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Influence of Income, Number of Family Members and Volume of Water Requirement on Community Ability to Pay Pdam Tirta Daroy Water Rates in Banda Aceh City During The Covid 19 Pandemic

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Abstract

PDAM Tirta Daroy is 43 years old, it turns out that there are still many problems faced by PDAMs. Based on the initial observations made, the PDAM stated that there were many complaints from the public regarding the PDAM's performance. One of the complaints of the community lies in the water discharge. Water debit is oriented to the amount of water distributed to the community, starting from the quality of the water and the volume of water distributed. This research was conducted at PDAM Tirta Daroy, Banda Aceh City to the community/household that uses water from PDAM Tirta Daroy. The data used are primary and secondary data. Primary data is data obtained directly from the field, direct interviews with respondents or through a list of questions (questionnaires) given to small business owners. Secondary data is data sourced from publications in various government agencies, including the Central Statistics Agency (BPS) of Aceh Province and other relevant agencies related to this research. The data analysis method used is the first to use the WTP value obtained from each respondent in the form of the maximum value of rupiah that respondents are willing to pay for water services, processed to obtain the average value (mean) of the WTP value. Second, a linear regression analysis tool, to test the theoretical truth of the effect of income, number of family members and volume of water needs on the ability of the community to pay water tariffs. The purpose of this study was to examine how much influence income, number of family members and volume of water needs have on the ability of the community to pay the drinking water tariff of PDAM Tirta Daroy Banda Aceh. Testing how much the community's ability to pay the drinking water tariff for PDAM Tirta Daroy Banda Aceh is. The types of data used in this study are primary and secondary data. Primary data were obtained directly from the field, direct interviews with respondents or through a list of questions (questionnaires). Secondary data is data sourced from publications in various government agencies, including the Central Statistics Agency (BPS) of Aceh Province. and other related institutions related to this research. The results showed that the average ability of the community to pay for Tirta Daroy Drinking Water in Banda Aceh City was between Rp.

60,000-69,999 per month. Per capita income, number of family members and volume of water needs both simultaneously and partially have a significant effect on the community's ability to pay the drinking water tariff of PDAM Tirta Daroy in Banda Aceh. Variations in the community's ability to pay drinking water tariffs for PDAM Tirta Daroy in Banda Aceh are influenced by variations in income per capita, number of family members and volume of water needs by 94.0 percent and the remaining 4 percent is influenced by other variables outside this research model. Regional Drinking Water Company (PDAM) Daroy should no longer carry out the policy of increasing PDAM water tariffs for the next few years. The need for additional Water Treatment Plants (IPA) if PDAM will increase the number of customers until 2030. Further research is needed for planning the addition of Water Treatment Plants (IPA) in stages and planning for PDAM service development networks.
Keyword: Community Ability in Paying PDAM Water Tariff.

Introduction

The Regional Drinking Water Company (PDAM) Tirta Daroy in running its business also has many problems, for example, many customers have paid every month but the water circulation is jammed. Then PDAM Tirta Daroy was built based on debt from abroad through the Dept. Finance. At the time it was built around th. In the 1970s, it was assumed that PDAM would be able to pay its debts based on the forecast of customer growth and the growth of economic activity in Banda Aceh and its surroundings. In reality PDAM is not able to pay the debt because the situation is not in accordance with the plan, at this time the debt must be paid. The government asks PDAMs to carry out good financial planning before applying for debt restructuring. Another requirement is the improvement of the management and administration system and that PDAM does not contribute to Regional Original Income (PAD) as long as the debt is not paid off. This sacrifice is difficult for PDAM owners to make.

PDAM has never had a major role in the construction of installations and distribution pipelines. For example, a distribution pipe network planting project is a project carried out by Public Works or other technical agencies with a supervisory team member from the PDAM. The role as project supervisor cannot be carried out optimally because the project leader only pursues targets. There are many incidents in the field such as pipes not being connected properly, the depth of the pipe being planted not according to the plan, sometimes the results of the pipe pressure test are not the main concern of the project leader.

Efforts to increase the amount of clean water consumption in an area both as a whole and in the household sector need to be considered by identifying factors that affect the community's ability to pay water tariffs, including: water price factors, population, number of household heads, regional income, income and development territory, education, and services. Some of the factors obtained will be able to plan either strategy or other plans that are adjusted to several factors that can support the increase in PDAM's clean water consumption. The tariff rates are classified based on customer groups, fixed costs and volume of water sold at PDAM Tirta Daroy Banda Aceh as shown in Table 1.

Table 1
Determination of tariffs for PDAM Tirta Daroy Banda Aceh

Customer Group	Fixed Load (Rp)	Base Rate 0-10 M3 (Rp)	Progressive Rates 11-20 M3 (Rp)
Group I	7.500	2.250	2.500
Group II	7.500	2.500	2.750
Group III	7.500	3.500	3.850

Source: PDAM Tirta Daroy Banda Aceh, 2021

From Table 1 there are several groups of customers who are charged both in the form of expenses and PDAM tariffs. This condition shows that PDAMs set different payment rates starting from group I to group III. Until 2021 the number of PDAM customers in Banda Aceh City reached 53,567 customers, both active and inactive. The number of active subscribers reached 42,998 subscribers and those who were inactive reached 10,569 subscribers.

During the Covid 19 pandemic, of course, the people's ability to pay for PDAM Tirta Daroy Banda Aceh water more or less influenced it, because in Covid conditions, many work activities that can usually be done by the community must be limited, so that income also decreases. This is a dilemma for the community. On the other hand, PDAM Tirta Daroy also expects the community to be smooth in paying bills for the smooth running of the PDAM's own business. Therefore, this research needs to be investigated further.

The purpose of this study was to examine how much influence income, number of family members and volume of water needs have on the ability of the community to pay the drinking water tariff of PDAM Tirta Daroy Banda Aceh. Testing how much the community's ability to pay drinking water tariffs for PDAM Tirta Daroy Banda Aceh is.

Literature of Related Review

Definition of Clean Water

Clean water is water that is used for daily needs and will become drinking water after cooking. As a limitation, clean water is water that meets the requirements for a drinking water supply system. The requirements in question are requirements in terms of water quality which include physical, chemical, biological and radiological qualities, so that when consumed it does not cause side effects (General Provisions of the Minister of Health No. 416/Menkes/PER/IX/1990.

Requirements in the Provision of Clean Water

The clean water supply system must meet several main requirements. These requirements include qualitative requirements, quantitative requirements and continuity requirements. Quality requirements describe the quality or quality of clean water raw water. These requirements include physical requirements, chemical requirements, biological requirements and radiological requirements. These requirements based on Permenkes No. 416 / Menkes / PER / IX / 1990 it is stated that the requirements for clean water quality are as follows:

1. Physical conditions

Physically, clean water must be clear, odorless and tasteless. In addition, the temperature of clean water should be the same as the air temperature or approximately C, and if there is a difference, the permissible limit is C ± C.

2. Chemical Requirements.

Clean water must not contain chemicals in amounts that exceed the limit. Some of the chemical requirements include: pH, total solid, organic matter, aggressive CO2, hardness, calcium (Ca), iron (Fe), manganese (Mn), copper (Cu), zinc (Zn), chloride (Cl), nitrite, fluoride (F), and heavy metals.

3. Bacteriological and microbiological requirements.

Clean water must not contain pathogenic and parasitic germs that interfere with health. This bacteriological requirement is indicated by the absence of E. Coli or Fecal coli bacteria in the water.

4. Radiological requirements.

Radiological requirements require that clean water must not contain substances that produce radioactive materials, such as alpha, beta and gamma rays.

Characteristics of Consumable Water

Research and Development Ministry of Health in Petra, 2008 the characteristics of drinking water are:

1. Clear, odorless, tasteless and colorless.
2. Free of harmful chemical elements, such as iron (Fe), zinc (Zn), mercury (Hg) and manganese (Mn).
3. Does not contain harmful microbiological elements such as fecal coliform and total coliform.
4. The temperature should be cool and not hot in accordance with the temperature of the human body.

Clean Water Distribution System

Damanhuri (2011), the distribution system is a system that is directly related to consumers, which has the main function of distributing water that has met the requirements to all service areas. According to Kamala, (2019), the water supply through the main pipe has two types of systems:

a. Continuous system.

In this system, drinking water supplied to consumers flows continuously for 24 hours. The advantage of this system is that consumers can get clean water at any time from the distribution pipe network at any pipe position. The disadvantage is that the use of water will tend to be more wasteful and if there is a slight leak, the amount of water lost will be very large.

b. Intermittent system.

In this system clean water is supplied 2-4 hours in the morning and 2-4 hours in the afternoon. The disadvantage is that water customers cannot get water all the time and need to provide a water storage area and if a leak occurs, water for fire fighters will be difficult to obtain. The dimensions of the pipes used will be larger because the water needs for 24 hours is only supplied in a few hours.

Clean Water Dispensing System

The method of water distribution depends on the topographical conditions of the water source and the position of the consumers. According to Howard, et.al (2015) the drainage systems used are:

Gravity Way

The gravity flow method is used if the elevation of the water source has a large enough difference with the elevation of the service area, so that the required pressure can be maintained.

Pumping Way

In this method the pump is used to increase the pressure needed to distribute water from the distribution reservoir to the consumer. This system is used when the elevation between the water source or treatment plant and the service area cannot provide sufficient pressure.

Clean Water Distribution System Planning

Martin (2014) categorizes planning activities for clean/drinking water distribution systems into two categories, namely:

1. Planning in areas where there is no piping distribution system at all or commonly referred to as Green Areas.
2. Planning in areas that already have a previous distribution system and the nature of planning is to develop an existing system.

In general, the difference in the steps in the planning of the two categories is in the planning, where the system already exists, the planner must evaluate the existing system, especially from the capacity, then move on from the existing capacity to plan its development.

Two important things that must be studied in designing a clean water system are:

1. Study from the side of water demand.
2. Study from the side of water supply.

By examining these two things properly, an optimal distribution system can be designed.

Clean Water Needs

The need for clean water is the amount of water needed to serve the population which is divided into two classifications of water use, namely for domestic and non-domestic purposes. total population. In serving the total population service coverage for clean water according to the target, it is planned that the capacity of the clean water supply system is divided into two classifications of water use, namely for domestic and non-domestic purposes.

Clean Water Needs for Domestic (Household)

Anonimus (2010) stated that domestic needs are intended to meet the need for clean water for household purposes which is carried out through House Connections (SR) and general needs provided through Public Hydrant (HU) facilities. The points below show that the amount of domestic debit needed to meet domestic needs is calculated against several factors:

a. The number of people who will be served according to the target of the planning stage is in accordance with the service coverage plan.
b. The level of clean water usage is assumed to depend on the category of the area and its population.

Clean Water Needs For Non-Domestic

Anonimus, (2010), stated that non-domestic clean water needs are allocated to services to meet the clean water needs of various social and commercial facilities, namely educational facilities, worship, health service centers, government agencies and commerce. The amount of water used for non-domestic needs is calculated at 20% of domestic needs.

Average Water Needs

According to Anonimus (2010), in the Standard Criteria for Design of a Clean Water Supply System, it is stated that the average need for clean water distribution per day is the amount of water needed for domestic purposes added to the need for water for non-domestic purposes.

Research Methodoogy

Research Sites

This research was conducted in the city of Banda Aceh, namely in households that use PDAM Tirta Daroy drinking water services.

Data Source

The types of data used in this study are primary and secondary data. Primary data is data obtained directly from the field, direct interviews with respondents or through a list of questions (questionnaires). Secondary data is data sourced from publications in various government agencies, including the Central Statistics Agency (BPS) of Aceh Province. and other related institutions related to this research.

Method of Collecting Data

Data collection was carried out using

1. Primary data, namely data obtained through interviews with prepared questionnaires and direct observations in the field.
2. Secondary data, namely data collection through documentary techniques and literature study. The documents used to obtain data were obtained from PDAM Tirta Daroy, BPS, PU and the Regional Financial Management Agency (BPKD).

Population and Sample

The population is the entire material or element under investigation (Marzuki, 2015:51). The population in this study were all water customers of PDAM Tirta Daroy, Banda Aceh City. The sample is part of the number and characteristics possessed by the population (Sugiyono, 2012). The population of PDAM Tirta Daroy Banda Aceh customers currently reaches 74,261 customers. The determination of the size of the sample taken by the researcher refers to the opinion expressed by Burns (2003:149), namely in quantitative studies with a population that is too large it is permissible to use a sample size of between 100 and 100. with 200. In this study, the researchers set a sample size of 100 people.

Data Analysis Tools

To find out the amount of people's ability to pay for service improvement and water flow improvement with PDAM Tirta Daroy Banda Aceh, the WTP value obtained from each respondent is in the form of the maximum value of rupiah that respondents are willing to pay for water services, processed to get the average value. (mean) of the WTP value with the formula (Aadland and Caplan, 2014):

$$MWTP = \frac{1}{n}\sum_{i=1}^{n} WTPi$$

Where : MWTP = Average (mean) WTP
n = Sample size
WTPi = Maximum WTP value of respondent – i

To determine the effect of income, number of family members and volume of water needs on the community's ability to pay for drinking water tariffs at PDAM Tirta Daroy Banda Aceh, the model developed by Islam, Roy and Hong (2014) with the following equation is used.

$$\mathbf{WTP = \alpha + \beta_1 Y + \beta_2 E + \beta_3 V + e}$$

Where :
WTP= Community ability to pay water tariff
Y = Income per capita per month (Rp/family/month)
E = Number of family members
V = Volume of water demand (m^3/month)
α = Intercept
β_1-β_3 = Regression coefficient
e = error term

Discussion

Analysis of Respondents Ability or Desire to Pay PDAM Tirta Daroy (WTP) WATER

To find out how the ability or desire of the people of Banda Aceh to pay for drinking water at PDAM Tirta Daroy Banda Aceh can be seen in Table 2.

Table 2
Banda Aceh Community WTP Group

No	Group of WTP	Frequency	Percentage
1	< Rp.50.000	6	6,0
2	Rp.50.000-59.999	8	8,0
3	Rp.60.000-69.999	36	36,0
4	Rp.70.000-79.999	23	23,0
5	Rp.80.000-89.999	15	15,0
6	Rp.90.000-99.999	12	12,0
7	> Rp.100.000	6	6,0
	Total	**100**	**100,0**

Source: Data Processing Results, 2021

Table 2 shows the willingness or desire of the people of Banda Aceh to pay for drinking water at PDAM Tirta Daroy in Banda Aceh. The group of PAPs who have the ability to pay less than Rp. 50,000 is 6 percent. People who have the ability to pay between Rp. 50,000-59,999 as much as 8 percent. People who have the ability to pay between Rp. 60,000-69,999 as much as 36 percent. People who have the ability to pay between Rp. 70,000-79,999 as much as 23 percent. People who have the ability to pay between Rp. 80,000-89,999 as much as 15 percent. People who have the ability to pay between Rp. 90,000-99,999 as much as 12 percent. 6 percent of the people who have the ability to pay above Rp. 100,000 are able to pay. The average ability to pay for Tirta Daroy Drinking Water by the people of Banda Aceh is between IDR 60,000-69,999 per month.

Per capita Household Income in Banda Aceh

How the picture of the income per capita of the people in Banda Aceh City can be seen in Table 3.

Table 3

Banda Aceh Community Per Capita Income

No	Income Per Capita (Rp)	Frequency	Percentage (%)
1	3.000.000-3.999.999	12	12,0
2	4.000.000-4.999.999	26	26,0
3	5.000.000-5.999.999	20	20,0
4	6.000.000-6.999.999	19	19,0
5	> 7.000.000	23	23,0
	Total	**100**	**100,0**

Source: Primary Data (Processed Data, 2021)

Table 3 Average Pendtan of the Banda Aceh community. The group of people who have an income between IDR 3,000,000-3,999,999 is 12 percent. Groups of people who have an income between Rp. 4,000,000-4,999,999 as much as 26 percent. The group of people who have an income between IDR 5,000,000-5,999,999 is 20 percent. Community groups with incomes between Rp. 6,000,000-6,999,999 are 19 percent. The group of people who have an income of more than IDR 7,000,000 is 23 percent. The average income of the people of Banda Aceh per month is between IDR 4,000,000-4,999,999.

Analysis of the Number of Family Members of the Banda Aceh Community

The description of the number of community family members in Banda Aceh City can be seen in Table 4.3.

Table 4

Number of Family Members of the Banda Aceh Community

No	Jumlah Anggota Keluarga	Frequensi	Persentase
1	1-2	3	3,0
2	3-4	63	63,0
3	5-6	26	26,0
4	>7	8	8,0
	Total	**100**	**100,0**

Source: Primary Data (Processed Data, 2021)

Table 4 shows the average number of family members in the Banda Aceh community. Respondents who have family members between 1-2 people are 3 percent. Respondents who have family members between 3-4 people are 63 percent. Respondents who have family members between 5-6 people are 26 percent. Respondents who have a larger number of family members 7 people as much as 8 percent.

Analysis of the Average Volume of Water Needs by the People of Banda Aceh

The description of drinking water consumption at PDAM Tirta Daroy by the community in Banda Aceh can be seen in Table 5.

Table 5

Volume of Community Water Needs Banda Aceh Regency (M3)

No	Volume Kebutuhan Air	Frequensi	Persentase
1	0-10	6	6,0
2	11-20	8	8,0
3	21-30	8	8,0
4	31-40	28	28,0
5	41-50	12	12,0
6	51-60	14	14,0
7	61-70	9	9,0
8	71-80	7	7,0
9	81-90	4	4,0
10	91-100	4	4,0
	Total	**100**	**100,0**

Source: Primary Data (Processed Data, 2021)

Table 5 shows the average volume of water used by the people of Banda Aceh. Is between 31-40 m^3 with a total percentage of 28 percent.

The Effect of Income, Number of Family Members and Volume of Water Needs on Community Ability to Pay Water Tariffs for PDAM Tirta Daroy Banda Aceh

To determine the effect of income, number of family members and volume of water needs on the community's ability to pay the tariff for drinking water at PDAM Tirta Daroy in Banda Aceh, the final results are presented in Table 6.

Table 6

Regression Calculation Results

Model	B	t	Sig.	F	Sig F
(Constant)	44284,496	18,013	0,000	501,322	0.000
Pendapatan Per Kapita	0,000311	4,396	0,00693		
Jumlah Anggota Keluarga	597,734	5,845	0,004	Adjusted R Square = 0,940	
Volume Kebutuhan Air	678,930	11,504	0,000		

Source: Data Processing Results (2021)

From the research results, the final estimation equation is Y = 44.284.496+ 0.000311Y+ 597.734E + 678.930V. From this equation, a constant of 44,284.496 is obtained, meaning that if per capita income, number of family members and volume of water needs are considered constant, the community's ability to pay drinking water tariffs for PDAM Tirta Daroy in Banda Aceh City is Rp. 44,284.496.

Income per capita obtained a regression coefficient of 0.000311, meaning that every 1 million rupiah change in per capita income will affect the community's ability to pay for drinking water tariffs for PDAM Tirta Daroy in Banda Aceh City of IDR 311 rupiah, assuming the variable amount family members and the volume of water demand is considered constant. This is in accordance with research conducted by Polyzou and Evangelinos (2011); Awad (2012); Jessoe (2013); Groothuisa, et al (2015), income has a significant effect on people's ability to pay for clean water. In contrast to research conducted by Li Lia, at all (2016) which states, the willingness of rural communities in Vietnam to pay for bottled water is preserved. There are many households in poor conditions, so some people rely on rainwater as the main source of drinking water. This condition affects the public's unwillingness to buy bottled preserved water, even if the price is lowered to a lower price.

The estimated coefficient of the number of family members is 597.734 which means that for every 1 person increase in the number of family members, it will affect the ability of the community to pay for drinking water tariffs at PDAM Tirta Daroy in Banda Aceh of Rp. 597.734 rupiah with the assumption that the variable income per capita and volume of water needs is considered constant. In accordance with research conducted by Fitria, et al (2012); Apriliyana and Putro (2015); Nasution, et al (2015), which affects the Willingness to Pay (WTP) value of Aek Arnga Springs is the average number of family members.

The coefficient of the estimated volume of water demand is 678.930, meaning that every 1 m3 increase in the volume of water demand will affect the ability of the community to pay for drinking water tariffs at PDAM Tirta Daroy in Banda Aceh of Rp. 678.930 rupiah, assuming the variable income per capita and the number of family members are considered constant. This is also in accordance with the theory stated by Islam at all (2014), and Burt et al (2017), WTP is strongly influenced by the volume of water consumption.

The value of the determinant coefficient (Adjusted R Square of 0.940) means that the variation in the community's ability to pay drinking water tariffs for PDAM Tirta Daroy in Banda Aceh City is influenced by variations in income per capita, number of family members and volume of water needs by 94.0 percent and the remaining 4 percent. influenced by other variables outside this research model.

Proving the hypothesis simultaneously obtained the calculated F value of 1.232.0528 which is greater than F table 4.2051, meaning that at the 95% convident interval level simultaneously per capita income, number of family members and volume of water needs have a significant effect on the community's ability to pay PDAM drinking water tariffs. Tirta Daroy in Banda Aceh.

In partial proof of the hypothesis, the t-count value for the income per capita variable is 4.396, which is greater than the t-table 1.3341, meaning that partially the per capita income has a significant effect on the ability of the community to pay drinking water tariffs for PDAM Tirta Daroy in Banda Aceh.

In partial proof of the hypothesis, the t value for the variable number of family members is 5.845, which is greater than t table 1.3341, meaning that partially the number of family members has a significant effect on the ability of the community to pay drinking water tariffs for PDAM Tirta Daroy in Banda Aceh.

In partial proof of the hypothesis, the value of t arithmetic for the variable volume of water needs is 11.504 which is greater than t table 1.3341, meaning that partially the volume of water needs has a significant effect on the ability of the community to pay drinking water tariffs for PDAM Tirta Daroy in Banda Aceh.

Conclusion and Suggestion

Conclusion

a. The people of Banda Aceh City have the ability to pay for Tirta Daroy drinking water.
b. The average ability of the community to pay for Tirta Daroy Drinking Water in Banda Aceh City is between IDR 60,000-69,999 per month.
c. Per capita income, number of family members and volume of water needs both simultaneously and partially have a significant effect on the community's ability to pay the drinking water tariff of PDAM Tirta Daroy in Banda Aceh.
d. Variations in the community's ability to pay drinking water tariffs for PDAM Tirta Daroy in Banda Aceh are influenced by variations in income per capita, number of family members and volume of water needs by 94.0 percent and the remaining 4 percent is influenced by other variables outside this research model.

Suggestion

1. Regional Drinking Water Company (PDAM) Daroy should no longer carry out the policy of increasing PDAM water tariffs for the next few years.
2. The need for additional Water Treatment Plants (IPA) if the PDAM will increase the number of customers until 2030.
3. Further research is needed for planning the addition of Water Treatment Plants (IPA) in stages and for network planning for PDAM service development.

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