Water and Sanitation in Slum Settlement: Case Study of Kaliawi, Indonesia

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Abstract. As stated in the Sustainable Development Goals (SDGs), water and sanitation are basic human needs that must be met to support livelihoods. However, in many developing countries, the issue of inequality continues to be faced, especially in slum settlements. The research was conducted in an area of slum settlements, in Kaliawi Village, Bandar Lampung to reveal the accessibility of water and sanitation using questionnaires and observation. The output is mapped using a spatial analysis approach. Furthermore, crosstab is used to analyze the possibility of internal factors affecting the condition of infrastructure provision in each house. The results showed that a large number of houses do not have a water source, some houses do not have septic tanks, the existing drainage network is not connected, and areas are not served by garbage collection services. Occupation, education level, land ownership status, and physical condition of the house are related to access to clean water and sanitation available in each house.

Keywords: water and sanitation, water, sanitation, slum, Indonesia

1. Introduction

Urbanization shows the urban rapid development with the population concentrated in urban areas. Urbanization happened due to natural population increase and migration. People migrate to the city because it is considered a very attractive place that promises a large number of supporting facilities, higher income, and a higher standard of living. That way, urban population and density will increase over time. As estimated by UN-Habitat, by 2030 cities in the world will be inhabited by 3.3 billion people. Along with this, the need for land will also increase. Communities will compete to get land and trigger the emergence of urban slum settlements. In the end, urbanization and urban development will face the problems of slum settlements which are full of inadequate basic infrastructure, especially clean water and sanitation. The provision of this infrastructure is one of the targets in achieving the Sustainable Development Goals (SDGs), especially in goal number 6: Clean Water and Sanitation.

Problems with urbanization, slum settlements, and lack of access to basic infrastructure also occur in Tanjung Karang Pusat, Bandar Lampung City Center, Lampung Province. In the Bandar Lampung Spatial Plan document, Tanjung Karang Pusat is designated as the capital city of Bandar Lampung. It is directed for high-density residential areas and centers of trade and services. Tanjung Karang Pusat is developing very rapidly as a center of urban activity accompanied by the emergence of slum settlements. The slum area is located in Kaliawi Village. Based on the Bandar Lampung Mayor's Decree regarding Housing and Slum Locations in Bandar Lampung (Bandar Lampung Mayor's Decree Number 406/III. 24/HK, 2016), Kaliawi has a very large slum area classified...
as a heavy slum area of 4.30 hectares, medium slum 38.64 hectares, and light slum 1.50 hectares of the total area of Kaliawi Village 56 hectares. The problems that occur in Kaliawi Village are quite concerning, especially RT 8 LK II which is the focus of this research. Based on the report of KOTAKU (Cities Without Slum Settlements - Indonesian Program Strategy for the Acceleration of Slum Management in Indonesia), RT 8 LK II is a slum location in terms of slum settlement criteria such as the number of irregular drinking houses, the number of houses that are not reached by quality and clean water, the number of houses that have wastewater facilities, the number of houses that have a sewage treatment system, and the condition for environmental drainage in accordance with the technical requirements.

The purpose of this research is to reveal the condition of the accessibility of clean water and sanitation including clean water, waste water, drainage, and solid waste in the slum settlements of Kaliawi Village. The problems raised in this study in research have been carried out in many places. However, the research focus discusses aspects of clean water and sanitation separately. This study also considers the existence of internal factors in community characteristics that may indicate factors affecting the availability of basic infrastructure so that it contains more data and a more complete discussion. The results of this study can illustrate how the urgency of basic infrastructure for the community, especially in urban areas, can influence cities to respond to the challenges of their sustainability goals.

2. Methods

The approach used in this research is quantitative. Quantitative research is the study of numbers and in the analysis using statistics to identify some phenomenon (Sugiyono, 2006). This research using statistical analysis and spatial mapping.

There are two types of data collection in this study: primary and secondary. The primary data is collected through a direct survey to the research site from RT 8 LK II population, Kaliawi, Tanjung Karang Pusat using a questionnaire and digital mapping (using Avenza application). The population selected is the head of a family in there. In mapping, an error might occur in the form of a shift in the coordinates. The possibility of two adjacent houses that were digitized together could also occur. The secondary data is used to know the general picture of Bandar Lampung, Tanjung Karang Pusat, and Kaliawi Village related to population and geographical condition. The source of this secondary data collection is a document from the central statistics agency of Bandar Lampung and KOTAKU.

Data collected is analyzed in this study using quantitative data analysis. Data analysis in quantitative research is to collect data from a population or population sample and then the data obtained are analyzed (Sugiyono, 2007). Water and sanitation infrastructure condition are identified by checking the availability and the distribution using descriptive spatial analysis. Descriptive analysis is used to determine the availability of clean water infrastructure and sanitation as well as the spatial analysis used for the distribution of clean water and sanitation infrastructure. Descriptive analysis is presented using tables or charts. The distribution of its availability is presented using maps.

Correlation between the water and sanitation infrastructure condition and the internal factors using cross-tabulation associations. The availability of clean water infrastructures that will be analyzing is the presence or absence of clean water and sanitation infrastructure in the slums of Kaliawi Village. The community characteristics to be analyzed are the type of community work, the level of education, the status of land tenure, the status of homeownership, and physical status of the building. Cross-tabulation analysis can also be called by crosstab method, this analysis is an analysis to see the linkage or correlation between two variables. In this study, the method used was the technique of contingency table (nominal data). The results of these analyzes are presented in a table form with variables arranged in rows and columns.

3. Result and Discussion

3.1 Characteristics of Slum Settlement in Kaliawi Village (RT 8 LK II)

The character of the slum is described based on the criteria of the resident community. These characteristics will then be considered as internal factors affecting water supply and sanitation in the home. These characteristics
include community occupation, level of education, homeownership status, and type of house. Almost all people work in the informal sector such as private freelancers or public workers and have low-income standards. Most of the people also have elementary school education which is in the low category. The status of homeownership is rent and the house is non-permanent.

3.2 Water and Sanitation Access in Slum Settlement

The components of clean water and sanitation infrastructure include clean water, wastewater, solid waste, and drainage.

3.2.1 Clean water infrastructure

Based on the survey results, only a few houses have individual air sources to meet their water needs at home. The source is a well. Meanwhile, people who do not have water sources that meet their needs by buying water. The water purchased comes from the head of RT 8 LK II Pak Sentani at a price of around 6,000.00 rupiahs/hour to 10,000.00 rupiahs/hour depending on the distance and slope from the location of the house. This fee is charged every 2 days for every purchase of water. Water using pipes connected to each house. The quality of water obtained by the community is quite good because it is clear, colorless, and tasteless. To get this service, people must first enter Mr. Sentani. After registering, the community has to queue according to the registration number until the clean water distribution installation is installed and water can be distributed. Even so, overall, most people still think that data is a problem that must be entered because most people find it difficult to get air directly by paying at once. If mapped, the distribution of houses that have their water source is shown in Figure 1.

As can be seen in Figure 1, there are three color distributions: blue, orange, and purple. The blue color indicates the location of houses that have water sources in the form of wells, the orange color indicates the location of houses that do not have their water source, while the purple color is a public service facility that already has its water source. Of the total housing population, only four houses have water sources consisting of bore wells. Orange-colored houses mostly get air by buying at Pak Sentani. Sources of water used by the community to meet basic needs such as bathing water and washing in the slums of RT 8 LK II Kaliawi Village are still limited. Pipelines such as PDAM have not yet launched the environment.
3.2.2 Wastewater infrastructure
Based on Indonesian National Standard, the provision of wastewater infrastructure includes bathrooms, lattices, septic tanks, sewerage, and IPAL / IPLT. Based on the survey results, it is known that all houses have a bathroom, but not all people have latrines and septic tanks. The number of houses that have latrines and septic tanks is 30, while the rest do not. Reality can be found if there is still a small portion of the community who defecate on the hill or hitchhike to neighbors. For wastewater treatment, no treatment is carried out. There is also no IPAL / IPLT for managing wastewater. Around 3 houses dispose of their wastewater in septic tanks, 39 houses dispose of wastewater in the trenches, and around 40 houses just dispose of wastewater. As can be seen in Figure 2, houses with latrines and septic tanks on the map above are blue, while people without latrines and septic tanks are yellow. Houses that have septic tanks are near urban areas, while houses that are closer to hills do not have septic tanks.

3.2.3 Drainage infrastructure
The availability of drainage based on survey results shows that around 35 houses have drainage and 49 houses do not yet have drainage. This amount is calculated based on the drainage network that has been mapped in Figure 3. In Figure 3 it can be seen that in the study area no drainage network is connected to the urban drainage network, 35 houses that have a drainage network are not connected causing waterlogging for more than 2 hours and unable to drain rainwater runoff. Also, water flowing in the drainage network mixes with wastewater, causing an unpleasant odor. This drainage problem causes this area to become one of the locations that often floods when heavy rains occur in Bandar Lampung City.

3.2.4 Waste infrastructure
The availability of waste handling facilities such as garbage bins, garbage carts, and TPS and garbage transport services are not yet available in the village of Kaliawi. To meet the needs of waste disposal facilities, the community dumps rubbish on the hill and discharges rubbish at the Tamin market in Kelapa Tiga Village. For rubbish on the hill, according to residents, there is often a landslide. Figure 4 shows a map of the distribution of solid waste infrastructure because these facilities do not yet have waste handling facilities. In Figure 4 it can be seen that houses that dump trash in markets are shown in blue, and houses that dump trash on hills are shown in yellow.

![Figure 2. Wastewater infrastructure availability](image_url)
Figure 3. Drainage network availability

Figure 4. Waste management
3.3 Correlation of Water and Sanitation Accessibility and Internal Factors

The availability of clean water infrastructure is related to community characteristics, namely the type of work, the level of education, land ownership, and the physical status of the house. Based on the results of the analysis, it was stated that the availability of clean water infrastructure was related to the type of work. Communities working in the informal sector such as labor, traders, and private sector tend to be mostly without a water source while people who work in the formal sector such as civil servants and retirees have a water source. The availability of clean water infrastructure is related to the level of education. Most people with low education do not have a water source and people who have a high level of education have a water source. Availability of clean water infrastructure is related to land tenure status. Most of the people whose ownership status has a water source are wells and the people whose land rental status does not have a water source. The availability of clean water infrastructure is related to the physical level of the house. The community only has a water source that has a permanent home.

The availability of wastewater sanitation infrastructure has a correlation with community characteristics, namely education level, land ownership status, and physical housing. The level of public education correlates with the availability of septic tanks. Communities with low levels of education tend not to be able to provide latrines and septic tanks and the higher education community tends to provide lattices and septic tanks. Land tenure status correlates with the availability of septic tanks. Communities with ownership status tend to provide wastewater infrastructures such as latrines, septic tanks, and sewage drains, while people with rental status have limited land to provide wastewater infrastructure. Community physical houses have a relationship with the availability of wastewater. Communities that have permanent and semi-permanent houses tend to have wastewater and non-permanent housing communities tend to have no sewerage.

The availability of drainage sanitation infrastructure does not correlate with community characteristics. The availability of drainage does not tend to community characteristics.

The availability of sewage sanitation infrastructure correlates with the characteristics of the land and the physical ownership of the house. Land tenure status is related to the availability of waste treatment facilities. People who own land dispose of garbage at the Tamin TPS market in Kelapa Tiga village and people whose rental status dumps garbage in the hills and slums of RT 8 LK II Kaliawi do not have waste handling facilities. Community physical houses correlate with the availability of waste treatment facilities. People who physically own a non-permanent house tend to dispose of trash on the hill, semi-permanent and permanent tend to dispose of garbage in Tamin village TPS, Kelapa Tiga.

4. Conclusion

The problem in the study area can be summarized as follows: most clean water infrastructure is not available either an individual or communal water sources, some communities do not have bathrooms equipped with sewers and wastewater and septic tanks, and drainage conditions are limited and not connected with urban drainage networks and no sewage treatment facilities. The availability of clean water infrastructure correlates with community characteristics: type of work, level of education, land ownership status, and physical property of the house. People who do not have a water source mostly work in the informal sector, with low education, ownership of rented land, and impermanent houses. The availability of wastewater infrastructure correlates with community characteristics: level of education, land ownership status, and physical housing. People who do not have wastewater infrastructure are low-educated, land rent, and non-permanent physical housing, and some semi-permanent housing. The availability of drainage infrastructure does not correlate with the characteristics of the community because of all types of work, level of education, land ownership or rental status, physical housing that is not permanent or semi-permanent, and status of ownership of drainage houses but the condition is intermittent. The availability of waste infrastructure is related to community characteristics, land tenure, and physical housing conditions. Most of the people who rent land and non-permanent houses are dumping trash on the hill because there are no garbage handling facilities.

Based on the results of this study, recommendations can be made that in providing basic infrastructures such as clean water, wastewater, and waste, the government must pay attention to the characteristics of the community, especially the socio-economic conditions of the community to determine the scale of priorities. Communities with lower socioeconomic conditions have lower access to basic infrastructure.
5. Acknowledgements

The conflicts of interest in the manuscript are among the people with landowners as well as governments. The majority of residents at the research site are people who do not have their land ownership status with the status of the leased land and also they reside not by the provisions in the regulations so that the public cannot provide clean water infrastructure and sanitation.

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