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Innovative Floating Latrine Technology Solutions for Regions Island Sinjai Regency, South Sulawesi Province, Indonesia

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Abstract

Ownership of toilets has long been an environmental sanitation problem in the coastal areas of Sembilan Island which are generally inhabited by residents with improper domestic wastewater (black water) treatment. Most of the people in the area use a "slung" type of toilet in their house, which results in direct contacts of their domestic wastewater, such as black water or feces, with nearby bodies of water. Additionally, these coastal communities openly defecate in the seafront at night. The implementation of community service is carried out in 4 stages, namely: socialization of innovative technology and FGDs, workshops, training in making innovative floating latrine technology, and assistance in installing floating/tidal latrines. The socialization was carried out at the sub-district level by inviting residents and related stakeholders, which was then followed by FGDs to explore problems and find solutions to sanitation-related issues. The workshop was conducted by making a manual for the management of floating/tidal latrines. The training on making floating/tidal latrine technology is only for the residents of Pulau Sembilan. Lastly, assistance was provided for the installation of floating latrines in a predetermined location. This community service resulted in the development of innovative floating / tidal latrine technologies that meet sanitation standards, making it easier for residents of Pulau Sembilan to defecate without violating health and hygiene standards. This technology has also been successfully developed and implemented at a relatively affordable cost with the hope that this innovation can be easily duplicated by other communities in Pulau Sembilan.

Keywords: Pulau Sembilan, Coastal, Sanitation, Floating/Tidal Latrine

INTRODUCTION

Latrine is an effective feces disposal facility to break the chain of disease transmission. The use of latrines is not only convenient but also helps protect and improve the health of families and communities. The increase in the number of residents is not proportional to the existing residential area, the problem of disposing of human waste is increasing, from a public health perspective, the problem of disposing of human waste is a key issue to be resolved as early as possible.

Healthy latrines are effective in breaking the chain of disease transmission. Healthy latrines must be built, owned, and used by the family in a position (inside the house or outside the house) that is easily accessible to the occupants of the house. At present, the selection of pit latrines is still a problem, considering that pit latrines are a type of latrines that is not eligible for health requirements (Peraturan Menteri Kesehatan Republik Indonesia, 2014)

Based on data from the Sinjai Regency Government in 2016, the proportion of private latrine owners reached 81.2% and 18.8% did not have private latrines. The type of toilet used varied as much as 73.2% was a squat goose neck toilet, and 58.7% had households that had a final disposal channel for fecal contents in the form of a septic tank. Access to sanitation in the form of latrines owned by the people in Sinjai Regency is generally inadequate and not eligible for health requirements. based on the results of the Environmental Health Risk Assessment (EHRA) study, the practice of defecating still showed a rate of 30.4% in 2012 (Pokja AMPL Kabupaten Sinjai, 2016).

Based on the observations, the conditions in Pulau Sembilan have diverse geographical characteristics, which is a separate problem in handling excreta disposal. Moreover, coastal areas

and coastal areas are generally inhabited by residents with middle to lower economic incomes and in terms of sanitation they do not have proper domestic wastewater (black water) treatment, most of them use pit latrines which are in houses with black water or sewage. The feces are in direct contact with surface water bodies. Almost all of the people in Pulau Sembilan are not eligible for health requirements. Some people prefer defecation which is thrown directly into the sea.

The Sinjai District Health Office in 2016 reported that Pulau Sembilan with coverage of 711 households. There are 494 households that used pit latrines, or unsafe latrines, 787 households used safe latrines with safe septic tanks and no facilities to bathe, to wash clothes and to defecate (shared latrines) were available, communal and there are no people who have a *Waste Water Treatment Plan* (WWTP), either private or communal (Pokja AMPL Kabupaten Sinjai, 2016).

Poor or inadequate sanitation is a challenge facing the world. Basically, inadequate sanitation is responsible for 432,000 deaths from diarrhea each year. Typhoid, hepatitis A, dysentery, and several neglected tropical diseases including schistosomiasis are associated with poor sanitation (Immurana M et al., 2022). Access to sanitation in the form of latrines owned by the people in Sinjai Regency is generally inadequate and does not meet health requirements. Based on the results of the Environmental Health Risk Assessment (EHRA) study, the practice of defecating still showed a rate of 30.4% in 2012. This would of course raise new problems. With the community's habit of defecating everywhere, the area is threatened with environmental-based diseases, such as diarrhea, cholera, worms, typhoid, paratyphoid, hepatitis A and E, malnutrition and other diseases (Mukherjee, 2011). In addition, the habit of defecating in any place can cause water pollution, bad smell and reduce aesthetics. The greater the percentage of people who defecate in any place, the greater the threat of environmental-based diseases. Environmental health problems arise due to low public awareness about environmental sanitation. This condition is like a ticking time bomb where one day an explosion of disease can occur due to an unclean environment (Departemen Kesehatan Republik Indonesia, 2009).

Interventions in the sanitation sector have three main objectives, namely: improving health conditions, increasing dignity and quality of life, and protecting the environment. So by determining interventions that can be applied in specific areas in the region, so that they can direct sanitation development programs to be technologically appropriate, affordable, right on target, and sustainable according to the physical conditions of the environment (Noor, 2011). Sharing latrines between men and women is not common in families. Women also highlighted this as a barrier to using public latrines. Because male and female members have to share the same public latrines, female respondents who continued to defecate in the open said that public latrines were inconvenient for women (Bhatt N et al., 2019).

The practice of open defecation is a challenge for the government of Sinjai Regency in improving the quality of the environment and the degree of public health in line with the high level of pollution to the environment. Ownership of private latrines which has an impact on the practice of open defecation provides encouragement to build community access to waste water facilities and infrastructure that meet health standards.

Seeing these problems and some of the literature obtained, the authors assume that these problems can be overcome by applying innovative floating/tidal latrine technology. In addition to its practical and efficient form and use, this technology also does not cost as much as healthy latrines in general. It is hoped that this can be a solution in overcoming the problem of latrines on Pulau Sembilan so that it becomes a healthy area.

METHOD

Service is carried out through the stages as shown in the following figure 1.

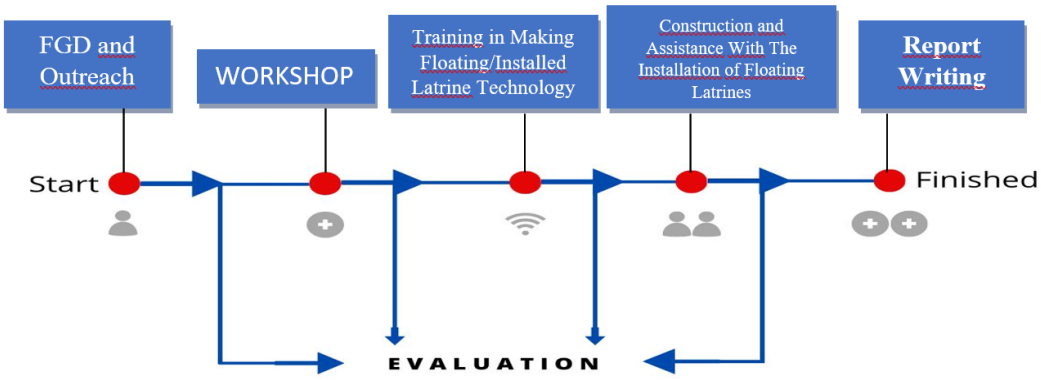

Figure 1. Writing Stages

Based on Figure 1, the general description of the activity process is:

- Information dissemination to residents and relevant stakeholders regarding the goals, objectives, and benefits of the activities to be carried out, followed by a Focus Group Discussion (FGD) to solve existing problems.
- Workshops and meetings for making guidebooks for the management of floating/tidal latrines with experts/experts.
- Training on Making Float/Tidal Latrine Technology for the residents of Pulau Sembilan.
- Assistance in installing floating latrines at predetermined points.
- Report Writing, in this stage work will be carried out to compile reports from activities during the writing process starting from data collection, system design to testing of Floating Latrine Technology for the residents of Pulau Sembilan.

RESULTS AND DISCUSSION

Socialization and Focus Group Discussion (FGD)

Socialization is a process of planting or transferring habits or values and rules from one generation to another in a group or society. A number of sociologists refer to socialization as a theory of roles (role theory). Because in the process of socialization taught the roles that must be carried out by individuals. (Yenni Amira et al., 2015)

This activity is the earliest activity that the author did where in this activity the author gathered residents and all stakeholders in Pulau Sembilan. Aiming to discuss the goals, objectives, and benefits of the dedication that will be carried out by the author, namely to introduce innovative floating/tidal latrine technology, especially for island areas that are effective, efficient, and at a relatively affordable cost.

After the socialization activities were carried out, the activities were then continued with discussions with the residents and all stake holders regarding the complaints of local residents regarding sanitation issues, especially the ownership of healthy latrines. The innovative floating/tidal latrine technology that the author will do has several models/types based on existing conditions so that this FGD activity is very important in determining what model of floating/tidal latrine is right to do in this community service activity.

The socialization and FGD were carried out in the Pulau Sembilan Health Center Meeting Room which was attended by the local government, heads of *Puskesmas* (public health center), religious leaders, youth leaders, house wifes and the local community.

Figure 2. FGD Documentation

Workshop

After hearing input from residents and stakeholders in Pulau Sembilan, the next activities carried out were workshops and meetings with experts and experts. The purpose of this activity is to design and determine the concept of floating/installed latrine technology to be used in this community service activity. Of course the floating/tidal latrines designed are in accordance with the geographical conditions and the input of the community members on Pulau Sembilan. The design needs to pay attention to the aspects of accuracy and repeatability (repeatability) of workmanship and related to human factors (Hindun et al., 2019). The need to know the potential that exists in society that can be developed into alternative solutions. This potential can then be used as a form of community participation in improving environmental sanitation (Yuningsih, 2019). After the raw materials are prepared, the next thing to do is to prepare design drawings that are used as guidelines in making the tool.

A workshop on making a manual for the management of floating/tidal latrines was held at the Makassar Health Training Center (BBPK) in April 2019, which was attended by latrines experts and environmentalists.

Figure 3. Workshop with a team of experts/latrine experts

The needs and procedures for making floating/tidal latrines are as follows :

a. Tools and Materials:
   - Pipe Polyvinyl Chloride
   - Elbow Pipe
   - Pipe T-connection
   - Glue Pipe
   - Cement
   - Sand
   - 2 Used Drums

b. Tool Specifications:
   - Tool diameter: PVC pipe 1 inch, 2 inch, 3 inch, 3 inch and 4 inch
   - Plastic drum with a capacity of 200 liters
   - Height / length: 90 cm, diameter 58 cm, or can be adjusted to the height of the stilt

houses on the coast
- Required Land Area: Width = 1 m, length = 1.5 m
- Color: free
- Fecal Destruction System: aerobic and anaerobic bacteria
- Estimated Age of Use: 30 to 50 years

c. Ways of making :
   - Take a PVC pipe measuring 1", 2", 3", and 4" then cut it to the desired length, such as 1" = 1.5m, 2" = 1m, 3" = 1m, 4" = 1m and 6" = 1 m.
   - Each at the lower end of the pipe is installed DOP to withstand sea air pressure during high tide
   - Meanwhile, the top of each pipe is also installed with DOP by connecting it with pipes of other sizes with the help of cells, which function to withstand the inflow of sea air pressure into the PVC pipes.
   - For infiltration tanks from plastic drums with a capacity of 200 liters, connected to a 6-inch PVC pipe, regulated by an autovalve, so that seawater cannot enter the 6-inch pipe. But the water in the 6 inch pipe easily flows into the absorption tub.
   - At the end of the infiltration tub, a connecting pipe is also installed with the help of a 2 inch elbow.
   - On the 4 inch pipe section which functions as feedback over flow, it is installed by connecting to a 6 inch PVC pipe
   - Likewise with a 4-inch PVC pipe that functions as a sludge reservoir, connected to a 6-inch PVC pipe in a parallel position and watertight
   - From the cover with a 3 inch PVC pipe, after passing through the elbow, attach a T connection and reducer from 3 inches to 2 inches and then the end of the 2 inch pipe enters the infiltration tub
   - After all the assembly is complete, the Floating Latrines are ready to be used
   - Estimated time for dewatering: If 1 household (4 to 6 people), assuming 1 person = 10 liters of feces/year, then in 1 year = 60 liters of feces. So the fastest drain time is 5 years. If 5 families (about 30 people), then in 1 year the volume of review at JPS is around 300 liters, the time to drain is every year or even more.

The following is a drawing of a floating/tidal latrine :

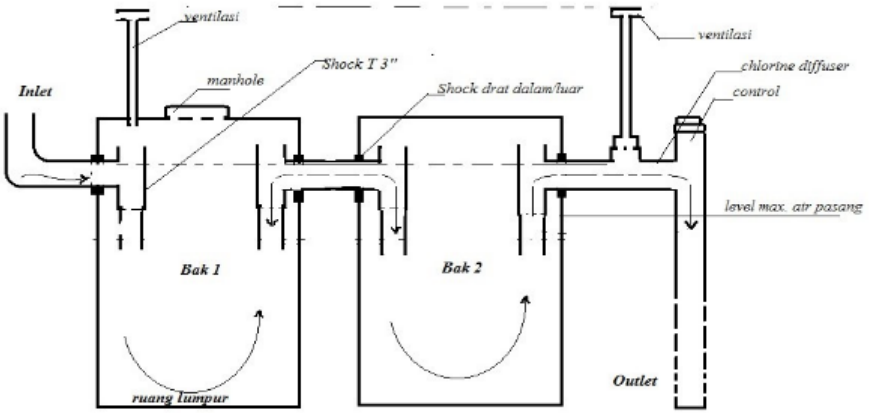

Figure 4. Floating/Tidal Latrine Design (Khaer, 2019)

Training on Making Float/Tidal Latrine Technology

The purpose of this Training Activity for Making Floating/Tidal Latrine Technology is to provide an understanding of the procedure for making floating/tidal latrine technology. Starting from the tools and materials to be used, designing tool specifications, to assembling floating/tidal latrines. According

to (Anggraini, 2011) mastery of knowledge and skills is useful for improving soft skills. Knowledge and skills from training in making floating/tidal latrine technology can also influence environmental factors as well as local community behavior factors. Environmental factors influence about 40% of health status while behavioral factors are 30%. When the two are combined, more than two-thirds of people's health status is influenced by environmental and behavioral factors. Controlling these two factors is very important in the practice of open defecation (BABs) in order to improve environmental quality and public health status (Novita, 2020).

Figure 5. The Training Process for Making Floating/Installed Latrine Technology involving residents and stake holders on Pulau Sembilan

The basis of this activity is the output of the Workshop activities that were carried out prior to this activity. Experts and skilled workers were brought in to support the success of this activity. Residents and all relevant stakeholders from Pulau Sembilan participated in this training. This training has many benefits for the physical and biological environment of the community in meeting health requirements. This is measured by the availability of latrines that comply with the requirements for healthy latrines.

Assistance in installing floating/tidal latrines

After the Training on Making Floating/Tidal Latrine Technology was held, the next step was to apply the training in the field. In general, appropriate technology (TTG) is a choice of technology and its application that has the advantage of solving local problems, is relatively small scale, energy efficient, the raw materials are easy to obtain, simple and in accordance with the conditions of the local community. The TTG used can be developed independently or utilize existing technology (Musadad, 2019). The innovation of floating/tidal latrine technology has many benefits, one of which is being environmentally friendly, avoiding disease, clean water sanitation and creating healthy latrines in coastal areas (Purwati & Aryantie, 2016)

In this stage direct operation of the equipment is also carried out to ensure that the function and work of the device are in accordance with the design and function properly without any damage or other errors due to other unexpected things (Indonesian National Standard 2398-2002, 2002). Assistance in making floating/tidal latrine innovation technology was carried out until it was completed in November 2019 which was completed at several predetermined points. It is hoped that in the future people will be able to follow the designs that have been made.

Regarding the adoption of innovative technology, including in this case the use of floating latrines in the Sinjai district, it can be related to the theory put forward by Rogers (in Zuraini, 2017) which has significant relevance and arguments in the innovation decision-making process. This theory, among other things, describes the variables that influence the level of adoption of an innovation and the stages of the innovation decision-making process. Variables that influence the stages of innovation diffusion include (1) perceived attributes of innovation, (2) types of innovation decisions, (3) communication channels, (4) social system conditions (nature of social system), and (5) the role of change agents (change agents).

It is hoped that the community will no longer defecate in any place where it can spread disease. Such as the service activities which were also carried out by (Saparina & Ali, 2021) in Bokori Village, Soropia District, which were activities carried out by the Community Service Team which focused on the behavior of people who defecate openly by building latrines in coastal areas along with communal septic tanks in accordance with Indonesian national standard (SNI) for counseling activities regarding defecation behavior. This is expected to minimize the impact of disposal of feces into the sea, facilitate the management of excreta disposal for coastal communities and avoid infectious diseases associated with poor sanitation caused by bacteria, viruses, parasites and fungi (Sumampouw, 2019).

This training is not only related to community innovation, but also to change people's behavior to always protect the environment. One method is Stop Open Defecation (STOP BABs), which is one of the Community-Based Total Sanitation (STBM) activities, which is a community empowerment program in the field of sanitation where activities are directed at changing behavior from open defecation to a certain place (latrines/latrines) even if only in its simplest form in the form of a hole or excavation with a squatting area which can prevent unpleasant odors, contamination of clean water sources, and the affordability of flies which can cause environmental-based diseases such as diarrheal disease (Kurniawati & Saleha, 2020).

Figure 6. Assistance in installing Tidal latrines

Figure 7. Public toilets on Kambuno Island, Pulau Sembilan

Figure 8. Installation of latrines in the columns of residents' houses which are inundated by sea water

CONCLUSIONS AND RECOMMENDATIONS

Community service is running well and smoothly. The residents and all related stake holders actively participate in this activity so that the two parties work together to complete the work together. The results of the Floating/Tidal Latrine Innovative Technology activities make it easier for the residents of Pulau Sembilan to own latrines that meet health standards at a relatively affordable cost. Future activities still need to be fostered with the aim of maintaining and caring for Floating/Tidal Latrines so that problems do not occur in the future. Of course, this dedication activity cannot be said to be perfect, so suggestions and input from various parties are still needed.

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