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Water and Sanitation Access: An Analysis of Households in Indonesia

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Abstract

Water and sanitation are critical components in achieving the SDGs. In Indonesia, poor water quality and sanitation have been the primary causes of diarrheal illnesses, resulting in high child death rates. This research investigates the extent to which a community's socioeconomic and demographic characteristics influence the adoption of water and sanitation facilities. Using the logit model analysis method, the data used is from an IFLS5 survey of 14,827 households. The findings indicate that sanitation improvements are linked to household expenditure and toilet use, but piped water availability is related to education and water source location. However, expenditure has no significant effect on the transition from non-piped to piped water sources. Limited access to clean drinking water and sanitation services can pose health risks to the community, socioeconomic status, and the environment. The study provides policy recommendations to expand the coverage of clean water and sanitation services to the community for better household health in Indonesia.

Keywords: Sanitation, Water Source, IFLS, Logit, Socioeconomic

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INTRODUCTION

Water and sanitation services are essential for achieving the Sustainable Development Goals (SDGs), as contamination or scarcity may negatively affect health and livelihoods (Caglar & Yavuz, 2023; UN-Water, 2020; UN, 2019). Adequate drinking water supply, sanitation, and hygiene are essential factors to encouraging

healthy living (Freeman et al., 2014; World Bank, 2014). Water is essential for human survival. Good water is water that promotes human health, particularly that of children.

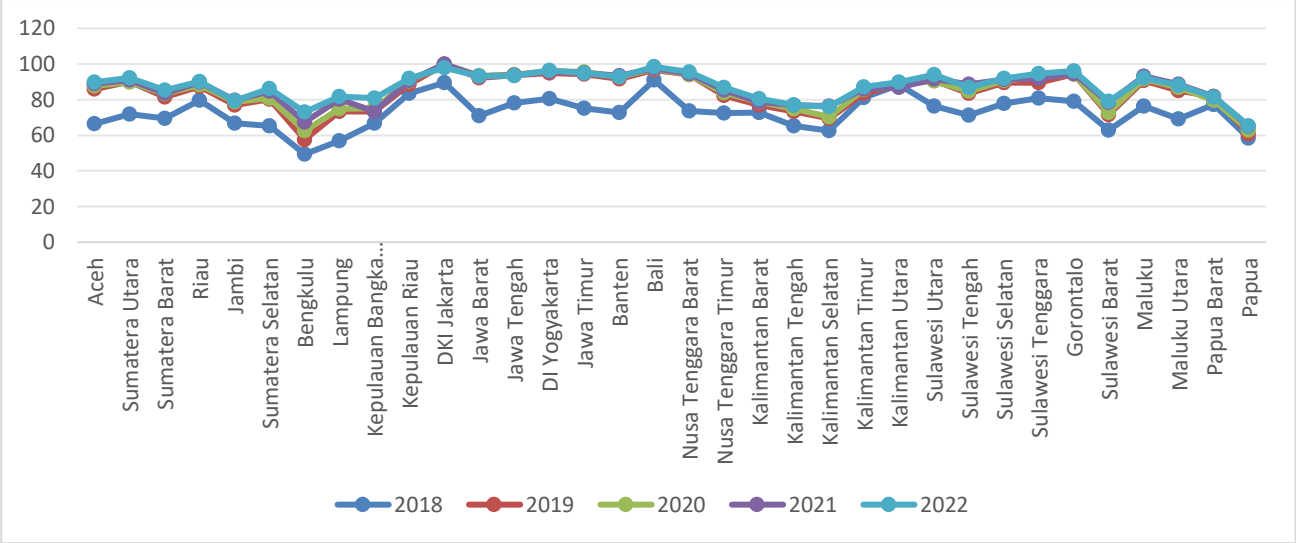

Figure 1. Household Drinking Water Percentage by Province
Source: BPS-Statistics Indonesia, 2018-2022

Diseases that frequently occur, such as diarrhea. Shrestha et al. (2017) studied water quality, sanitation, and hygiene in schools and households in Dolakha and Ramechhap districts of Nepal. They recommended that the government focus more on Water, Sanitation, and Hygiene (WASH) in these areas. Sigel et al. (2012) conducted a study in Darken, Mongolia's second-largest city. Almost half of respondents indicated that they utilized water from other houses' private wells as a secondary source of drinking water.

According to UNICEF (2021) diarrhea infects nearly a quarter of all children under the age of 5 in Indonesia, which renders it the top cause of child mortality. Poor water quality and sanitation have been the leading causes of illnesses such as diarrhea in Indonesia. The appearance of such significant threats caused international organizations to encourage management to maintain all countries' health, prosperity, equality, and the environment. In Indonesia, the issue with household safe drinking water that can be seen in figure 1.

Figure 1 illustrates that provincial variations of Indonesia's Drinking Water Access reveal significant disparities across province. Provinces such as DKI Jakarta, Bali, and DI Yogyakarta consistently exhibit high percentages of households with access to clean drinking water, often exceeding 90%, reflecting their urbanized nature and well-developed infrastructure. In contrast, provinces like West Java, East Java, and South Sulawesi show moderate access levels, as semi-urban and rural regions still face challenges in expanding water supply systems.

Eastern provinces like Papua and West Papua exhibit the most notable gaps, with access remaining limited due to logistical challenges, dispersed rural populations, and underdeveloped infrastructure. These disparities

highlight the need for targeted interventions to address regional inequities in clean water access. As compared to all provinces in Indonesia, the distribution remained uneven.

Figure 2. Household Drinking Water Percentage by Province and Urban/Rural area
Source: BPS-Statistics Indonesia, 2018-2022

Figure 2 shows area classification (rural and urban) also contribute a role in the considerable differences in access to drinking water observed across Indonesia. Provinces such

as DKI Jakarta, Bali, and DI Yogyakarta typically have high percentages of households having access to safe drinking water in both urban and rural areas, often reaching 90%.

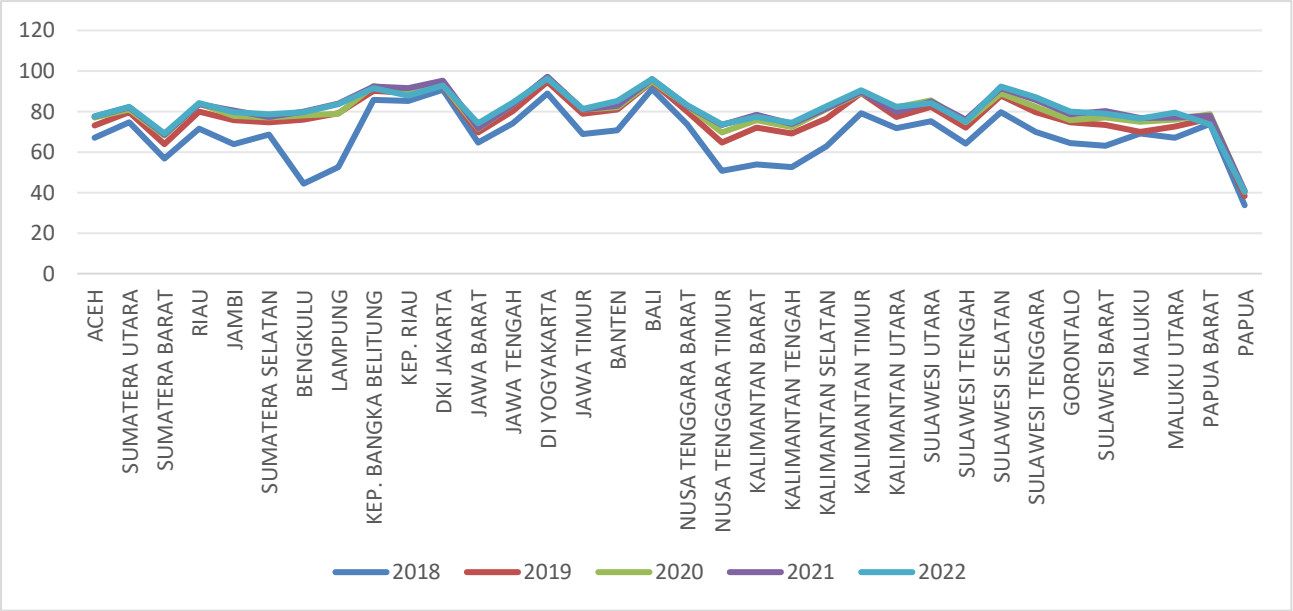

Figure 3. Household Sanitation Coverage in pencentage by Province
Source: BPS-Statistics Indonesia, 2018-2022

These provinces benefit from well-developed infrastructure and easy access to centralized water systems. Urban areas in generally developed provinces such as West Java, East Java, and South Sulawesi maintain high levels of access, but rural areas suffer slower progress due to greater populations and more dispersed areas.

On the other hand, eastern provinces such as Papua and West Papua have the lowest access rates, particularly in rural areas where topographical challenges and poor infrastructure impede progress. These provinces' urban centre's do better but remain below the national average.

These disparities highlight the ongoing importance of targeted policies and investments, particularly in rural and remote areas, to close the gap and provide equitable access to clean drinking water for all households. SDG Goal 6 'Clean Water and Sanitation' and Goal 12 'Responsible Consumption and Production' specify that 2,030 countries must attempt to reduce untreated wastewater to half of its current part, enhance recycling, and reduce solid waste pollution.

The SDG 6 achievement targets are as follows: (a) Ensure universal access to safe and cheap drinking water; (b) Provide appropriate sanitation and hygiene for all, including the elimination of open defecation, with a focus on women, girls, and vulnerable populations; (c) Improving water sustainability through the reduction of pollution, waste, harmful chemicals, untreated wastewater discharge, and encouraging international safe recycling and reuse; (d) Improving water sustainability through the reduction of pollution, waste, harmful chemicals, untreated wastewater discharge, and encouraging international safe

recycling and reuse; (e) Achieving integrated water resource management across all tiers alongside the necessary international cooperation; (f) Protect and maintain water ecosystems, these as mountains, forests, wetlands, rivers, aquifers, and lakes; (g) Strengthen international collaboration and capacity-building assistance for developing nations in water and sanitation activities, such as source water maintenance, desalination, water efficiency, wastewater treatment, recycling, and reuse technological advancements. (h) Strengthening a culture of community engagement in water and sanitation management.

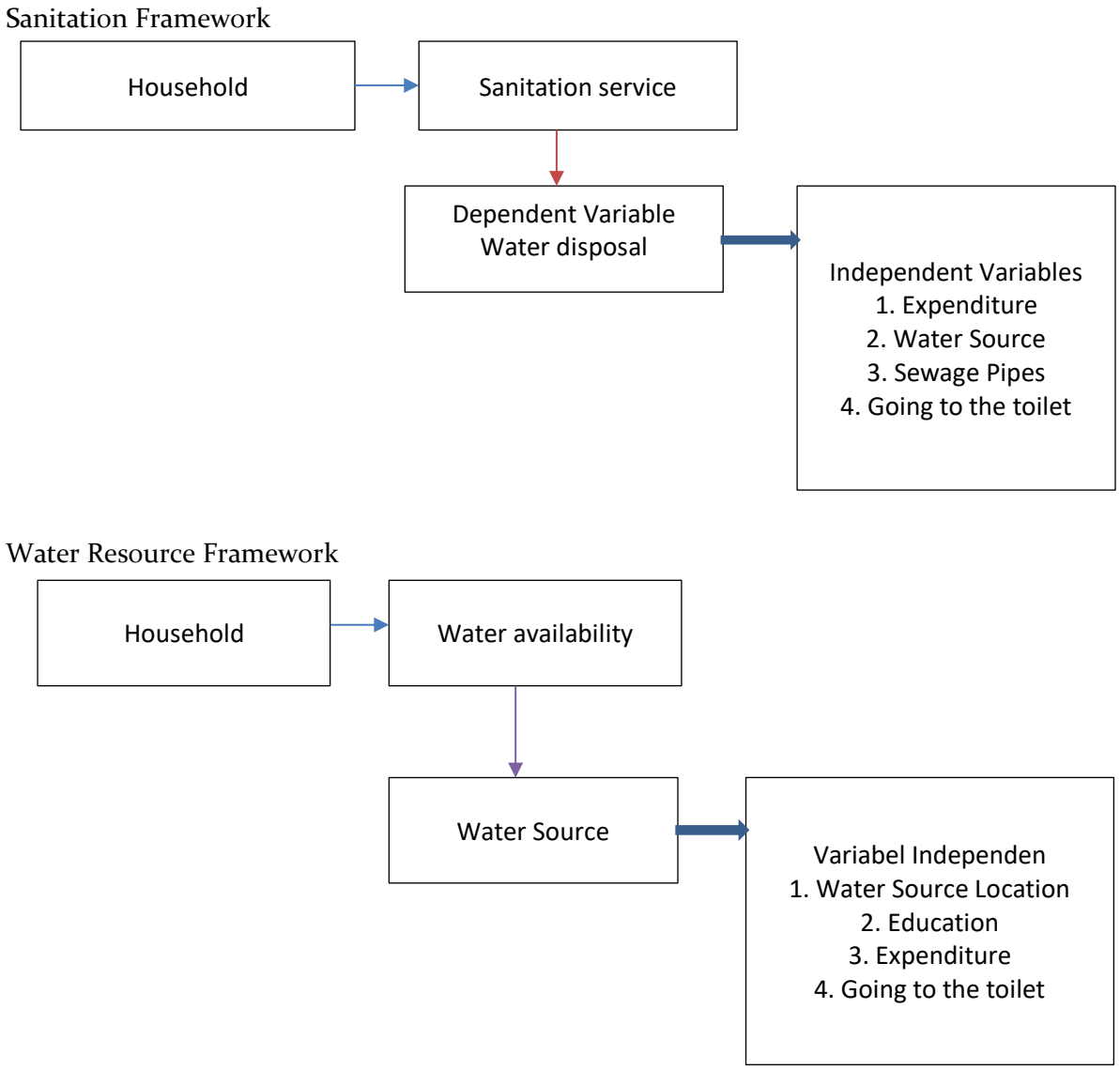

Figure 4. Sanitation and Water Resource Framework
Source: Data Processed, 2024

However, fulfilling these goals in the SDGs will be particularly challenging in countries with poor infrastructure where sanitation infrastructures are still inadequate. The graph

below shows Indonesia's achievement of improved sanitation from 2018 to 2022.

Figure 3 shows that, according to BPS-Statistics Indonesia, there is a favourable national trend, with progressive improvements over time. Provinces like Jakarta and Bali frequently achieve greater percentages due to their advanced infrastructure and growth in urban areas, while rural provinces like Papua and East Nusa Tenggara lag due to geographic isolation and a lack of investment.

Annual development varies by province, with some seeing major improvements because of particular government initiatives such as PAMSIMAS (Community-Based Water Supply and Sanitation), while others experience slower growth due to chronic socioeconomic and infrastructure challenges. There is still a significant difference between urban and rural communities, with urban areas benefiting from greater facilities and rural areas needing more resources and cultural barriers to adoption.

Access to sufficient sanitation services remains extremely limited among all of Indonesia's provinces. This shows that there are still many difficulties with sanitation and water in Indonesia, which can lead to a decrease in health, particularly health that is directly tied to sanitation and water sources, such as diarrhea.

The daily consumption of clean water and sanitation management can be used as the foundation for evaluating the factors that influence clean and healthy living habit in households. The determinants of behaviour are utilized to better understand behaviour and devise intervention strategies to create the intended changes in household behaviour.

This study aims on rising difficulties in Indonesia's household water and sanitation sector. An examination of factors influencing water and sanitation service adoption was undertaken using data from the IFLS5 Survey and a logit regression model. The findings of this study will assist the government in developing policies linked to the construction of drinking water sources and the enhancement of sanitary facilities, which will benefit public health. Previous study has indicated that the use of water and sanitation by homes has a significant impact on household health, both in urban and rural settings, particularly in rural areas with sanitation.

As stated by the World Health Organization (WHO), sanitation is collecting and disposing human excreta, urine, and wastewater from the community in a approach that does not endanger human or community health. In industrialized countries, the sanitation challenge is to increase the capacity and effectiveness of current technology to ensure that sanitation facilities remove human excrement and urine, consequently avoiding health concerns from existing contamination. In developing countries, essential sanitation concerns include increasing access to toilet facilities and reducing open defecation habits (Kasper, 2013).

The linkage between sanitation and health, in addition to increasing populations emphasize the need of sanitation planning. According to William et al. (2004), improved water supply and sanitation improve human health and life expectancy. Several attempts have been made to model sanitation using frameworks for sanitation-related behavior change initiatives (Dreibelbis et al. 2013).

According to Omole and Ndambuki (2014), whenever education levels rise, households become more likely to pursue water-saving techniques and prefer better sanitation.

Educated households are more likely to have high-paying occupations, access to drinking water sources, and the ability to connect water to their own dwellings, as well as safe sanitation facilities. A reliable source of drinking water and adequate sanitation facilities are both essential aspects of Rwanda's long-term water and sanitation distribution (Bikorimana and Shengmin, 2019).

RESEARCH METHODS

The study focused on the community component survey from the fifth wave of the Indonesia Family Life Survey (IFLS-5) (RAND, 2016). IFLS is a longitudinal study conducted by RAND in partnership with many Indonesian organizations in Indonesia using multiple waves of data. IFLS-5 was carried out jointly with the Survey METRE.

Table 1. Details of Dependent Variable

No	Dependent variables	Dummy Variables	Name of Variable
1	Sanitation service. Using the sanitation system renovation indicator	0= No; 1=Yes, renovated	d_sanitation
2	Water source, using indicator water source used is pipe water or other (other than pipe water), tap is considered to be the most water source water source compared to others	0= No; 1= Yes (Pipe Water)	d_source

Source: Data Processed, 2024

The survey had two components: a household-based survey and a community facility survey, which assessed public amenities available in the region where the household survey participants lived.

Table 2. Details of Independent Variables

No	Variables	Dummy Variables	Description	Type
1	Education (Educ)	Dummy, 1=graduate senior high school, 0= Not graduated from high school	A score of 1 indicates that the educational level possesses a proficient comprehension of health.	1/0
2	Water source location (location)	Dummy, 1=inside the house, 0=outside the house	A score of 1 means the location of the water source in the house	1/0
3	Going to the toilet (toilet)	Dummy, 1=own toilet with septic tank, 0=others	A score of 1 means healthy behavior	1/0
5	Sewage Pipes (Sewage)	Dummy, 1=Drainage ditch; 0= others	A score of 1 means fficient and cleanly shifting sewage pipes.	1/0
6	Total expenditure (expenditure)	The total expenditures by all household	Total expenditure of household	IDR
	hhid14		Household id	
	Observation	14,827		
	Source	IFLS5		

Source: Data Processed, 2024

The present research applied cross-sectional data from the IFLS household survey. The variables that were used can be seen in table 1 and 2. The method used in this study uses a logistic model approach. The logit model uses a cumulative logistic function. The general form of the logit model is as follows.

$$L_i = \ln\left(\frac{P_i}{1-P_i}\right) = \beta_1 + \beta_2 X_i + u_i$$

A form of relative frequency that can be used as an estimate of Pi :

$$\hat{P}_i = \frac{n_i}{N_i}$$

Sanitation model:

logit(p) = ln(p/(1-p)) = α0 + α1Expenditure + α2location + α3Educ + α4Sewage + α5toilet + ϵ

Water Source Model:

logit(p) = ln(p/(1-p)) = α0 + α1Expenditure + α2location + α3Educ + α4toilet + ∝5Sewage + ϵ

RESULTS AND DISCUSSION

Achieving higher incomes and a better quality of life also calls for much more improved and more equitable opportunities for education and jobs, better health and nutrition, a cleaner and more sustainable natural environment, an impartial judicial and legal system, greater civil and political liberties, trustworthy and transparent institutions, and freedom of access to a rich and diverse cultural life.

The benefits of improved sanitation are clear, particularly in enhancing quality of life and alleviating poverty. Sanitation, water supply, education, location, toilet, and sewage tend to be a binary variables. As for total expenditure, it uses IDR units. For expenditure, the number of observations is 14,774 and the data distribution is very high. Average total household expenditure of IDR 1.251.619.

Logit regression was applied to determine the variables influencing sanitation and water source ownership. This logit approach is used to investigate the link between dependent variables consists of qualitative data and independent variables made of qualitative as well as quantitative information. This study included a dependent variable with four categories. The estimation results for are shown in table 3.

Table 3 highlights that expenditure, water source, toilet use, and sewage have a substantial impact on home sanitation. These findings suggest that all of the measures considered are relevant in understanding home sanitation. According to IFLS5 data, households in Indonesia had different levels of access to clean water and sanitation, both rural and urban.

The log likelihood value adequately reflects that the model fit and the pseudo R2 value is low, this is due to the type of cross section data. Meanwhile, the coefficient values for the constant, water source, and sewage are negative and significant.

The number of health facilities that are not entirely distributed in each sub-district, the number of areas that are included in high sanitation risk areas, the lack of ownership of privately owned sanitation, and high levels of public toilet behaviour.

The World Bank (2014) stated that for over a decade, the Indonesian government has maintained its commitment to ensuring that the community has access to safe drinking water and appropriate sanitation. However, approximately 75 million individuals have yet to

receive these services. Moreover, approximately 100 million individuals continue to be unable to access clean sanitation facilities, and over 60 million individuals are compelled to defecate in the open, in rivers, or in the open.

Table 3. Estimation Result of Sanitation Model

No	Variables	coefficient	z-value
1	Constant	-2.060739	-36.69
2	Expenditure	2.99e-09	2.03
3	Water source	-.4491536	-5.71
4	Toilet	.7015437	11.86
5	Sewage	-.1593267	-3.47
	Log likelihood = -6,445.8674		
	Pseudo R2 = 0.0150		

Source: Data Processed (IFLS5), 2024

In Blantyre's South Lunzu Municipality, Palamuleni (2002) investigated the impact of sanitation facilities, domestic solid waste disposal, and hygiene practices on water quality. The research indicated that a significant amount of wastewater came out of over half of respondents use on-site sanitation systems utilizing regular toilets, resulting in pollution of water resources.

Table 4. Estimation Result of Water Resource Model

No	Variables	coefficient	z-value
1	Constant	-3.620205	-44.07
2	expenditure	8.71e-10	0.56
3	location	1.945763	32.60
4	educ	0.4132079	3.51
5	Toilet	0.2407516	3.24
6	sewage	0.6527989	10.41
	Log likelihood = -4529.7424		
	Pseudo R2 = 0.1570		

Source: Data Processed (IFLS5), 2024

The urgency of ensuring access to safe drinking water and better sanitation should not be underestimated. Table 4 shows that the estimation findings of water source ownership with independent variables such as spending, water source location, education, sanitation habits, and drainage are positive and significant, with the exception of expenditure, which is positive but not significant.

In this context, it implies that household expenditures have not yet been adequately acknowledged as a means of redirecting funds from non-piped to piped water sources. The log likelihood value indicates that the model fits,

although the pseudo R2 value is low due to the nature of cross-sectional data.

Tumwebaze, et al. (2023) conducted a study in Kampala, Uganda and found that the primary source of drinking water used by households was the most important factor to water service levels. Increased access to residential drinking water sources contributed to 0.26 times increase in water service levels.

In this study, 76% of respondents reported getting piped water from public stand posts, while 11% had private connections at their residences. Respondents with formal education were 0.16 times less likely to access water sources with restricted or unimproved services. Furthermore, the gender of the household head had a statistically significant effect on water service levels.

In line with the findings of previous studies, the estimated result of education is positive and significant. Increased education boosts piped water use at home, as educated households prioritize water safety benefits in remote locations (Adams et al., 2016). According to Rahut (2015), household members' education level influences their education increases toilet adoption due to awareness of health and environmental benefits of having a septic tank. The toilet use variable is likewise positive and significant, indicating that families with toilet are more conscious of their water source than those without toilet.

Based to the World Bank (2014), in 2006, the Indonesian government established the Community-Based Drinking Water and Sanitation Program (PAMSIMAS) to encourage community access to drinking water services and the usage of healthy sanitation facilities in rural regions. PAMSIMAS is opposed to the installation of water supply and sanitation infrastructure as an objective in itself. To reduce or eliminate diseases caused by contaminated water, inadequate sanitation, and poor hygiene, all Indonesians must have access to healthy water to consume and facilities.

According to Tables 4 and 5, households in Indonesia use clean water from pipe (PAM) in urban areas and wells in rural areas. In terms of toilet use, many households continue to defecate in rivers or open places, particularly in locations that lack infrastructure. Good sanitation behaviours, such as hand washing with soap, are carried out by more urban households than rural ones.

These hygienic conditions are also related to the household head's or family members' education, as well as the government's community sanitation health program. Household waste management is challenging, especially if houses are located distant from waste treatment infrastructure. Although access to safe water and sanitation remains limited in Cambodia, the Lao People's Democratic Republic, and Vietnam, it has been steadily improving in line with economic growth (World Bank, 1999).

CONCLUSION

The estimating model indicates that, whereas household in Indonesia made significant progress in sanitation access, the installation of piped drinking water has not been prioritized in terms of total spending. Limited piped water access and sewerage can provide a negative impact on community socioeconomic health status, and the environment.

It also demonstrates a certain lacking in the policy-making process for ensuring essential services for all communities. Specific data on factors influencing household access to clean

water and sanitation might help to highlight policy implications and potential solutions.

Rural and urban household have drastically different situations, require strategies suited to the individual demands of each location to effectively enhance sanitation quality and access to clean water. Improving sanitation involves more than just physical infrastructure, it also relies heavily on changing human behaviour and quality of life.

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