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Ability and Willingness to Pay for Waste Water Management Services: A Case Study in Lampung Province, Indonesia*

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Abstract

This study aims to estimate and calculate the ability to pay (ATP) and the willingness to pay (WTP) of households for wastewater management services (IPAL), the relationship between ATP and WTP, and factors that affect WTP. The location of IPAL construction is in the area of Lampung Province, Indonesia. There are 158 selected households for this study. The study employs a purposive sampling method in which the characteristics of households are classified into 3 categories - former households, newcomer households who had come to this area and have no experience of using water supply services, and newcomer households who have experience of using water supply services such as PDAM. The results of this study are, ATP and WTP values were not always in the same direction. The highest ATP was for newcomer households with experience of water supply services but the WTP was the lowest, on the contrary, the lowest ATP was for former households, but the WTP was the highest. Furthermore, experience and cognitive reference are positively correlated with WTP. Service quality perception, education/knowledge of respondents about environmental conservation, and level of income correlate with WTP.

Keywords: Willingness to Pay, Ability to Pay, Waste Water Management Services, Indonesia

JEL Classification Code: D12, H41, L95, Q5

1. Introduction

We consider wastewater treatment as a water use because it is so interconnected with the other uses of water. Much of the water used by homes, industries, and businesses must be treated before it is released back to the environment. Lack of public awareness of wastewater treatment has led to a clean water crisis and polluted the environment. Today, wastewater management services are becoming an important issue in water conservation in Indonesia. Wise investments in wastewater management will generate significant returns, as addressing wastewater is a key step in

reducing poverty and sustaining ecosystem services. Instead of being a source of problems, well-managed wastewater will be a positive addition to the environment which in turn will lead to improved food security, health, and therefore the economy. According to Wang (2010), the global water crisis, the shortage of fresh water, contamination of water, and increasing volumes of wastewater being produced have eventually necessitated the use of wastewater. A paradigm shift is therefore required not only to prevent further damage to the ecosystems but also to emphasize that wastewater is a resource whose effective management is essential for future water security.

Despite the striving economy, Indonesia lacks quality water treatment, supply and sanitation, effective waste management, and adequate water access. As a result, these issues have posed a heightened challenge in Indonesia, especially with the growing business activities and increasing household consumption, giving rise to a higher amount of plastic packaging, industrial waste, and food waste. For many years, the government has been urged to address and improve these increasingly severe issues by enforcing wastewater treatment regulation with the critical licensing process and facility construction in Indonesia. As a public good, wastewater management services (IPAL) in Indonesia,

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are not on the market mechanism. The tariff cannot be determined because no one can express their preference. Therefore, a method to arrive at a tariff that reflects the beneficiaries' ability and willingness to pay is needed to maintain the sustainability of this public infrastructure.

IPAL is a wastewater treatment technology used to eliminate non-degradable pollutants – both biological and chemical – in the water so that the water can be recycled for other usages. According to Indonesian law, all hotels, villas, and restaurants are required to acquire an IPAL license for IPAL compliance. This is considered a very critical effort implemented by the government to achieve the clean water supply goals for the entire country. Furthermore, the IPAL program aims to overcome the problems of clean water and sanitation through the provision of assistance to low-income communities by building communal IPAL. This public facility will treat household black water and gray water waste so that treated wastewater can be returned safely to households and the environment in accordance with environmental quality standards. This processed wastewater will be the next source of clean water. The regional government cooperating with the Islamic Development Bank (IDB) build the IPAL infrastructure, however, operational and maintenance costs are expected to come from community participation. Hence, the tariff needed to cover the operational and maintenance costs of IPAL (which will be charged to the community, especially beneficiaries) must be in accordance with the ATP and WTP of beneficiary households.

Now, the city government has set a tariff for communal IPAL in the Lampung Province for the operation and maintenance of this public infrastructure at the rate of IDR100.000/ month/ household. This tariff is set by the city government with the consideration that the government will provide a subsidy of IDR 50.000/household. Allen Consulting Group (2003) stated that one source of financing for public infrastructure can come from fees in the form of tariffs, where the levy rates are influenced by ATP and WTP. Based on this background, estimation of the tariff that covers operational and maintenance costs and encourages environmental awareness is based on the Ability to Pay (ATP) and Willing to Pay (WTP).

2. Literature Review and Hypotheses

ATP is the ability to pay for public services received based on income that is considered ideal. According to Russel et al. (1996), households may persist in paying for care, but to mobilize resources they may sacrifice other basic needs such as food and education, with serious consequences for the household or individuals within it. The opportunity costs of payment make the payment 'unaffordable' because other basic needs are sacrificed. An approach to ATP founded on basic needs and the

opportunity costs of payment strategies (including non-utilization) is therefore proposed. According to Widstrom and Seppala (2012), there was a strong and statistically significant relationship between income and WTP and ATP for urgent dental care. High income is positively associated with the probability of paying a higher price. Based on Sarwandy et al. (2019), in designing the tariff structure for light rail transit (LRT), it is necessary to consider WTP and ATP; moreover, the ideal LRT rate must be subsidized when WTP is below ATP.

According to Fujita and Mori (2005), WTP can provide useful information from the demand side for the determination of service tariff by including user limitations (ATP). If the ATP value is low while the WTP value is high, then the community needs support in the form of a favorable financial arrangement. On the other hand, if both ATP and WTP rates are low, it means the community needs financial support and motivation. Based on Nandi (2016), factors such as family income, size of the family, gender, and other opinion variables significantly influence consumers' WTP. WTP according to Wedgwood and Sansom (2003) is the maximum amount an individual is willing to pay for an item or service, while Mankiw (2014) defined WTP as the highest price that each beneficiary is willing to pay using the consumer surplus approach of the demand curve. Consumer surplus is defined as the difference between the consumers' willingness to pay for a commodity and the actual price paid by them, or the equilibrium price.

WTP is the maximum amount a customer is willing to pay for a product or service. This makes willingness to pay a crucial factor when finding the best price to sell a product at, for both the seller and buyer. Reaching a happy medium between the two entities must be done to make a sale. WTP varies based on a number of factors but is one of the best ways to conceptualize overall demand at any given time. Ability to pay refers to whether individuals have the effective income to be able to purchase a good. The ability to pay can also be important in determining effective demand (Meinrad et al., 2013). Therefore, this study aims to calculate the ATP and WTP off households for wastewater management services (IPAL) to get the tariff that covers operational and maintenance costs and raise the awareness of households toward water protection.

Public participation is essential and may lead to enormous benefits for sustainability development. Brahim (2015) agreed public goods which are built by the government should be managed by the community which requires active community involvement. Involvement, participation, and some characteristics of the household determine WTP. Some experts also define WTP as the maximum price beneficiaries are willing to pay for a given quantity of product (Whittington et al., 1990). Boyce (2013) found that almost 85% of respondents are willing

to pay a higher tariff and this WTP is affected by the level of education and family income. This result is also supported by Wang (2010) who stated that the tariff consumers are willing to pay for waste treatment services is higher than the actual tariff paid.

WTP is based on the user's perception of the public services. To get user perception, the Contingent Valuation Method (CVM) can be used. According to Finger (1994), the contingent valuation method (CVM) is used to estimate economic values for all kinds of ecosystems and environmental services. It can be used to estimate both use and non-use values, and it is the most widely used method for estimating non-use values. CVM involves directly asking people, in a survey, how much they would be willing to pay for specific environmental services. In some cases, people are asked for the amount of compensation they would be willing to accept to give up specific environmental services. It is called "contingent" valuation because people are asked to state their willingness to pay, contingent on a specific hypothetical scenario and description of the environmental service. CVM is referred to as a "stated preference" method because it asks people to directly state their values, rather than inferring values from actual choices, as the "revealed preference" methods do (Wedgwood & Sansom, 2003). In these surveys, households or beneficiaries are offered some alternative services or conditions with varying attributes. WTP is inferred indirectly from their ranking or ratings of these alternative services.

Afroz (2010) employed a contingent valuation method to estimate the willingness to pay (WTP) of the households to improve the waste collection system in Kuala Lumpur, Malaysia. The objective of this study was to evaluate how household WTP changes when recycling and waste separation at the source is made mandatory. The methodology consisted of asking people directly about their WTP for an additional waste collection service charge to cover the costs of a new waste management project. The new waste management project consisted of two versions: version A (recycling and waste separation are mandatory) and version B (recycling and waste separation are not mandatory). The households declined their WTP for version A when they were asked to separate the waste at the source although all the facilities would be given to them for waste separation.

Djayasinga and Virsa (2019) found that level of education, the number of family members, job, income, knowledge, and satisfaction of respondents have a positive correlation to WTP for waste management services. A study from Nguyen et al. (2019) found that consumer behavior in buying organic-based cosmetics products is driven by the level of consumer satisfaction, knowledge and information of the product, safety values, awareness of the need for environmental protection and a green environment. Some

characteristics of community such as education level, gender, age, lines of class, race, ethnicity, house type, house distance, income, service quality, awareness, perception, and household satisfaction level have an impact on the benefits of water supply services.

The second objective is that if there is a correlation between the characteristics of the respondents with their WTP, this analysis uses cross tab techniques. The respondent's characteristics consist of 5 elements, namely the number of family members, the level of education, cognitive reference, level of income, and satisfaction of the services. The hypothesis developed as follows:

H1: Number of family members has a positive correlation with WTP.

H2: Level of education has a positive correlation with WTP.

H3: Cognitive reference has a positive correlation with WTP.

H4: Level of income has a positive correlation with WTP.

H5: Level of satisfaction with water services has a positive correlation with WTP.

3. Research Method

The location of IPAL construction is in the area of Lampung Province, Indonesia. 158 households are selected for this study. To answer the objective of this study, the study uses a purposive sampling method in which the characteristics of households are classified into 3 categories - former households, newcomer households who had come to this area and have no experience of using water supply services, and newcomer households who have experience of using water supply services such as PDAM. Municipal Waterworks (PDAM) is a state-owned water supply company that serves consumers throughout Indonesia. The former household is a house that never moved from this area and has knowledge of the water supply condition in this area. Newcomer households are households who stay at least for 2 years in a location with or without experience of using water supply services. There are 78 former households and 80 newcomer households. Structured questionnaires and interviews are conducted to determine the ATP and WTP of households and how satisfied they are with IPAL. The Contingent Valuation Method (CVM) method with game bidding techniques is used by asking questions about the desire to pay for wastewater management services. The frequency of water supply (water flow) to the household is a service scenario. At the starting point, the tariff fixed by the government is IDR 100.000/month/household, and water is supplied to the household twice a week. The 7 scenarios are designed as follows (Table 1).

The starting point of IPAL service is scenario B, in which treated wastewater will flow to the household 2 times a week at a rate of IDR 100.000. For every increase in water flow frequency, there is an increase of IDR 10.000. If the majority of respondents select a particular scenario, then this scenario is the actual WTP.

4. Results

4.1. Descriptive Statistics

The composition of respondents is 49% former households, 27% newcomer households who have no experience of using water supply services, and 24% respondents who have experience of using water supply services like PDAM (see Table 2).

78 former households have experienced difficulty in obtaining clean water. 43 respondents are newcomer households who moved to this area. They have no experience of using water supply services like IPAL. 37 respondents are newcomer households who have experience of using water supply services like PDAM. Newcomer households are unsure about the quality of water produced from wastewater treatment. Since the source of water comes from black and gray water, households are not sure if the treated wastewater is hygienic or not, or if it can be

consumed. Based on the IPAL experience, water usage is only limited to non-cooking and non-drinking purposes. Some newcomer households already know about the quality of PDAM water, PDAM tariffs, and the frequency of the water flowing from PDAM to their previous home. The characteristics of respondents based on the number of family members, level of education, and level of income are shown in Table 3.

Former households have a greater number of family members. On the other hand, newcomer households who have experience of using PDAM services are dominated by small families. They have family members of less than 5 people, but they have a relatively higher level of education and income than former households and newcomer households without experience with PDAM. Their level of income is more than 3.000,000 IDR when compared to the other 2 categories of households. Even though these newcomer households have experience of using water supply services, have a higher income as well as their level of education/knowledge is higher compared to the other 2 categories of households, their willingness to pay (WTP) is the lowest. This household group is very rational and cares deeply about the quality of service. If the service provided by the government is poor, their WTP is low. On the other hand, if the service provided is good and they are satisfied with it, their WTP is high.

Table 1: Five Scenarios Services IPAL Offered

Scenarios	Services	Tariff/month
Scenario A	Water will flow to the household once a week	90.000
Scenario B (Starting Point)	Water will flow to the household 2 times a week	100.000
Scenario C	Water will flow to the household 3 times a week	110.000
Scenario D	Water will flow to the household 4 times a week	120.000
Scenario E	Water will flow to the household 5 times a week	130.000

Table 2: Percentage Household Respondent Composition

Former Households	78	49%
Newcomer Households without PDAM service experience	43	27%
Newcomer Households with PDAM service experience	37	24%

4.2. ATP and WTP Analysis

The Ability to Pay (ATP) for former households on average is lower than the ATP of newcomer households, but their Willingness to Pay (WTP) is higher than the other 2 categories of households. This is presumably because they highly value water and know how difficult it is to obtain clean water when the dry season arrives. While ATP for newcomer households who have experience of using PDAM services is the highest compared to the other two household categories, but they have the lowest WTP compared to the other two household categories. Newcomer households who have experience of using PDAM services were able to get water supply services at cheaper rates because PDAM tariffs have been subsidized by the government. The average tariff for PDAM water services ranges from IDR 100.000–300.000 IDR/ month where the water is clean and can be used not only for bathing but also for drinking and cooking. Newcomer households consider that wastewater management from IPAL is unsafe. They are not too sure about the quality of water produced. Since the source of water comes from black and gray water, households are not sure if the treated wastewater is hygienic or not, or if it can be consumed. Based on the IPAL experience, water usage is only limited to non-cooking and non-drinking purpose.

Table 3: Percentage Household Respondent Characteristics

Categories Respondent	Former Households	Newcomer Households with no experience	Newcomer Households with experience
Family Members			
<5 person	40%	65%	60%
≥5 person	60%	35%	40%
Level of Education			
<9 years school	40%	20%	15%
9 ≤ × <12 years school	25%	25%	20%
≥12 yeas school	35%	25%	65%
Level of Income			
<3.000.000 IDR	30%	35%	20%
≥3.000.000 IDR	70%	65%	80%

From Table 4, it is concluded that ATP and WTP values for wastewater management services were not always in the same direction. The highest ATP was for newcomer households but the WTP was the lowest, on the contrary, the lowest ATP was for former households, but the WTP was the highest. This indicates that households who have lived in the location for a long time know a lot about the condition of the water supply before and after the WWTP program, have environmental awareness, and believe in saving water. Therefore, the willingness to pay (WTP) for public facilities is high, although the ability to pay (ATP) is relatively low. On the other hand, migrant households who have experience of using PDAM services, are not very satisfied with the performance of the IPAL when compared to PDAM services. Hence, the WTP for newcomer households with experience is low, even though their ability to pay is better than former households

Of the 158 respondents, 35.7% of households dominantly chose scenario F in which wastewater treatment services are provided 6 times a week to supply clean water to households. They agreed to pay IDR 140.000 charged per month. If it is compared to the initial government tariff which is IDR 100.000, the WTP increases by 40%. 31.4% of respondents are willing to pay IDR 110.000 or scenario D, in which wastewater treatment services are provided 4 times a week to supply clean water to households. Only 10,5% of respondents are willing to pay IDR 90.000 which is the fixed charge collected by the government. The respondents' choice is shown in Table 5.

The WTP rate is IDR 140,000 a month or an increase of 40% as long as the quality of water treatment is improved, and the flow of water to the household is increased to 6 times a week. This result is in accordance with Finger (1994), who found that the WTP for using water supply services

Table 4: ATP and WTP Respondent

Categories Household	ATP	WTP
Formerly Household	295	125
Household without experience	305	115
Household with experience	315	95

Table 5: WTP of IPAL (IDR) and Validity

Scenario	WTP (1 IDR)	Validity
A	90.000	10.5%
B	100.000	26.3%
C	110.000	30.8%
D	120.000	31.4%
E	130.000	24.2%
F	140.000	35.7%
G	150.000	20.8%

in Nigeria increases if households' satisfaction with water supply services increase.

4.3. Correlation Between the Characteristics of Respondent with WTP

Pearson test was used to understand the relationship between some characteristics of respondents with their WTP. Characteristics of respondents consist of 5 elements, namely family members, the level of education, cognitive reference, the level of income, and satisfaction. The result is shown in Table 6.

Table 6: Correlation Between Characteristic of Respondent on Their WTP

Characteristic Respondent	Coefficient	Sign
The family member	0.593	0.230
Level of Education	0.786	0.036*
Cognitive Reference	0.155	0.025*
Level of Income	0.733	0.090**
Level of Satisfaction	0.740	0.010*

Note: *Significant at 5%.

The second objective of this study to investigate if there is a correlation between the characteristics of the respondents with their WTP. The respondents' characteristics consist of 5 elements, namely the number of family members, the level of education, the cognitive reference, level of income, and satisfaction of the services. Using cross tab techniques, the results are – the number of family members has no correlation with WTP, but the level of education, cognitive reference, level of income, and level of satisfaction of water services has a positive correlation with WTP. This study is in line with Muazzinah et al. (2020) who used a multiple regression model and found that except for gender and age, the level of income, education, and family size were found to positively affect households WTP for clean water in Aceh Besar Regency. In this study, family members have no correlation with their WTP because the IPAL tariff which is set by the government is based on a set policy and not based on the number of members per household. Also, the tariff is fixed and it does not depend on the usage. Wastewater treatment by IPAL is not equipped with a meter or water volume meter like PDAM. Increasing WTP is also supported by the level of education with a coefficient correlation of 78. The higher the level of education, the higher the WTP because a higher level of education has an effect on customer loyalty and increases awareness of wastewater treatment. The more the knowledge about the environment and wastewater treatment services, the higher the WTP (Kumakawa, 2015).

The level of income correlates with WTP with a coefficient correlation of 73.3. It means that if the household has more income, then they have more WTP. WTP also reflects customer satisfaction with public services. The level of satisfaction also correlates with WTP with a coefficient correlation of 74.0. If consumers are satisfied they will be willing to pay more and even promote it to others. This study results support the findings of Tjahjaningsih et al. (2020) and Giao (2020) who found that customer satisfaction has an effect on WTP. The higher the customer satisfaction towards a particular service, the

higher the desire to recommend it to others and the higher the willingness to pay more. Cognitive reference is used as a variable because past experiences of services (either satisfied or unsatisfied), has a big influence on WTP. For former households who often found it difficult to get clean water especially in the dry season, they have the highest appreciation for wastewater treatment.

Chutarat (2017) showed that experience is positively correlated with environmental awareness. People who have environmental awareness are willing to pay higher. Thieme et al. (2015) suggested that environmental involvement and willingness to pay more for green products mediate the relationship between environmental concern and sustainable behavior. The satisfaction of the household increases if the quality of wastewater treatment by implementing new technology will increase. This result is in line with the study conducted by Nursiana et al. (2021), who examined factors that affect insurance demand in Indonesia and found that service quality has a positive and significant effect on purchase intention. Hagos (2012) showed that if more quality services are provided, the more WTP increases. Therefore to get higher WTP from consumers, the government should promote service quality as well as product quality and include information about the safety of recycled water. The level of income does not have a significant effect on WTP with a degree of freedom at 5% but is significant at 10%. This means whatever the income level is, it has no impact on WTP because water is an essential good for households, especially in urban areas. Hence, whatever tariff is charged by the government, households still have to pay for it. This result is in line with Jacobsen and Hanley (2008), who empirically studied the relationship between biodiversity conservation values and income. They used random effects panel models to examine the effects of income and GDP per capita on willingness to pay for habitat and biodiversity conservation. GDP per capita seemed to perform as well as an explanatory variable as the respondent's mean stated income indicated that the wealth in society as a whole determined variations in WTP. Even with a large variation, their main conclusion was that the demand for biodiversity conservation rises with a nation's wealth, but the income elasticity of willingness to pay is less.

5. Conclusion

The ATP of former households on average is lower than the other 2 categories of households, but their WTP is comparatively higher than the other 2 categories of households. This is because this category of households highly value water and know how difficult it is to obtain clean water when the dry season arrives. The average ATP of newcomer households who have experience of using PDAM

services is the highest compared to the other 2 categories of households, but on average, their WTP is low. This is because this category of households has had the experience of enjoying water supplied by the government that has better quality and so this household category is unsure about the quality of water supplied by IPAL. Reference cognitive is positively correlated with WTP because previous references are mainly based on experiences with PDAM that offer better quality and tariff rates. The government needs to improve wastewater treatment by IPAL using high technology so that the quality of water is of a high standard like other drinking water quality. Education and income of household have a relationship with WTP and ATP, so government should increase these factors to get a high WTP tariff per household.

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