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Controlling the growth of housing clusters and the mobility rate of residents in Barombong area, Makassar City

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ABSTRACT

The pattern of housing growth in Kelurahan Barombong as a rapidly increasing suburban area tends not to be integrated with its infrastructure, so that the development pattern focused on addressing housing needs has created new problems in the transportation system. There are several arterial roads and collector roads that are not in ideal condition. Economic activity that tends to increase causes an increase in population mobility based on the pattern of origin and destination of travel, which has an impact on increasing traffic volume, slowing down vehicles, traffic congestion and high transportation costs. The purpose of this study is to identify the growth pattern of housing clusters in the Barombong Area, and analyze the correlation form of housing growth to the mobility conditions of residents in the Barombong Area. The spatial analysis method (analysis of nearest neighborhood) utilizes ArcGIS 10.3.1 software and non-parametric correlation statistical analysis using Jamovi. The result of this study is that there is a positive linear relationship between the distribution pattern of clustered settlements and the correlation form of housing growth with the mobility conditions of residents where the determining variables are the number of people per house, and the number of vehicle ownership. The dominant activity time of residents occurs at 05.00–07.00 and the destination of the movement is towards Makassar. While the negative (inverse) relationship is another factor that does not significantly influence the mobility of residents, namely infrastructure (level of service of schools, hospitals and traditional markets and others).

Keywords: growth pattern, housing, mobility rate, Barombong.

INTRODUCTION

The need for housing increases along with population growth and regional development. The World Health Organizations (WHO, 2028) website states that in 2028, an estimated 55% of the earth's population lives in urban areas, and this number is expected to increase to 68% by 2050. This means that the need for housing is urgent and plays a role in changing the face of an area to become more blooming and spacious. The expansion of an area due to the growth of housing demand has a significant impact on the social, economic and environmental aspects. These aspects play a major role in determining the quality of life of people in an area. The growth of residential housing can be seen from analyzing its distribution pattern (Widodo and Sunarti, 2019). Therefore, the growth of housing needs needs attention so that the problems that arise following it can be immediately identified and resolved.

Makassar City is one of the cities in Indonesia that has a population density of 8.329.73 people/km^2 (Makassar City Government, 2024), needs attention to housing growth and its impact. Makassar is located between 119º24'17'38" East and 05º8'6'19" LS which is bordered to the north by Maros Regency and Pangkajene and Islands Regency (Liukang Tupabiring District), to the east by Maros Regency (Mocongloe District) and Gowa Regency (Pattallassang District), to the south by Gowa Regency (Somba Opu

and Barombong Districts) and Takalar Regency (North Galesong District), and to the west by the Makassar Strait. There are several important road sections that are not in an ideal condition, while the attraction and generation of trips in Makassar City (including those leaving and entering Makassar City) currently reaches 1.625.720 people/day. Existing public transport services can only absorb 11.72%, namely 190.534 people/day, while the remaining 88.28% or 1.435.186 people/day still rely on the use of private transportation (Department of Transportation, Communication and Information of South Sulawesi Year, 2016) in (Mulawarman, 2017). This certainly applies also around the Barombong village which is traversed by the main road to Gowa and Takalar regencies.

The city's magnetism as a center of economic activity has sparked people's interest in finding housing close to their work locations. The southern region of Makassar city, namely in the Barombong sub-district, eventually became the target of an increase in the location of new residential openings and soon became the prima donna of location selection for residents whose jobs were around the city center area. During this time, rapid housing growth tends to be uncontrolled and undirected, especially regarding the distribution of housing and settlement locations (Widodo and Sunarti, 2019). The settlement distribution pattern formed in an area can be influenced by several factors, namely: (1) topographic factors including land slope and land elevation; (2) infrastructure factors including facilities and infrastructure services; and (3) population factors including population growth and population density (Nur Aini et al., 2022). The government is focused on addressing housing needs, especially for low-income people (MBR), but has not been integrated with the mobility of residents for social and economic activities, so that the development pattern has created new problems in the transportation system, especially the main road network, increasing the volume of traffic movements from suburban areas to urban areas or vice versa (Wunas, 2011).

Related to the pattern of settlement distribution in Barombong towards the development of an integrated and hierarchical intermodal transportation system (Makassar City Regional Regulation Number. 4 Year 2015, Makassar City Regional Spatial Plan, 2015), the city's spatial structure development policy will focus on developing a mass public transport system with the city transportation mode as a feeder of parts of the regional space, and the becak mode as a mode of community transportation between neighborhood areas; developing and perfecting the balance of the transportation system between the north-south corridor and the east-west corridor and the possibility of developing alternative diagonal corridors of the city. The term is an integrated transportation system, in this case in the Mamminasata metropolitan area.

Areas with easy or high levels of accessibility will develop faster and will attract more people to come and conduct business activities. Conversely, areas with a low level of accessibility are less attractive to people to conduct business activities, and even tend to be abandoned. This situation, if left unaddressed, will result in an increase in gaps and imbalances between regions (Mulyono, 2023). The accessibility factor will play a very important role in mobilizing various aspects of life, both social, economic and political. Regional development efforts must be supported by a good transportation system, where good transportation facilities and infrastructure will definitely support better regional development (Ramadhani et al., 2019). Sustainable transportation is a multidimensional concept that prioritizes reducing the environmental, social, and economic impacts of the transportation system while maintaining accessibility and efficiency (Kemmala and Aris Krisdiyanto, 2023). Economic activity that tends to increase causes an increase in population mobility based on the pattern of origin and destination of travel and has an impact on increasing traffic volumes, vehicle slowdowns, traffic congestion and high transportation costs. It is necessary to control the use of space, land use planning and structuring the transportation system towards the sustainable development of Makassar's suburban areas (Surya et al., 2022).

The Tanjung Bunga area is the access point to Barombong Village, so this clearly affects the road network in the area. Gowa Regency and Takalar Regency are two neighboring areas of Makassar city that are connected by the Barombong bridge. The capacity of the bridge body does not match the number of vehicles passing through, resulting in congestion during peak hours. The peak hour occurs in the afternoon (17:00–18:00) with the highest traffic volume on Barombong Bridge and the degree saturation value shows forced traffic flow, low speed and volume above capacity (traffic jam) at light vehicle speeds. According to Belegur et al.,

(2023) the ratio of road capacity to traffic volume is not in accordance with the 2014 PKJI method.

The distribution pattern of settlements is influenced by several factors such as topography, population density and infrastructure availability (Widodo and Sunarti, 2019). With the construction of new settlements, there will be an increase in traffic volume on the roads around the settlement. The pattern of settlement growth that occurs in Barombong urban village forms a symptom of increased mobility of residents which is shown in the length of congestion that occurs during rush hours every weekday and will be exacerbated when the school season is active again. According to the author, this needs to be identified in depth because there has been a gap between the theory of ideal conditions and field conditions.

RESEARCH METHODS

Research location

This research location is in Barombong Village with a high level of population intensity of 13.765 people and has a density of 1875.34 people/km^2 (BPS Kota Makassar, 2020). This research location is geographically located between 5°12'33.90" N-S and 119°23'15.10" E.

Data type and source

The data needs used in this research depend on the research questions studied. The data needs and data analysis used for each research question are as follows:

First research question

Data needs in the first research question related to the growth pattern of the Barombong area housing cluster. The variables used are: number of housing clusters, number of houses in the cluster, number of houses outside the cluster/settlement, location of housing clusters to main roads, distance between clusters to public facilities. The type of data is secondary data which includes:

- spatial data includes; analog map data (topography), remote sensing data (satellite imagery and aerial photography),
- attribute data includes: data that contains characteristics or information of an object contained in a map that is not at all related to the geographical position of a particular object. For example, the attribute data of a city is the area, population, population density, and data containing the results of interviews/surveys on travel origin and destination patterns of residents of Barombong Village who represent the city.

The analysis used in the first research question is:

1. Spatial analysis; by identifying spatial patterns to obtain the distribution pattern and density of housing in the research location. This analysis technique is called analysis of nearest neighborhood (ANN), using ArcGIS 10.3 Geographic Information System software.
2. Neighborhood characteristics analysis; Analysis using descriptive explanations that provide a description of the neighborhood such as road accessibility, distance to major distances, road density, public facilities, and commercial zones.
3. Descriptive statistical analysis for non-parametric, and because it is a relationship, it uses correlation statistical analysis techniques (Priyono, 2021). The selection of statistical tools (non-parametric) later determines the validity test of the relationship (correlation) of housing development to community mobility.

The nearest neighbor ratio value is the ratio between the observed average distance and the expected average distance. This value is used to determine the dispersion pattern, whether it is random, clustered, or uniform. The following is the nearest neighbor ratio value and the resulting dispersal pattern:

- 0–0.7: Clustered distribution pattern;
- 0.71–1.4: Random dispersal pattern;
- 1.41–2.15: Uniform distribution pattern.

Nearest neighbor analysis is a quantitative geographic analysis method used to determine settlement distribution patterns.

Second research question

Data needs in the second research question, related to the correlation of housing growth to the mobility conditions of residents in the Barombong area. The research variables in the second question are; ownership of mode type, destination/location of movement, frequency of movement, route selection and movement time. The types of data are:

- Interview survey data;
- Data on public facilities such as: trade facilities/traditional markets, education and health.

The analysis used in the second research question is correlation analysis. Used to analyze the relationship between the condition of housing cluster growth and the mobility of residents in Barombong Village.

The data used in the formulation of the second problem is in the form of a questionnaire conducted to respondents who live in Barombong Village. The questionnaire method uses the Google Form application which is distributed via social networks to speed up time and maintain privacy and safety factor considerations for respondents and interviewers. Determining the number of samples is one way to make efficiency because of the limitations of researchers to reach all populations which often requires a long time and a lot of money. The number of samples used in this study refers to the Slovin formula. The Slovin formula is one of the commonly used sampling theories for quantitative research. The Slovin formula is commonly used to take the number of samples that must be representative so that the research results can be generalized. Based on the *Slovin* formula, the number of samples in this study were 100 samples with an error rate of 0.1.

RESULTS AND DISCUSSION

The growth pattern of housing clusters in the Barombong area is classified as a spatially clustered pattern, which can be seen from the number of housing groups, (groups of slum houses along the Barombong beach). Statistical results that have HTML extensions support the above assessment which presents the nearest neighbor index, such as the z-score value, p-value.

In the Jamovi software, the output can appear in the form of a correlation matrix, which means that it shows the correlation relationships between each variable under review, where variables that have a very strong relationship are marked with a p-value < 0.05. From the results of the correlation matrix in JAMOVI, it can be seen that variable 8 (X8 = ownership of a 2-unit motorcycle) has a strong correlation relationship with variable 3 (X3 = occupancy price) with a p-value of 0.036; as well as with variable 4 (X4 = number of occupants in the house) with a p-value < 0.001; and has a strong correlation with variable 7 (X7 = ownership of a 1-unit motorcycle) with a p-value of 0.036.

From the correlation matrix (detailed correlation matrix results are attached), it can be summarized for each variable relationship that has a p-value < 0.05, as in Table 1.

The results of the T-test analysis on JAMOVI, it can be concluded that X3 (residential price category), X4 (number of people in the house), X7 (type of motorcycle ownership 1 unit) have a very strong correlation with X8 (type of motorcycle ownership 2 units). The results of this T-test analysis can be summarized for each variable, to be as shown in Table 2.

The next step after the T-test is linear regression. Linear regression is a data analysis technique that predicts the value of unknown data using the value of other related and known data. Linear regression has the following functions: test the relationship / correlation of the effect of one independent variable on one dependent variable; predict or estimate the dependent variable based on the independent variable; the data analyzed must be interval / ratio scale data. The

Table 1. Summary of correlation matrix, p-value < 0.05

Variable correlation	P-value	Variable correlation	P-value
X8 – X3	0.039	X10 – X3	0.043
X8 – X4	< 0.001	X10 – X4	0.088
X8 – X7	0.036	X11 – X2	0.032

Note: analysis results, 2024

Table 2. T test analysis

Variable relationship	There is a correlation (directly comparable)	No correlation	There is a correlation (inverse)
X8 – X3	√	–	–
X8 – X4	√	–	–
X8 – X7	√	–	–

Note: analysis results, 2024

regression form of the variables that are directly proportional to the mobility rate can be displayed through the JAMOVI software.

Population settlement pattern is the form of distribution of residential areas based on natural conditions and activities of the population (Sumiyati, 2014). The settlement distribution pattern in the Barombong area is categorized as Clustered pattern. This can be seen in the number of housing clustered along the main road in Barombong and also along the Barombong beach and is also supported by the results of the nearest neighbor index, which has a ratio value of 0.430453 and a z-score value of -107.4006 < -2.58, this indicates that the distribution pattern is classified as clustered. While the p-value is 0.00 or not close to 1.00, this indicates that the null hypothesis value is rejected (data feasibility is accepted). When compared with previous research with the title "Analysis of distribution patterns and settlement supportability in Padamara Subdistrict, Purbalingga Regency", it was found that the nearest neighbor ratio was 1.06797 and the z-score value was 1.072272 (in the range -1.65 - +1.65), it appears that the settlement distribution pattern is random / random for Padamara Subdistrict and geospatially follows the environmental road transportation route that connects between villages and the largest concentration is following the transportation route of the Purwokerto Purbalingga city corridor.

This equation is influenced by variables that contribute to the rate of mobility in the Barombong Area, such as the respondent's occupation, occupancy status, occupancy price, number of people in the house, ownership status of 1 unit of motorbike, the hour of commencement of activity, distance traveled, and direction of movement to the activity location.

The R-square (R^2) value is a statistical measure that shows how much variation in a dependent variable (Y) can be explained by the independent variables (X) in a regression model. The number ranges from 0 to 1, indicating the magnitude of the combination of independent variables together affecting the value of the dependent variable. The R^2 value is used to assess how much influence a particular independent latent variable has on the dependent latent variable.

In previous research, the influence of population density on settlement distribution patterns was also found in the research of Pigawati et. al., (2018) and Martono and Cholil (2010). Areas with medium population density tend to form uniform settlement distribution patterns and areas with low population density tend to form clustered and random settlement distribution patterns (Pigawati et. al., 2018). Zones with high population density tend to form random settlement distribution patterns. Meanwhile, zones with medium and low population densities tend to form clustered settlement distribution patterns. The high number of people living in Kartasura Sub-district against the proportion of the overall zone area causes the uneven distribution of settlements so that the settlement distribution pattern formed is random. This causes settlements to grow in areas that have been crowded with previous settlements so that the settlement distribution pattern formed is clustered. Based on the multiple linear regression analysis that has been carried out, the following regression model is obtained:

$$Y = 0.164 + 0.040X_1 + 0.001X_2 + 0.026X_3 - \\ - 0.026X_4 + 0.005X_5 + 5.179\text{E-}5X_6 + 0 \quad (1)$$

The results of previous research show that population factors consisting of population growth and population density are factors that cause the formation of clustered and random settlement distribution patterns in Kartasura Subdistrict. While other factors, such as topography (land slope and land elevation) and infrastructure (level of service of facilities and infrastructure) do not affect the settlement distribution pattern. The faster the population growth rate, the pattern formed has a tendency to cluster. The higher the level of population density, the pattern formed has a random tendency.

CONCLUSIONS

Based on the results and discussion of research conducted using variables, the following conclusions are drawn:

- Kelurahan Barombong has a settlement distribution pattern, which is clustered. This clustered settlement distribution pattern is linearly continuous along the main road of Barombong or even clustered along Barombong beach due to the availability of adequate road network and ease of access with the main destination to Makassar.
- The existence of factors that correlate between housing growth and residents' mobility conditions include the number of people per

house, the number of vehicle ownership, the dominant activity time at 05.00–07.00 and the route of activity movement from residents is still dominated towards Makassar. While the correlation of other factors, such as infrastructure (level of service of schools, hospitals and traditional markets and other facilities) does not affect the mobility conditions of residents.

- Based on the results of the correlation analysis between factors related to the distribution pattern, there are factors that have a positive (linear) relationship, and some factors have a negative (inverse) relationship.

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