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THE SOCIAL AND CULTURAL ASPECTS OF WASTE DISPOSAL MANAGEMENT IN THE PLANNING REVITALIZATION OF RIVERBANK SETTLEMENT

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ABSTRACT

The research discussed a strategy for revitalizing the slum settlement environment by previously mapping the geographical condition, the culture of living on the waterfront, as well as waste management practices by residents along the banks of the Musi River, Palembang. Most riverbank slums in the big city occupied dirty neighborhoods filled with garbage and waste. Most of the revitalization programs for riverbank waste management in Indonesia only focused on improving the physical quality with less attention to understanding the social and cultural aspects. These improvements resulted in temporary progress that relied on external interventions and subsidies. The interventions often resulted in temporary improvements because of the unsustainable approach. The field surveys collected data observations and interviews from homeowners within a radius of 100m from the riverbanks in four settlements with different physical environmental conditions. The survey collected data on communities' use of river water for daily use and coping with flood conditions. The researchers processed all data to get a complete picture of the residents' cultural view of living, potential, and constraints on waste disposal management. These results reveal the misunderstanding that residents in the settlements have no awareness of environmental cleanliness. On the contrary, they have the intention of mutual cooperation for environmental management. It is a potential strength in social ties and dependence on the community for developing sustainable environmental management strategies based on community empowerment. Improvements, both physical and infrastructure, should strengthen social bonds and community involvement in environmental management. Support in the waste disposal and management should aim to increase community cooperation in managing and monitoring the environment independently, not only at increasing awareness of cleanliness and health as always.

Keywords: *settlement revitalization, waste disposal management, riverbank settlement*

INTRODUCTION

Sustainable housing planning requires efficient environmental management. One of the routine treatments in housing is household waste management. Improving attitudes and behavior in hygiene is the main point in planning waste management in settlements. The condition mainly occurs in organic housing developed by residents independently, as slums. It grows without advance planning. Residents design an environmental management system according to neighborhood conditions and residential growth. The development of environmental management systems more often fails in these settlements. Residents live in dirty environments without a sustainable management plan. The neighborhood cleans waste temporarily at attention from the government or the outside community. To design sustainable environmental management, the plan needs to understand the people's point of view in viewing the environment and their attachment to the environment.

Waste management planning for slums is more

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difficult because of more socio-cultural and economic problems. Slum settlements lack the infrastructure for household waste. Lack of appropriate facilities, inadequate management and technical skills, improper collection of garbage bins, and route planning responsible for the poor collection and transport of municipal solid waste are the causes of the problem of solid waste management in settlements (Marshall & Farahbakhsh, 2013).

Riverside settlements in big cities in Indonesia always face piles of garbage that fill the riverbanks. These dense settlements with minimal urban infrastructure obstacles develop an environmental management system. The difficulty of infrastructure development is not only density but also geographical conditions. The dwellings stand on a tidal wetland flooded with water. Construction of roads to and within the neighborhood is often inadequate. Almost all the neighborhood roads are cut off, narrow, and dangerous (Idham, 2018).

The river flows waste in and out of the settlement zone. The practice of residents throwing trash into the river exacerbates the pile of garbage. It spreads to pollute the river and makes the water very cloudy. The river quality is decreasing along with the increasing density of settlements. Regardless of whether they live in dirty river circumstances, some still rely on river water for their daily needs.

Palembang is located in the downstream zone of the Musi river. This area has a high water level at high tide every day. The settlements have developed since the beginning of the rise of the city. Residents' built houses are on a sloping riverbank with a slow river velocity. At the earliest, residents only rely on rivers as transportation routes and river water as a source of clean water. Residents use a floating foundation system or stilts to adapt to inundated land. Houses built on wetlands also rely on tides to refresh the water. The river flow washes away household waste. The processes rely on the ability of natural ecosystems to recycle waste. The process is ideal for very low-density settlements with organic waste.

The growing population and non-biodegradable waste have disrupted the balance of the ecosystem. Natural distress processes recycle waste not only by inorganic material but also by increasing in number. Residential waste management is no longer automatically recycled naturally, while residents still use the pattern of dumping waste into rivers. The problem of environmental hygiene is getting more difficult without a change in the waste management system (Vergara & Tchobanoglous, 2012).

The circling of activities of residents who depend on the river also pollutes the river water. The current density of settlements on the banks of the river causes river pollution. River pollution is becoming a more severe hazard in developing countries from human activities (Reshma, Pai, & Manjula, 2016). Residents along the river lack clean water. Water availability is abundant but not suitable for use. It affects most of the population who use river water directly for daily needs (Tortajada & Joshi, 2013). They use the river as a water source for cooking and washing water without going through a filtering and purification process.

From a socio-cultural perspective, local residents always attach to rivers for their life activities (Fitri, Triyadi, & Harun, 2017). It creates a pattern of living activities that depend on the river. Residents rely on rivers for various needs, such as drinking water, transportation, food sources, and other natural resources. The challenges of revitalizing waste management in riverbank settlements are not only technical aspects but also socio-cultural and economic aspects. Understanding local conditions is needed in planning sustainable waste disposal management to improve environmental quality (Lüthi, McConville, & Kvarnström, 2010). The population's social, cultural, and economic conditions are important considerations for formulating more sustainable environmental management (van Dijk, Bhide, & Shivtare 2016).

Renewal of cleaning facilities only focuses on physical improvements without considering the socio-cultural context of residents, which is not sustainable. The development operates inappropriately or always requires subsidies to maintain planning without understanding the needs and perspectives of the residents (Azevedo, Scavarda, & Caiado, 2019).

The planning can balance humans and nature. The settlement planning approach focuses not only on the completion of physical development but also on the development of human life and socio-culture. The research identifies the behavior, habits, and practices of the riverbank residents regarding waste disposal. It aims to understand the problems and reveal the potential and socio-cultural constraints for improving strategic waste disposal management of riverbank settlements.

METHODS

The research identifies four locations to represent the diversity of settlements along the Musi river in Palembang. It includes age, density, and physical condition. The two locations are old sites near the city center. The building covers 60-70% of the total land, and open space covers 30-40%. Open space is between buildings, yards, vacant land, and other open spaces. The other locations have lower densities with 50-60% building area. The last residential location is on the city border in a suburban area with a building density of 40-50% (Figure 1).

Field surveys collect data through observation and interviews with 406 respondent residents. The observations concentrate on condition data of houses and settlement infrastructure; the data collection on homeowners 100 m within the riverbank regarding the research objection. River overflow always hits the area closest to the riverbank within that distance. The daily activities of residents are in intensive contact with the river, but the area is the dirtiest by garbage.

The research collects data from random

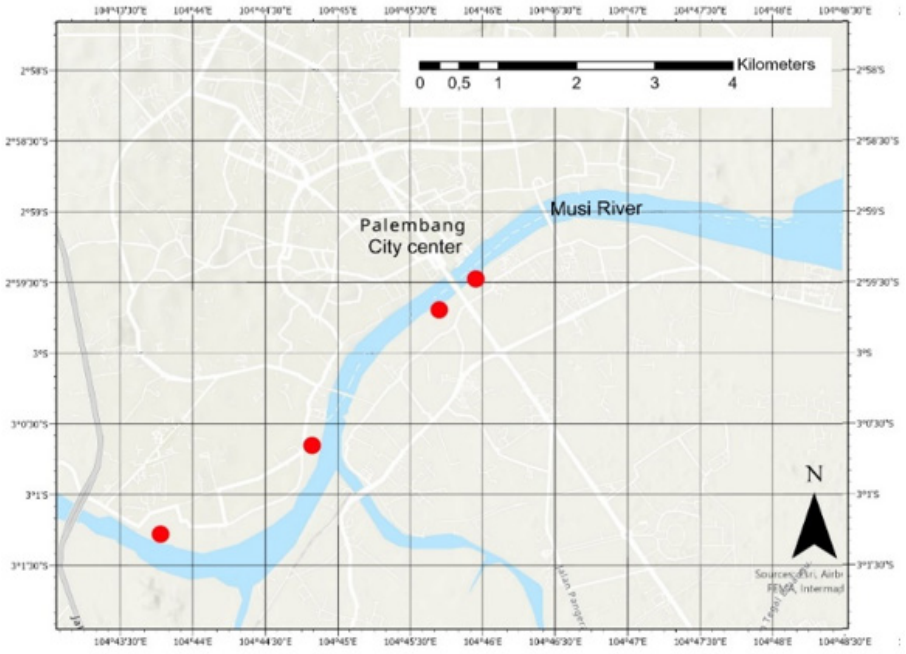

Figure 1 Map of The Study Locations

households in the four study settlements. Physical observations complement data collection with interview location points, photos, and house sketches. The data complete the interview data with residents.

Distribution analysis calculates the frequency of each data collection and displays it as a percentage. The processing of each data compares data separately to discover the relationship between water use activities, environmental perceptions, and waste disposal activities. It composes a waste management strategy by considering the potential and limitations of the geographical and socio-cultural conditions of the residents of slum settlements along the river.

RESULTS AND DISCUSSIONS

The slum settlements on the banks of the Musi river provide land and buildings at low prices but have some problems with buildings and the environment. The residents of these settlements face problems such as cramped housing and inadequate infrastructure and utilities. Most of the settlers also occupied houses without legal ownership. These problems make most residents uncomfortable, as shown in Figure 2.

Sanitation and cleanliness are one of the residential problems that interfere with the comfort of residents. Although almost all houses have bathrooms and latrines, only 41% of bathrooms have latrine sewage treatment tanks. This is the main condition that interferes with the comfort of its residents. Residents find it difficult to build septic tanks in wetlands. The residents only know about septic tank technology built and worked on dry land with low groundwater levels. On the other hand, tidal conditions also cause latrine waste to dissolve and drift along the river. Some residents' houses, especially those on the banks of rivers that are inundated with river water, use *cemplung* latrines. A *cemplung* latrine is a perforated latrine that dumps its waste directly into the river (Azizah et al., 2021). Changes in water from the tides drain the latrine waste into the river's mainstream. This condition pollutes river water which is a source of drinking water for all other city residents.

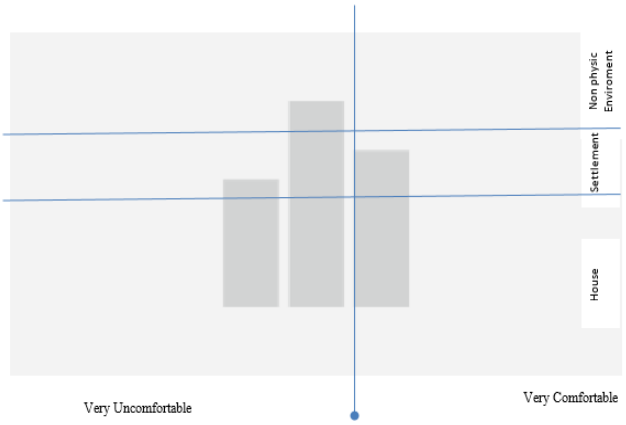

Figure 2 The Comfort of The Neighborhood and House

Therefore, residents need to be introduced to technology for infrastructure development and sanitation management following the wetland environment context. The technology of latrine waste treatment applies by utilizing wetland bioengineering to minimize the impact of pollution on the health of ecosystems. Various sustainable technologies have been developed and applied in urban slums (Katukiza et al., 2012). Technology with ecological principles

can work semi-automatically along with the natural recycling ecosystem. Environmental improvement can start by introducing these technologies.

Although more than half of the houses have not received clean water distribution from drinking water companies, the availability of clean water is not a major problem to disturb the comfort of residents. Residents who do not get a clean water supply from the city's infrastructure lines buy water for their cooking and drinking needs. Several other residents get their clean water supply from a neighbor's house. However, in several other houses, residents still use river water for cooking and drinking, either distilling it before use or directly using it. The resident with no clean water supply uses river water for bathing and washing purposes. In some houses on land that is only occasionally flooded, residents dig wells to meet their water needs. The well water is cloudy because it is polluted by puddles of water from overflowing rivers. The water is not hygienic to be consumed as drinking water. Table 1 shows daily water source.

Residents have also expressed dissatisfaction with the very narrow yard. Most houses in this settlement are tenements with no distance between neighboring houses. In some locations, the front of the house is also directed to the alley, the traditions of the old communities to live in a close house with their families from generation to generation. Parents will divide the area for their children to build houses on the same plot. In some other families, several heads of families can inhabit one large house with children of the same lineage. The settlements become increasingly congested by buildings and the number of settlers. Another condition that reduces their comfort in life is the house's condition. Most of the wood houses have a damaged construction. The forests around Palembang were a source of abundant wood material, but the current logging restrictions make wood rare and expensive, so house repairs become more expensive. In contrast to these conditions, the legality of ownership is not a concern for homeowners. The house stands on a river buffer area which is designated as a building-free area. Many residents do not know this regulation because they have lived on the banks of the river for generations.

Residents still depend on the river in their daily activities (Table 2). People who have lived on the riverbanks for a long time have an attachment to the river as a place to live and a natural resource for their life (Jiménez, Cortobius, & Kjellén, 2014). The activities of residents along the river use the river as a body of water and for household needs. Residents in slum settlements on the river bank have daily activities that are always related to the existence of the river. Some residents are still active in bathing and washing activities, and children swim and play in the river. Others fish and build cages to raise fish for recreation, not for work. Some residents still use boats for transportation and other work related to the river. Besides these activities, they use the river as a drainage channel for wastewater from toilets and garbage dumps. Some residents still use river water for their daily needs, cleaning the house, washing clothes, cooking utensils, and bathing. Some residents take a river as an activity place or suck water to their water reservoirs. The resident's house, which directly connects to the river, builds terraces for bathing and washing. They wash and bathe using water from the river on this waterfront terrace.

Table 3 shows the flooded house intensity. In riverside settlements, flooding is a natural cycle, not a disaster. Residents along the river already know the annual cycle of flooding that enters their settlements. Riverflow always expose the house on the riverbank, either continuously or temporarily (Figure 3). It submerges areas with monthly or annually tidal. However, most of the houses are never flooded. Residents have raised the ground floor of their homes above the annual flood level. Floods are only in areas where the land is inundated, and residents' houses are free from flooding. Most residents are not disturbed by the flood for their daily activities. Residents overcome transportation problems during floods by using small boats to move from one location to another.

Table 1 Daily Water Source

Type of Water Use	Purchase	Neighbors Sharing	City Water Service	Water Well	Filtered River Water	River Water
Drinking	50,0%	6,4%	35,7%	0%	6,4%	1,5%
Bathing	0,2%	1,5%	45,1%	2,5%	15,3%	35,5%
Washing	0,5%	1,0%	42,6%	3,0%	17,2%	35,7%

Table 2 The Intensity of Daily Activities Related to The River

Intensity in days per month	Working	Boating	Fishing	Taking Water	Bathing	Washing
Never	82,0%	61,2%	52,6%	46,2%	44,7%	44,9%
Less than 10 days	8,1%	24,2%	27,4%	12,3%	10,4%	13,8%
10-20 days	0,5%	4,9%	8,9%	4,0%	6,2%	4,0%
More than 20 days	9,6%	9,6%	11,4%	37,8%	39,0%	37,5%

Table 3 The Flooded House Intensity

House Being Flooded Intensity in Days per Year	Point
Never	64,3
Less than 10 days	25,12
10-20 days	2,95
20-30 days	4,68
More than 30 Days	2,7
Average flood water level	14 cm

River landscapes provide more added value as open spaces or natural visuals of riverbank landscapes compared to losses due to flooding (Wu, Chen, & Liou 2021). Flood conditions do not interfere with the comfort of residents. They experience annual floods with high water levels only a few days of the year. Annual flood inundates about twenty-five percent of houses. The stilt foundations of the house are still above the flooding level. The flooded houses are modified by making a border wall under the floor to make a room. Residents only use this room as an additional space or for rental.

Table 4 Ways Residents Cope with Flooding

Ways Coping Flooded	Percent
Nothing	63,8%
Elevate Furniture	16,7%
Move to a room with a higher elevation	14,6%
Evacuate	3,3%
Other ways	1,4%

Table 4 shows the ways residents cope with flooding. The homeowners of flooded houses do not take certain actions to cope. The other homeowner elevates the furniture leg or moves into a higher house floor. Flooding only takes a few days a year, so the underfloor room does not have a much-disturbed function. In the room, residents usually only put some small and light furniture to complement the function of their activities. It facilitates the removal of furniture during a flood. People's daily activities continue as usual.

Table 5 The Currents Garbage Processing

Garbage Processing	Percent
Taken by cleaner staff	2,22
Thrown in the landfill	24,14
Burned	20,73
Thrown in the river	43,63
Thrown away	6,16
Thrown in own yard	2,94

Table 5 shows the current garbage processing. The amount of garbage in residential areas, especially in rivers, is a major concern for residents. Other aspects that become objections to comfort include the lack of open fields, smelly residential neighborhoods, and narrow neighborhood roads. Unlike residents in other settlements, flooded land is not an objection from residents. Garbage is a problem for environmental comfort caused by the pattern of waste disposal. Most residents dispose of their waste, not in the designated garbage dumps. Less than a quarter of the population throws their waste directly into the landfill, and cleaning staff only served a small percentage of the settlement area. For owners of the land that is not flooded, they can burn their garbage in the yard. Most of the waste comes from disposal by the residents themselves. Residents throw it in the yard of the house,

Figure 3 Physical Condition of Settlements and Houses on The Banks of The Musi River

in any place, or the river. The same problem occurs in almost all settlements along the river in Palembang (Trisnaini, Idris, & Purba 2019). Even disposal to the river is the most common pattern of waste disposal by residents. Waste disposal in one location will pollute the entire environment because waste can flow from one plot to another. The house's yard is land inundated with river water that flows without being limited by a fence. The reason is that the fence will limit the movement of boats to pass between plots or pass under the building. This condition forces the waste problem, which can and usually is the responsibility of every homeowner with their respective plot limits, into the community's responsibility.

Many residents complain regardless of the condition of cleanliness and sanitation. Residents already have an awareness of environmental cleanliness and the desire to clean the environment, although, in reality, this awareness does not run in harmony with their daily practices. In slum settlements, there is often a gap between knowledge and practice of cleanliness and hygiene among residents (Mohd & Malik, 2017). Residents may be discomfort by the amount of garbage surrounding their homes, but in practice, they still throw garbage carelessly. They realize that throwing garbage into the river is the main problem of waste in their environment.

Almost all the yards of residents' houses on flooded wetlands are built without fences. Garbage can drift from one yard to the neighbor's yard without being hampered. This makes littering in the yard not a personal responsibility (Ushijima et al., 2013). The tidal river carries garbage in and out of the settlement area. The tides often carry garbage in. However, waste from domestic residents is also the most litter the river water. The same water is used by residents for bathing, washing, and even drinking water.

Table 6 shows people's reasons for garbage in the residential area. The lack of cleaning staff is an obstacle in collecting waste. It only serves houses on the main road that trucks pass. Residents want more garbage collector places and cleaning staff to reduce waste in their environment. The garbage place should be in proximity place to their houses.

Table 6 People's Reasons about Garbage in Residential Areas

The reasons	**Likert interval (1-5)**
	Strongly Disagree 1– 5 Strongly Agree
The people throw their waste to the river	3,36
The river tidal drains garbage in	3,23
No pick-up garbage staffs	3,21
No garbage collector place	3,05

Residents do not complain about the social conditions between residents and the security conditions in their neighborhoods. The bond of togetherness between residents shows a sense of trust and close relationships within the settler community. This can be a potential for environmental management based on community empowerment. Residents are willing to work together to clean the environment. Willingness in mutual cooperation is one way to overcome the waste problem of residents' choices. Actually, they prefer to work together rather than provide cleaning staff.

Table 7 Resident' Preferences Regarding Management of Garbage Disposal

Solutions	**Likert interval**
	Strongly disagree 1 - 5 Strongly agree
Temporary garbage disposal	3,46
Community mutual cooperation in cleanliness neighborhood	3,45
Adding staff for pick-up garbage	3,43
Education about environmental cleanliness	3,27
Education about technical garbage disposal	3,22
Periodic garbage clean-up by city cleaning staff	3,18
Punishment for throwing garbage into the river	2,88

Table 7 shows the residents' preference regarding the management of garbage disposal. Environmental improvement can rely on a system that is managed independently by residents. The government can act as a facilitator who bridges the desires and fosters community togetherness. This neighborhood management system based on community empowerment is often more effective than involving implementers as outside parties or by providing supervisors to keep the garbage disposal rules (Ssemugabo et al., 2020). The development of the waste management system should continue with the monitoring system by the community in their own environment. Strong and effective social institutions can play an important role in managing infrastructure. The role of the service assistant should focus on promoting waste disposal technology, motivating activities, and necessary follow-up/ monitoring programs. Governance that relies on social institutions can be the key to the success of improving environmental sanitation and hygiene.

CONCLUSIONS

The main summary of the research is that residents of settlements on the banks of the river experience various building and environmental problems that cause discomfort in living. The river is the source of their life. Unexpectedly, residents are

comfortable with the geographical conditions of soft soil, constantly inundated, and periodic flooding. On the contrary, the residents are very uncomfortable with garbage and waste in the river.

Population dependence on rivers can also be an entry point for environmental management to become river sustainability. Residents are aware of the importance of rivers in their lives. Improving the management system in managing the river environment is a difficult program that certainly needs to be completed comprehensively. However, in the housing environment, internal environmental management still needs to be developed.

The proximity of settlements to the river causes community activities related to the existence of the river. The river becomes a gathering place and facility for various activities of residents. Residents depend on rivers as water sources, public open spaces, communal areas, and even a location for household waste disposal. People in wetland settlements view inundation from overflowing rivers and streams as a benefit and not a threat to their daily activities. Rivers provide a flow and water source and become an open space for airflow, a wide atmosphere, and wide views for dense settlements. The practice of utilizing river water still relies on natural processing by the ecosystem without further processing. The residents use river water taken directly for daily use without processing. They only rely on the tides' natural recycling process and flowing water as a water purification process. The same practice applies to waste disposal practices. Residents throw their garbage and waste directly into the river without treatment. The river becomes an open water channel as a solid waste disposal channel and latrine waste disposal. The practice relies on the natural recycling of direct river ecosystem services.

Revitalizing waste management in riverside settlements can improve urban ecosystems because it can reduce river water pollution. The research results reveal that waste management in riverbank settlements has the potential for sustainable management. The social bonding between communities is an important point for building environmental management. Residents of riverside settlements have strong social ties. They also prefer working together to clean the environment rather than adding cleaners. Social relations and the willingness to work together are positive things for the basis of an environmental management system based on community empowerment.

Environmental management activities must begin with mentoring to train collective environmental management skills. Residents are already aware of the need for environmental cleanliness, so counseling about environmental hygiene is no longer to provide environmental cleanliness but to raise awareness of building togetherness in maintaining environmental cleanliness. Such empowerment can increase supervision and reminders among residents. Community assistance programs focus on extended collaborative environmental management, such as providing and improving the physical environment. It is sustainable environmental management based on community empowerment.

The revitalization of sustainable riverside settlement infrastructure must begin by understanding the needs, daily activity practices, and environmental perceptions of the local community. Improvement of the current cleanliness situation begins by listing the most problematic residential areas and potential environmental improvements involving the community. Improvements in one location can be a pilot project deployed in other areas in the vicinity. This program should plan to ultimately bring sustainable and long-term benefits from environmental revitalization from and by local residents. Mapping settlements for early stage revitalization to determine areas has urgent problems. The next step is to construct solutions with significant environmental and health improvement impacts. These steps can take a mixed approach, e.g., consultation using participatory methods introducing various technology solutions and final decision-making taking into account grassroots opinion, especially those who have not been informed and those who will bear the risk in project planning and implementation. The role of non-governmental organizations is to develop public non-governmental organizations for each neighborhood as a participatory governance strategy for urban low-income settlements.

The research still relies on data from survey respondents. It needs to be equipped with experiments of residents participating in cooperation activities for cleanliness. Further research detailing mutual cooperation-based waste management also needs to be done. It should detail the integration of cleaning, collection, transportation, and reprocessing. The discovery of waste management should include the best efforts with residents to encourage changes in the pattern of throwing garbage into rivers. Accordingly, the change process will move from the cause of the pile of garbage to recycling the waste.

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