religion and origins. Most population in the area were Moslem and Catholics, while the the people were migrant and non-migrant. The cross-tabulation data were presented in the following table.

**Table 2.** Percentage of Religion and Origins

No	The religion of the head of the family	Origin of the head of the family		Total
		Migrant	Non-migrant	
1	Islam	38,50	61,20	99,70
2	Catholic	0,00	0,30	0,30
	Total	38,50	61,50	100,00

Based on the data, Islam dominate the population, reaching the highest score both for the migrant (38.50 %) and non-migrant (61.20 %). No migrant were Catholic, while the non-migrant (head of the family) reached 0.30 %. The correlation occurs when the Moslem migrants married with the non-migrants, the new members of the family will automatically follow the head of the family. Therefore, more population became Moslem. The results aligned with the previous one, revealing that the Moslem dominated slum areas, while others were Hindu [10]. However, the results were different from the one occurred in India, in that the dominant was Hindu, and others were Moslem and Christian. Nevertheless, the crowded population was the results of the combination of migrants and non-migrants in the areas [11]. The migrants entering the slum areas in the city were mostly from villages [12].

### 3.1.3 Origin and occupation

The analysis using the cross-tabulation can be conducted to the variables of origin and occupation of the population in the slums of Palembang City. The data are presented in the following table.

With cheaper living cost. Therefore, the slums became overcrowded. This finding is similar to that of other studies, stating that the informal sector dominates the slum population, 72 %. The occupation includes carpentry, commerce, and fishery [13]. Besides, the alternative occupation in the cities are in the informal sector [28], the developed countries were the ones with workers in the informal sector [29].

**Table 3.** Percentage of Origin and Occupation

No	Origin of the respondent functioning as the head of the household	Occupation of the respondent functioning as the head of the household							Total
		Jobless	Labor/ Manual Worker	Farmer	Fisherman	Seller	Private Sector Employee	Civil Servant	
1	Migrant	2.62	19.89	0.00	1.31	3.66	10.47	0.53	38.48
2	Non-migrant	3.66	32.98	2.88	0.78	5.54	14.64	1.04	61.52
	Total	6.28	52.87	2.88	2.09	9.20	25.11	1.57	100.00

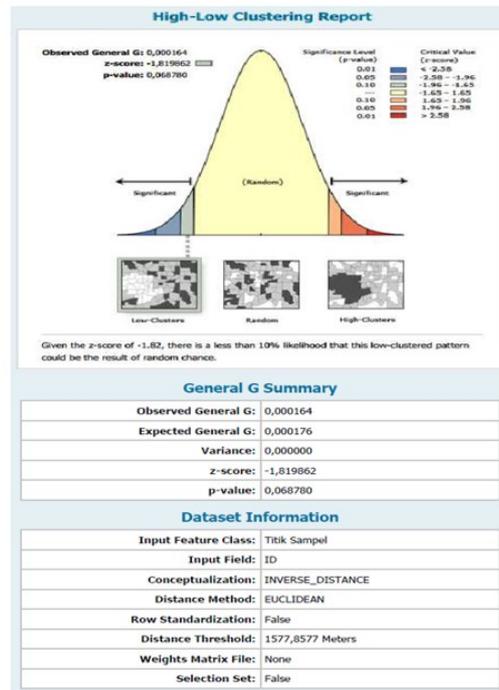
The table shows that the highest score of the migrant population is reached by those working as labor / manual workers, which is 19.89 %, while the lowest (0 %) is a farmer. For the non-migrant population, the highest score is similar to that of the migrant category, but the lowest is different, which is a fisherman (0.78 %). Therefore, it can be concluded that laborers or manual workers, or the informal sector, dominates the non-migrant and migrant population. The occupation held by the population reflects the condition of their economic level, in that they are still in the low level of the economy, which leads to an increase in the poverty rate. Indeed, the people living in the slums of Palembang City cannot improve their life quality.

Furthermore, the poor environmental condition has worsened their situation, causing the area to be even much dirtier. Place of origin and occupation were correlated with slums, in that the migrants could not work in the formal sector because they did not have the necessary skills. Thus, they worked in the informal one with low income. As a result, they could not afford an appropriate dwelling and decided to live in the slums

### 3.2 Slum distribution pattern in Palembang city

The slums' distribution pattern in Palembang city is a low cluster, meaning that the area is formed in clumps, but it is low. The cluster is caused by the clumped buildings separated by the city infrastructures. The government has attempted to reduce the slum areas in Palembang City. In general, a cluster analysis is the division of the clusters based on the characteristics. The analysis result of Getis Ord General  $G_i^*$  statistics is explained in the following figure.

The Figure 1 shows the analysis result of High-Low Clustering for the distribution pattern of the slum areas in Palembang City, in that the observed general score  $G$  is 0.000164, z-score -1.819862, and p-value 0.068780. The results indicate that slum areas in Palembang city are low because the z-score is -1.82. A low cluster is formed because the government has organized the settlements. The damage caused by the slum areas has decreased, It is similar to the results of another study, where houses are overlapping, and the people are poor [14]. In the low or high cluster, the units can change from significant to non-significant, and vice versa.



**Fig. 1.** Graphic of High Low Clustering Report

The figure shows the analysis result of High-Low Clustering for the distribution pattern of the slum areas in Palembang City, in that the observed general score G is 0.000164, z-score -1.819862, and p-value 0.068780. The results indicate that slum areas in Palembang city are low because the z-score is -1.82. A low cluster is formed because the government has organized the settlements. The damage caused by the slum areas has decreased, It is similar to the results of another study, where houses are overlapping, and the people are poor [14]. In the low or high cluster, the units can change from significant to non-significant, and vice versa.

Hence, the locations and size of the clusters are not different [15]. Low clusters are measured by the low level of damage on the buildings, while the high clusters are otherwise [16]. The analysis of High-Low Clustering using Getis Ord General  $G_i^*$  represents the whole condition of the slums in Palembang City, which forms a low cluster. Further, each cluster is analyzed in the same way.

In a more specific analysis using Getis Ord  $G_i^*$ , the slums' distribution pattern is reflected in the spread of cold spot and hot spot. The cold spot is the name for low clusters [17]. The data analysis is presented in the following figure.

The map (Figure 2) illustrates that the distribution pattern of slums in Palembang, which is prone to be a cold spot, is in the city center. Meanwhile, the city center, which is at the 0km of Palembang City, includes several sub- districts: Ilir Timur I, Ilir Timur II, Ilir Barat I, Ilir Barat II, Seberang Ulu I, and Seberang Ulu II. The cold spot cluster is formed due to the changes in the building structures resulting from the government's intervention. The sub-districts at the farther distance of the city center, such as Kertapati, Karya Jaya, Kalidoni, Sematang Borang, and Plaju, are categorized as the hot spot. Meanwhile, Gandus, Purwokerto, and Kebun Bunga are less significant because of the expansion of the crowded city.

The mapping reveals that the slums dominate the less significant spots in Gandus and Kertapati Sub-districts. The Cold spot with -99 % confidence is in Seberang Ulu I, while the hot spot with -99% confidence is in the Plaju sub-district. The hot spot also becomes the issues about urban areas [18]. The spatial distribution [19] and the location of the households can be observed accurately using the map or hot spot analysis [20]. Spatially, the high clusters of a statistically significant high score are shown by the hot spots, while the low clusters are indicated by the cold spots [21–24].

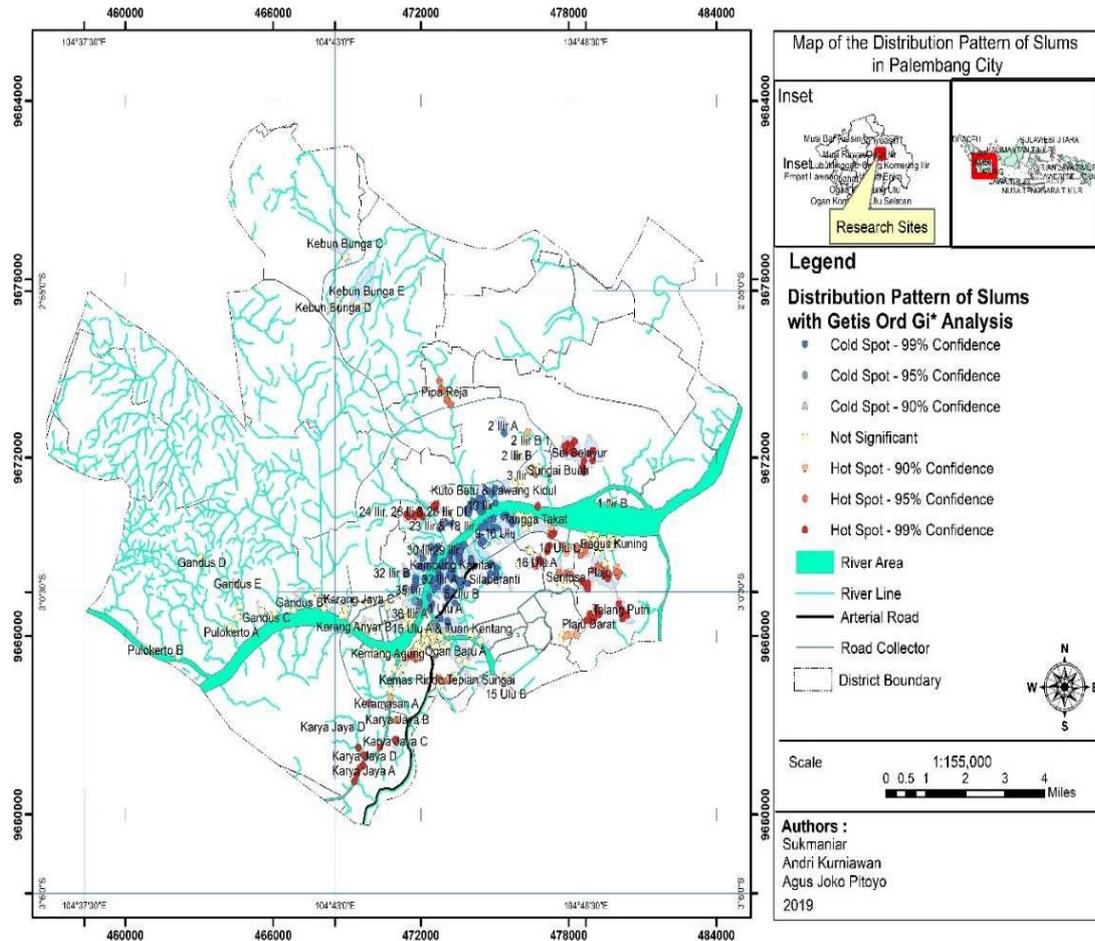


Fig. 2. Map of the Slum Distribution Patterns in

#### 4. Conclusion

Based on the results and discussion, it can be concluded that the population of Palembang City is dominated by non-migrants who are married and Muslim. The population, both migrants and non-migrants, are mostly labor or manual workers. The demographic shows that the occupation represents a low level of economy, which worsens the slum condition. The pattern of slum distribution forms a low cluster, meaning that the cluster is not strong because it is in the city center, and the government has managed the settlements. Besides, the development of the market sector has limited the spread of slum areas. The analysis using Getis Ord  $G_i^*$  reveals that the slum areas in the city center and the dense population is a cold spot (low cluster), while those that are far from the city center are hot spot (high cluster).

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