Changes of Settlement environmental Quality in Semarang City Center

by Bitta Pigawati

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Abstract: City center is the core of a city that was originally used as settlement, it is, further, developed into a center of economic activities and as a center for settlement facilities and infrastructure. The city center area is a city growth center which often experiences rapid changes. The development of the city center has resulted in the conversion of landuse non built up area into a built up area. The wide increase in built up area indicates a reduction in green open space and catchment areas that can cause degeneration in environmental quality. Semarang as the capital of Central Java Province develops quite rapidly. This condition is seen in the increasing of the built up area that functions as a settlement and commercial activities. The development of settlements in the City Center, however, can cause a decline in environmental quality if it is not balanced with a good environmental arrangement and the availability of sufficient facilities. This study aimed to analyze the changes in the quality of the residential environment over 10 years and to determine the typology of the area of the area in the Semarang Tengah District located in the City Center of Semarang. This study used spatial approach by utilizing Geographic Information System and Remote Sensing (GIS/RS) technology. The results of the research showed that there was a change in the quality of the settlement environment in Semarang Tengah District. Settlement areas that experienced a decrease in quality were block settlements in Brumbungan Village and Miroto Village, it was due to reduced vegetation protection and facilities. On the other hand, the quality improvement occurred in Sekayu Village which developed as a commercial area. Settlements in Semarang City Center can be divided into 3 topologies based on the characteristics and quality of the environment

Keyword: *Settlement, Environmental Quality, Semarang City Center*

1. Introduction

The rapid and irregular urban expansion driven by high economic growth is the foremost cause of green land loss, social inequality, and environmental damage in cities in China [1] [2] [3] [4] .The development of Semarang City has caused the built up land in the city center area tends to increase. On the other hand, the green open space is decreasing due to the development of the city center area of Semarang. The condition of Simpanglima area as the center of Semarang, currently, only has green open space area of 16.82% [5]. The main factors of urban development are population growth and land consumption per capita [6]. Cities have large populations and tend to increase rapidly over time [7] [8]. Humans in living process have diverse activities. It is deemed possible their activities create big impacts for the environment, even these impacts can continuously damage the existing environment. The increasing number of urban population has a very huge impact on the level of comfort. The closeness of the reach to the economic centers in the city becomes another attraction, so that some residents prefer to live in the city, even though they are forced to live in a very limited space. As a result, slum areas, with limited living facilities and general needs, are becoming increasingly widespread

The City Center is the core of a city which was originally a settlement and then developed into the Central Business District [9]. The city center serves as a center of economic activity, residential facilities and infrastructure service centers [10] [11]. The city center area is a zone that has been saturated

with near-maximum settlement growth capacity [12] [13]. The city center area has the characteristics of high population density and rapid demographic changes.

Settlements are part of a residential environment which consists of more than one housing unit that has infrastructure, facilities, public utilities and is a tangible form of fulfillment of human needs for space (Undang-undang Nomor 14 Tahun 2016). Settlements are part of the environment outside the protected areas, both in the form of urban and rural areas that function as a residential environment and a place of activities that support life and livelihood (Tata Cara Perencanaan Lingkungan Perumahan di Perkotaan, 2004). Residence is generally called a settlement and is specifically referred to as a house. [16] [17]. In essence, settlements have a dynamic structure, at any time can change and in each change accompanied by growth. The settlement system consists of the composition of various elements, namely Nature, Man, Society, Shells and Network. All the integral elements of the settlement are interrelated, influenced and determined each other [18]. The quality of the settlement environment is a capability of the settlement environment to meet the needs of the community. The quality of urban settlements is influenced by physical and non-physical conditions. Changes in physical development and land use can cause a variety of problems, one of which is the settlement environment problem. Furthermore, this has an effect on the quality of the settlement environment [19]. Infrastructure is the completeness of the physical basis of a residential environment that meets certain standards for the needs of a decent, healthy, safe and comfortable place to live. Means are facilities in a residential environment that function to support the organization and development of social, cultural and economic life. (Undang-undang Nomor 1 tahun 2011)

Settlement location as a place of residence is influenced by several factors depending on the activity of the city in question. According to [21] low-income communities choose house location near the work place as the main preference, while for middle-above-income people prioritize place of residence is based on convenience and availability of social facilities . Factors of ease of access to reach facilities are determinants of settlement development [22]. The policy of Semarang City's settlement land use has been explicitly stated in the Semarang City Spatial Plan by setting its location and distribution based on its environmental carrying capacity and not to be converted, (Undang-undang Nomor 26 tahun 2007).

The decline in the quality of settlements is an important problem for all countries in the world. The good quality of the settlement environment in an area is able to increase the welfare and pleasure for the people who live in it [24]. It is important to have more innovative policies for urban informal settlements as a tool to regulate land functions and ensure environmental conservation [25].

The construction and development of residential areas is a precondition for improving the welfare of the community. Since human productivity is very dependent on the availability of adequate places for activities. Settlement as a place of human life is not only about quantity but also quality. At present the new residential area is more emphasized on the physical aspects of the building, while the old settlements are growing and developing rapidly without control because they are less orderly and lack of supervision in its development. Both of these matters resulted in a decline in the quality of settlements [26].

Quality of life related to living conditions in a place needs to be distinguished into subjective and objective measurement. Subjective measurement is about feeling good and satisfied with the existing conditions, while objectively is related to things that can be measured in life [27]. This research focused more on objective or measurable indicator. The development of the city center causes landuse non-built up area conversion to be built up area. The increase in the size of the built up area which is mostly used for settlement construction indicates the reduction of green open space and catchment area. It, further, can result in a decrease in environmental quality. The decline in the quality of the settlement environment can be characterized by high building density, the disappearance of parks and open spaces, inadequate housing/environmental facilities and infrastructure and the loss of specific characteristics of residential areas.

This study aimed to analyze changes in environmental quality and determine the typology of the City Center of Semarang: a case study in the Semarang Tengah district. The research approach used was spatial by utilizing Geographic Information System and Remote Sensing (GIS/RS) technology in most of its analysis. Residential environmental assessment criteria can be identified in remote sensing

imagery [28]. Remote sensing is defined as collecting and interpreting information about a target without being in physical contact with the object [29]. Remote sensing refers to the activities of recording, observing, and perceiving (sensing) objects or events in faraway (remote) places. In remote sensing, the sensors are not in the direct contact with the objects or events are observed [30]. Remote sensing data has a wide scope so that it is possible to see the overall environmental conditions. Through remote sensing data can be identified in detail the distribution of houses. Land valuation for settlement analysis based on environmental limiting criteria can be seen clearly in the image.

2. Research Location

The location of the study was in the city center of Semarang, Semarang Tengah district. The area of study is 6058406 m² covers 15 villages (Figure 1).

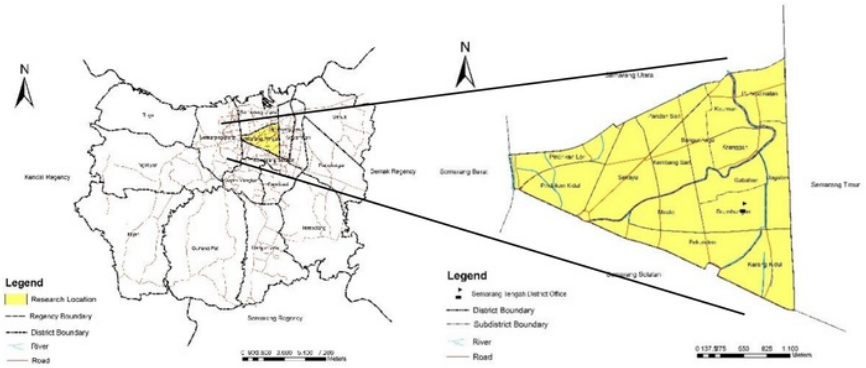


Figure 1 Research Location

3. Methods

This research aimed to analyze **Changes of Settlement Environmental Quality in Semarang City Center** This study used descriptive quantitatie method with a spatial approach utilizing Geographic Information System and Remote Sensing (GIS/RS) technology in most of the analysis. The main data source was Quickbird image. The analysis technique was done based on weighted overlays. The analysis stages were as follows:

a. Characteristic analysis of socio-economic status and population in the city center area
b. The analysis of the built up land change aimed to find out the development of the urban settlement area for 10 years. (2006 - 2016)
c. Analysis of the quality of the city center residential environment aimed to determine changes in environmental quality and typology of settlements. It was done by using physical environment variables namely building density, road width, road conditions, vegetation, layout of buildings and facilities

4. Result and Disscusion

4.1 Population and socio-economic characteristics of the Semarang Tengah District

The livelihoods/jobs of the residents of Semarang Tengah District mostly work as traders and entrepreneurs (26%) in accordance with the functions of the city center as the Central Business District and industrial workers (20%). Increased livelihoods of residents who work as traders and entrepreneurs are quite significant (13%). The industries in the Semarang District are in the household industry which does not require large areas of land. The value of land in the city center area is very expensive, so it is not suitable to be used for activities that are less profitable based on location. The dominant education of the residents of Semarang Tengah District is Elementary School (≥ 49%), Junior High School (21%), Senior High School (21%) and College (9%). This composition has not changed for 10 years. This condition can be explained that the young urban center prefers to live near the location of educational

facilities, which are available in several locations in the city center. In addition, low-educated industrial workers live close to the location where they work.

Population density in Semarang Tengah District was 9833 people/km^2 [31]. This density value ranks in the 3rd (third) of the population density of Semarang City (Table 1). The Central Location of Semarang City Area is known as Simpang Lima. Population density around Simpang Lima is low and the value is getting higher at a distance further from Simpang Lima (city center).

Table 1. Population of Semarang Tengah District

No	Village	Population (person)		Δ Population 2006 - 2016	
		2006	2016	Person	%
1	Pekunden	4536	4079	-457	10
2	Karang Kidul	5208	4888	-320	6
3	Jagalan	6731	6235	-496	7
4	Brumbungan	3782	3430	-352	9
5	Miroto	5390	5245	-145	3
6	Gabahan	7481	6363	-1118	15
7	Kranggan	5619	5579	-40	1
8	Purwodinatan	4753	4663	-90	2
9	Kauman	3988	3768	-220	6
10	Bangunharjo	3634	3212	-422	12
11	Kembangsari	4763	3914	-849	18
12	Pandansari	3511	3241	-270	8
13	Sekayu	4170	3847	-323	8
14	Pendrikan Kidul	4102	3945	-157	4
15	Pendrikan Lor	7424	7302	-122	2
		75092	69711		

The decrease in the number of residents in the city center due to the increase in city center activities causes various problems, so that the people prefer to stay away from the city center to the outskirts of the city [22]. The largest decline in population was in Gabahan Village. Generally, there was a decrease in the population in the Semarang Tengah District during the period of 10 (ten) years. (Table 1.)

4.2 Landuse of Semarang Tengah District

Land use in the Semarang Tengah District is mostly used for settlements 88% and 10% is used for commercial activities. Analysis of land changes was done by using image data/Quicbird image. The capability of high-resolution satellite imagery is very suitable for identification, rapid urban area monitoring. The Semarang Tengah District experienced land use changes for 10 years period. There was an increase in the built up area of 11%, which mostly functioned for settlements and commercial activities. Other landuse remains unchanged (Table 2). During this period, the area of land used for trade and services activities was increased by 2% (70322 m^2). The city center area is considered by activities of the Central Business District which is characterized by the use of trade and service land [9].

Table 2. Landuse Semarang Tengah District

No	Sub District	Built Up Area (m^2)						Non Built Up Area(m^2)		Total
		Settlement		Commercial		others				
		2006	2016	2006	2016	2006	2016	2006	2016	2006
1	Pekunden	707,887	708,281	91,492	91,619	0	0	520	0	799,900
2	Karang Kidul	813,865	813,849	21,535	21,551	0	0	0	0	835,400
3	Jagalan	243,605	243,641	26,695	26,659	0	0	0	0	270,300
4	Brumbungan	298,035	280,085	499	19,124	0	0	5,366	4691	30,3900
5	Miroto	328,598	335,992	8	8	0	0	7,394	0	336,000
6	Gabahan	203,534	198,560	1,666	6640	0	0	0	0	205,200
7	Kranggan	252,500	252,500	0	0	0	0	0	0	252,500
8	Purwodinatan	376,014	375,572	11,6386	11,6828	0	0	0	0	492,400
9	Kauman	166,581	159,463	119,719	126,837	0	0	0	0	286,300
10	Bangunharjo	235,265	231,101	15,735	19,899	0	0	0	0	251,000
11	Kembangsari	226,368	226,360	66,168	66,176	0	0	4,964	4964	297,500
12	Pandansari	362,729	363,164	40,766	40,815	0	0	62,505	62022	466,000
13	Sekayu	446,377	498,455	75,116	90,345	0	0	67,307	0	588,800
14	Pendrikan Kidul	284,452	287,661	4613	3673	1,1875	1,1967	2,360	0	303,300
15	Pendrikan Lor	367,900	347,354	0	20,546	0	0	0	0	367,900
	Total	5,315,715	5,324,052	582,405	652,737	11,875	11,967	152,422	73692	6,058,406

4.3 Analysis of the City Center Settlement Environment

The problem of the quality of neighborhood settlements is related to slum environmental conditions. Slum Settlements are settlements that are uninhabitable due to building irregularities, high levels of building density, and the quality of buildings and facilities that do not meet the requirements. Furthermore, the criteria of slum settlement can be seen from buildings including building irregularities, building density and building quality. Building technical requirements relate to the suitability of the location and function of health and comfort. [32].

The evaluation of the quality of the environment in the city center area of Semarang adopts the scoring technique method used by Purwadi, S.H. and Sanjoto, T.B. [28] to assess slum residence. This was done with the consideration that the quality of the settlement environment can be assessed based on the condition of the slum of a settlement environment. Modification of the criteria for each settlement environment scoring was carried out in the study area in the city center (Table 3).

To explain the changes in the quality of the settlement environment, it was assessed on 6 variables that affect the quality of the settlement environment, namely building capacity, road width, road conditions, shade vegetation, building arrangement and completeness of facilities. The facility was used as one of the assessment variables because it has an important role related to the conditions of the settlement environment. The study used data with a span of 10 years (2006-2016). Analysis of changes in the quality of the settlement environment begins with reviewing changes in the quality of each variable.

Table 3. Variables and Weighting of Environmental Quality Assessment

No	Variable	Weight	Score (criteria)		
			1	2	3
1	Building Capacity	3	building roof area >68%	building roof area /block 58 - 68 %	building roof area /block <58%
2	Road Width	2	width road of the entrance to the settlement <3m	width road of the entrance to the settlement /block 3-4 m	width road of the entrance to the settlement /block >4m
3	Road Condition	2	<20% the entrance is paved and cemented	20-40% the entrance is paved and cemented	>40% the entrance is paved and cemented
4	Vegetation	2	Shade vegetation per block <7%	Shade vegetation protector per block 7 - 14%	Shade vegetation protector per block >14%
5	Building Arrangement	3	<22% regular settlements per block	22 - 44% regular settlements per block	>44% regular settlements per block
6	Facilities	3	Available <9	Available 9-11	Available >11

Source : Purwandhi,S.H.;Sanjoto,T.B. dengan modifikasi , 2010

Each variable used to assess the quality of the neighborhood was given a score. The lowest score is 1 and highest score is 3 (Table 3). The results of the assessment of the quality of the settlement environment variable were divided into 3 classes, namely:

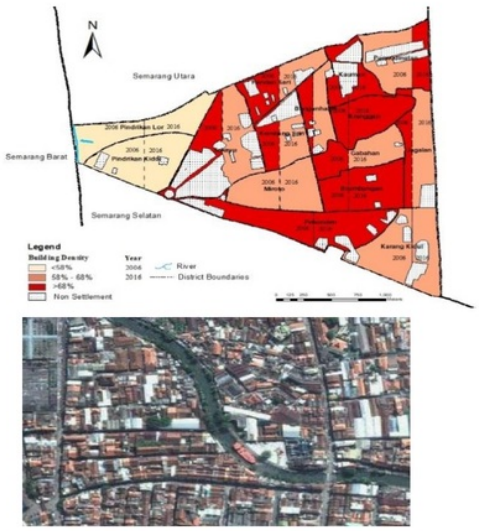
- Score 1: Low quality
- Score 2: Moderate quality
- **Figure 2**. Building Density Distribution 2006-2016

a. Building Density

The condition of residential building density is inversely proportional to the quality of the settlement environment. The scores and criteria used for building capacity analysis are shown in Table 3. Block settlements that have high density indicate low quality settlements. Analysis of the density of residential buildings was assessed based on the formula:

Building density = building roof area / settlement block area x 100%.

There was a decrease in building density in the Semarang Tengah District during 2006-2016. Initially it was known that there were 10 villages which had high density and then decreased into 5 villages (Table 4). The decline in building density occurred in the Jagalan and Gabahan villages while the increase occurred in the Purwodinatan Village. This building density decreased in score from a distance further from the center of the city. The phenomenon of the building density in the center of Semarang is also found in other cities. The distribution of building density in the District of Semarang Tengah is shown in Figure 2.



>68% Kauman

Figure 2. Distribution of building density in the District of Semarang Tengah

Table 4. Building Density 2006-2016

No	Villages	2006	2016
		Density	Density
1	Pekunden	73%	70%
2	Karang Kidul	61%	65%
3	Jagalan	75%	67%
4	Brumbungan	74%	72%
5	Miroto	62%	66%
6	Gabahan	73%	68%
7	Kranggan	71%	76%
8	Purwodinatan	68%	69%
9	Kauman	83%	77%
10	Bangunharjo	75%	68%
11	Kembangsari	72%	65%
12	Pandansari	86%	66%
13	Sekayu	74%	62%
14	Pendrikan Kidul	49%	48%
15	Pendrikan Lor	57%	53%

b. The width of the entrance road to the settlement block

The width of the entrance to the settlement block was used as a variable for the quality of the settlement environment because it can be an indicator of environmental quality.it stated the easy access to Settlements. A good quality of settlement environment can be identified based on the existence of a wide road with good conditions (Keputusan Menteri Permukiman dan Prasarana Wilayah No. 534/KPTS/M/2001)

The scores and criteria used to analyze the width of the entrance to the Middle District settlement block are shown in Table 3.

Overall, the Semarang Tengah District did not experience a change in the width of the entrance road to Settlement. Most of the area has an average road width of 3-4 meters (Table 5). At the farthest distance from the city center, the average entrance road is <3 meters, namely in the Kauman Village. The width distribution of the entrance road to the settlement block in Semarang Tengah District 2006-2016 is shown in Figure 3.

Table 5. Width Entrance to the Block Settlement in Semarang Tengah District

No	Villages	Average of Road Width (m)	
		2006	2016
1	Purwodinatan	4	4
2	Jagalan	3	3
3	Karang Kidul	3	3
4	Pekunden	4	4
5	Kauman	2	2
6	Bangunharjo	4	4
7	Pandan Sari	5	5
8	Sekayu	5	5
9	Miroto	3	3
10	Brumbungan	3	3
11	Gabahan	3	3
12	Kranggan	3	3
13	Kembangsari	5	5
14	Pindrikan Kidul	4	4
15	Pindrikan Lor	2	2

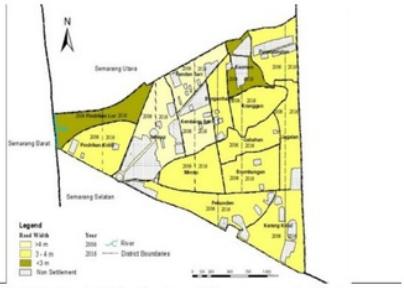


Figure 3. Wide Spatial Distribution of the entrance the Settlement block in the Semarang Tengah District 2006-2016

3 – 4 m : Brumbungan

c. Road Conditions

The condition of the entrance to the Semarang Tengah District Settlement was > 40% paved and cemented. This condition has not changed for 10 (ten) years and is spread evenly throughout the settlement blocks. The score and criteria for the entrance to the residential area used to assess the quality of the residential environment are shown in Table 3.

Figure 4. The condition of the entrance to the Semarang Tengah District Settlement

d. Vegetation

Vegetation for greening in the housing environment is as protector and also serves for conditioning, beauty and natural sustainability. Settlement location as a residence is influenced by several factors depending on the activities of the city in question. Score and Criteria. Settlement vegetation is shown in Table 6. The vegetation protector can be easily interpreted in the sensory image because it is clearly seen as a land cover on. Vegetation protector analysis using a formula:

Vegetation protector = Area of vegetation cover / Area of settlement block x 100%

There was a decrease in the extent of the shade vegetation during the period of 2006-2016. (Table 6) Initially there were 10 urban villages which had vegetation> 14% then reduced to 3 villages. Areas that experienced a decrease in the extent of shade vegetation were found in 7 villages, Karang Kidul. Miroto, Bangunharjo, Kembangsari, Pandansari, Sekayu, Pendrikan Kidul. Distribution of residential areas that have a good pelidung vegetation is located closest to the city center. Its condition declined at a distance further from the city center (Figure 5)

Table 6. Settlement's Vegetation/ shade trees Block di Semarang Tengah District

Village	% Shade vegetation per block	
	2006	2016
Pekunden	51%	19%
Karang Kidul	33%	14%
Jagalan	11%	8%
Brumbungan	26%	19%
Miroto	17%	13%
Gabahan	6%	4%
Kranggan	2%	1%
Purwodinatan	4%	5%
Kauman	3%	5%
Bangunharjo	19%	3%
Kembangsari	15%	2%
Pandansari	39%	6%
Sekayu	36%	20%
Pendrikan Kidul	21%	7%
Pendrikan Lor	12%	10%

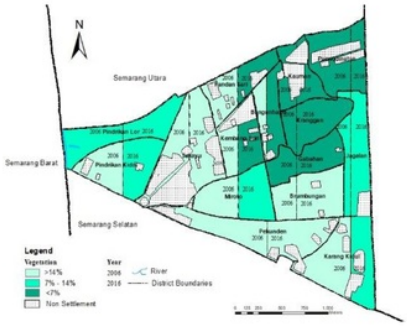


Figure 5. Shade Vegetation the Settlement

>14% : Pandansari

e. Building Arrangement

Analysis of changes in building arrangement in 2006-2016 aimed to determine changes in the buildings arrangement in a settlement block in each village in Semarang Tengah District. The score and criteria for building arrangement are shown in Table 7. The building arrangement reflects the regularity of the building pattern in the settlement block. The building arrangement was analyzed by using a formula:

Building Arrangement = area of regular settlements / area of settlement blocks x100%

The central location of Semarang City (in Karang Kidul village) showed the buildings arrangement > 44% in the form of regular settlements. However, Pekunden Village, which is also located in the city center, showed fewer regular settlement arrangements (22% - 44%). This is because Pekunden village has a fairly large slum area of 5000 m² (Lampiran Keputusan Wali Kota Semarang Nomor 050/801/2014).

The layout of settlements in the Semarang Tengah District has not changed its location and quality value for 10 years. Overall the location closest to the city center shows the largest area of regular settlement (Figure 6).

Table 7. Building Arrangement

No	Village	Arrangement	
		2006	2016
1	Pekunden	17%	17%
2	Karang Kidul	50%	50%
3	Jagalan	0%	0%
4	Brumbungan	65%	65%
5	Miroto	33%	33%
6	Gabahan	0%	0%
7	Kranggan	0%	0%
8	Purwodinatan	0%	0%
9	Kauman	0%	0%
10	Bangunharjo	0%	0%
11	Kembangsari	0%	0%
12	Pandansari	0%	0%
13	Sekayu	4%	4%
14	Pendrikan Kidul	34%	34%
15	Pendrikan Lor	34%	34%

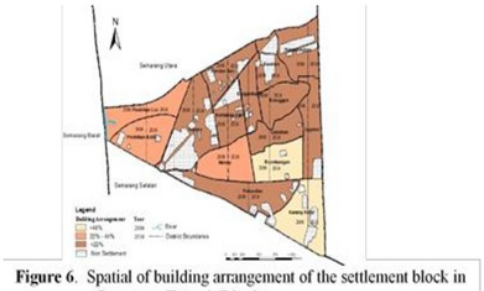


Figure 6. Spatial of building arrangement of the settlement block in Semarang Tengah District

>44% : Karang kidul

f. Settlement Facility

Settlement environmental facilities need to be considered in determining the quality of settlements because facilities are needed to meet a decent residence and function to support the activities of the population. The facilities used to assess the quality of the settlement environment were: educational facilities, religious facilities, health facilities, trade facilities and other services/facilities (Table 8). In determining the settlement facility assessment scores refereed to the Likert scale that used level 3. Score/Criteria of the number of facilities used to determine the quality of the settlement environment are as follows:

Score 1: available < 9 kinds of facilities
Score 2: available 9 - 11 kinds of facilities
Score 3: available > 11 kinds of facilities

Table 8. Calculation of completeness of facilities in Semarang Tengah District

No	Village	Educational facilities		Religious facilities		Health facilities		Trade facilities		TOTAL	
		2006	2016	2006	2016	2006	2016	2006	2016	2006	2016
1	Pekunden	4	2	4	4	3	3	3	3	14	12
2	Karang Kidul	4	3	4	4	1	1	4	4	13	12
3	Jagalan	4	2	4	4	2	2	3	3	13	11
4	Brumbungan	4	3	3	3	1	1	3	2	11	9
5	Miroto	4	2	3	3	2	2	3	3	12	10
6	Gabahan	4	2	2	3	1	1	4	3	11	9
7	Kranggan	2	1	3	3	1	1	4	4	10	9
8	Purwodinatan	3	3	3	4	1	1	4	4	11	12
9	Kauman	3	2	2	2	1	1	4	4	10	9
10	Bangunharjo	3	3	3	3	1	1	4	4	11	11
11	Kembangsari	2	2	2	2	1	1	2	2	7	7
12	Pandansari	2	3	3	3	1	1	4	4	10	11
13	Sekayu	4	3	3	3	3	3	4	4	14	13
14	Pendrikan Kidul	4	3	3	3	2	2	4	4	13	12
15	Pendrikan Lor	4	2	3	2	1	1	3	3	11	8

The most complete set of settlement facilities in Semarang Tengah were in 7 villages (Table 9). In 2016, there was a decline in quality in Jagalan Village, Miroto and Pendrikan Lor. Spatial distribution of facility availability is shown in Figure 7.

Table 9. Facility Availability

No	Village	TOTAL	
		2006	2016
1	Pekunden	14	12
2	Karang Kidul	13	12
3	Jagalan	13	11
4	Brumbungan	11	9
5	Miroto	12	10
6	Gabahan	11	9
7	Kranggan	10	9
8	Purwodinatan	11	12
9	Kauman	10	9
10	Bangunharjo	11	11
11	Kembangsari	7	7
12	Pandansari	10	11
13	Sekayu	14	13
14	Pendrikan Kidul	13	12
15	Pendrikan Lor	11	8

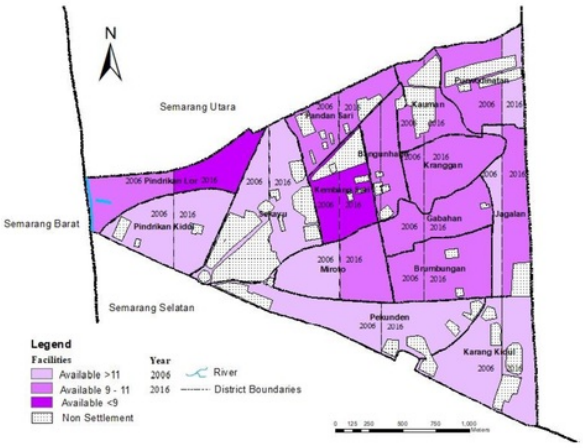


Figure 7. Spatial distribution of the availability of block facility in settlement in Semarang Tengah District.

g. Changes in the quality of the environment in the Semarang Tengah District 2006-2016

The quality of the settlement environment in Semarang Tengah District was assessed based on 6 (six) variables. Each variable was given a score and weighting score. The lowest score was 1 and highest score was 3. Giving weighting score was based on the influence of each variable on the quality of the settlement environment (Table 10)

- Weighting score 1 means that the effect on the quality of settlements is very small
- Weighting score 2 means that the effect on the quality of housing is moderate
- Weighting score 3 means the effect on the quality of large settlements

Environmental assessment results were divided into 3 classes, namely:

- Score 1: Low quality
- Score 2: Moderate quality
- Score 3: High quality

Changes in environmental quality in Semarang District were relatively small. Of the 15 villages that became the study area, there were 2 villages which showed a decrease in environmental quality, namely Brumbungan and Miroto villages due to reducing the extent of shade vegetation and reduced facilities. Miroto and Brumbungan villages were identified as Semarang slum locations Semarang (Lampiran Keputusan Wali Kota Semarang Nomor 050/801/2014). There was one urban village that showed an improvement in the quality of the settlement environment, namely Sekayu Village. Trade and service activities in Sekayu Urban Village have rapidly increased, the conversion of residential land has changed to commercial. In the period 2006-2016 was the beginning of the construction of trade and service areas in Sekayu Village, namely the construction of Paragon Mall/Hotel, DP Mall, Novotel Hotels and others. The implication of this condition is a decrease in the density of residential buildings (Figure 8).

Table 10. Calculation of the Quality of Settlement Environmental Areas in Semarang Tengah District 2006-2016

No	Kelurahan	Building Density		Road Width		Vegetation		Building Arrangement		Facilities		Weighting Score	x	Environmental Quality	
		2006	2016	2006	2016	2006	2016	2006	2016	2006	2016	2006	2016	2006	2016
1	Pekunden	3	3	4	4	6	6	3	3	9	9	25	25	Moderate	Moderate
2	Karang Kidul	6	6	4	4	6	4	9	9	9	9	34	32	High	High
3	Jagalan	3	6	4	4	4	4	3	3	9	6	23	23	Moderate	Moderate
4	Brumbungan	3	3	4	4	6	6	9	9	6	6	28	28	High	Moderate
5	Miroto	6	6	2	2	6	4	6	6	9	6	29	24	High	Moderate
6	Gabahan	3	6	4	4	2	2	3	3	6	6	18	21	Low	Low
7	Kranggan	3	3	6	6	2	2	3	3	6	6	20	20	Low	Low
8	Purwodinatan	6	3	6	6	2	2	3	3	6	9	23	23	Moderate	Moderate
9	Kauman	3	3	4	4	2	2	3	3	6	6	18	18	Low	Low
10	Bangunharjo	3	6	4	4	6	2	3	3	6	6	22	21	Low	Low
11	Kembangsari	3	6	4	4	6	2	3	3	3	3	19	18	Low	Low
12	Pandansari	3	6	4	4	6	2	3	3	6	6	22	21	Low	Low
13	Sekayu	3	6	6	6	6	6	3	3	9	9	27	30	Moderate	High
14	Pendrikan Kidul	9	9	4	4	6	4	6	6	9	9	34	32	High	High
15	Pendrikan Lor	9	9	2	2	4	4	6	6	6	3	27	24	Moderate	Moderate

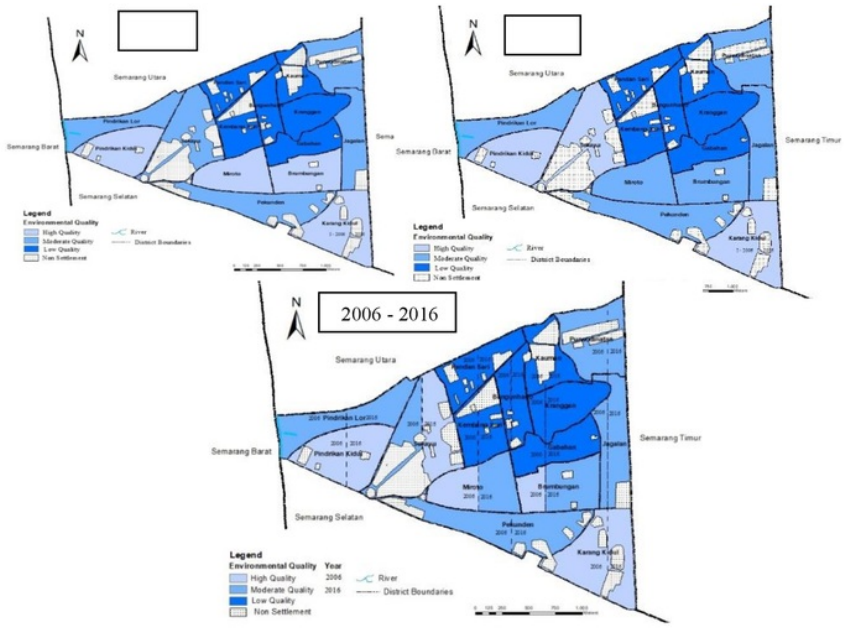


Figure 8. Changes in the quality of the environment in the Semarang Tengah

i. Typology of Settlement in Semarang Tengah District based on the quality of the settlement environment

Grouping of settlements is generally caused by several causes, such as social class and the ability to access land to build a house. The preference of the community in choosing settlements considers environmental characteristics such as location of education, crime, environmental quality, facilities, socio-demographic composition, characteristics of settlements and land prices [35]

The following is the Typology of Settlements in the Semarang Tengah District located in the City Center of Semarang based on the quality of the settlement environment (Figure 9):

Typology I
Block Settlement with High Environmental Quality
Area block settlement 482280 m^2
Population Density: 10242
Higher Education People (Collage): 11.5%
A dominant job as a retired building worker, and a trader
Access/average travel time to the city center: 6.25 minutes
Location: Karang Kidul, Brumbungan, Miroto, Pendrikan Kidul (2006)
: Karang Kidul, Sekayu, Pendrikan Kidul (2016)

Typology II
Block Settlements with Moderate Environmental Quality
Area block Settlement 405089 m^2
Population Density: 13726
Higher Education People (Collage): 8.6%
Dominant jobs as industrial workers, entrepreneurs, traders
Access/average of travel time to the city center: 7.03 minutes

Location: Pekunden, Jagalan, Purwodinatan,, Sekayu, Pendrikan Lor (2006)
: Pekunden, Jagalan, Brumbungan, Mirot, Purwodinatan, Pendrikan Lor (2016)

Typology III:
Block Settlements with Low Environmental Quality
Area block Settlement 685009 m2
Population Density: 17619
Higher Education People (Collage): 8.2%
A dominant job as a trader, laborer, transporter
Access/average of travel time to the city center: 8.17 minutes
Location: Gabahan, Kauman, Bangunharjo, Kembangsari, Pandansari (2006)
: Gabahan, Kauman, Bangunharjo, Kembangsari, Pandansari (2016)

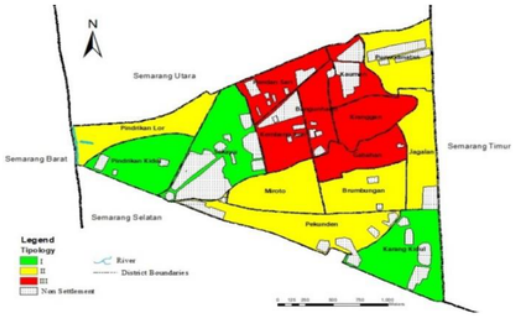


Figure 9. Typology of Settlements based on Semarang Tengah

5. Conclusion

The livelihood/occupation of the residents of Semarang Tengah District mostly work as traders and entrepreneurs, this is in accordance with the function of the city center as the Central Business District. The increased livelihoods of residents who work as traders and entrepreneurs were quite significant (13%). The population density of Semarang Tengah District was 9833 people/km^2. This density value ranks in the 3rd (three) of the population density of Semarang City. The location of Semarang City Center is known as Simpang Lima. The closest location to Simpang Lima the low of population density, on the other hand, the further distance to Simpang Lima, the higher population density.

Land use in the Semarang Tengah District is mostly used for settlements 88% and 10% is used for trade and service activities. Analysis of land changes was done by using image data/Quicbird image. The District of Semarang Tengah experienced land use changes for 10 (years). There was an additional built up area of 11%. Other land uses remain unchanged. During this period, the area of land used for trade and services activities was increased by 2% (70322 m^2). Semarang City Central Area is branded by activities of the Central Business District which is characterized by the landuse of trade and service activities [9].

Changes in environmental quality in Semarang District were relatively small. There was decrease in the quality of settlements in the Miroto and Brumbungan villages due to the reduced facilities of the Miroto and Brumbungan villages, it was identified as the location of the slums of Semarang City [34]. Sekayu Village showed an improvement in the quality of the residential environment for 10 years. Trade and service activities have increased rapidly, and there has been a change in the function of residential land into land for trade and service activities.

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