Analysis of Customer Willingness to Pay (WTP) Water of Pekanbaru Tirta Siak Water Supply Company

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Abstract: Pekanbaru is one of rapidly growing city in Sumatera Indonesia so that causes the increasing of population and many things such as drinking water needs. Tirta Siak Water Supply Company (TSWSC) is a company that takes responsibility in supplying clean water in Pekanbaru city. Nowadays Tirta Siak Water Supply Company is getting reduction of water quality so that require a technology to overcome the problem. Technology application will require an additional cost till needed the data of willingness to pay the surcharge. Methodology used was questionnaries deployment with deployment area involve Tampan subdistrict, Payung Sekaki subdistrict, Bukit Raya subdistrict, Marpoyan Damai subdistrict, Tenayan Raya subdistrict and Rumbai Pesisir subdistrict. Data reviewed by using multiple linear regression, while statistic test used were regression test (R^2) and stasticic test F. Instrument used were excell and SPSS 17.0. Based on analysis result obtained that willingness to pay more was 77,5% affected by income, last education, duration of subscription, average consumption per month and value of customer perception. The willingness to pay obtained was Rp 5,349,- per m³/day or Rp.160,470,- per m³/month.

Keywords: ANOVA, Tirta Siak Pekanbaru Water Supply Company, Drink Water Financing, regression, SPSS, willingness to pay

1.Introduction

Water is a main needs that has big role in social and economic life. Rapidly growing in a region will affect quantity and quality of available water. Pekanbaru city is one of rapidly growing region in Indonesia. It causes an incerasing of population and many things such as water requirement in Pekanbaru. Tirta Siak Water Supply Company (TSWSC) is a company that takes responsibility in supplying clean water in Pekanbaru city. Tirta Siak Water Supply Company has a main task and purpose to carry out the service requirement fulfillment of clean water for the people and also has a role in supporting Pekanbaru city development. Yet the number of Tirta Siak Water Supply Company's customer gets reduction from year to year. The decreasing of clean water demand is caused by the reduction of water quality from year to year.

One of efficient way to enhance water quality is by using membrane technology. Membrane technology can be applied to improve water quality of TSWSC that sourced from Siak River water so that will increase the demand of Tirta Siak Water Supply Company. Yet membran technology application will require more expensive cost and eventually will affect the water cost that is going to distributed by TSWSC. Hence it needs an analysis of willingness to pay more by direct interview of 387 respondents to know people perception about distributed water of TSWSC.

Based on interview result conducted, 49% of respondents had perception that quality of TSWSC water is rather turbid, 23%

of respondents had perception that TSWSC water quality is normal, 18% of respondents had perception that TSWSC's water quality is less limpid, 5% of respondents had perception that TSWSC water quality is turbid and only 5% of respondents that said the quality is limpid. So it can be concluded that the highest customer perception about TSWSC water quality is rather turbid of 49%. Yet the perception about that water quality still must be reviewed its linkages with another factors such as customer education, duration of subscription, average consumption of water and customer income per month. Therefore, in this research will be conducted the determination of those variables interaction. So by analyzing those factors will be known wether customer is willing or not to pay with the increased cost of TSWSC water.

2. Literature Review

Water is one kind of infrastructure or basic needs that is essential for life continuity of people both in urban or rural. Beside to be consumed, clean water also can be one of averages to enhance the welfare through the effort of health standard enhancement [7].

According to Suripin (2001), public water supply basically needs a potable water. That water in question must be safe (healthy) and good to drink, colorless, odorless, with the fresh taste. Clean water must have a high quality physically, chemically and biologically to prevent the incidence of a disease. Generally, Clean Water Quality Requirements is regulated in the Regulation of Indonesian Ministry of Health

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One of technology that can be used by drink water supplier to produce more qualified drinking water is membrane technology. Membrane serves as a thin obstacle that is so selective between two phase. Membrane works by restraining certain component from a flow that is passed to membrane. Membrane separates material based on form and molecule size by restraining component from feed that has bigger size than membrane pores and skipping the smaller component. Solution that consists of restrained component is called concentrate or retentate and solution that consists of skipped (not restrained) component is called permeate [5].

Yet the technology utilization by drink water supplier will cause an increasing production cost. Hence, it needs a level determination of customer's willingness to pay more if drink water supplier use that technology. The way to determine the level of willingness is by Willingness To Pay (WTP) Analysis. Generally, economic value is defined as a measurement obtaining other goods and services. So formally, this concept is called willingness to pay of someone towards goods and service that resulted by natural resources and environment.

By using this measurement, ecological value of ecosystem can be translated in economic language by measuring the monetary value of goods and service. Willingness to pay also can be measured in form of increasing income that causes a person exists in indifferent position toward exogenous change. This exogenous change can be occured due to cost change (as a result of its resources scarce for instance) or because of resource quality change. Therefore this concept of WTP closely related with the concept of *Compensating Variation* and *Equivalent Variation* in demand theory. WTP also can be defined as maximum amount that people willing to pay to avoid the decreasing towards something.

3. Methodology

Willingness to pay is a behavioural attribute of water consumers, and the data required include: information on the socio-economic characteristics of respondents such as level of education, income level, uses of water, and quality of water demand e.t.c. These information and others were obtained through primary sources with the use of structured questionnaire. Questionnaire deployment's area involves Tampan subdistrict, Payung Sekaki subdistrict, Bukit Raya subdistrict, Lima Puluh subdistrict, Sail subdistrict, Pekanbaru City subdistrict, Sukajadi subdistrict, Senapelan subdistrict, Rumbai subdistrict and Rumbai Pesisir subdistrict.

4. Analytical Procedure

Data obtained than arranged in form of table to ease quantitative analysis. The relation between one dependent variable with some independent variables determined by using multiple linear regression, while statistic test used were regression test (R^2) and statistic F. This research was conducted by using instruments as below:

- a. Excell Program used to data tabulation
- b. Statistical Package for the Social Science (SPSS) 17.0 used to multi variants analysis

SPSS used with the stages as below:

Click SPSS Statistics 17.0 until appearing start display screen that consists of 2 kind of editors i.e data view and variable view. Data view is part of data editor that serves as location for processed statistic data. While variable view is part to define inserted data variable. Box of variable view is activated by clicking variable view at the bottom of data editor.

- a) Tabulation data result is copied to data view. Data such as education and water quality that is verbal should be changed into gradual number to ease equation determination.
- b)In variable view there are data of information that should be adjusted. The informations are:
- Name which contain the name of variable used
- Type is data type that consists of numeric, string and date
- Width the amount of character that will be inputted in Data View
- Decimal is amount of decimal character that will be inputted in Data View
- Label is column that shows additional information by giving label of data variable
- Value to give codification
- Missing is column to show the missing data
- Columns serve to change the amount of character that can be entered in a certain variable
- Align to organize the display of words flattening in Data View
- Measure is variable type that will determine the kind of analysis that will be used i.e nominal, ordinal or scale
- c) Analysis towards adpated data is conducted by choosing menu Analyze, then Regression → Linear. Untill the box of Linear Reression appears. Variable of Additional_Cost is clicked and entered to dependent box, while variable of Income, Education, Duration of subscription, Quality_Perception, Average_Consumption are entered to indepedent box. Then click OK
- d) The result of SPSS 17.0 analysis towards used data appears on new screen. The result obtained is tables like **Model Summary, ANOVA, Coeficients**, etc.

5. Results and Discussion

This research is analyzing about the influence of some variables like income level per month, level of education, average consumption of water, and perception about quality towards customer's willingness to pay more water supply company (TSWSC) and how much cost over that TSWSC's customer willing to pay in Pekanbaru. Variable in this research was divided into 2 main variables i.e willingness to pay additional cost of water and how much willingness to pay more by TSWSC customer as dependent variable (Y) while income level per month, level of education, average consumption of water and perception of quality as independent variable (X).

5.1 Respondent Characteristic

Respondent characteristic that will be described is reviewed from income level per month, level of education, average consumption of water and perception about quality. Further details about respondent characteristic are as below :

5.1.1 Income

Income in this research is total income received by each respondent for a month. Where income is an essential factor in determining the level of willingness to pay more of a person towards water distribution service by Tirta Siak Water Supply Company (TSWSC). Demand feature of a person towards goods and service, high or low the income level of a person will affect the his consumption pattern, in other words, the higher the income level, the higher the willingness of a person to pay more in order to enjoy the facility of clean water. So it can be called that income level is directly proportional with willingness to pay more and the level of willingness to pay water.

The result of research towards 387 respondents obtained the estimation of income level that can be seen in picture below :



Figure 1: Diagram of Respondent Income

Figure 1 shows that most of the respondent has income between Rp 2,500,000,- to Rp 4,000,000,- as much as 39% of respondents. Moreover, respondent with the bigger income than Rp 6,000,000,- is 19.3%. While another respondent who has income of Rp 4,000,000 to Rp 6,000,000,- is 26%, respondent who has income of Rp 1,200,000,- to Rp 2,500,000,- is 12.7% and respondent with the lower income than Rp 1,200,000,- is 3%. Based on question result, then the highest income level of respondent is Rp. 2,500,000,- to Rp 4,000,000,- as much as 39%. Level of customer's WTP value affected significantly by variable of house total income. Furthermore, the higher the income level, the higher the possibility to pay more of TSWSC's water]

5.1.2 Last Education

Level of education is one of affecting factor in this research, because commonly it determines the ability and quality of someone in mastering knowledge. This factor also has a role in determining customer's choice to use or consume a product of goods and service.

Where generally, the higher the level of education that customers had, the higher their way of thinking and way of looking in judging a service which in this research is the service of clean water supply by TSWSC, and also the higher the way of looking about the important of water that its availability is so affected by environmental quality. Hence, this also will be affecting in the level of willingness to pay more of TSWSC water that will be payed towards goods and service and the environment.

Level of education is the highest education stage that had been reached by TSWSC customer like graduated from elementary school, graduated from Junior High School (JHS), graduated from Senior High School (SHS), graduated from college becoming Diploma or Bachelor. Further details about the level of education of 387 respondents in this research can be seen in this picture below:



Figure 2: Diagram of Education Level of Respondent

Figure 2 shows that most of respondents are in SHS level 44.4% while the rest are in the level of elementary school, JHS, Diploma and Bachelor. Education level between SHS to Bachelor is one of intermediate class characteristic. This causes a demand in quality of the infrastructure's availability especially clean water also will be important in accordance with their high level of knowledge. Level of education in its relation with water utilization for domestic needs takes effect towards variation and the amount of used water, beside it's not out in people's comprehension in consuming water properly and efficiently [4]. Based on questionnaire result then concluded that the most of respondents are in SHS by 44.3%.

Level of education has an positive effect toward willingness to pay more the additional cost of water [2]. The higher the customer's level of education, the higher the probability of education level for affecting the willingness to pay more

5.1.3 Duration of Subscription

Duration of subscription of TSWSC water is a factor that affects willingness to pay. Further details about of subscription of 387 respondents in this research can be seen in picture below:

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Figure 3: Diagram of Duration of TSWSC Water Subscription

Based on Figure 3 can be explained that in average, the repondent subscribes water for 6-15 years by 60%, then followed with duration of water subscription for 16-25 years by 17%, duration of water subscription for less than 5 years by 20% and duration of water subscription for more than 26 years by 4%. Then can be concluded that highest result for respondent's duration of water subscription is 6-15 years by 60%.

5.1.4 Average Consumption of Water

The payment of water cost that conducted in society is a payment by calculating the amount of water used every month (Rp/month). Each group of society pays with different cost corresponding with assigned cost.

People who use water in large quantities surely expect for the lesser cost in order no to incriminate. The assumption applied in this variable is the more the consumption of water, the lesser the value of WTP that willingly be paid by people as water cost. The unit used in regression analysis in this research is $m^3/month$.



Figure 4: Diagram of Average Consumption of Water

Based on Table 4.4 and Figure 4.17 known that the highest average consumption of water is in the range of 20-30 m³/month by 56%, then average consumption of water in range of 30-40 m³/month is 11%, average consumption of water in more than 40 m³/month is 3%, average consumption of water in range of 10-20 m³/month is 23% and average consumption of water in less than 10 m³/month is 7%. It can be concluded that the average consumption of water by Tirta Siak Water Supply Company customer is in the range of 20-30 m³/month by 56%. Asih [2006] said that on average, the biggest usage of TSWSC customer is for MCK needs (public bathing, washing and toilet facilities). While for drink water needs is using mineral/gallon water.

5.1.5 Perception of Water Quality

Customer perception in this research is the view or opinion about TSWSC water quality. This perception has an effect towards customer decision to use TSWSC service in obtaining clean water. This perception also affects about willingness to pay more and how big the willingness to pay of TSWSC customer. Where the higher the perception or rating of customer toward TSWSC water quality, the higher the willingness of a person to consume TSWSC water. The customer perceptions about TSWSC water quality are like turbid, rather turbid, normal, less limpid and limpid. From the result of research is obtained the data about customer perception of TSWSC water quality with predetermined categories. Further details of customer perception about TSWSC water quality can be seen in the table below:



Figure 5. Diagram of Perception about Water Quality

Based on the result of research corresponding with Tale 4.6 and Figure 4.18 resulted that 49% of respondents had perception that quality of TSWSC water is rather turbid, 23% of respondents had perception that TSWSC water quality is normal, 18% of respondents had perception that TSWSC water quality is less limpid, 5% of respondents had perception that TSWSC water quality is turbid and only 5% of respondents that said the quality is limpid. So it can be concluded that the highest customer perception about TSWSC water quality is rather turbid of 49%.

Water of Tirta Siak Water Supply Company comes from Siak River. Amri [2006] had conducted a research about parameter contained in Siak River water. The result showed that various activity in the Siak watershed apparently has changed the structure of watershed itself from pure condition into synthetic environment. The effect of various activities was not only profitable in aspect of economic, but also gave contribution in decreasing the environment quality along the Siak watershed. This can be seen from the measurement of various physic and chemical parameter such as Depth, pH, TSS, TDS, DO, BOD and COD that entirely give information that Siak watershed has been heavily contaminated [3].

5.2 Willingness to Pay (WTP)

Willingness to Pay (WTP) is an analysis of customer willingness to pay the services that they accept [6]. This analysis is useful to know people perception of the services

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they get so that can be estimated how the additional cost that willingly be paid by people.

Analysis used to get equations of willingess to pay more by water costumer is multiple linear regression. The equation that has requirement of F test and significant value that qualify then be choosen. The equation that has most fuulfilling requirement consists of income per month, last education, duration of subscription, average consumption of water and customer perception. Hence, dependent variable and independent variable used are :

- a) dependent variable : additional cost,
- b) independent variables : income per month
 - last education of customer,
 - duration of subscription,
 - average consumption of water,
 - customer perception.

The influence of chosen independent variables is shown in Table of Model Summary like in Table 1. The table is an output from SPSS 17.0 that shows value of correlation coefficient (R) and determinant cofficient (R^2) of used parameter. The value of correlation coefficient (R) obtained was 0,882 that means the chosen parameters have a close relation. While the value of determinant coefficient obtained

was 0,778 that means variation of high or low the willingness to pay can be explained by the variation existence of income, education, duration of subscription, customer perception about quality and average consumption of water per month by 77,5% and the rest is explained by another variable out of the equation.

	Table 1: Model Summary Table as Output of SPSS 17.0				

Model Summary								
Mode				Adjusted R	Std. Error of the			
1		R	R Square	Square	Estimate			
-	1	.882 ^a	.778	.775	1426.09657			
a. Predictors: (Constant), perception, income,								
	subscription_duration, education, consumption							

5.2.1The Influence of Each Dependent Variables Toward WTP

Each variables gives the diferent influence towards willingness to pay more by customer. The influence of dependent variables used can be seen through coefficient value from test using SPSS 17.0. coefficient of each variables shown in Table 2 that is coefficient table as an output of SPSS 17.0 and expressed in Unstandarized Coefficient B Column.

 Table 2: Coefficients Table as Output of SPSS 17.0

Coefficients ^a						
	Unstandardized Coefficients		Standardized Coefficients			
Model	В	Std. Error	Beta	t	Sig.	
1 (Constant)	264.601	446.502		.593	.554	
income	.001	.000	.857	34.096	.000	
education	47.384	82.902	.015	.572	.568	
subscription_duration	-4.861	11.619	010	418	.676	
average_consumption	31.269	11.918	.072	2.624	.009	
perception	109.776	75.806	.035	1.448	.148	
a. Dependent Variable: additional_cost						

5.2.1.1 The Influence of Income Towards Willingness To Pay (WTP)

Total income accepted by each respondents for a month is a factor that determine the level of willingness to pay more of a person towards water distribution service by TSWSC. Income is economic variable that closely related with society economic ability in doing the payment of the used water [2]. Generally, the higher the income, the higher the level of willingness of a person to pay more in order to enjoy the ease of obtaining clean water. So it can be called that income level is directly proportional with willingness to pay water.

Based on the test result by using multiple linear regression obtained that the income of customer has possitive effect towards willingness to pay more. That is shown from the coefficient of income variable that was positive. On average, the customer income per month based on questionnaire is Rp 5,104,000,- with its influence towards WTP is 0.001. So the average of additional cost that willingly be paid by customer if only reviewed from income per month is Rp 5,104,134,-.

5.2.1.2 The Influence of Education Towards Willingness To Pay (WTP)

Level of education will be affecting people's mindset towards natural resource that they use both freely or not. This variable gives the effect because generraly people with the better level of education tend to understand economic value of resource that is getting limited untill becoming an economic goods [2]. So the assumption applied is the higher the respondent level of education, the higher the WTP that will be paid by customer.

Based on the test result by using multiple linear regression obtained that the education of customer has possitive effect towards willingness to pay more. That is shown from the coefficient of education variable that was positive by 47.384.

5.2.1.3 The Influence of Duration of Subscription Towards Willingness To Pay (WTP)

The duration of a customer using TSWSC service to fulfill clean water needs will affect his willingness to pay more. Generally, someone will be less willing to pay more if had been using a service for a long time. Yet overall, a customer who becomes an informant is willing to pay more if the quality of TSWSC is better.

Based on the test result by using multiple linear regression obtained that the subscription duration of customer has possitive effect towards willingness to pay more. That can be reviewed from the coefficient of subscription duration variable that was positive. The average of subscription duration of customer who becomes a informant for 12 years with its influence towards WTP is -4.861. Based on the WTP result can be concluded that the duration of subscription did not have a possitive effect towards willingness of customer to pay.

5.2.1.4 The Influence of Average Consumption of TSWSC Water Towards Willingness To Pay (WTP)

Average consumption of TSWSC water for a month will affect the willingness of customer to pay more. Average consumption of TSWSC water will affect the payment of water dues that done in ($Rp/m^3/month$). People who use water in large quantities surely expect for the lesser dues in order not to incriminate [2]. So it's assumed that the more the water consumption, the lesser of WTP value that is paid by people.

Based on the test result by using multiple linear regression obtained that the average consumption of customer in a month has negative effect towards willingness to pay more. It shows that customer is not willing to do payment more if reviewed from monthly average consumption aspect. The average consumption of customer in a month reached 27 m³ with its influence towards WTP is 31.269. Therefore the average consumption of Tirta Siak TSWSC water has a positive effect towards the willingness of customer to pay more of Tirta Siak Supply Company water.

5.2.1.5 The Influence of Quality Perception Towards Willingness To Pay (WTP)

Quality perception according to customer in this research is a their view or opinion about the quality of TSWSC water that they use. Perception of quality has an effect towards customer choice to use TSWSC service in obtaining clean water and affecting the willingness to pay more and also the cost. The higher the perception of a person towards TSWSC water quality, the higher the willingness of a person to consume that TSWSC water.

Based on the test result by using multiple linear regression obtained that the quality perception of customer has negative

effect towards willingness to pay more. That is shown from the coefficient of quality perception variable that was positive by 109.776. So if it's reviewed from quality perception side according to the customer, then customer will be willingly to pay more and do additional cost of Rp 29.046,-.

5.2.2 The Value of Willingness of Customer to Pay More /Willingness To Pay (WTP)

Every dependent variable that used gives the effect with different value towards the willingness of customer to pay more/willingness to pay (WTP). WTP value if affected by the all of dependent variable that used is determined by using an equation. The equation is obtained from the result of multiple regression analysis using SPSS 17.0.

Based on output of SPSS 17.0, obtained an equation of customer willingness to pay more as below :

$$\label{eq:264.601} \begin{split} Y &= 264.601 + 0.01 \ X_1 + 47.384 \ X_2 - 4.861 \ X_3 + 31.269 \ X_4 \\ &+ 109.776 \ X_5 \end{split}$$

- Where Y = additional cost (Rp),
- X_1 = income per month (Rp)
- $X_2 = last education$
- X_3 = duration of subscription (month)
- X_4 = average consumption per month (m³)
- X_5 = value of customer perception

By looking the influence of all independent variables and using the equation, then it is obtained that additional cost that willingly paid by customer (WTP) to get better quality of TSWSC water is Rp 5,349,- per m^3 /day or Rp160,470,- per m^3 /month.

5.3 ANOVA Test Result

ANOVA test of data used is necessary to do to know if the regression result obtained is acceptable or not where the hypothesis used are :

Ho = dependent variable does not have significant effect towards independent variable

Ha = dependent variable has significant effect towards independent variable

The regression result is acceptable if the test result using ANOVA prove that dependent variable used has significant effect towards independent variable (Ha is accepted). Hypothesis of Ha is accepted if ANOVA test from SPSS 17.0 output fulfills the characteristic i.e sig < 0.05 and $F_{value} > F_{table}$. ANOVA Table as output of SPSS 17.0 towards data used is shown in Table 3.

	ANOVA ^b							
Model		Sum of Squares	df	Average Square	F	Sig.		
1	Regression	2.717E9	5	5.434E8	267.196	.000 ^a		
	Residual	7.749E8	381	2033751.436				
	Total	3.492E9	386					
a. Predicto	ors: (Constant), perceptio	n, income, subscription_d	uration, educatior	n, average_consumption				
b. Depend	ent Variable: additional_	cost						

Table 3: ANOVA Result Using SPSS 17.0

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Based on criteria of significance value (sig), regression result is acceptable if sig < 0.05. Data from Table 3 shows that significance value obtained is 0,00 so it already fulfilled the criteria of sig < 0.05. While the value of F_{table} from regression data obtained is 2,31 where the value is less than F_{value} so it already fulfilled the criteria of $F_{value} > F_{table}$. Furthermore, Ha hypothesis where the chosen dependent variable has significant effect towards customer willingness to pay more and additional cost of Rp 5,349,- per m³/day or Rp160,470,per m³/month as a result of multiple regression analysis is acceptable.

6. Conclusion

Based on analysis result, then conclude that :

- 1)Income, last education, duration of subscription, average consumption per month and value of customer perception have effect of 77.8% towards customer willingness to pay more to obtain the better quality and quantity.
- 2)Based on output of SPSS 17.0, obtained an equation of customer willingness to pay more as below :

 $Y = 264,601 + 0,01 X_1 + 47,384 X_2 - 4,861 X_3 + 31,269 X_4 + 109,776 X_5$

Where Y = additional cost (Rp),

 X_1 = income per month (Rp)

 $X_2 = last education$

 X_3 = duration of subscription (month)

 X_4 = average consumption per month (m³)

 X_5 = value of customer perception

By looking the influence of all independent variables and using the equation, then it is obtained that additional cost that willingly paid by customer (WTP) to get better quality of TSWSC water is Rp 5,349,- per m^3 /day or Rp160,470,- per m^3 /month.

1. ANOVA result shows that the first hypothesis i.e the need to increase cost already fulfilled the criteria of sig < 0.05 and $F_{\text{value}} > F_{\text{table}}$ i.e 48.149 > 2.31 so that worth accepted.

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