

Sustainable Salt Farmer's Settlement Concept with Zero Wastes Principle, based on Community Participation (A Case Study in Pinggir Papas Village, Sumenep Regency)

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Abstract— Salt settlements must have a clean, healthy, and sustainable environment to support quality salt yields. But in reality, there are currently many dirty and unhealthy farmer settlements. The main cause is the high intensity of waste and low level of public awareness. So it requires a special concept in dealing with waste problems contained in settlements and ponds to improve community welfare. The zero-waste strategy is one of efficient waste management in minimizing household waste in settlements and requires community support in increasing it. The purpose of this study was to develop the concept of sustainable salt farmer settlements in the village of Pinggir Papas, Sumenep Regency, Madura with the concept of zero waste. This research uses a descriptive qualitative method by looking at physical and non-physical conditions and problems. in a location that will be used to unite the concept of sustainable settlement. The analysis includes aspects of buildings, people, and the environment. The results of this study provide solutions to the concept of structuring sustainable salt settlements with the concept of zero waste and community participation adjusted to the conditions at the study site. The research result show that the concept of sustainable settlements is adjusted to the facilities and infrastructure needed in a sustainable settlement and the needs of the salt ponds.

Keywords— Salt Farmer Settlement, Sustainable Settlement, Community Participation, Zero waste

I. INTRODUCTION

International world mandates the latest goals in the Sustainable Development Goals (SDGs) and the Habitat III conference which produced the New Urban Agenda which is a key element for implementing SDGs, specifically goal 11, which is to build cities and settlements that are inclusive, safe, resilient and sustainable. The importance of sustainable settlements formulated in the New Urban Agenda is also reinforced by the program of the Ministry of Public Workers, namely the Sustainable Settlement Program towards cities without Slums.

Many settlements that are still unhealthy due to excessive waste intensity and low public awareness. Present, the waste problem is not only found in urban areas, but also in salt pond settlement areas. One of them is in the salt pond settlement located in the village of Pinggir Papas, Sumenep Regency,

Madura. This area has experienced a decline in salt yields due to a decrease in the quality of the neighborhood. This problem occurs because of the increasingly high population density in coastal areas, limited land for landfills, and the lack of adequate facilities and infrastructure. Piles of household waste in daily life cannot be stopped but must be managed, reduced, or minimized properly.

Therefore a special concept is needed in dealing with landfill waste in a settlement based on community participation. The concept of zero waste is applied in the global community to reduce waste generation. According to the Recycling Council of British Columbia (RCBC), zero waste is a principle for designing a resource cycle so that it can be used by minimizing waste productivity. The principle of zero waste or zero waste is a waste management concept that is based on recycling activities [12]. In its success, the improvement of sustainable settlements with the concept of zero waste requires community participation and local institutions. Salt ponds in the village are one of the assets owned by the community for their survival and the results of the ponds are important for the community. So that there is a need for continuity between settlements and salt ponds to make the settlements sustainable and produce quality salt ponds.

II. RESEARCH THEORY

A. Sustainable Settlement Development

[3] Hawkes, added culture as an aspect of vitality in sustainable development. Culture will be the key to the success of sustainable development policies, as a driver of a community centered on the development and its people. The cultural aspect is recognized as an inseparable part of people's welfare and development which is connected with recognizing diversity in cultural heritage and values [6]. This approach is explained through indicators on every aspect of sustainable settlements, including:

1. Environmental or physical aspects

- Ensuring the efficiency of water, energy, and resources.
- Availability of sanitation facilities and waste

segregation.

- Availability of green space and vegetation
 - Waste and waste management
 - Environmental hygiene and safety
2. Social aspects
 - Empower community and community participation.
 - Ensuring health, safety, welfare for residents.
 - Creating a sense of community and identity.
 3. Economic aspects
 - Increase labor productivity.
 - Supports HBE (Home Based Economic and Enterprise).
 - Creating new jobs for the community.
 4. Cultural Aspects
 - Increase the aesthetics, diversity, and sophistication of environmental culture.
 - Helping community creativity.

B. Zero Waste

According to the World Commission on Environment (1987) in [13], introducing the concept of sustainable development based on the recovery of sustainable waste management as one of the main priorities in the development of an area. To transform settlements into 'zero waste' and sustainable settlements, it is important to know why the community produces so much waste. This is related to community behavior, individual and social perceptions, environment, social welfare, economic development related to the problem of waste in a settlement [4]. In the concept of zero waste has several steps [8], including:

1. Avoiding : Cleaning trash
2. Reducing : Minimizing waste generated in an environment.
3. Reusing : Reusing materials that can still be used
4. Recycling : Recycling from useless materials into new materials, can be reused, and has economic value.
5. Landfill : Used when all other possibilities cannot be used

C. Society Participation

Participation according to Mikkelsen [13], is taking part or taking part in activities. According to Cooke and Kothari (2001) in Benites Lazaro, a participatory approach is used by involving or involving the community in the development process. Thus post-participation is very important in terms of sustainability, justice, equality, and empowerment [1]. The forms of participation according to Cohen and Uphoff can be divided into four, including [11]: Participation in Decision Making, Participation in Implementation, Participation in Benefits, and Participation in Evaluation. According to Holil (1980), forms of participation that can be given include thoughts/ideas, energy, social, expertise, goods, money, and decision making. There are several internal factors such as age, gender, income, education and employment, and external factors, namely the government that influences participation [2].

III. METHOD

This research was conducted with a post-positivism approach because this research has external influences that can affect the research object and can be applied to the same problem with different objects. The concept of formulation considers the theory of sustainable settlements, zero waste, and the completion of participatory planning arrangements. This research uses a descriptive qualitative method by looking at physical and non-physical conditions and problems in the location which will be used to develop the concept of sustainable salt farmer settlements [5].

Data collection is done by participatory observation and in-depth interviews. Participatory observation is carried out to observe in depth the environmental conditions of settlements and communities to analyze the suitability of physical and non-physical conditions with sustainable aspects. In-depth interviews were conducted with the community regarding the habits, activities, and desires of the community on the environment of their settlements and the impact of waste on settlements and salt ponds on social, economic, cultural, and environmental conditions.

IV. RESULT

A. Settlements in Pinggir Papas Village

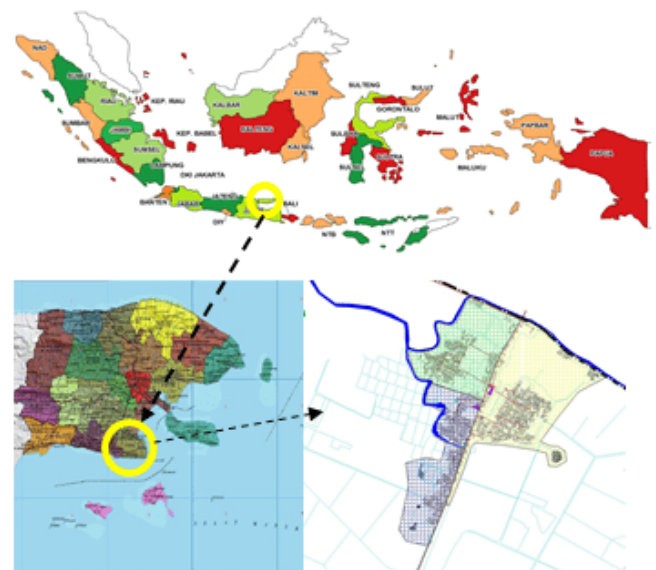


Fig. 1. Research location in the village of Pinggir Papas, Sumenep District, East Java, Indonesia. (Source: Archieve, 2019)

The village of Pinggir Papas is one of the largest salt producing areas on Madura Island, East Java Province, Indonesia (Figure 1). Settlement in the village of Pinggir Papas is surrounded by salt ponds. Settlements in the village of Pinggir Papas adjust to natural conditions so that they have the characteristics of settlements that are adapted to their living conditions. Spatial formation patterns that occur are influenced by the location of ponds that surround settlements. The village of Pinggir Papas consists of three hamlets namely Ageng which is located in the east, Dhalem hamlet in the west, and the Kauman hamlet. The orientation of the building that is

believed to be the best is the north-south direction and the direction that is believed to be not good is the east direction, because of trust and influence on the thermal conditions of the building.

B. Physical and Non-Physical Characteristics of Settlements by Sustainable Aspects

The results of observations and interviews regarding the physical and non-physical conditions of settlements are adjusted with policies and indicators regarding environmental sustainability and settlements as a basis for evaluating and drafting the concept of sustainable settlements consisting of social, cultural, economic, and residential environmental aspects.

1. Non-physical

a. Social Aspect

The social conditions in the village of Pinggir Papas can be said to be quite good if adjusted to the indicators on sustainable settlements. This is because the level of public awareness of the cleanliness of settlements and salt ponds is still low. People are accustomed to throwing garbage in rivers, ponds, gutters, and corridor areas. The community disposed of and piled up garbage in the pond area due to making the pond dense with rubbish that their homes would later build. Some activities have been carried out in this village such as community service, counseling, and meetings as show ini Figure 2, but not all communities participate in it.



Fig. 2. Counseling (a) and community service (b) in the village of Pinggir Papas
(Source: Personal Dokumentation, 2020)

b. Cultural Aspect

The condition of the cultural aspects in the village of Pinggir Papas can be said to be quite good if adjusted to the indicators on sustainable settlements. This is because the community still has a tradition that is still practiced today. This also relates to trust in the settlement arrangement. One of the traditions is the Nyadar ceremony, a ceremony as a thank you to the village ancestors for the salt ponds. This tradition is one of the strengthens of village solidarity and social activities. However, the village community still has not made any efforts to increase community sensitivity.

c. Economic Aspect

Economic conditions in the village of Pinggir Papas can be said to be not good if adjusted for indicators of sustainable settlements. This is because most people work as salt

farmers and fishermen who have a lower-middle economic level. Inadequate condition of the trade area (Figure 3). In settlements where fish drying, fish auction, salt storage, and salt product processing are not available. The results of drying of salt and fish are carried out around ponds and areas around residential roads so that they disrupt circulation, settlements, and areas of salt ponds (Figure 3).



Fig. 3. Conditions of trade and salt storage areas around the road
(Source: Personal Dokumentation, 2020)

2. Physical

Physical conditions consisting of the environment and housing in the village of Pinggir Papas can be said to be not good if adjusted for indicators of sustainable settlements.

a. Building Conditions

The condition of the building is close together, irregular and some buildings are not feasible from the shape and construction. The distance between buildings is separated by a neighborhood road that has a road width of 2 meters (Figure 4).



Fig. 4. The condition of buildings and roads in settlements
(Source: Personal Dokumentation, 2020)

b. Solid waste conditions

People throw garbage into empty lands such as corridors, rivers, and salt ponds (Figure 5). Waste management is often done by burning and dumping it into ponds and sea. TPST (integrated waste disposal site) is not yet available as a place for collecting and processing waste. In addition, there is no optimal waste transportation system.



Fig. 5. Waste conditions in rivers (a) and ponds (b)
(Source: Personal Dokumentation, 2020)

c. Condition of clean water, sanitation and drainage networks

The drainage can not hold water so that inundation often occurs in residential areas. Several channels for clean water and dirty water are located in one location, namely in sewers. Improper MCK (toilet) conditions are found around salt ponds (Figure 6).



Fig. 6. Condition of canals (a) and MCK (toilet) (b) in the village
(Source: Personal Dokumentation, 2020)

d. RTH and Vegetation

The availability of adequate public open space is useful to support social, economic, and public transportation activities. In the housing area and salt pond area, there is no available green space in the form of playgrounds or outreach and green lines in the form of plants around the road (Figure 7). Open space in the form of burial areas and land that is not used. Vegetation in the settlement and around the road a little. The number of goat animals that roam causes vegetation is not well maintained.



Fig. 7. Conditions of settlements without vegetation
(Source: Personal Dokumentation, 2020)

C. Zoning Plan for the Settlement of Kecamatan Desa Papas

The zoning plan is adjusted to the results of the analysis of settlements and village communities which are adjusted to the regulation of sustainable settlements, namely the housing area being the center that connects all areas and the road is the link between the areas. Building orientation is adjusted to climate and community trust. Provision of supporting facilities for the salt industry and the existence of green spaces connecting ponds and settlements. The zoning plan for salt pond settlements can be seen in Figure 8.

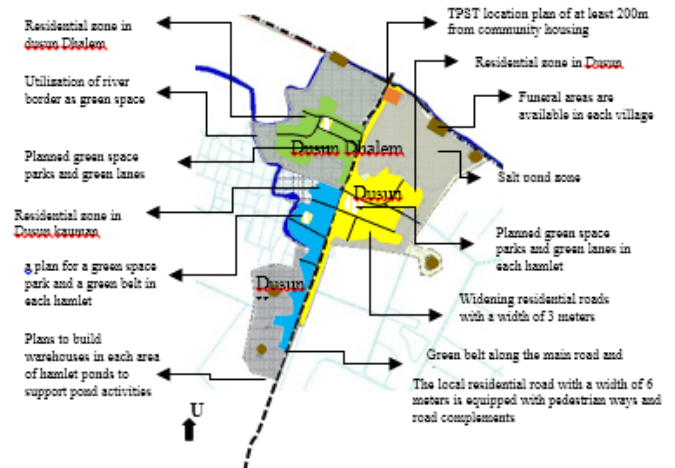


Fig. 8. Zoning plan for settlement and salt ponds in Pinggir Papas Village
(Source: Personal Dokumentation, 2020)

D. Society Participation

1. Planning / decision making stage

Internal factors that influence community participation consist of the level of education, income, and employment of village communities. External factors that influence are from the local government and village administrators in the socialization of the community. The forms of participation that can be given at this stage are ideas, community attendance at meetings, and decision making. The concept of community participation in this stage is in the form of, involving the community in every plan, protecting all communities, cooperation, socialization, strengthening community knowledge about sustainable settlements, compiling activities and regulations for village improvement, and forming groups as the responsibility of each community.

2. Implementation Stage

Internal factors that influence participation at this stage are gender, age, education, income, and community employment. External factors that influence the local government, village officials, and the community. The forms of participation that can be given at this stage are ideas, energy, expertise, goods, and money. The concept of community participation in this stage is in the form of regular counseling, cleaning tray work, distribution of job desks, contributions, managing and maintaining facilities in every house, proper and adequate TPS (small waste collection), MCK (toilet), and TPST(main waste

collection) construction, creativity training, monitoring of each activity.

3. Evaluation Stage

Internal factors that influence participation at this stage are education, employment, and age of the community. External factors that influence the local government and village administrators. The forms of participation that can be given at this stage are ideas, energy, expertise, goods, and money. The concept of community participation in this stage is in the form of a checklist of activities to evaluate the success of activities and make corrections to activities that have not been successful and find solutions together.

4. Maintenance Stage

Internal factors that influence participation at this stage are gender, age, education, income, and community employment. External factors that influence the local government, village officials, and the community. The forms of participation that can be given at this stage are ideas, energy, expertise, goods, money, and social. The maintenance phase is needed so that settlements are maintained and sustainable by the existence of an online citizen complaints system, conducting settlement checks regularly, maintenance is carried out by all villagers, there are sanctions for people who violate agreed rules, and minimize waste brought to the landfill with waste processing.

E. Zero Waste Concept

The concept for structuring solid waste facilities is the provision of solid waste facilities, namely TPS (small waste collection), garbage bins, garbage trucks, scheduling the transportation of waste, and involving community participation in each process. The existence of TPST (Main waste collection) as a center for collecting, sorting, and managing village waste, as a place for socializing the community and providing village goods and services. Zero waste management by (Figure 9):

- Refuse: by refusing to use plastic bags when shopping and sorting waste according to type.
- Reduce: to avoid the use and purchase of products that produce large amounts of waste.
- Reuse: Reuse containers with the same function repeatedly. For example, using used cooking oil used as a substitute for polybags.
- Recycle: uses products and packaging that can be recycled. Process waste into goods that have economic value (bags, wallets, and other handicrafts)
- Exchange rubbish for money or groceries (daily necessities)
- Provision of trash bins and TPS (small waste collection) in all zones.
- Scheduling garbage transportation.

F. The Concept of Sustainable Salt Farmer Settlements with the Principle of Zero Waste

From the results of the analysis of settlement conditions, community participation, and the concept of zero waste

adjusted to the environmental conditions and village communities, so as to produce the concept of sustainable settlement arrangement, the concept of zero waste that can be done in salt farmer settlements, and the concept of community participation in settlements (Figure 10). This structuring concept is complemented by illustrations of sustainable salt farmer settlement design. The following are the results of the compilation of settlement arrangements, the concept of participation, the concept of zero waste, and the design illustrations of the Pinggir Papas Village, Sumenep Regency, Madura (Table 1).

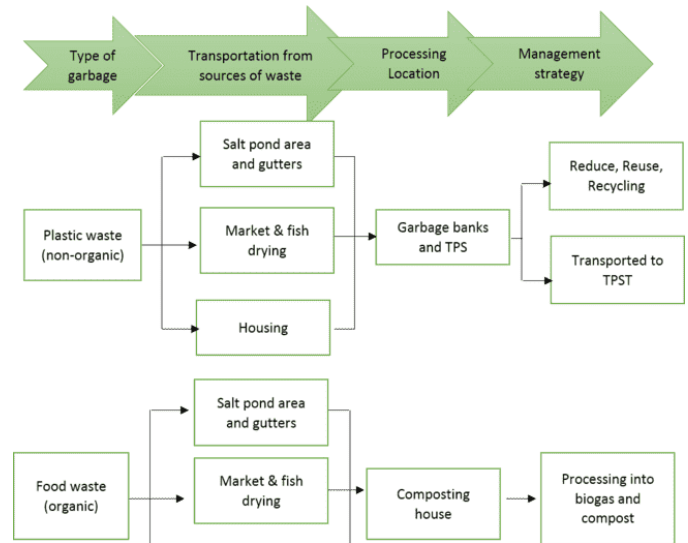


Fig. 9. Waste Management Strategy (Source: Analisis Results, 2020)

Table 1. Compile the concept of sustainable settlements with the principle of zero waste based on community participation

Aspect	Concept of Settlement	Concept of Participation	Zero Waste Concept
Environmental aspects Residential Buildings	<ul style="list-style-type: none"> Repair of sub-standard houses. Residential rehabilitation Optimizing the area/size of residential space Trading room facilities 	<ul style="list-style-type: none"> Involve the community in every stage of the activity Good collaboration between local government, village officials, and the community. 	<ul style="list-style-type: none"> Waste collection is classified according to type. Provision of garbage bins in all zones Provision of waste banks
Environmental facilities and infrastructure	<ul style="list-style-type: none"> Development of IPAL (Waste water treatment plant) Proper public MCK (toilet) Control of waste in rivers and ponds by planting vegetation. Provision of waste bins Provides environmentally friendly roads 	<ul style="list-style-type: none"> Strengthening community knowledge. Establishment of environmental maintenance groups. Perform community service activities. 	<ul style="list-style-type: none"> Provision of polling stations in each hamle. Provision of TPST (main waste collection). Provision of compost house. Waste

Open Space	<ul style="list-style-type: none"> The construction of recreational space and outreach. Green belt procurement. RTH on the edge of salt ponds. 	<ul style="list-style-type: none"> Job desk distribution. Village contributions Prohibition and monitoring of community activities. Citizen complaints online. 	<p>management through 5R:</p> <p>Refuse: Refuse the use of plastic bags Reduce: Avoid the use and purchase of products that produce large amounts of waste Reuse: Collect reusable rubbish. Recycle: Recycling organic (compost) and inorganic waste (items that have economic value) Landfill: Disposing of waste that cannot be processed and reused.</p>
Social Aspects	<ul style="list-style-type: none"> Socialization and education of the building and environmental regulations Training and counseling Increase public awareness some sanctions violate regulations. 		
Cultural Aspects	<ul style="list-style-type: none"> Perform community service to the entire community Conduct training, to increase community knowledge and creativity. 		
Economic Aspects	<ul style="list-style-type: none"> Local economic development Business capital assistance. Provision of appropriate trade areas. 		

(Source: Analysis Results, 2020)

- Repair of Houses in Settlements:** Structuring of housing is done by structuring residential houses with a north-south orientation according to beliefs and climate. Structuring the house by showing the characteristics of the function and improvement of the appearance of the building on the character of the mass layout and the feasibility of space and material (Figure 10).



Fig. 10. Home improvement design according to regional characteristics (Source: Analysis Results, 2020)

- Salt Ponds:** Arranging salt ponds with the addition of green space around the pond as a link between the

pond area and housing (Figure 11). Add salt storage warehouse.



Fig. 11. The concept of upgrading the border park between the pond and settlement (Source: Analysis Results, 2020)

- Public Space:** Facilities in the form of recreational space and community space in the form of attractions, play, and gathering space (Figure 12).



Fig. 12. The concept of public space in the village of Pinggir Papas (Source: Analysis Results, 2020)

- Trade and TPI (fish auction) Areas:** Improvement of more viable markets, construction of TPI (fish auction), and fish drying areas (Figure 13).

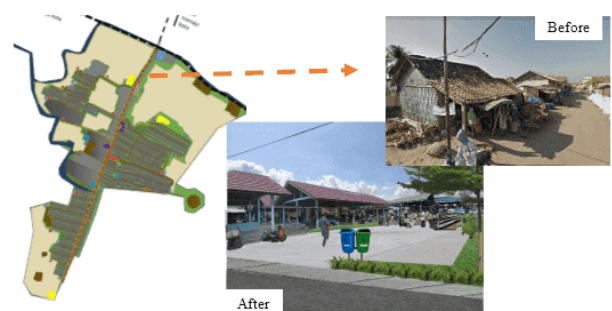


Fig. 13. Concept of improvement of trade area, fish drying and TPI (fish auction place) (Source: Analysis Results, 2020)

- Garden green space:** Processing of river bank vacant land, pond edge, roadside as green space, and vegetation management for greening settlements (Figure 14).

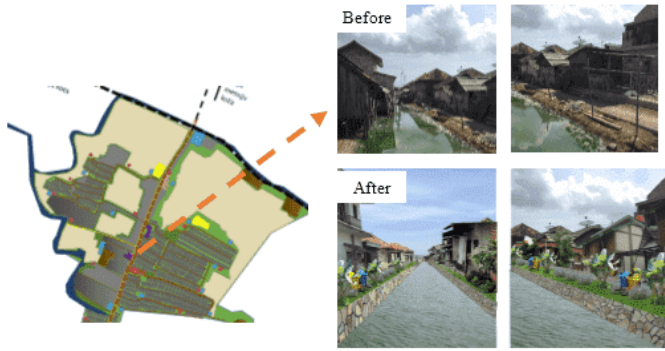


Fig. 14. The concept of a park around a river
(Source: Analisis Results, 2020)

- **Communal IPAL (Waste water treatment plant):** Management of household wastewater by developing a Communal IPAL system to prevent pollution of rivers and ponds.
- **TPST (Main waste collection):** is a place for the collection, sorting, reuse, recycling, processing, and final processing of the garbage that is transported from the landfills of each village and house.
- zoning of settlement areas and salt ponds as well as supporting infrastructure facilities for settlements and salt ponds can be seen in figure 15.



Fig 15. Simulation of settlement structuring and improvement in the village of Pinggir Papas, Kabupaten Sumenep, Madura.
(Source: Analisis Results, 2020)

V. CONCLUSION

The concept of sustainable salt farmer settlements with zero-waste based on community participation in the village of Pinggir Papas, namely: (1) Settlement arrangement by taking into account the characteristics of the occupancy function and building mass order improvement in appearance and feasibility of residential buildings by the character of the house in the village of Pinggir Papas. (2) Improve village facilities and infrastructure related to sanitation, drainage, green space, and public and social facilities in the village. (3) Developing the local economy of salt pond communities by providing facilities to support the activities of the salt industry and utilizing the potential of the village, (4) Involving community participation in every village activity without exception with the required rules. (5) Processing waste and waste with the concept of zero waste by the type of waste,

namely organic waste, utilization, and processing into compost. Inorganic waste, by reducing the yield of waste, sorting is done individually or communally (garbage bank), reuse of waste that can still be used and processing waste into goods that have economic value, and (6) Affirmation of building and land use regulations and the application of waste regulations on the residential environment.

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