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Preliminary Analysis of Factors Affecting Communities in Management of Stool at Sources in the Jakarta Communal Wastewater Treatment Service Area

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ABSTRACT

This study examines the public perception of several Jakarta communities served by communal WWTPs on in situ management or wastewater sources and the relationship between factors. This research used a questionnaire and random sampling technic. The questionnaire is based on study indicators. This study uses nine domestic wastewater indicators. The corrected Item-Total correlation indicates that the variable is invalid and does not need to be continued to the reliability test. The Kaiser-Meyer-Olkin (KMO) and Bartlett's Test showed that factor analysis is appropriate. This study groups indicators into four dimensions. Factor 1 includes septic tank draining, sewage treatment, subscribing to sewage treatment, feces sludge management, and sewage sludge disposal. Second, septic tank performance and draining. Third, open defecation and septic tank owner are factors 2 and 4. Fourth, delete indicators with the same variable but different dimensions.

Keywords: domestic wastewater, factor analysis, in situ management, communal WWTPs

1. Introduction

The success of development, particularly human development, can be measured partly by the extent [1] to which the most fundamental problems in the community can be overcome. For example, understanding the relationship between an aging population and the changes occurring in urban areas, as well as the necessity of creating urban communities that are supportive of one another, are major issues for public policy [2]. Poverty, unemployment, illiteracy, food security, and the enforcement of democracy are among these issues [3]. However, the problem is that partial development achievements vary widely, with some aspects of development succeeding. In contrast, others fail, raising the question of how to assess the success of human development as a whole [4].

The Indonesian government is targeting 100% achievement for the 6th Sustainable Development Goal (SDG), namely clean water and adequate sanitation by 2030 [5] with two indicators, namely universal and equitable access to safe and affordable drinking water for all and access to adequate [6] and equitable sanitation and hygiene for all by ending open defecation and paying special attention to the needs of women and vulnerable groups [7]. Domestic wastewater management facilities and infrastructure not owned by the community are one of the government's programs to provide access to these facilities in an effort by the government to improve sanitation conditions [8]. However, the community can rely on the government and public awareness that maintaining water sources is the duty of the community and local government.

Communal WWTPs that are built do not always have optimal performance in reducing pollutant levels of domestic wastewater [9]–[12]. The studys showed that there were still some parameters of the communal WWTP effluent that did not meet the standard [9], [13], [14]. Domestic wastewater that does not meet these quality standards when discharged into the environment can increase the burden of pollution [15]–[17]. For this reason, community management efforts for existing WWTPs need

to be carried out in the form of participation from the wastewater source, which is disposed of with a septic tank.

Community participation has a close relationship between one individual and another or vice versa, and there is a reciprocal and mutually influencing relationship [18]–[21]. The association exists between individuals with individuals, individuals with groups, or groups with groups. In general, it can be said that any development activities will be less successful without community participation. Perception is one of the essential psychological aspects for humans in responding to the presence of various aspects and symptoms around them [22]. Perception has a comprehensive meaning. Multiple experts have given different definitions of perception, although they have the same principle meaning. This study aims to examine the public perception of several communities served by communal WWTPs in Jakarta on in situ management or wastewater sources and to identify the relationship between factors.

2. Material and Methods

This study was designed as a descriptive cross-sectional analysis. The presence or ownership of latrines and their risk factors are measured at the same time. The place of this research is the community in three locations in Jakarta, which have been served by communal IPAL. This research was conducted from June to December 2021.

In this study, the sample was taken by random sampling technique. Random sampling is one of the sampling techniques that you need to understand in research[23]. In statistics, the sample is a small part representing a larger group or whole. Random sampling, or this simple random method, is usually used to describe an unbiased group [24]. Random sampling is a sampling technique from a population based on each element of the existing population. Each member of the subset has an equal probability of being selected.

Data collection techniques in this study used a questionnaire. Indicators of the factors that were investigated for this study served as the foundation for the questionnaire preparation. In addition, the validity and reliability of the instrument were examined as part of the testing that was carried out. The instrument's validity was tested using Pearson correlation's product-moment correlation. In addition, the Cronbach Alpha coefficient is utilized during testing for reliability.

This study focuses on wastewater management using nine indicators for a questionnaire derived from domestic wastewater generation sources. Table 1 shows all the questions in their entirety. The original version of the Likert scale consisted of a five-point rating system with the following response options: strongly agree, agree, disagree, and disagree.

Table 1. Questions in the questionnaire about managing domestic wastewater in the communal WWTP service area

Question	Indicator	Code
I still like to see feces thrown into the area around where you live	Open defecation	X1
I have an individual or communal septic tank to complete the sanitation facilities in my home	Septic tank owner	X2
I think the septic tank used is working well	Septic tank performance	X3
I think I need to do regular draining of the septic tank	Importance of septic tank draining	X4
I do the installed septic tank is regularly drained	Regularly drained	X5
I think the importance of subscribing to sewage treatment	Sewage treatment	X6
I have started subscribing to sewage treatment	Subscribing to sewage treatment	X7
I Do not throw away the results of the sludge of feces	Sludge of feces management	X8
I still like to see the results of the sewage sludge that is thrown into the area around the house	Sewage sludge disposal	X9

The data that has been collected will be processed and analyzed to determine the factors that influence sewerage or domestic wastewater management in the source. This will determine the factors that influence the source's sewerage or domestic wastewater management. In the current investigation, dimension reduction will be performed to ensure that all data can be used for data processing. After that, an analysis will be performed to accomplish the research goals.

3. Results and Discussions

The validity test is seen from the Corrected Item-Total correlation, which is smaller than the r table, meaning that the variable is invalid and does not need to be continued to the reliability test. For the reliability test of Cronbach's Alpha Based on Standardized Items from this study, it is between 0.4-0.6. For the results of this study, all indicators are reliable at a moderate level. The reliability test result was between around 0.4 and 0.6, which is considered to have "moderate" reliability [25].

A validity test is used to measure the validity or validity of a questionnaire [26]. A

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questionnaire is said to be valid if the questions on the questionnaire can reveal something that the questionnaire will measure. So, validity wants to measure whether the questions in the questionnaire that we have made can measure what we want to measure. The validity test used is Pearson Correlation. The significance of the Pearson correlation used in this study is 0.1. Suppose the significance value is less than 0.1. Then the question item is valid, and if the significance value is more significant than 0.1 [27], then the question item is invalid. The statement is considered valid if the significance is lower than the significance level [28]. The reliability and validity test results in the questionnaire on managing domestic wastewater in the communal WWTP service area can be seen in Table 2.

Table 2. Reliability and Validity Test Results in the questionnaire on managing domestic wastewater in the communal WWTP service area

Variable	Reliability	Validity
	Cronbach's Alpha if Item Deleted	Pearson Correlation
X1	0.556	0.468**
X2	0.594	0.263*
X3	0.611	0.327**
X4	0.518	0.608**
X5	0.576	0.499**
X6	0.547	0.515**
X7	0.483	0.737**
X8	0.573	0.371**
X9	0.559	0.511**

*sig 0.1; **sig0.05

The average responses to each question on the Likert scale are presented in Table 3. The value X7 is the one with the lowest price. A scale of five demonstrates a deficient level of public interest in subscribing to domestic wastewater treatment. In the meantime, from the highest mean level, the need for wastewater management to ensure that it is not disposed of indiscriminately into water bodies is at its highest level.

Table 3. Descriptive value of the mean answer from the Likert scale

Variable	Mean	Std. Deviation
X1	4.597	0.527
X2	4.452	0.533
X3	3.952	0.838
X4	4.387	0.710
X5	3.677	1.004
X6	3.839	0.751
X7	2.839	1.283
X8	4.726	0.450
X9	4.307	0.898

It is often helpful to organize and summarize a large data set by creating a table that lists the possible different data values (either individually or by grouping) with an appropriate frequency, representing the number of times they occur. This can be done when confronted with an extensive data set for the first time. The frequency list is sometimes referred to as the frequency distribution (frequency distribution) [29]. In addition, various socio-demographic aspects can shed light on the respondents' personalities and other characteristics. Four components comprise the social aspect: the location, the highest level of education attained, the occupation, and the total annual income. In the meantime, the demographic component considers four factors: age and gender. Table 4 shows the Socio-demographic data of respondents in the communal WWTP service area.

Table 4. Socio-demographic data of respondents in the communal WWTP service area

Variable		Frequency	Percent
Area	Jakarta Barat	20	32.3
	Jakarta Pusat	20	32.3
	Jakarta Selatan	22	35.5
Gender	Female	42	67.7
	Male	20	32.3
Age	20-29	5	8.1
	30-39	15	24.2
	40-49	14	22.6
	50-59	21	33.9
	≥ 60	7	11.3
Education	Bachelor	2	3.2
	Primary school	19	30.6
	Secondary school	41	66.1
Occupancy	Formal	1	1.6
	Non-Formal	61	98.4
Income	<Rp. 5.000.000	60	96.8
	Rp. 5.000.000 - Rp. 10.000.000	2	3.2

The steps taken after each initial variable that was going to be included in the analysis were obtained. These steps included testing the adequacy of the sample by using the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy index and determining the significance value of Bartlett's Test of Sphericity. The factor analysis methodology's reliability is evaluated with this index's help. It indicates that factor analysis is appropriate if the KMO value is between 0.5 and 1 and the significance of Bartlett's Test of Sphericity is less than the significance level that was used. Table 6 shows the KMO value calculated using the output of SPSS.

Table 6. The value of the kaiser-meyer-olkin measure of sampling adequacy and bartlett's test of sphericity model factors formed

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.578
Bartlett's Test of Sphericity	Approx. Chi-Square	88.074
	df	36
	Sig.	0.000

When all the requirements for the correlation calculation have been satisfied, the next step is to form factors to discover the structure that underlies the relationship between the initial variables. This occurs after the variables have been identified and chosen. The first step in the process of factor formation is establishing the total number of factors, and the second is rotating the already formed factors. Several criteria are combined to determine the number of factors that will be formed, which is done to obtain the number of factors that best fit the research data.

Eigenvalues measure the total amount of a variable's variation that can be accounted for by a particular principal component. In theory, they can have a positive or negative value, but in practice, they explain the variance, which is almost always interpreted as a positive value. This is a positive indication if the eigenvalues are higher than zero. Table 7 shows the eigenvalues for the factors formed in the data test.

Table 7. Eigenvalues of factor analysis in managing domestic wastewater in the communal WWTP service area.

Comp.	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cum. %	Total	% of Variance	Cum. %
1	2.299	25.548	25.548	2.299	25.548	25.548
2	1.608	17.866	43.413	1.608	17.866	43.413
3	1.2	13.335	56.749	1.2	13.335	56.749
4	1.06	11.779	68.528	1.06	11.779	68.528
5	0.859	9.548	78.075			
6	0.701	7.785	85.861			
7	0.471	5.234	91.094			
8	0.403	4.478	95.573			
9	0.398	4.427	100			

Scree plots are used to make determinations that serve as the criteria for the factors used. The scree plot is a plot that compares the eigenvalues to the total number of factors that have been extracted. The precise number of factors can be determined by locating the point at which the scree first begins to occur. This point is reached when the scree begins to appear flat. When all initial variables are collapsed into one factor in Figure 1, it is common knowledge that the scree plot will begin to level off. The results obtained have been halted and have fulfilled the second criterion's requirements.

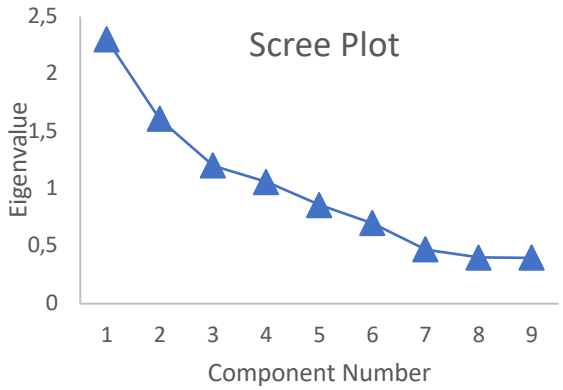

Figure 1. Scree plot of factor analysis in managing domestic wastewater in the communal WWTP service area.

This study groups each indicator into its respective dimensions into four dimensions. In dimension one, there are variables of the importance of septic tank draining, sewage treatment, subscribing to sewage treatment, sludge of feces management, and sewage sludge disposal. The second dimension consists of septic tank performance and is regularly drained. The dimensions of factor 2 and factor 4 each consist of open defecation and the septic tank owner. The indicator must be removed if there are indicators with the same variable but different dimensions.

Table 8. The resulting loading factors

Comp.	Factor 1	Factor 2	Factor 3	Factor 4
X7	0.753	-0.049	-0.241	0.116
X6	0.621	-0.389	0.226	0.086

X4	0.617	0.408	0.384	-0.161
X9	0.557	-0.375	-0.43	0.107
X8	0.503	-0.497	0.382	-0.294
X3	0.127	0.63	0.053	0.278
X5	0.382	0.595	0.29	-0.257
X1	0.465	0.386	0.669	-0.062
X2	0.158	0	0.281	0.877

Due to the fact that the KMO value is 0.578 and the significance value of Bartlett's Test of Sphericity is 0.000, it is possible to conclude that factor analysis is an appropriate method to use to simplify the set of 9 variables. The results of the statistical tests for handling factors, quality factors, ownership factors, and awareness factors can affect people's interest in managing domestic wastewater in situ. This is demonstrated by the fact that these factors can affect people's interest in managing domestic wastewater in their living hood.

It is essential to determine whether technology is more environmentally friendly than the other [30]. A socially acceptable, cost-effective method satisfies the requirement of efficient resource recycling while also ensuring that harmful substances are not transferred to humans [31], or the environment can be referred to as sustainable sludge handling. Therefore, this method may be defined as "sustainable sludge handling." Unquestionably, this unconventional and strategic resource would become scarce, particularly in water planning and exploitation systems that prioritize the preservation, protection, and improvement of water quality [32]–[34], as well as the sustainable and efficient use of natural resources. Because of this, more people in the community will want to promote sewage treatment use [35]. There was a correlation between this rise in the ownership of hygienic latrines and significant shifts in how people defecated [36]–[39]. Open defecation-free (ODF) messages are targeted at providing enough information and knowledge on the harmful impacts of open defecation practice and encouraging individuals to refrain from engaging in this behaviour [40]–[43]. A more detailed explanation of the formed factors can be seen in Table 9 and Figure 2.

Table 9. Final description of the formed factors

Factor	Information
Handling (X4, X6,X7,X8,X9)	Sustainable sludge handling may be a socially acceptable [31], cost-effective method that meets the requirement of efficient recycling of resources while ensuring that harmful substances are not transferred to humans or the environment [44].
Quality (X3 & X5)	This unconventional, strategic resource would become scarcely unquestionable, particularly in cases where water planning and exploitation systems prioritize the preservation, protection, and improvement of water quality, as well as the sustainable and efficient use of natural resources [45], [46]. This makes the community want to subscribe to sewerage treatment
Ownership (X2)	This increase in ownership of hygienic latrines was associated with major changes in defecation practices [39], [47].
Awareness (X1)	ODF messages aimed at providing adequate information and awareness on the negative effects of open defecation practice [17] and to sensitise the people to adopt behavioral change of saying no to open defecation practice but rather use the toilet to achieve an ODF environment [48], [49].

Due to the limited number of respondents (n=62) in this study, wider recommendations were made to achieve relevant and representative significance of the total population. Furthermore, because the number of populations served by communal WWTPs in Jakarta is still limited, further mapping studies are also needed to facilitate research. Finally, wastewater management must also look at the community's opinion on the environment as part of their awareness of the sustainability of the welfare of their place of residence.

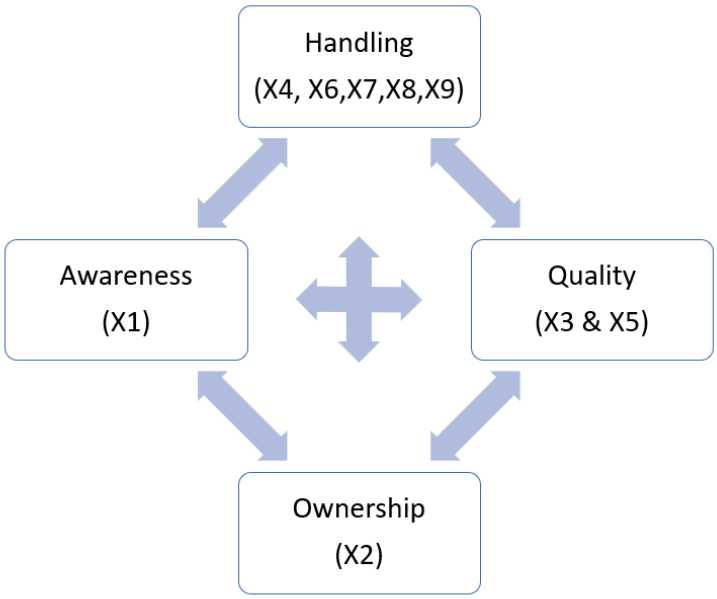

Figure 2. The resulting framework of factor analysis is the result of factor analysis in managing domestic wastewater in the communal WWTP service area.

4. Conclusion

The level of success achieved in development, particularly in human development, can be evaluated based on the degree to which the most fundamental challenges faced by the community can be conquered. No guarantee that newly constructed communal WWTPs will have the best possible performance in lowering the pollution levels in home wastewater. In Jakarta, various areas are served by communal WWTPs. This investigation shows the public's impression of in-situ management or wastewater sources and establishes the relationship between the components contributing to that perception. Data gathering strategies in this investigation utilize a questionnaire. Indicators of the parameters investigated for this study served as the foundation for constructing the questionnaire. This study focuses on managing wastewater using nine indicators derived from household wastewater-generating sources. The validity test can be noticed from the corrected item-total correlation, which is lower than the r table. This indicates that the variable is not valid. Thus, the reliability test does not need to be continued with it. If the KMO value is between 0.5 and 1, and if the significance of Bartlett's Test of Sphericity is less than the significance threshold, then factor analysis is the suitable statistical method to utilize. When all of the prerequisites for the correlation calculation have been satisfied, the following step is to build factors to discover the structure underlying the link between the original variables. This occurs after the variables have been identified and chosen.

This study organizes each indicator into its dimension, totaling four different dimensions altogether. Septic tank draining, sewage treatment, subscribing to sewage treatment, sludge of feces management, and sewage sludge disposal are the essential variables included in factor 1. The performance of the septic tank and the frequency with which it is drained make up the second dimension. Open defecation and the person who owns the septic tank comprise the dimensions of component 2 and factor 4, respectively. It is necessary to eliminate the indicator if other indications use the same variable but have distinct sizes themselves.

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