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Relationship between Regional Development Level and Accessibility Index in Makassar Coastal Area

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Abstract. Makassar population growth is also quite large, accompanied by the development of urban activities. The development was followed by city facilities and road. The connection between central and periphery area is a demand for community activities in an efficient, safe and comfortable manner. However, in general, the area has low-level accessibility, although the distance is relatively close. The study aims to examine the relationship between regional development level and accessibility level in Makassar coastal area. The accessibility index is analysed using the alpha index (α), while regional development level using LQ-analysis which focuses on residential, education, health, worship, and commercial. Furthermore the relationship between accessibility index and regional development using correlation analysis. The study results showed that the highest accessibility index was located in the city centre and the lowest in the urban periphery. It was also found that urban facilities tend to be higher in city centre than periphery direction. Low accessibility as a result of inequality in road infrastructure has implications for low performance of urban development. It shows that there is a connection between regional development and accessibility level. Therefore, it is recommended to policymakers to build access with high connectivity between the city centre and periphery area while paying attention to the availability of public open space.

9 Introduction

It has become the common view that a development good attention to the development of the society, social and environmental needs economic cost [1]. Urban space needs to have implications for the development of the built area. There are two aspects that affect urban development, namely physical aspects such as geographical location and non-physical aspects such as socio-economic potential of the region [2]. Development of urban areas uses a variety of resources, both natural resources, artificial and human resources optimally in the region. The development of urban area is a continuous process of the various results decision making inside or outside that effect an area. Factors that influence urban development are influenced by various locational aspects, urban systems, and agglomeration mechanism.

Inter-regional quality in the level of development, level of welfare, and rate of economic growth exists to some extent in almost every country [3]. Each region has different social, economic, cultural and physical conditions, so the concept of regional development should emphasize its potential. According to [4], regional development is an effort to spur socio-economic development, reduce disparities between regions and preserve the environmental sustainability of a region. Meanwhile, according to [5], one indicator of regional development is the ease of people obtaining the necessities of daily life. The life needs of the community can be met from various urban service facilities.

especially social and economic facilities such as education, health, worship, government and public services, trade and industry, as well as sports facilities and green open spaces. This is relevant to the view of [6] that the built environment variable can be defined in four factors, including: population density factor, land use diversity factor, design factor (road quality, block size), and accessibility factor. In this case, in addition to the city service facilities, the availability of infrastructure and facilities is also needed. The infrastructure and facilities referred to include the completeness of the physical basis that enables urban areas to function. Some types of urban infrastructure, according to [7] include transportation, freshwater, greywater, drainage, waste, electricity, and telecommunication.

Between regional development and accessibility, there is very dynamic and complex interaction, involving various aspects of activities and interests. Changes in land use always influence road development and vice versa. The condition then creates a spatial relationship between the socio-economic and physical characteristics of the environment [8]. In line with that, [9] states that the pattern of change and the magnitude of movement and the choice of movement modes are functions of land-use change patterns. Likewise, any change in land use will certainly require an improvement in the transportation system. According to [10], accessibility is a concept that combines a geographic land use system with a transportation system that connects it. Furthermore according to [11] land use can identify urban activities in each zone. According to [11], each zone can be characterised by three measures, such as the type of activity, intensity of use, and accessibility between land use. The development of the area will quickly develop if supported by the fulfilment of facilities and good accessibility. While the development of urban infrastructure, especially road will facilitate the achievement of area.

Accessibility is one part of the analysis of the activities that interact with the transportation network system. One variable that can be stated whether the level of accessibility is high or low can be seen from the number of network systems available in the area. The more network systems available in the area, the easier accessibility is obtained and vice versa the lower the level of accessibility is obtained, the more difficult the area is reached from another region [12]. Besides, what determines the level of access is the pattern of land use management. Land use that has characteristics and is closely related to the function will cause high accessibility, and conversely, irregular land use planning will have an impact on inefficiency inaccessibility between regions. Thus the distance factor is not the only element that determines the level of accessibility. The fact, two adjacent zones cannot be said to have high accessibility if there is no connecting road between these zones. Likewise, on the contrary, two zones that are far apart cannot be fully said to have low level of accessibility, if between the zones there are adequate road infrastructure and fleet services [13]. According to [13], the level of regional accessibility can be determined based on several variables, namely availability of roads, the number of transportation means, the length and width of roads, and quality of the road. According to [14], accessibility conditions can be presented by road conditions, class of roads, and public transport lines. While, according to [15], accessibility is often associated with distance, travel time and travel costs. Based on the discussion above, the road within a region or inter-region connecting road is very influential in increasing the people flow and goods. If the accessibility of the area becomes greater, it will open up possibility of urbanisation process and regional development, in the development form of various regional function facilities such as housing, trade and services, government, and socio-cultural facilities. According to [12] and [16] are located in the focus of heavy traffic will experience rapid development. The development of an urban area and its population is largely determined by the availability of road facilities.

The literature review above is relevant to the regional development phenomena in Makassar city, especially in some suburban areas. Concerning its role as the main gateway to the eastern part of Indonesia, Makassar city is very potential to experience development due to high commercial and residential activities. This certainly requires roads that can access service centres such as housing, education, health, worship, and commercial facilities. The results of observations, especially in areas along the southern coast of Makassar, show that there is a tendency for roads in the city centre area (CBD Karebosi) to be more dominant than periphery area (Tanjung Bunga). In this case, the city

centre area represents a regional variable with a much higher development level than the periphery area. Besides, several periphery areas were also seen which although the distance was relatively close, but because of limited road, accessibility was low. This phenomenon is interesting to study further, especially related to the presence or absence of correlation between road construction level and regional development level.

One of the problems that occur in the connecting road of the city centre area with urban periphery of Makassar is congestion that occurs at some of road points due to inefficient accessibility between the two regions. The amount of mobility to the city centre area is not supported by an evenly distributed road system in several alternatives but tends to be concentrated. The road connecting the city centre area around Karebosi area with Tanjung Bunga area is relatively only served by one main road so that there is excess capacity at certain times. This research is classified as important to find out the accessibility level and the regional development level on connecting roads in the city centre and periphery to improve the economy of Makassar, and to improve quality of life safely, comfortable, and productive due to equitable distribution of urban infrastructure and facilities. The results of this study are expected to be basis for enriching norms, standards, guidelines, and criteria, related to increasing the accessibility and urban development area that are anticipatory and adaptive to the dynamics of science and technology development.

2. Methods

The object of study covers an area along Makassar coastal area that connects the downtown area (Karebosi) with the periphery area (Tanjung Bunga). The study area covered four districts, namely Ujung Pandang, Wajo, Mariso, and Tamalate, which included as many as sixteen sub-districts (see Figure 1). The research method design includes:

- a. Conduct field observations by identifying road conditions along the coastal area that connects the city centre and periphery. The observed road includes the length and width of the road, the number of road, the number of nodes, and area of the delineation, which is contained in the GIS map. The data is analysed with alpha index analysis techniques to find the accessibility index (road connectivity) of the area to other regions.
- b. Conduct field observations by identifying the area of several city facilities, such as education, worship, health, commercial, and residential. The data is analysed with LQ analysis techniques to determine the superior sector of the facility in terms of area.
- c. Analysing the relationship between accessibility index variables and regional development variables using correlation analysis.

In addition, the research sample was also observed in the form of several urban facilities. The sampling technique is done by purposive sampling method. There are two types of alpha index (α), namely planar and non-planar graphs. A block is defined planar if the graph (path) is without intersecting segments. Whereas a block is defined as non-planar if the graph cannot be presented without intersecting segments. Road characteristics at the study site are classified as the alpha planar index. The Alpha Index formula is as follow [12]:

$$\text{Alpha Index } (\alpha) = \frac{m-t+s}{2t-s} \dots\dots\dots (1)$$

where,

- Alpha (α) : Accessibility level
- m : Road (graph)
- t : Place point (node)
- s : Region (sub-graph)

To determine the level of regional development, Location Quotient (LQ) analysis techniques are used to understand the leading sectors that are driving growth. LQ measures the relative concentration or degree of specialisation of economic activity. This technique presents a relative comparison between the ability of an observed regional sector with the ability of a broader regional sector.

The LQ formula is as follows [17].

$$LQ = \frac{\frac{X_{ij}}{X_i}}{\frac{X_j}{X}} \dots\dots\dots (2)$$

where,

- Xij: Degree of 'j' activity in the 'i' region
- Xi: Total activity in the 'i' region
- Xj: Total of 'j' activity in all regions
- X.: Degree of total area activity

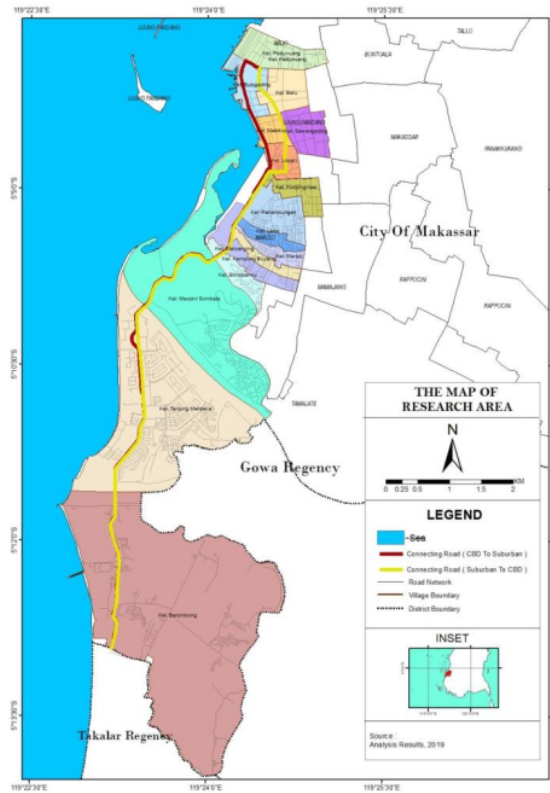


Figure 1. Map of research area

LQ > 1¹² indicates that the area has proper facilities so that the development of the region is classified as high. LQ = 1¹² indicates that the area has adequate facilities so that the development of the area is classified as moderate. LQ < 1 indicates that the area has infeasible facilities so that the development of the region is classified as low [11]. To find out the relationship between regional development and accessibility, a correlation analysis (SPSS) was conducted. The correlation coefficient is stated as follows [18].

$$r = \frac{N \sum xy - \sum x \sum y}{\sqrt{N \sum x^2 - (\sum x)^2 N \sum y^2 - (\sum y)^2}} \dots\dots\dots (3)$$

where,
 r = Correlation coefficient
 x = Regional accessibility
 y = Regional development
 N = Number of the city area

Value of “r” range from -1 to 1. If r approaches 0 value, the relationship between the two variables is very weak (no relationship). If r approaches to 1 or -1 value, the relationship between the two variables is very strong. Variable ‘X’ is road, while variable ‘Y’ is number of facilities such as education, health, worship, commercial, and residential.

3. Results and Discussion

3.1. Analysis of Accessibility Levels in Regions between City Centre and Periphery Area

Accessibility level analysis aims to determine the connectivity of a graph (road or symbolized-s) to the area. Roads and number of nodes are used as variables in determining the level of accessibility in each sub-district. Roads and nodes are known through two stages, namely by using secondary data in the form of road segment attribute data. Furthermore, interpretation and digitation of GIS-based image maps are carried out by determining the number of road (symbolized-m) and the nodes number of road (symbolized-t) in each sub-district. The level of accessibility is calculated based on the number of roads and nodes compared to the area of each sub-district using the Alpha Index formula. The alpha index calculation to determine the accessibility of the area is done with the assumption that the area under study is flat. Accessibility index calculation is only based on the appearance of the results of the interpretation of satellite images as previously explained. The Alpha Index is relatively high if it approaches to 1. Based on the calculation that has been done using the formula, the Alpha Index is obtained as follows:

Table 1. Accessibility index values for each sub-district

No.	Sub-District	Number of Road (m)	Number of Node (t)	Sub-graph (s)	(m-t+s)	(2t-s)	Index Value α
1	Pattunuang	42	41	6	7	76	0.092
2	Bulogading	28	26	4	6	48	0.125
3	Baru	18	17	3	4	31	0.129
4	Maloku	24	24	4	4	44	0.091
5	Sawerigading	36	33	3	6	63	0.095
6	Losari	27	25	3	5	47	0.106
7	Kunjungmae	35	34	4	5	64	0.078
8	Panambungan	91	113	8	-14	218	-0.064
9	Lette	43	44	5	4	83	0.048
10	Mariso	52	51	5	6	97	0.062
11	Matoanging	40	38	4	6	72	0.083
12	Kampung Bayang	32	30	4	6	56	0.107
13	Bontomarannu	54	51	5	8	97	0.082
14	Maccini Sombala	169	204	9	-26	399	-0.065
15	Tanjung Merdeka	297	334	8	-29	660	-0.044
16	Barombong	180	195	13	-2	377	-0.005

If the Alpha Index value is close to 1, the value is getting higher, or the level of accessibility is high. Based on calculations that have been made using the alpha index formula in each sub-district, the alpha index value is found, based on the following formula.

$$Interval\ Class = \frac{Maximum\ Value - Minimum\ Value}{Number\ of\ Class\ Desired} \dots\dots\dots (4)$$

$$= \frac{0.129 - (-0.065)}{3} = 0.065$$

The interval from each index classification is 0.065. Then the interval class category is determined with the following values: High Class = 0.129 - 0.064; Medium class = 0.063 - (-0.001); and Low class = (-0.002) - (-0.066). For an explanation of the accumulation of index classification along the coastal area between the centre and the periphery area of Makassar, see Table 2.

Table 2. Level of region accessibility by sub-district

Sub-District	Number of Roads (m)	Number of Node (t)	Subgraf (s)	(m-t+s)	(2t-s)	Index Value	Interval Value	Level of Accessibility
Baru	18	17	3	4	31	0.129	0.065	High
Bulogading	28	26	4	6	48	0.125	0.065	High
Kampung Bayang	32	30	4	6	56	0.107	0.065	High
Losari	27	25	3	5	47	0.106	0.065	High
Sawerigading	36	33	3	6	63	0.095	0.065	High
Pattunuang	42	41	6	7	76	0.092	0.065	High
Maloku	24	24	4	4	44	0.091	0.065	High
Matoanging	40	38	4	6	72	0.083	0.065	High
Bontomarannu	54	51	5	8	97	0.082	0.065	High
Kunjungmae	35	34	4	5	64	0.078	0.065	High
Mariso	52	51	5	6	97	0.062	0.065	Medium
Lette	43	44	5	4	83	0.048	0.065	Medium
Panambungan	91	113	8	-14	218	-0.064	0.065	Low
Maccini Sombala	169	204	9	-26	399	-0.065	0.065	Low
Tanjung Merdeka	297	334	8	-29	660	-0.044	0.065	Low
Barombong	180	195	13	-2	377	-0.005	0.065	Low
Average Accessibility Index level on Research Sites						0.058		Medium

The analysis showed that the highest Alfa Index value was found in Baru Sub-District (0.129), and the smallest in the Maccini Sombala Sub-District (-0.065). There are ten sub-districts that receive an accessibility index score of the High category, all of which are located in the city centre. In these ten sub-districts, the number of road networks is greater than the node. This proves that the city centre has a more optimal road arrangement compared to the suburbs. The city centre has good connectivity between regions. The arrangement of the road network is used optimally in the city centre by connecting all the existing node points to facilitate the accessibility of each location of activity points.

Furthermore, there are as many as two sub-districts that get the accessibility index value of the Medium category, all of which are located in the suburbs. This is based on the number of roads that tends to be proportional to the number of existing nodes. Whereas the sub-district with low accessibility are four sub-districts, all of which are located in the periphery area. The low accessibility is due to the small number of road compared to the sub-district area. The small number of the road is also caused by a large amount of land that is not developed with dominant agrarian function of land.

The level of accessibility of the area traversed by the city centre connecting roads with Makassar peripherals is highest in the Baru Sub-District. The number of roads and nodes in Baru Sub-District is relatively small, but because the area in the region is relatively small, the accessibility is relatively high. Baru Sub-District, aside from being evenly distributed, is also caused by the arterial road, Jl. Ahmad Yani and Jl. Jend. Sudirman whereas the lowest level of accessibility is in Maccini Sombala. This is due to the uneven road nodes, which tend to be concentrated in only one area in a residential area. Overall, the level of accessibility on the downtown connecting road (Karebosi) with the periphery area (Tanjung Bunga) has index of 0.058 or is included in the classification with the accessibility level of the Medium category. For details, the results of calculating the level of accessibility can be seen in Figure 2.

3.2. Regional Development between the City Centre and the Periphery

Regional development is calculated by sub-district that is traversed by the connecting road from the downtown area to the periphery of Makassar using the Location Quotient (LQ) analysis. This method is used to determine the potential for economic activity as an indication of the basis sector by looking at the comparison between the ability of certain sectors in the study area. In order to be spatially analysed, the level of regional development is measured based on the area of each sub-district facility. The results of the analysis show that the LQ value of urban facilities in the coastal area of Makassar city along the road between the city centre (CBD Karebosi) and the periphery area (*Tanjung Bunga*) is classified as uneven. Some facilities tend to be distributed in one area or do not spread evenly within a region, so accessibility to reach these facilities is inefficient. Based on Table 3, the average LQ obtained for each Sub-district in the study location is 1.61. Furthermore, the LQ value is classified into three classes with the following categories:

$LQ > 1$, states that the facilities are proper and categorised as High level of development.

$LQ = 1$, stated that the facilities are adequate and categorised as moderate level of developmental.

$LQ < 1$, stated that the facilities are infeasible and categorized as Low level of development.

In Table 3 can be seen the level of regional development by the sub-district in the study area.

Table 3. Level of regional development by sub-district

Sub-District	LQ Education	LQ Health	LQ Worship	LQ Commercial	LQ Residential	LQ Average	Level of Regional Development
Baru	0.97	1.31	1.85	1.21	1.17	1.30	High
Bulogading	1.28	5.33	0.43	1.04	17.08	5.03	High
Kampung Buyang	0.58	5.33	0.43	4.43	1.03	2.36	High
Losari	1.30	0.47	1.12	3.09	5.56	2.31	High
Sawerigading	1.74	2.72	0.53	1.39	1.44	1.57	High
Pattunuang	0.58	0.49	6.00	0.82	2.90	2.16	High
Maloku	1.28	2.96	0.43	0.80	0.94	1.28	High
Mattoanging	0.58	2.72	0.43	0.20	1.03	0.99	Low
Bontorannu	2.49	0.00	0.43	0.20	0.73	0.77	Low
Kungjungmae	0.58	3.91	1.02	3.76	0.70	1.99	High
Mariso	0.58	3.91	1.02	2.35	0.70	1.71	High
Lette	0.58	4.90	0.43	0.28	2.74	1.79	High
Panambungan	0.58	0.94	0.43	0.45	0.70	0.62	Low
Maccini Sombala	1.28	2.72	0.43	0.64	0.33	1.08	High
Tanjung Merdeka	0.78	0.00	0.43	0.56	0.56	0.47	Low
Barombong	0.58	0.00	0.43	0.46	0.51	0.40	Low
Average LQ on Research Sites						1.61	High

Table 3 shows that the highest level of regional development along the study site is the Bulogading Sub-District (LQ = 5.03) located in the downtown area. The region has adequate facilities, such as education, worship, sports and recreation, trade and services, and transportation. On the contrary, the lowest level development in the whole area of the study area is Barombong Sub-District (LQ = 0.40) which is located in the periphery area (southern part of Makassar). The low development in the region is influenced by the factor of considerable distance from the city centre. This area is classified as the lowest availability of urban facilities such as education, health and trade facilities, compared to other regions. It can be said that in general the development of the research area is quite high (LQ=1.61). Among them, there are eleven sub-districts with a high level of development in the region and five sub-districts with a level of development in the region that are classified as Low.

In general, regions that have a relatively high level of development are located in the city centre (north), except Mattoangng (LQ = 1.03) and Bontorannu (LQ = 0.73). This is caused by not many and not yet spread the number of roads built in the sub-district compared to the surrounding area. Likewise, in general, areas that have a relatively low level of development are located towards the outskirts of the city (south), except Maccini Sombala Sub-District (LQ = 1.08) classified as having a high level development. This is caused the area functions as an elite residential and tourist area where there are relatively large numbers of roads spread in the area compared to the surrounding area.

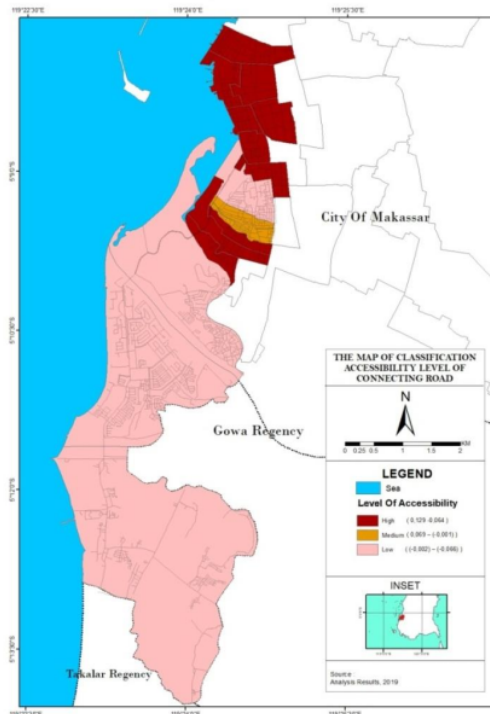


Figure 2. Map of classification of accessibility level in research area

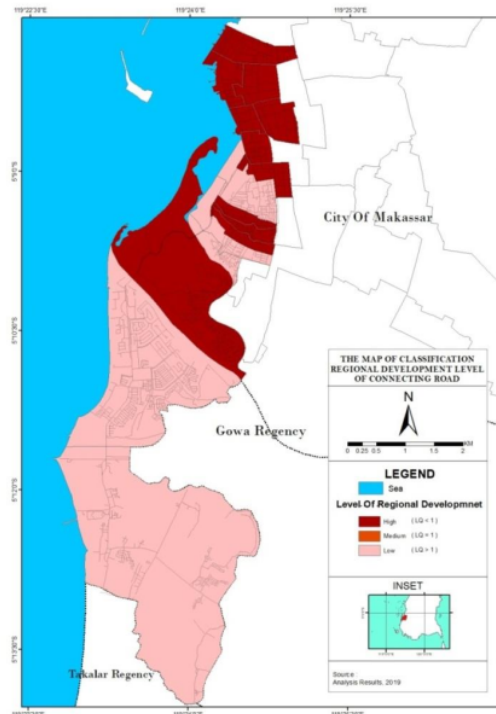


Figure 3. Map of classification of regional development in research area

3.3. The correlation between Accessibility and Regional Development in Makassar Coastal Area

The main objective of this study is to determine the relation (correlation) between accessibility (independent variables) with regional development (dependent variables) in several urban areas that are traversed by central city and connecting road in Makassar. Correlation analysis was performed using the SPSS for Windows program using the Spearman Rank Correlation analysis. This analysis aims to look for relationships or test the significance of the relationship between accessibility variable with road indicator and regional development variable with an indicator of urban facility availability. The accessibility value variable areas of the Alfa index value (see Table 1), while value of the regional development variable is obtained the LQ calculation results for each region (see Table 3). For clear results of the correlation analysis between accessibility level and regional development level on each area, can be seen in Table 4 below.

Tabel 4. Value of variables x and y in the research area

No	Sub-District	Accessibility (X)	Regional Development (Y)
1	Pattunuang	0.09	2.16
2	Baru	0.13	1.30
3	Losari	0.11	2.31
4	Maloku	0.09	1.28
5	Sawerigading	0.10	1.57
6	Bulogading	0.13	5.03
7	Barombong	-0.01	0.40
8	Maccini Sombala	-0.07	1.08
9	Tanjung Merdeka	-0.04	0.47
10	Bontorannu	0.08	0.77
11	Kampung Buyang	0.11	2.36
12	Kungjungmae	0.08	1.99
13	Lette	0.05	1.79
14	Mariso	0.06	1.71
15	Mattoanging	0.08	0.99
16	Panambungan	-0.06	0.62

Based on the Spearman Rank correlation rule, to measure the level of relationship between two variables can be seen based on the value of the relationship coefficient (r). The greater of " r " value means, the stronger of relationship, and conversely the lower of " r " value means, the weaker of relationship. To determine significance level of the relationship between variables using the criteria for the closeness of the relationship [19], as follows:

- a. r - value < 0.2 : Relation are very small
- b. r - value $0.2 \leq X < 0.4$: Relation are small
- c. r - value $0.4 \leq X < 0.7$: Relation are significant enough
- d. r - value $0.7 \leq X < 0.9$: Relation are significant
- e. r - value $0.9 \leq X < 1.0$: Relation are very significant
- f. r - value 1.0: Perfect relation

Based on the results of the correlation that has been done, it is known the significance level of the relationship between variables as stated in Table 5.

Table 5. Relationship between accessibility levels and regional development

		Correlations	
		Accessibility	Regional Development
Accessibility	Pearson Correlation	1	.596*
	Sig. (2-tailed)		0.015
	N	16	16
Regional Development	Pearson Correlation	.596*	1
	Sig. (2-tailed)	0.015	
	N	16	16

** . Correlation is significant at the 0.01 level (2-tailed).

Based on the results of the correlation analysis between accessibility and regional development in the coastal area that connects the city centre to the periphery area of Makassar shows “r” value (Pearson correlation) of 0.596 which has a fairly close and direct relationship with a significance value of 0.015 (<0.05). This shows that if regional accessibility has increased, regional development will also experience the same thing. It can be concluded that there is a significant relationship between the accessibility level and the regional development level in the southern coastal area of Makassar city.

The connecting road between the downtown area (CBD Karebosi) and periphery area of the southern part of Makassar is one of the economic pathways that connect many economic activities both industrial and tourism sector. Based on interpretations on image map Makassar, it shows that at present there are more roads in the city centre and surrounding area than the periphery area. The lack of roads in Tanjung Bunga area has implications for Low accessibility of several urban facilities in general in the region as well as accessibility between the surrounding area. Good accessibility will facilitate community interaction inter-regions, resulting inequitable development. Fulfilment of road infrastructure will have an impact on regional development in a city or region.

4. Conclusion

The highest level of regional development along the southern coastal area of Makassar is Bulogading Sub-district, located in downtown area. The region has adequate facilities, such as educational, worship, sports and recreation, trade and services, and transportation. Conversely, the lowest level of regional development is Barombong Sub-District in the periphery area, which are relatively far from the city centre and availability of the facilities is still Low. However, in general, the development of the area in the research area is quite High. In this case there are eleven sub-districts with a high development level and five sub-districts that are classified as Low. The areas with high development lead to the centre of the city except Mattoanging and Bontorannu Sub-District, due to limited the number of roads compared to surrounding area. On the other hand, the Low development urban sub-district is located on the periphery area, except Maccini Sombala Sub-District, which has developed environment related to its function as a residential and tourism development area. Furthermore, the level of accessibility in general along the south of Makassar coast is classified as Moderate ($\alpha=0.058$). Among them, there is ten regions with High accessibility, two regions with Medium level, and four regions classified as Low. Pearson correlation analysis results show that there is a significant direct relationship between the level of accessibility and regional development. Baru Sub-District, located in the city centre, is the region with the Highest accessibility value. While Maccini Sombala Sub-District which is located in the periphery area, has the Lowest accessibility value. This analysis explains that the accessibility level in the city centre is generally Higher than the periphery area. This is indicated by as many as twelve sub-districts that are relatively close to the city centre that has a High level of

accessibility, and four sub-districts are relatively far from the city centre that has a Low level of accessibility. This fact corresponds to the regional development conditions of the sixteen regions studied and is relevant to the results of the correlation analysis. It can be concluded that there is a relationship between the accessibility level and regional development level in the coastal area of Makassar. In addition to accessibility, regional development is also influenced by other factors such as regional potential.

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