THE ANALYSIS OF SETTLEMENT QUALITY USING GEOGRAPHIC INFORMATION SYSTEM IN MEDAN LABUHAN DISTRICT

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Abstract

This study aims to determine: (1) the quality of the residential neighborhood in the District of Medan Labuhan, (2) the distribution of the quality of the residential neighborhood in the District of Medan Labuhan. This research was conducted in Medan Labuhan District in 2020. All settlements in the Medan Labuhan District are the research subjects. Data collection techniques used in this research are Image interpretation of *Quickbird* satellite imagery, field checks, and documentation. The data analysis technique used is descriptive qualitative analysis, quantitative analysis, and overlay analysis. The results of this study indicate that: (1) the quality level of the residential neighborhood in Medan Labuhan District is classified as medium with an area of 822.13 hectares or 84.24% of the residential area of Medan Labuhan District. (2) the distribution of the quality of the residential neighborhood is divided into three classifications, the widest one in the good quality level is in Pekan Labuhan with a total of 1 residential block covering an area of 21.1 Ha or 2.16% of the area of the residential block in Medan Labuhan District. Whereas for medium classification and poor classification, the widest range is in Besar Sub-district with 22 settlement blocks covering an area of 216.36 hectares and poor classification with a total of 6 settlement blocks covering an area of 22.17% 38. 32 Ha and 3.92% of the area of the residential block in Medan Labuhan District, respectively.

Keywords: *Quality of the Residential Neighborhood, Quickbird Satellite Imagery, Geographic Information System*

Introduction

A city is one of the places where the living system has a strong appeal for residents to live or settle there (Marwasta & Ritohardoyo, 2001) where the influx of people from rural to urban areas continuously will lead to increasing population growth which results in more problems that occur in the city. Population growth which continues to increase and is classified as high in urban areas will cause problems for settlements. Population growth continues to develop at a rapid rate resulting in a greater need for space used for housing and other facilities (Yunus, 2005: 56). The need for space or land will have an impact on the emergence of new settlements in existing residential areas causing the settlements to become denser. This is indicated by the existence of even narrow lands, which should not be suitable for settlement, have also been occupied by housings. Houses of small size and low quality or less livable. This is what triggers the growth of uninhabitable slum settlements and of course, affects the quality of the settlement environment.

Medan is a metropolitan city consisting of 21 districts. The condition of the people who live in Medan is said to have not had a decent life because there are still places to live that are not suitable for occupancy or have low-quality settlements (Maisaroh, 2017). In 2018, the population of Medan reached 2,264,145 lives. Compared to the total population in 2017, there was a population increase of 16,720 people (0.74%). With an area of 265.10 km², the population density reaches 8,541 people/km² (Badan Pusat Statistik Kota Medan, 2019)

Medan Labuhan is one of the sub-districts in Medan City. There are six sub-district, namely Besar Sub-district, Tangkahan Sub-district, Martubung Sub-district, Sei Mati Sub-district, Pekan Labuhan Sub-district, and Nelayan Indah Sub-district. The population in Medan Labuhan District in 2018 was 139,480 people, while in 2017 there was a population increase of 19,971 lives (14.32%), with a population density of 3,296 km² (Badan Pusat Statistik Kota Medan, 2019). The larger the population and the number of households, the wider the settlement area. This, of course, will cause problems in the quality of the settlement neighborhood in Medan Labuhan and can reduce the quality of the residential environment (Ritohardoyo, Sudrajat, & Kurniawan, 2014).

Another problem is the occurrence of floods and tidal flooding in Medan Labuhan. Tidal floods often occur in Medan Labuhan that has soaked several areas, such as in neighborhoods 2 to 12 of Tangkahan Village, Medan Labuhan District (Medan Bisnis Daily Online, 2018). Tidal flooding occurs in Medan Labuhan District because the area is close to the coastal area of Belawan and the coast of Deli Serdang. One of the areas affected by the tidal flood is Nelayan Indah (Regional Disaster Management Agency of Medan City Government, 2018). The location of settlements in Medan Labuhan which is close to the sources of tidal floods will affect the quality of the settlement (Ritohardoyo et al., 2014).

The quality of the residential neighborhood that has changed must be monitored and evaluated by the government and policy managers. Monitoring and evaluating the quality of the settlement neighborhood requires high costs, high labor, and time-consuming. Advances in information technology make it easier to determine environmental quality conditions in urban settlements for the planning and management of residential areas. Alternatives that can be taken in determining the quality conditions of residential environments are by utilizing remote sensing technology and Geographical Information Systems (GIS). One of the data that can be used to determine the quality level of settlements is the Quickbird satellite imagery because it has high spatial resolution so that it can present sufficiently accurate data to identify settlements properly. Settlement density, layout, location, road surface conditions, the width of the entrance to the settlement, the cover of vegetation, and the quality of the roof are used as parameters to determine the quality of the settlement neighborhood. The identification process can be done by visual interpretation using a Geographical Information System (GIS) tool.

Methods

This research was conducted in Medan Labuhan District, Medan City. The population in this study was all residential blocks in Medan Labuhan District. To test the results in this study, I carried out a ground check. For this, a percentage of blocks settlements representing the good, medium, poor quality classes are selected based on the ease of access. The number of blocks for each residential environmental quality class can be seen in Table 1 below.

Table 1. Number of Blocks for Ground Check from Each Class

Class	Number of Blocks	Number of Field Points
Good	11	$\frac{11}{263} x\ 36 = 2$
Medium	212	$\frac{212}{263} x\ 36 = 29$
Bad	40	$\frac{40}{263} x\ 36 = 5$

Source: Analysis, 2020.

The image used in this research is Quickbird covering Medan Labuhan in 2020. Data collection is done by first interpreting Quickbird. The data obtained from Quickbird interpretation is then ground-checked to the field.

There are three data analysis techniques used. First, qualitative descriptive analysis is used to analyze the results of image interpretation using predefined variables and is used to analyze the results of the quality of the settlement neighborhood to determine its distribution. Second, quantitative data analysis is used for

scoring the quality parameters of the settlement neighborhood. After the scoring is complete, an assessment of the quality level of the settlement is carried out. To determine the quality level class of the residential neighborhood the score of each factor and its weight are multiplied and then summed (Kurniadi, 2014). The weight of each variable can be seen in table 2.

Table 2. The weight of the variables

No	Variable	Criteria	Weight	Classification
1.	The density residential	density <40%	3	Good
		density of 40% -60%	2	Medium
		Density> 60%	1	Poor
2.	The layout of	settlements>50% of the buildings on a regular ordered	3	Good
		25% -50% of buildings arranged regularly	2	Sedan
		<25% of buildings arranged regularly	1	Poor
3.	Location of settlement	Far from source of disaster (> 50m)	3	Good
		Not directly affected (15-50m)	2	Moderate
		Close to source of disaster (<15m)	1	Poor
4.	Condition of entrance road	> 50% paved road	3	Good
		25-50% paved road	2	Medium
		<25% paved road	1	Poor
5.	Access road	width> 6m	3	Good
		road width 4-6m	2	Medium
		road width <4m	1	Poor
6.	Vegetation cover	> 50% of land that is not built is covered with vegetation	3	Good
		25% -50% of land that is not built is covered with vegetation	2	Medium
		<25% of land that is not built is covered with vegetation	1	Poor
7.	Quality of roof	permanent (cast, tile)	3	Good
		Semi-permanent (zinc)	2	Medium
		Non-permanent (Nipah leaf)	1	Poor

Source: Directorate General of Human Settlements, Ministry of Public Works, 2006.

Third, overlay analysis is performed to map the quality of the settlement neighborhood. The classification of the settlement quality is presented in table 3 below:

Table 3. Classification of Settlement Neighborhood Quality

Total	Classification	Grade class
38 - 48	Good	I
27 - 37	Medium	II
16 - 26	Poor	III

Source: Analysis, 2020.

Results and Discussion

Based on the results of the map overlay for each parameter, the quality of the settlement neighborhood in Medan Labuhan can be seen in Table 4 below.

Table 4. Quality Level of Settlement Environment

No.	Classification	Class	Area (Ha)	Percentage (%)

1.	Good quality	I	61.56	6.31
2.	Medium quality	II	822.13	84.24
3.	Poor quality	III	92.19	9.45
	Total		975.88	100

Source: Analysis, 2020.

From table 4 we can that settlements with good quality (total value range 38-48) have an area of 61.56 hectares or 6.31%, the medium quality (total value range 27-37) has an area 822.13 hectares or 84.24% while for settlements with poor quality (total dignity range 16-26) has an area of 92.19 Ha or 9.45%. Therefore, the overall quality of the residential neighborhood in Medan Labuhan is of medium quality.

Based on Figure 1, we know that the widest distribution of the good settlement neighborhood quality in Medan Labuhan is in Pekan Labuhan Sub-district with a total of 1 settlement block covering an area of 21.1 hectares. This is influenced by good classification parameters such as the condition of the road to the settlement which has been paved so that it facilitates mobility and the width of the entrance to the settlement that is wider than 6 m. The width of the roads in Pekan Labuhan Village that are categorized as good is influenced by the proximity of arterial roads and the presence of factories surrounding the area that needed wider roads so that large transports can pass it. On the other hand, the parameters that lead settlements in Pekan Labuhan Sub-district to a medium quality are the quality of residential roofs that use tin roofs and vegetation cover. The presence of vegetation will help absorb pollution so that the air becomes cleaner and can also reduce the risk of flooding.
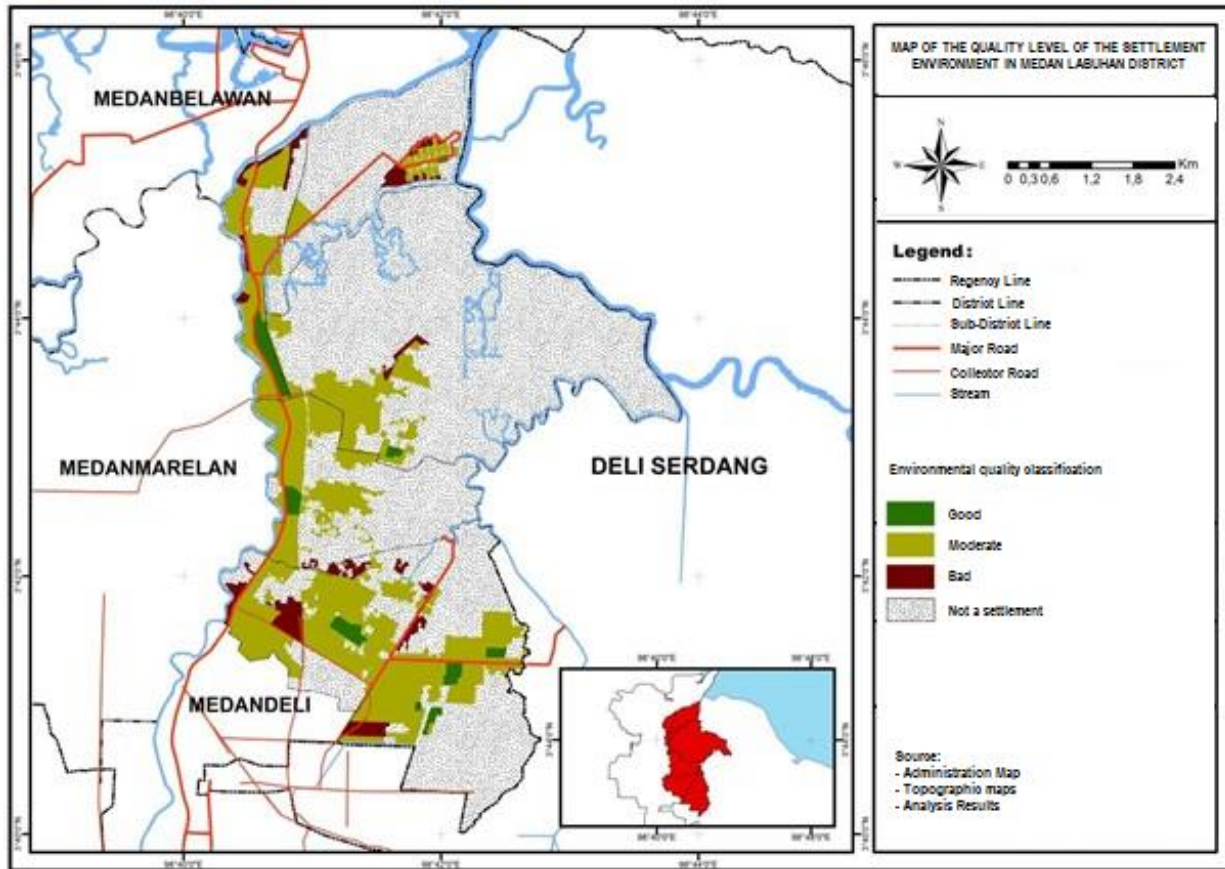

Figure 1. Map of the Quality Level of the Settlement Environment in Medan Labuhan District

Whereas for medium and poor classification, the widest range is in Besar Sub-district with 22 settlement blocks covering an area of 216.36 hectares and a total of 6 settlement blocks

covering an area of 38. 32 hectares for medium and poor classification, respectively.

For the moderate classification, it is influenced by several parameters including good classification such as the location of the settlement which is far from the source of the flood (river) so that the risk of flooding or tidal flooding is smaller. The condition of the entrance road has been paved using asphalt or cement and the width of the entrance to the settlement more than 6 m so that it provides easy access to the place.

As for the poor classification, Besar Sub-district is a sub-district where almost all of its settlement blocks are classified as dense, the density of the buildings affects the layout of the settlements to become irregular due to the narrow land to build houses so that it affects the quality of the settlement neighborhood.

Table 5. Distribution of Quality of Settlement Environment in Medan Labuhan District.

No.	Classification	Tangkahan		Besar		Martubung		Sei Mati		Pekan Labuhan		Nelayan Indah	
		Total Block	Size (Ha) %	Total Block	Size (Ha) %	Total Block	Size (Ha) %	Total Block	Size (Ha) %	Total Block	Size (Ha) %	Total Block	Size (Ha) %
1.	Good	5	16.82 (1.72%)	1	10.74 (1.1%)	1	8.6 (0.88%)	1	3.18 (0.32%)	1	21.1 (2.16%)	2	1, 12 (0.11%)
2.	Moderate	34	186.38 (19.10%)	30	216.36 (22.17%)	25	175.13 (17.94%)	48	100.94 (10.34%)	22	102.23 (10.47%)	53	41.09 (4.21%)
3.	Poor	2	17.81 (1.82%)	6	38.32 (3.92%)	1	1.23 (0.12%)	3	5.01 (0, 51%)	6	14.85 (1.52%)	22	14.97 (1.53%)
Total		41	221.01	37	265.42	27	184.96	52	109.13	29	138.18	77	57.18

Source: Analysis, 2020.

Conclusion

The study shows that Geographic Information System (GIS) can effectively assist the analysis of settlement quality. The settlement quality of the studied area are as follows:

1. The quality level of the settlement environment in Medan Labuhan District is classified as medium with an area of 822.13 Ha or 84.24% of the area of the settlement block in Medan Labuhan District.

2. The distribution of the quality of the residential environment is divided into three classifications, both in Medan Labuhan Subdistrict, the widest one is in Pekan Labuhan Village with a total of 1 settlement block covering an area of 21.1 Ha or 2.16% of the area of the residential block in Medan Labuhan District. Whereas for medium classification and poor classification, the widest range is in Besar Sub-district with 22 settlement blocks covering an area of 216.36 hectares or 22.17% of the area of the settlement block in Medan Labuhan District for medium classification and poor classification with a total of 6 settlement blocks covering an area of 38. 32 Ha or 3.92% of the area of the residential block in Medan Labuhan District.

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