

# Community-based Management of Household Waste in Tamalate District, Makassar

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**Abstract** The community-based household waste water management needs evaluation program, with the intention that the programs that have been planned to run optimally and useful in improving the quality of the living environment in the city of Makassar. This study aimed to identify the factors that influence the community-based household waste management in Makassar. The research was conducted in Makassar City, District of Tamalate. This study used primary (interview and questionnaire, workshop and Focus Group Discussion) and secondary data (documents) to strengthen analysis towards the problems. The method used in this research is Structural Equation Modelling (SEM). SEM analyse the effect of the exogenous variables, namely human resources ( $X_1$ ), natural resources ( $X_2$ ), artificial resource / facilities and infrastructure ( $X_3$ ), as well as social resources ( $X_4$ ), towards endogenous variable community-based household waste management ( $Y$ ); besides analyse the correlation between the four exogenous variables. The results showed household waste management in the area of Makassar City is influenced by several factors, among others: human resources, natural resources, artificial resources, and social resources. Between the four variables, significant linkages were shown between natural resources with artificial resources. On the other hand, there is no linkage between human resources and natural resources, human resources with artificial resources, human resources with social resources, natural resources with social resources, and artificial resources with social resources. Community-based household waste management policy on residential areas needs more attention on community development and empowerment. The management should take into account the level of community participation from planning to the implementation of activities.

**Keywords** Community-based, SEM, Wastewater management

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## 1. Introduction

The challenges of sanitation development in Indonesia is a cultural, social and behaviour problems of people that accustomed to defecating in inappropriate place, especially to the body of water which is also used for washing, bathing and other hygienic needs. The poor state of sanitation is one of the causes of children's deaths under 3 years for 19% or approximately 100,000 children die from diarrhea in each year and economic losses estimated at 2.3% of Gross Domestic Product [1]. Based on Law No. 32 of 2004, handling sanitation problems is the regional authority. However, it has not demonstrated sufficient progress so that local governments need to show their support through policies and budgeting. The behaviour of people who do not understand the health of the environment is also strengthened by the results of the study Indonesia Sanitation Sector Development Program [2] in 2012, which showed

47% of people still behave defecating into rivers, fields, pools, gardens and open spaces.

The City Government of Makassar implements the wastewater treatment plant that connects to household waste pipeline of the settlements. It is a challenge for Makassar City Government to increase the willingness of society to utilize benefit from centralized wastewater system and how to integrate the local community with a centralized system that was built in serving their community. It is becomes important to know the technical feasibility of a septic tank in the community. This is directly related to the construction costs because the customer has a responsibility in terms of the cost of construction of the household waste pipeline. Society must be able to afford the implementation of management systems, operational and maintenance cost of development and improvement in the future [3]. Benefits arising from the wastewater treatment process must exceed the total invest and also the processing into a positive process that not only from an environmental perspective but also economically [4].

Successful handling of liquid waste is largely determined by the public awareness of the contributions and their participation in these activities. Handling of liquid waste

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through development programs is ideally always emphasizes community involvement in the process of planning, implementation, monitoring and evaluation.

However, community participation in the handling of waste in Makassar is still limited on the awareness of living healthy by self-building toilet and septic tanks without government assistance. The citizens contribute to build their toilet facilities and communal wastewater treatment on the environment of the poor. But the level of public awareness for the use of toilet at home or public toilets are still lacking as indicated by (a) there are still some people who dispose of liquid waste directly from the toilet to the river, (b) public toilet is less maintained (c) only 46.59% of households behave in a healthy life of the target 65% [5].

Community-based sanitation is a program to provide waste water infrastructure for people in crowded urban slums. The Indonesian government has committed to increase resources to support replication and scaling-up approach to Decentralized Wastewater Treatment Systems (DEWATS) nationally.

The Community-based sanitation used the concept of empowering communities to make public the main actors in the process of planning, construction, operation and maintenance of communal sanitation facilities, in order for the facility can provide sustainable benefits. The concept using community-based principles for the development of water and environmental sanitation such as an informed choice as a basis in response of needs approach, water is a matter of social and economic, environmentally sustainable development, people's active participation, as well as the application of cost recovery principle.

Hence, the community-based household waste water management needs evaluation program, with the intention that the programs that have been planned to run optimally and useful in improving the quality of the living environment in the city of Makassar. This study aimed to identify the factors that influence the community-based household waste management in Makassar.

## 2. Material and Method

### 2.1. Study Site

The research was conducted in Makassar City, District of Tamalate with 6.471 indv. per km<sup>2</sup>. District of Tamalate was chosen because it has no effective system or operational procedure for wastewater treatment thus cannot support the goal of Makassar City to become clean and comfort city for their people. Therefore, it needs a study that provides the information on the existing condition of wastewater treatment in the District of Tamalate. Furthermore, the results will be used as the consideration for further decision making of the policy of wastewater treatment that involved the community.

District of Tamalate is one of large districts in Makasar which has increased trend on its activities of economy,

business, and education. The changes of the socio-economy dynamic affect the increasing need on the wastewater treatment in a sufficient and effective way. It is necessary to support the city's environment quality. District Tamalate have various regional functions, e.g. economic, educational and residential for the community. In addition Tamalate District has a large population and density that affect the dynamics of the settlements on the management of household waste in the city of Makassar.

### 2.2. Data Collection

This study used primary and secondary data analysis to strengthen analysis towards the problems that have been formulated. Analysis on household waste management based on community participation in Makassar concern to the spatial aspects so that the residential area was chosen for this study. Settlements in the District of Tamalate have several activities, i.e. economic and educational activities as well as for residential area. Therefore, in the aspect of data collection, we included the residential area that has its own specific characteristic, with large population and population density in an area.

Primary data were collected through: 1) dialog (interview) with the community in the District of Tamalate; 2) workshop with several related official institution, such as Office of Public Works, academics, community's leaders, NGOs, and cleaner workers; 3) Focus Group Discussion (FGD) with a more in-depth discussion among environmentalist communities, the cleaner workers, community groups which manage the environment sanitation, staff of Office of Public Works Makassar with discussion topics related to institutional factors, infrastructure, community participation in Makassar associated with the operations of community-based household waste management in Makassar.

Secondary data were collected from file and documents from related institution or parties, such as Office of Environmental Impact Control Makassar, Office of Regional Development Makassar, Department of Public Works Makassar, Environmental activists Makassar, Chairman of the Community Empowerment, and Chairman of the janitor Society in Makassar.

### 2.3. Data Analysis

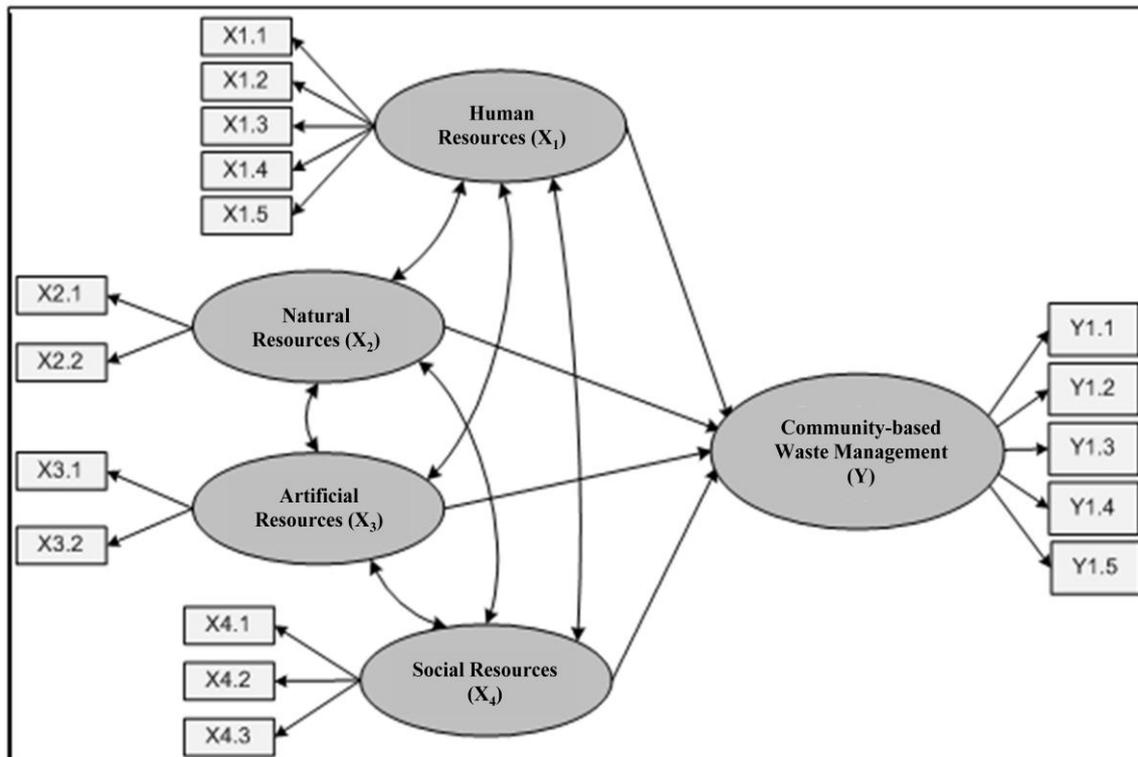
The analytical method used in this research is Structural Equation Modelling (SEM). SEM was used for the causal relationship in this study which arranged in a complex model. SEM analyse the effect of the exogenous variables, namely human resources ( $X_1$ ), natural resources ( $X_2$ ), artificial resource / facilities and infrastructure ( $X_3$ ), as well as social resources ( $X_4$ ), towards endogenous variable community-based household waste management ( $Y$ ); besides analyse the correlation between the four exogenous variables.

SEM is a collection of techniques that allow the testing on a range of relatively complex relationships simultaneously.

The complicated relationships can form between one or multiple dependent variables by one or more independent variables. Each construct is built from several indicator variables [6].

The data collected from the respondent as the samples through questionnaires distribution. It will be analysed by using Structural Equation Modelling (SEM) by AMOS 6 and SPSS 16. AMOS program indicate structural measurement on the problems and are used to test the hypothesis model.

This is due to their ability to estimate the unknown coefficients of the linear equation of structural model that accommodates the latent variables, accommodate the measurement error on the dependent and independent variables, and accommodate simultaneous reciprocity and interdependence. Based on the theoretical review, we formulate following diagram for the SEM as following Figure 1.



#### Description:

##### Y Community-based Waste Management

- Y<sub>1,1</sub> Potential/Capacity of natural and environmental resources
- Y<sub>1,2</sub> number and variety of adequate infrastructure and facilities to support community-based waste management
- Y<sub>1,3</sub> number and variety of adequate public infrastructure and facilities
- Y<sub>1,4</sub> number and variety of infrastructure and waste management facilities (latrines, clean water pipe network, etc)
- Y<sub>1,5</sub> Conservation of the environment (natural and socio-cultural resources)

##### X<sub>1</sub> Human Resources

- X<sub>1,1</sub> Mastery of knowledge on household waste
- X<sub>1,2</sub> Skills on household waste management
- X<sub>1,3</sub> Operational, maintenance and handling competence
- X<sub>1,4</sub> Work ethic, social waste management
- X<sub>1,5</sub> Motivation of management
- X<sub>1,6</sub> Attitude towards the management

##### X<sub>2</sub> Natural Resources

- X<sub>2,1</sub> Availability of natural resources of land
- X<sub>2,2</sub> Density of area against the population

##### X<sub>3</sub> Artificial Resources/Infrastructure and Facilities

- X<sub>3,1</sub> Accessibility to government and private facilities
- X<sub>3,2</sub> Availability of supporting facilities

##### X<sub>4</sub> Social Resources

- X<sub>4,1</sub> Self-confidence
- X<sub>4,2</sub> Social Organization (Network)
- X<sub>4,3</sub> Regulation/traditional rules/culture (Norm)

Figure 1. Structural Model (Path Diagram) for the SEM on the Community-based Management of Household Waterwaste in Tamalate District, Makassar

### 3. Result and Discussion

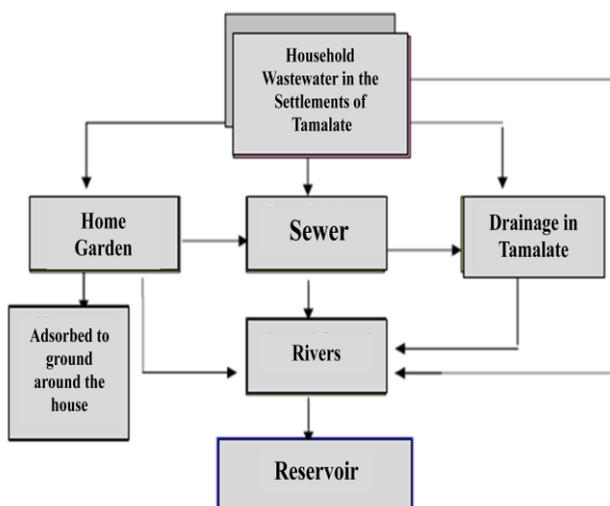
#### 3.1. Existing Condition of Domestic Wastewater Management

The findings from the field study explained that public understanding in Makassar on domestic waste water is limited to the impact that can be seen and felt visually and instantly, like a smell, dirty environment and abundance mosquito. While the impact of domestic waste water to ground water and surface water was less known. It is seen by the phenomenon that occurs in the community about the habits of managing household waste.

People in residential area in the District of Tamalate have a habit to dispose domestic wastewater to inappropriate place. There are several forms of community activities carried out in the settlement area of Makassar City in disposing of household waste water, including: 1) disposing household waste water into the gutter or ditch near their house with or without the pipeline, 2) littering into the river with or without the pipeline, 3) Accommodating household wastewater into the hole made near the bathroom, and 4) Use household waste water for watering the streets. The reason they treat household waste water as mentioned above is as follows:

1. The lack of wastewater management services as well as household rubbish by 54.13% of respondents
2. It is easier way to remove the waste by 33.94% of the respondents
3. No costs needed by 7.34% of respondents
4. There is no restrictions to discharge wastewater into the sewer by 20.18% of respondents

Household waste water that discharged into the roadside or gutter will ultimately also flow to the river. The results of observations on the domestic waste management described with the following schema in Figure 2.



**Figure 2.** Scheme of Household Wastewater in the Settlements of Tamalate District, Makassar

Means and household waste water infrastructure in the District of Tamalate currently in the form of communal

septic, i.e. 2 units with each volume of 170 m<sup>3</sup> which can serve each 110 households. The communal septic tank built by the Public Works Department of Makassar at the end of 2008.

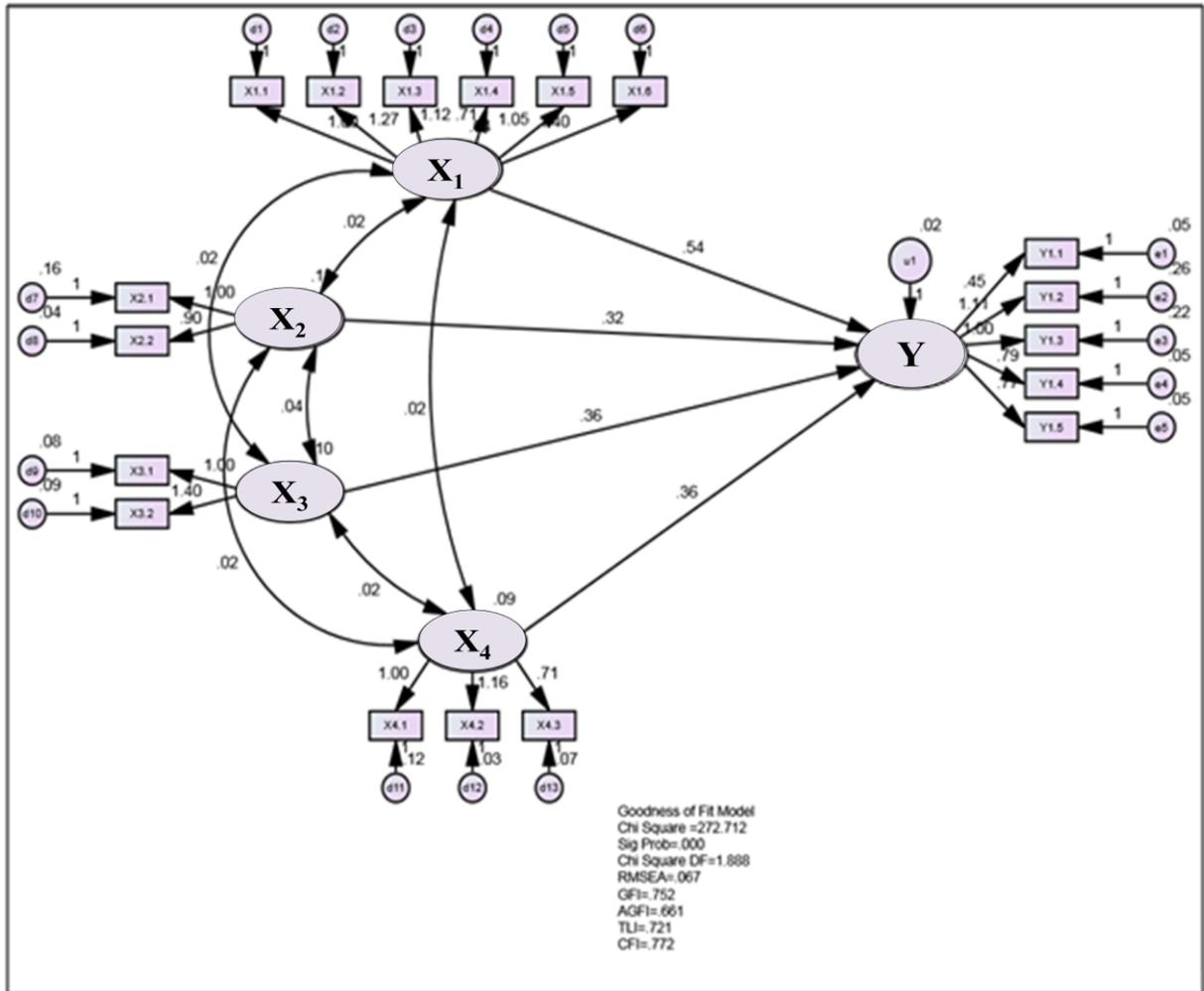
#### 3.2. Factors Affecting the Wastewater Treatment Management

Household waste management in the area of Makassar City is influenced by several factors, among others: human resources, natural resources, artificial resources, and social resources. Characteristics of human resources, natural resources, artificial resources / infrastructure and social resources associated with the management of household waste is very diverse. The quality of human resources analysed by indicators of the acquisition of knowledge, skills, competencies, work ethics/social ethic, motivation and attitudes towards waste management. Indicators of natural resources include land resource availability and population density in the area. Indicator of artificial resources / infrastructure is accessibility to public facilities and availability of facilities. Indicator of social resources include self-confidence, social organization (network), and regulations/traditional rules/ culture (norms).

The test on the relationship between the four variables showed significant linkages between natural resources with artificial resources. On the other hand, there is no linkage between human resources and natural resources, human resources with artificial resources, human resources with social resources, natural resources with social resources, and artificial resources with social resources. Following Figure 3 describe the results on SEM Analysis on the variables of community-based household waste management.

Figure 3 shows that the human resource is the strongest variable associated with community-based household waste management in Makassar, especially in the District of Tamalate. Indicator of human resources that has the most powerful effect is work/social ethic of community participation in the community-based waste management in residential areas in the city of Makassar. Motivation indicator towards the community-based household waste management has the weakest contribution.

Variables of natural resources is the weakest aspect in the management of community-based household waste in the city of Makassar, where the indicator of availability of land is the most powerful indicators and indicators of the density of the region is the weakest indicator. The results of this study indicate that people in residential areas in the city of Makassar is fundamentally already have adequate knowledge and skills related to the community-based management of household waste which is a comprehensive approach to address the problems of urban sanitation. However, to improve the performance of the management of household waste, they must pay attention to the capabilities of the existing land natural resources, particularly in relation to the sustainability of the natural resource potential of existing land in the area.



**Description:**

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- Y<sub>1.1</sub> Potential/Capacity of natural and environmental resources
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**X<sub>4</sub> Social Resources**

- X<sub>4.1</sub> Self-confidence
- X<sub>4.2</sub> Social Organization (Network)
- X<sub>4.3</sub> Regulation/traditional rules/culture (Norm)

**Figure 3.** Path Diagram of SEM Analysis on the Community-based Wastewater Management in the District of Tamalate, Makassar

The results of SEM analysis showed a high value of the coefficient that describes the strength of the contribution of indicator towards community-based household waste management. From these results, the strong indicators are  $X_{1,4}$  (work/social ethic),  $X_{2,1}$  (availability of natural resources),  $X_{3,2}$  (availability of facilities),  $X_{4,2}$  (social organization/network) and  $Y_{1,2}$  (number and variety of facilities and infrastructure necessary to support the community-based household waste management). In accordance with the criteria of a residential area should be healthy and sustainable to consider a region is eligible as a settlement area if: 1) it has a carrying capacity towards land availability for waste management, 2) it has a service and availability of the installation of waste management, 3) the size of the density of the area and population must meet the requirements for social activities and economic development, 4) has the facilities and infrastructure management of household waste that is accessible to the public, 5) has strong institutions, led by the local community, and 6) have adequate access to resources help from government and private [7, 8].

Indicators of management motivation ( $X_{1,5}$ ), the density of populated areas ( $X_{2,2}$ ), accessibility to government assistance and private facilities ( $X_{3,1}$ ), regulation/traditional rules/culture ( $X_{4,3}$ ) and potential natural resources and environment ( $Y_{1,1}$ ) are weak indicators related to the management of community-based household waste in the residential neighbourhood of Makassar. It means people in residential areas in the city of Makassar, during the community-based waste management still do not get the maximum benefit. It is indicated by no changes in the motivation of the public to the management of household waste to create healthy and sustainable neighbourhoods. Residential area in Makassar is basically the dominant region for residential area, thus community-based household waste management is expected as an instrument to resolve issues related to environmental health and residential areas.

Accessibility to government and private facilities rated very weak by the society. Accessibility in this study concerns the accessibility of citizens to obtain assistance or grants from the government or private, to increase the capacity and competence of the community, both physical and network of installation for household waste. This means that public participation in the management of household waste will be higher if the government and the private sector also supports both physical and non-physical aspects because of their understanding provision of facilities for waste installations is the duty of the local government. Because of people's lower willingness to participate in the management of household waste, the accessibility to government and private support is an important factor influencing their decision to participate in the management of household waste.

## 4. Conclusions

Household waste management in the area of Makassar City is influenced by several factors, among others: human resources, natural resources, artificial resources, and social resources. The test on the relationship between the four variables showed significant linkages between natural resources with artificial resources. On the other hand, there is no linkage between human resources and natural resources, human resources with artificial resources, human resources with social resources, natural resources with social resources, and artificial resources with social resources. In the planning stages of community-based household waste management policy on residential areas needs more attention and optimizes aspects of community development and empowerment as a subject in the waste management activities by taking into account the level of community participation from planning to the implementation of activities.

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