Factors That Influence Water Demand in Special Region Yogyakarta

Auladina Rizqina[1]✉, Deky Aji Suseno[2]

Development Economics Department, Economics Faculty, Universitas Negeri Semarang

Article Info	Abstract
	_____ The demand for water in Special Region Yogyakarta, which is increasing every year, is not matched by the quality and effectiveness of water production. The distribution of PDAM water is uneven in every region in the Special Province of Yogyakarta. The purpose of this study is to determine the effect of water prices, the number of hotels, the number of industries, and the GRDP per capita of the population, also, in order to determine the effect of employee retribution and operational costs of the PDAM on PDAM water prices. The study uses secondary data analysis technique used is descriptive statistical analysis and SEM structural modeling analysis. The results showed that the number of employees had a significant positive effect on remuneration for PDAM employees. Reply to PDAM employee services and PDAM operational costs affect water prices. At the same time, the price of PDAM water and GDRP per capita of the population has a significant positive effect on PDAM water demand. The number of hotels and industries that subscribe to water in PDAMs has a significant negative effect on water demand.

✉Corresponding author :
Address: : L2 Building, 1st Floor FE UNNES
Sekaran Campus, Gunungpati, Semarang, 50229
E-mail: safitrastar043@gmail.com

INTRODUCTION

Today, the world is increasingly faced with severe challenges in survival, even though there have been many innovations aimed at developing available resources. Therefore, it is necessary to create prosperous social life in synergy. Countries in worldwide currently intensively developing sustainable development programs that we commonly call SDG's (Sustainable Development Goals). This program appears and replaces the previous program, MDG's (Millennial Development Goals). Basically, SDG's in Indonesia has 17 goals and 169 measurable indicators or targets at a specified time. Of the 17 SDG's objectives, one of them is to guarantee the management and availability of water along with good and sustainable sanitation for everyone. The goal listed in number 6 has a target, one of which is affordability to get safe and proper drinking water. (BPS Indonesia)

Drinking water is an important source of life in meeting every daily need. Water is also very instrumental in efforts to improve the welfare and prosperity of the people, it is stated in article 33 paragraph 3 of the 1945 Constitution which reads: "The earth and the water of the natural wealth contained in it is controlled by the state and used for the greatest prosperity of the people." Meanwhile, according to Permenkes No.416 / Menkes / PER / IX / 1990 regarding clean water requirements as a limit by meeting drinking water requirements. The physical conditions that indicate the water is odorless, clear, tasteless, do not contain chemicals, radiological and harmful bacteria. Clean water requirements can also be sustainable and meet daily water needs in the dry season and rainy season. Yet as we know, the amount of usage or consumption and the type of water needs of each person vary depending on all activities and patterns of life. The community is expected to be able to more easily obtain decent water at least 12 hours a day and be able to meet their daily needs without experiencing a water scarcity crisis. Water is also used by various economic sectors, including households, agriculture, industry, and infrastructure.

In managing and distributing water by health requirements, Indonesia is governed by the state, which is responsible for the Regional Water Company (PDAM). The PDAM is the only regional company that is spread in every regency/city in Indonesia to strive for the fulfillment of clean drinking water. Especially in the Special Region of Yogyakarta, water distribution always increased, but the potential production capacity and effectiveness of honest water companies are not equal.
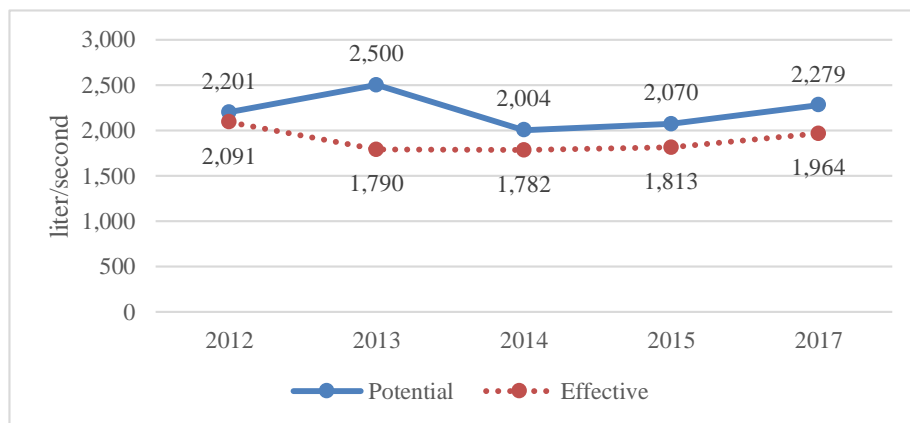

Figure 1. Potential Production Capacity and Effectiveness of Clean Water Companies in DIY in 2011-2017 (liters/second)
Source: BPS Indonesia water statistics

In Figure 1, we can see that clean water companies' potential production capacity in the Special Province of Yogyakarta fluctuative. This is due to the increasing number of water

customers in the PDAM, but the quantity of water distributed is the same or even decreased from previous years. Effective production capacity from 2012-2017 also experienced a downward trend from 2012,amounting to 2,091 liters/second. Then in 2013, it experienced a significant decrease to 1,790 liters/second until in 2017 amounting to 1,964 liters/second. If the effectiveness same with capacity, the distribution of water can be better.

This is what causes the distribution of water that varies in each region. Several factors are causing different water distribution, one of them is rainfall, the Special Region of Yogyakarta Province is a Province with a tropical climate and an average annual rainfall of 718 mm/year to 2,992.3 mm/year, and an average temperature of 23-33 ℃ so that the resulting water production capacity of each region is also different, which is why the distribution in the Regency / City, Yogyakarta Special Region Province experiences differences from one another.

Table 1. PDAM Water Demand in Regencies / Cities in DIY Province (m3) in 2013-2018

Year	Yogyakarta	Sleman	Bantul	K.Progo	G.Kidul	DIY
2013	8.568.924	3.872.056	3.294.224	2.512.453	6.133.755	24.381.412
2014	7.738.865	6.787.775	3.412.848	2.942.193	7.082.326	27.964.007
2015	7.403.096	7.101.604	3.779.386	3.426.622	7.519.882	29.230.590
2016	7.341.861	7.449.027	4.428.936	3.617.740	7.400.853	30.238.417
2017	7.127.550	7.841.924	4.846.925	4.005.399	8.122.378	31.944.176
2018	7.273.364	8.620.428	5.242.591	4.739.884	8.891.201	34.767.468

Source: Regency / City PDAM in DIY and Regency / City BPS Publication in Figures

This The difference in the quantity of water between regions is made clear by the data in table 1 regarding the water demand for PDAMs in the Regency / City, Yogyakarta Special Province. The highest water demand is in Sleman Regency with water demand in 2018, reaching 8,620,428 m3, then Gunung Kidul Regency 8,891,201 m3, Yogyakarta City 7,273,364 m3, Bantul Regency 5,242,591 m3, and the last is Kulon Progo Regency 4,739,884 m3. The highest increase from water demand in 2013 to 2014 was 3,582,595 m3.

We can see the water problem from the table above that the demand for water in the Regency/City, Special Region of Yogyakarta, increases. However, the capacity and effectiveness of water production have declined. This mismatch results in inadequate daily needs and clean water requirements. Thus, the factors that influence water demand, in this case, are highly questionable, given that water conservation needs to be maintained to be controlled both in quantity and quality.

In the theory of demand, if the price of goods and or services rises, it will reduce the quantity of demand for an item and vice versa if the price of an item decreases it will increase the demand for such goods and or services assuming ceteris paribus or other factors are considered constant (Gregory Mankiw, 2000). However, different from the theory, the amount of water demand has increased even though PDAM water price has increased. The decreasing quantity of PDAM water compounds this. Thus, water is no longer a free commodity but an economic good with limited supply but an unlimited or higher demand.

The determination of PDAM water prices is carried out by the PDAM and the Regional Government. The study was based on Permendagri No 23 of 2006 after the Regional Head determined it. From various studies conducted, it can be concluded that the price of PDAM water is influenced by several factors, namely basic costs, including labor costs, operational costs such as electricity, chemicals, and so forth. The amount of labor can also affect the price of goods because if the number of employees/labor increases, it will increase labor costs, which significantly affect the cost of

producing goods/services (Bustami & Nurlaela, 2013: 207).

As we know, Yogyakarta Special Region Province is one of the provinces with tourism excellence. Thus, facilities and infrastructure that can support in the field of tourism are built without thinking about the impacts that occur. One of them is the construction of hotels near tourism and urban areas, which can improve facilities and infrastructure in tourism. Not only does it have an impact on the environment, but hotel construction can also effect water demand. The higher the number of hotels, the water demand also increases, resulting in increased water demand. Because the hotel is one of the main customers of PDAM water classified as commercial (PDAM Tirtanadi Medan), and being a place of tourism, Yogyakarta Special Region Province also has several industries.

Industrial progress in this Province has resulted in increased economic growth, not only that the Government of the Special Region of Yogyakarta Province will also prepare two industrial zones in the districts of Bantul and Kulon Progo. The industrial area also needs water so that industrial activities run well. The Industry is one of the main groups of PDAM water customers to influence water demand (PDAM Tirtanadi Medan). Not only the price factor, the number of hotels, and the number of industries other factors that can affect water demand is the Gross Regional Domestic Income (GRDP) per capita of population in the Special Province of Yogyakarta. The higher one's income, the more consumption will incur. This is supported by BPS (Central Statistics Agency) data on GRDP per capita data based on constant prices (ADHK) in 2010 in five Regencies / Cities of the Special Province of Yogyakarta.

The problems that have been described above make the factors that influence the demand for water from the Regional Drinking Water Company in the Special Province of Yogyakarta very questionable. Because there need to be efforts to preserve water to maintain the stability of the quantity of water, in this case, to see the amount of water demand in the Special Region of Yogyakarta there are several factors, namely

price, number of hotels, number of industries, and GDRP per capita population. Therefore, researchers are interested in compiling a thesis entitled "Factors Affecting PDAM Water Demand in Regencies / Cities in Yogyakarta Special Province" to determine the factors that can affect water demand in five Regencies / Cities, Special Region of Yogyakarta Province.

RESEARCH METHODS

This study included the type of quantitative research to examine a particular population or sample, data collection using research instruments, quantitative/statistical data analysis to test the hypotheses that have been set (Sugiyono 2016: 8). This study uses a quantitative approach with a hypothesis-testing study, to test the direction of the variables hypothesized in the study. This hypothesis study is causality to test the effect of the number of PDAM employees, the costs of PDAM employee repayment services, and the PDAM operational costs on PDAM water prices. Then the effect of PDAM water prices, number of hotels, number of industries, and GDRP per capita on PDAM water demand.

The data used in this research is secondary data. Secondary data used in this study were sourced from BPS Indonesia and District / City PDAMs in the Special Province of Yogyakarta. They are using the panel data method, where this method is a combination/combination of place data (cross-section) and time series collected based on samples. Using place data in five Regencies / Cities, Special Region of Yogyakarta Province, including Sleman Regency, Bantul Regency, Kulon Progo Regency, Gunung Kidul Regency, Yogyakarta City. While the time data is for six years starting in 2013-2018. The data consist of the number of PDAM employees, PDAM employee service fees, and PDAM operational costs, PDAM water prices, number of hotels, number of industries, GDRP per capita and PDAM water demand in the Regency/City of the Province of Yogyakarta Special Region, obtained from BPS (Statistics Indonesia) and data internal District/City PDAMs in the Special Province of Yogyakarta.

This research's analytical method is structural equation modeling (SEM) to test the seven hypotheses in this study and the relationships between variables. So that through these stages are expected to be able to obtain results and conclusions that can answer the problems formulated in this study. This study uses WarpPLS 6.0 software to test the hypotheses that have been determined. The method of analysis of this study is the SEM structural modeling analysis. In testing the SEM model using WarpPLS 6.0.

RESULTS AND DISCUSSION

The increasing demand for water in the PDAM Yogyakarta Province is not matched by the effectiveness and capacity of the distributed water. The factors that can influence water demand are very important to be investigated so that the water distribution runs well and can meet all PDAM / Regency PDAM customers' water needs in Yogyakarta Province. This study aims to examine the influence of variables. The method used is the Partial Least Square (PLS), which is the method of solving Structural Equation Modeling (SEM). Research with the title Factors Affecting PDAM Water Demand in Regencies/Cities in Yogyakarta Special Province in 2013-2018 data analysis using SEM through WarpPLS 6.0 application. Step of Analysis:

The data processing in this study uses PLS (Partial Least Square), where the dependent variable is the demand for PDAM water, while the independent variable is the price of PDAM water, industries that subscribe to PDAM water, hotels that subscribe to PDAM water, and GRDP per capita. Employee costs and operational costs corroborate the independent variable of water price by testing the data as follows:

Model fit aims to test the suitability of all research models. Significant testing of the independent variable on the dependent variable is significant if it meets the P-value less than 0.05.

Table 2. Model Fit

Model	Fit Indices	P-Value
APC	0.437	P=0.001
ARS	0.41	P=0.003
AVIF	1.407	Good if < 5

The results of table 4.1 analysis show that the model fit indicators with APC 0.437 with P-values = 0.001, and ARS 0.410 with P values = 0.003 significant because the significant value is <0.05. In AVIF, that is 1.407, it satisfies <5, so that data does not occur multicoleration. (Mahfud and Ratmono: 2013,115).

Combined Loading and Cross Loading, At alpha 5% and t-statistics> 1.96, the low-value loading variable explains that the indicator does not have a good effect on the reflective indicator> 0.7, while Cross loading is another measure of the validity of the disclaimer.

Table 2. Long-run Regression Results

	Y	X1	X2	X3	X4	Z1	Z2	P-Value
Y	-1	0	0	0	0	0	0	<0.001
X1	0	-1	0	0	0	0	0	<0.001
X2	0	0	-1	0	0	0	0	<0.001
X3	0	0	0	-1	0	0	0	<0.001
X4	0	0	0	0	-1	0	0	<0.001
Z1	0	0	0	0	0	-1	0	<0.001
Z2	0	0	0	0	0	0	-1	<0.001

The results of combined loading and cross-loading tests are tests on the reflective and formative indicators in this study, X1; X2; X3; X4; Z1; Z2; Y with a p-value of <0.001 for all research variables, it was declared significant because <0.05.

The AVE shown in table 4 is used to test the construct's variance compared to the variance generated in the measurement. The results of AVE of X1, X2, X3 & X4 are worth 1; Z1 & Z2 are worth 1, and Y with a value of 1, so it is declared to meet the standard because the AVE value is more than 0.05. Path Coefficiens and P-Value:
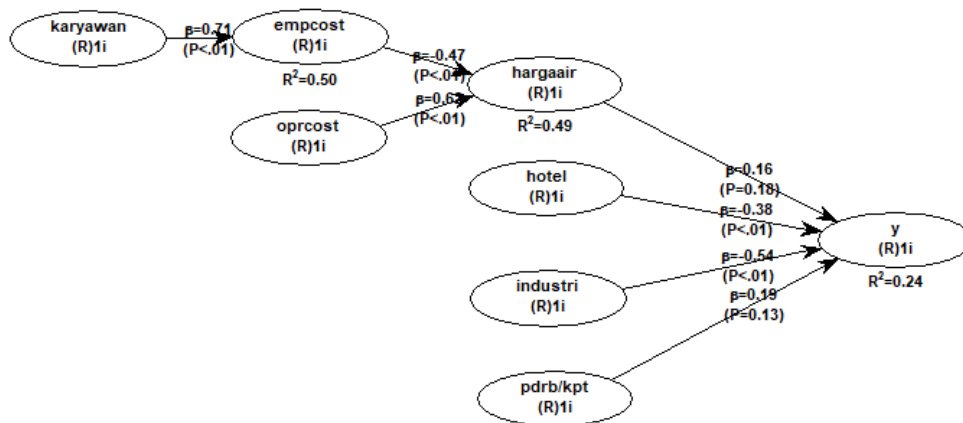
Tabel 4. Average Variance Extracted

Y	X1	X2	X3	X4	Z1	Z2
1	1	1	1	1	1	1

Figure 2. The results of the analysis use WarpPLS

Table 5. Path Coefficient dan P-Values

Corelation		Path Coefficient	P-Value	Signifi-cance	Relation	Explana-tion
Z1	Z2	0,71	<0,001	significant	H0 rejected H1 accepted	Positive
Z2	X1	0,47	<0,001	significant	H0 rejected H1 accepted	Positive
Z3	X1	0,62	<0,001	significant	H0 rejected H1 accepted	Positive
X1	Y	0,16	0,18	Not significant	H0 accepted H1 rejected	Positive
X2	Y	-0,38	<0,001	significant	H0 rejected H1 accepted	Negative
X3	Y	-0,54	<0,001	significant	H0 rejected H1 accepted	Negative
X4	Y	0,19	0,13	Not significant	H0 accepted H1 rejected	Positive

The relationship between the influence of latent variables with constructs is called the path coefficient/path coefficient value. The results of the research test obtained a P-value between the

independent variables influencing the dependent variable PDAM water demand, where Z1 PDAM employees with a coefficient of 0.71 and p-values <0.001, it can be explained that the Z1 variable has a significant positive effect on the costs of PDAM employee repayment services (Z2). The employee compensation costs with a coefficient of 0.47 and p-values <0.001, show that the variable Z2 has a significant positive effect on water prices (X1). At an operational cost, Z3 has a coefficient of 0.62 and p-values <0.001, so it can be explained that the variable Z3 has a significant positive effect on water prices (X1). The water price variable (X1) has a coefficient of 0.16 and a p-value of 0.18 so that it can be explained that the variable X1 has no significant effect on PDAM water demand (Y). Hotel variable (X2) has a coefficient of -0.38 and p-value <0.001 so that hotels that subscribe to PDAM water have a significant negative effect on PDAM water demand (Y). For industry variables that subscribe to PDAM water (X3), the coefficient is -0.54 and p-values <0.001, so industries that subscribe to PDAM water have a significant negative effect on PDAM water demand (Y). The results of variable X4 show that the coefficient is 0.19 with a p-value of 0.13, so it can be explained that the GRDP per capita of the population has a significant positive effect on PDAM water demand (Y).

The coefficient of determination can be seen in the picture. The R-square value of employee retribution costs is 0.50, which means that employee variables can affect employee retribution costs by 50% ; other variables outside the model influence the remaining 50%. The R-square value of the PDAM water price is 0.49, which means that variable employee retribution costs and PDAM operational costs can affect the PDAM water price by 49%. And the remaining 51% results from variables outside the model. The R-square value of PDAM water demand is 0.24, which means variable water prices, hotels that subscribe to PDAM water, industries that subscribe to PDAM water and GRDP per capita can influence PDAM water demand by 24%, the remaining 76%, influenced by variables outside the model.

Table 6. Inner Model

	Z	X	Y
Cronbach Alpha	1,00	1,00	1,00
QSquared	0,479	0,448	0,677

Q-squared table 4.4 in the Z variable (employees, employee retribution costs, and PDAM operating costs) 0.479; variable X (PDAM water prices, hotels that subscribe to PDAM water, industries that subscribe to PDAM water, GRDP per capita) 0.448; and on the Y variable the magnitude of Q-sqaured is 0.677. So that it can be concluded the value of predictive validity> 0, the data of this study have been well constructed and have predictive relationships. Cronbach alpha test in variables Z, X, and Y value of 1.00 value is less than 3.3 so that the results are free from colinearity.

Effect of Number of PDAM Employees on the Fee for PDAM Employee Retribution. The mediation test and data analysis results stated that the variable number of employees (Z1) had a significant positive effect on the costs of PDAM employee repayment services with coefficient values of 0.71 and p-value <0.001. This study's results are appropriate in Bastian Bustami & Nurlaela's 2013 cost accounting book: 207 The number of employees can affect the labor costs of a company. If the number of PDAM employees/workers has increased, it will increase in employee service fees and vice versa assuming ceteris paribus. The higher the number of employees, it will increase the price of PDAM water because it can increase the basic costs of employee compensation and various other activities. Thus, the increasing number of PDAM employees will increase employee fees, causing PDAM water prices to increase each m3 (Basu Swastha and Irawan 2005).

Effect of Retribution Fees for PDAM Employees on PDAM Water Prices. Partial least square test results, the coefficient value of employee retaliation costs (Z2), the coefficient is 0.47, and the value of P-Value <0.001 to the price of PDAM water (X1). It can be concluded that the variable employee retribution costs have a

significant positive effect on PDAM water prices. This means that if the PDAM employee retaliation costs increase, the price of PDAM water will also increase and vice versa with the assumption of ceteris paribus. By the book Modern Marketing Management Basu Swastha and Irawan (2005), the results of this study are one of the determinants of prices is cost, in this case, the cost of returning employee/labor services. Employee/labor costs are all remuneration provided by the company for its employees, which is the production cost. The output price's size depends on the cost of the inputs used (Mulyadi, 2005). The higher the total cost of remuneration for PDAM, employees will increase the PDAM water price per m3.

Effect of PDAM Operating Costs on PDAM Water Prices. The results of data analysis, the value of the operational cost coefficient (Z3), the coefficient value is 0.62, and the P-value is <0.001 to the price of PDAM water (X1). That is, the variable operational costs have a significant positive effect on PDAM water prices. This means that the fixed price of PDAM water also depends on the operational costs of the PDAM. Operational costs are closely related to the production function from raw materials to finished products such as chemical costs, machinery costs, rental fees, and other costs. The results of this study are by the findings of Basu Swastha and Irawan (2005) in his book Modern Marketing Management, one of the determinants of the price is cost, in this case, operational costs. The output price's size depends on the cost of the inputs used (Mulyadi, 2005). The higher the PDAM's operational costs, the higher the price of PDAM water per m3. This proves that operational costs are a factor that can affect the price of PDAM water.

Effect of PDAM Water Prices on PDAM Water Demand. Based on the partial least square test results, the PDAM water price variable (X1) has a coefficient of 0.16 and a P-Value of 0.18 to the PDAM water demand (Y). This means that the variable price of PDAM water has a positive and not significant effect on the demand for PDAM water, it means that if the price of PDAM water rises, the demand for PDAM water also

increases and vice versa with the assumption of ceteris paribus. While the effect of PDAM water prices is insignificant on PDAM water demand, other factors can affect PDAM water demand, such as population per capita income. This is in line with the research of Yuni Masdayani Harahap, Faigiziduhu Bu'ulolo, and Henry Rani Sitepu (2013), where the water price determined has no significant effect on water demand.

This study's results are by the theory of demand, where several factors affect demand, one of which is the price. The price can influence the number of goods requested will depend on the elasticity of the goods concerned if the goods are more elastic, the more sensitive the change in quantity/quantity due to price changes. Vice versa, if the goods are more inelastic then the quantity/quantity of goods/services requested is increasingly insensitive to price changes. A monopolist, usually the amount of sub-distribution goods is relatively small, resulting in the demand for goods/services produced to be inelastic. Then the price change in the monopolist does not significantly affect the number of goods demanded. This happens to the Regional Drinking Water Company (PDAM) because, the company is a monopoly or the only regional company engaged in the distribution of drinking water services, so price changes do not have much effect on sales volume, so the price increase will result in increased company revenue and vice versa (Sudarman, 2000).

Effect of Number of Hotels on PDAM Water Demand. Based on the results of data analysis, where the variable number of hotels (X2) has a coefficient of -0.38 and a p-value of <0.001 concerning (Y). Thus, the hotel variable that subscribes to PDAM water has a significant negative effect. Negative effect on PDAM water means that if the number of hotels that subscribe to PDAM water increases, the water demand will decrease/remain and vice versa, assuming ceteris paribus. This is because the number of hotels that subscribe to PDAM water makes PDAM water only a substitute item, where most hotels also use other sources of water outside the PDAM. (PDAM Tirtamarta 2019). This is consistent with the findings of Lambok Hutasoit (2017) PDAMs

will not serve the needs of all hotels in an area, so most hotels use groundwater or make PDAM water a substitute item.

Effect of Industry Amount on PDAM Water Demand. According to the results of the analysis of partial least square test, where the number of industries subscribed to PDAM water (X3) with a coefficient of -0.54 and a P-Value of <0.001 to water demand (Y). The variable number of industries that subscribe to PDAM water X3 has a significant negative effect on demand for PDAM water. The negative effect of the number of industries that subscribe to water in the PDAM means that if the number of industries that subscribe to water in the PDAM increases, the demand for PDAM water decreases/stays. That is because most industries prefer to subscribe to water outside the PDAM, such as bore-wells. This is consistent with Santoso (2018) findings where industries prefer other water sources outside the PDAM because, the higher water prices, the decreasing water capacity of the PDAM so that it cannot reach all water needs in each industry. However, this study's results do not support the results of previous studies by Intan Ladyana Fatoni, Hadi Sasana, Panji Kusuma P (2019), which states that the number of industries in the city of Magelang has a positive effect on water demand.

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CONCLUSION

Based on the research discussion of the Factors Affecting PDAM Water Demand in the Regency / City of the Special Region of Yogyakarta in 2013-2018, it can be concluded. The number of PDAM employees indicated by data on the number of employees in person units from 2013-2018 in the PDAMs of each Yogyakarta Special Region Province has a significant positive effect on PDAM employee repayment services costs. This indicates that the increasing number of PDAM employees will increase in PDAM employee repayment costs.

PDAM employee repayment costs have a positive and significant effect on PDAM water prices. One of the determinants of PDAM water prices is the basic costs incurred by the PDAM, such as PDAM employee repayment services. The cost of paying back PDAM employee services will also increase the price of PDAM water. PDAM operational costs have a

significant effect on PDAM water prices. However, water prices do not significantly influence water demand, because several other factors can affect the water demand of PDAMs such as GDRP per capita population.

The number of hotels has a significant negative effect on PDAM water demand. The hotel is part of the PDAM water customers that are included in the commercial class. Despite an increase in water customers by hotels, the demand for PDAM water has decreased. This can be caused by the fact that most hotels that subscribe to PDAM water make PDAM water a substitute item and depend on other water sources outside the PDAM. The number of industries has a significant negative effect on PDAM water demand. Because industries that costumers to PDAM water in five Regencies/Cities, Yogyakarta Province do not make PDAM water the main source of water in conducting their production activities. The industry reasoned that the affordability of access to water sources and the capacity of water produced by PDAMs is still low when compared to other water sources outside of PDAM. GDRP per capita population in five regencies/cities, Yogyakarta Special Province, has no significant effect on the demand for water from PDAM. That is because several other factors can affect PDAM water demand, such as water prices and others.

The PDAM is expected to pay attention to the number of employees to reduce the number of service fees incurred by the PDAM. The results showed that the price of PDAM water measured using SEM had no significant effect on PDAM water demand. The failure of PDAM water demand is thought to be caused by several other factors that can affect PDAM water demand. The company is expected to provide information on factors in determining the price of PDAM water and can reduce the price of PDAM water, thereby reducing misunderstanding about the price of PDAM water. Therefore, high water prices are not in harmony with the quantity of water distributed to customers. Therefore, customers should not focus on the quantity of water only, but other factors can cause PDAM

water prices to increase, such as guaranteed PDAM water quality and compliance with health standards.

Based on the results of this study, the GRDP per capita of residents in five Regencies/ Cities, Yogyakarta Special Region Province, does not have a significant influence on PDAM water demand. Increasing the demand for water for local governments can be beneficial because profits are also getting higher. However, the PDAM should be able to provide socialization and knowledge to the community about saving water even though the population's income has also increased and is considered capable of paying whatever the price of PDAM water is. PDAM in five regencies/cities, Yogyakarta Special Region Province, are the only government companies that distribute water that is expected to improve the quality and quantity of water so that it can reach all regions and meet daily water needs.

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