



## Study on the Impact of Water Quality from the Mebidang SPAM on Customer Satisfaction

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### Abstract

In 2021, the service coverage of PDAM Tirtanadi's water supply system reached 73.3%. To further improve the service capacity, a new raw water source was developed through the construction of the Mebidang Regional Water Supply System (SPAM), which draws water from the Bingei River in Binjai City. The PDAM Tirtanadi branches directly affected by this change in raw water source include the Sei Agul and Diski branches. This study aims to evaluate customer satisfaction levels with the water product quality and service performance of the Mebidang SPAM at PDAM Tirtanadi. The methods employed include the Customer Satisfaction Index (CSI) and Importance and Performance Analysis (IPA). Data were collected through questionnaires distributed to both existing customers and new service connections at the Diski and Sei Agul branches of PDAM Tirtanadi. The results showed that customer satisfaction levels were as follows: long-term customers at the Diski branch scored 83.56%, new connections at Diski 83.57%, long-term customers at Sei Agul 82.78%, and new connections at Sei Agul 92.26%. These results indicate that both long-term and new customers at the Diski and Sei Agul branches are generally satisfied with the overall service quality. Based on the IPA results, the main priority for improvement at the Diski branch concerns the imbalance between the cost paid by customers and the volume of water received. Meanwhile, for the Sei Agul branch, variables categorized as low performance and low importance but still of lower priority include PDAM's responsiveness to customer requests, such as for new connections or meter repairs.

## Introduction

Article 33 paragraph (3) of the 1945 Constitution of the Republic of Indonesia states, "The land, water, and natural resources contained therein shall be controlled by the state and used for the greatest prosperity of the people." To realize this article in the distribution of drinking water, the Regional Owned Enterprise (BUMD) responsible for managing water resources and providing water in each region is the Regional Water Company (PDAM) (Budiati et al., 2018). One of the PDAMs in North Sumatra Province is PDAM Tirtanadi, located in the city of Medan. Currently, PDAM Tirtanadi's drinking water service area for the city of Medan and its surroundings is included in Zone-1, while the service area in the regencies/cities in North Sumatra is part of an Operational Cooperation (KSO) with 6 regencies/cities in North Sumatra Province (Directorate of Drinking Water Development, 2017).

At the end of 2021, the coverage of drinking water services through the piping network of Perumda Tirtanadi was 73.3% or around 405,000 customers (Tirtanadi, 2022). In order to

achieve a 100% drinking water service level in Medan City, efforts are needed to increase the service by 20%. The policy to develop the Mebidang Regional Drinking Water Supply System (Medan, Binjai, and Deli Serdang) is an appropriate step in utilizing raw water potential that can be used jointly to overcome the limitations in the quantity and quality of surface water used as a raw water source in several regencies/cities (Directorate of Drinking Water Development, 2017). The Drinking Water Supply System is one of the uses of water resources and sanitation management as a form of protection and preservation that needs to be carried out by the Government (Purba et al., 2023; Masum et al., 2025; Mohapatra et al., 2025). The development of the Mebidang Regional SPAM is divided into two implementation phases. Phase I (2019-2021) involves the development of a capacity of 1100 liters/day, allocated to the city of Medan (750 liters/day), the city of Binjai (150 liters/day), and the district of Deli Serdang (200 liters/day) (Directorate of Drinking Water Development, 2017).

The SPAM Mebidang pipeline in the Medan city area flows to the storage tank or offtaker Sejarah in the Diski branch and the Sumarsono offtaker in the Sei Agul branch. Since the SPAM Mebidang was approved in October 2023, some of the drinking water sources for customers in the Sei Agul and Diski branches have switched to using the SPAM Mebidang water source. To determine the level of satisfaction of PDAM Titanadi customers after the use of the Mebidang SPAM raw water source, it is necessary to measure the performance of PDAM Tirtanadi based on customer satisfaction with the quality of water products and the quality of water services received (Tirtanadi, 2022; Satya et al., 2023; Kholik, 2025; Jasin & Sriwahyuni, 2014).

Customer satisfaction with the fulfillment of drinking water needs is important and is a basic need in housing and settlements (Askal et al., 2023; Mantey et al., 2024; Haikal et al., 2025). Customer satisfaction is the overall attitude of customers after using or consuming a service or product. The level of satisfaction is a function of the difference between perceived performance and expectations (Firdaus & Nur, 2023; Schiebler et al., 2025; Ferreira et al., 2025). If performance fails to meet expectations, consumers feel dissatisfied. If performance meets expectations, consumers feel satisfied (Hartono et al., 2023; Hao et al., 2025; Kristioni et al., 2025). The customer satisfaction variables in this study are Water Product Quality and Water Service Quality. Product quality is a product characteristic that largely depends on its ability to meet predetermined or realized consumer needs (Anggarawati, 2021). Service quality is an activity or series of activities that are visible (not tangible) that occur as a result of interactions between consumers and employees or other things provided by the service provider company intended to solve consumer/customer problems (Mabrur et al., 2022; Wandu et al., 2025; Suryani et al., 2025).

The research by Angelia (2021) also used the Importance Performance Analysis (IPA) method, the Customer Satisfaction Index (CSI) method, and the Principal Component Analysis (PCA) method. The variables used were New Installation, Water Quality, Water Quantity, Water Continuity, Water Usage Recording, Water Bill Payment, Service at the PDAM Office Counter, Technical Complaint Handling, Type of Water Use, Supporting Aspects, Call Center, and PDAM Application. The findings from the PCA analysis in this study indicate that communication facilities and water quality for various types of usage are factors in customer satisfaction with PDAM's non-field services (Angelia et al., 2021). Analysis of customer satisfaction levels for the development of a drinking water supply system: the Sukabumi SPAM case study using the Importance Performance Analysis (IPA) and Customer Satisfaction Index (CSI) methods. The variables used were Home Connection, Payment, Complaints/Service, Quality, Quantity, and Water Meter. The Customer Satisfaction Level was in the "very

satisfied" category with a score of 86.87% (Akbar et al., 2024). Furthermore, research by Separdi Haja (2015), namely Analysis of Customer Satisfaction with PDAM Kota Denpasar from a Technical Perspective using the gap analysis method and the IPA method, shows that several indicators must be improved by PDAM Kota Denpasar to increase customer satisfaction, namely water clarity, water odor, water availability during active hours, operator responsiveness in installing new connections, repairing water meter damage, and responsiveness/speed in handling complaints regarding piping (Haja et al., 1970). Research on the topic of the effect of water prices and water service quality on customer satisfaction with PDAM in the city of Surabaya using multiple linear regression methods. This study concluded that price (X1) has no significant partial effect with a negative value and service quality (X2) has a significant partial effect with a positive value on customer satisfaction (Radiarti et al., 2024; Suryati et al., 2025; Setianingrum & Farida, 2025).

## Methods

The research location taken in this study was the Tirtanadi Medan Zone I Regional Water Company (PDAM), namely the Diski and Sei Agul Branches. The Tirtanadi PDAM Diski Branch office is located at Jl. Medan - Binjai No.Km. 13, Puji Mulyo, Kec. Sunggal, Deli Serdang Regency. This service area consists of part of the Medan Helvetia District, Medan City, and part of the Sunggal District, Deli Serdang Regency, with an area of approximately 57124020.69 m<sup>2</sup> or 5,712 ha. The PDAM Tirtanadi Sei Agul Branch office is located at Jl. Gereja No.32, Sei Agul, Medan Baru District, Medan City. This service area includes parts of Medan Helvetia Subdistrict, Medan Petisah Subdistrict, Medan Barat Subdistrict, Medan Deli Subdistrict in Medan City, and parts of Sunggal Subdistrict, Deli Serdang Regency, covering an area of approximately 22,334,005.28 square meters or 2,233 hectares.

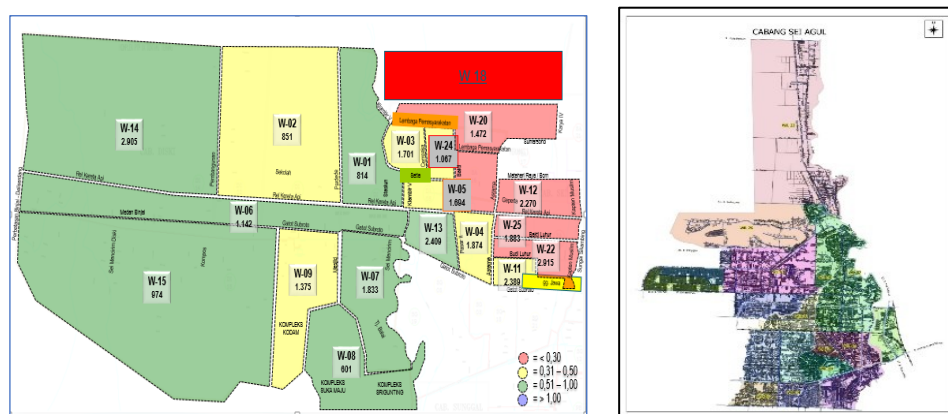


Figure 1. (a) Location of the Tirtanadi PDAM Diski Branch Research, (B) Location of the Tirtanadi PDAM Sei Agul Branch Research

The data collected was categorized into primary and secondary data. The secondary data in this study consisted of water usage sales data, coordinate data for new customer connections from April 2024 to April 2025, branch service area maps, and documents from the 2017 Feasibility Study for the Development of the Mebidang Regional Drinking Water Supply System (Medan, Binjai, and Deli Serdang) in North Sumatra Province. The primary data in this study is a questionnaire on the level of satisfaction and importance of PDAM customers regarding water product quality. The questionnaire sampling technique used probability with simple random sampling.

The method used to determine customer satisfaction levels in this study was the Customer Satisfaction Index (CSI). The Customer Satisfaction Index (CSI) was used to determine overall

customer satisfaction levels using an approach that considered the importance levels of the measured service quality attributes (Wijaya, 2017). The steps for calculating the Customer Satisfaction Index (CSI) are as follows: 1) Determine the Mean Importance Score (MIS), which is derived from the average importance of each consumer; 2) Determine the Mean Satisfaction Score (MSS), which is derived from the average reality of each consumer; 3) Create Weight Factors (WF), which are the percentage of the MIS value per attribute to the total MIS of all attributes; 4) Create Weight Scores (WS), which are the product of WF and the average satisfaction level (MSS); 5) Determine the Customer Satisfaction Index (CSI).

*Importance Performance Analysis (IPA)* is a method used to analyze variables and measure the relationship between consumer perceptions and priorities for improving product/service quality in the form of quadrant analysis. The combination of the x-axis (performance) and y-axis (importance) will determine the position of each attribute. Attributes will be located in one of the four quadrants ( ) (Halief & Putro, 2017). The quadrants in the IPA method are the High Priority Quadrant (important attributes with low performance, must be a priority for improvement), the Maintain Performance Quadrant (important attributes with high performance, must be maintained), the Low Priority Quadrant (less important attributes with low performance, not a priority), and the Excess Quadrant (less important attributes with high performance, resources can be diverted) (Suryadi et al., 2021; Octasyilva et al., 2025; Nyirenda et al., 2025).

To test the effect of two or more independent variables on the dependent variable, multiple linear regression analysis is used (Nada et al., 2025; Rimpler et al., 2025; Masteali et al., 2025). Before processing the data in the multiple linear regression analysis test, several hypothesis tests are carried out, namely: 1) T-test (Partial): The t-statistic test shows how much one independent variable (X) contributes to explaining the dependent variable (Y); 2) F Test (Simultaneous): The F statistical test is used to determine whether several independent variables will have a relationship with the dependent variable; 3) Multiple Coefficient of Determination Test (R<sup>2</sup>): The coefficient of determination (also known as R<sup>2</sup>) measures how well the model can explain the variation in the dependent variable.

The respondents of the questionnaire in this study were existing customers and new customers of PDAM Tirtanadi Diski and Sei Agul branches. Existing customers are customers who were already and still members before SPAM Mebidang water was distributed at PDAM Tirtanadi. New customers are customers who joined after SPAM Mebidang water was distributed, namely from April 2024 to April 2025. The independent variables in this study are product quality aspects, namely water color and clarity (X1), water smell and taste (X2), water pressure (X3), Water Supply Availability Time (X4), and Service Quality aspects, namely Water Disruption (X5), Service Speed and New Meter Installation (X6), Appropriate Tariffs (X7), and Tariff Transparency (X8). All methods in this study were processed using the IBM SPSS 30 (Statistical Product and Service Solution) application.

## **Results and Discussion**

This study was conducted by first collecting secondary data, namely the number of existing customers and the number of new customers from April 2024 to April 2025 in the PDAM Tirtanadi Diski and Sei Agul branches. After obtaining the population size, the sample size was determined using the Slovin formula with a margin of error of 10%. After that, primary data was collected, namely a questionnaire on the level of satisfaction and importance to PDAM customers based on the SPAM Mebidang water product quality variable. Before analyzing the level of satisfaction and importance, data testing was carried out, namely validity and reliability tests.

### Long-term Customers of PDAM Tirtanadi Diski Branch

The number of old customers of the Diski Branch as of April 2024 was 41,003 SR. Using the Slovin formula, the sample size was 102 samples. The responses of old customers of the Diski Branch to the water quality of SPAM Mebidang can be seen in the table below.

Table 1. Results of the Questionnaire for Long-Term Customers of PDAM Tirtanadi Diski Branch

No	Statement	MSS	MIS	Total
X1	Water clarity and color that is not cloudy	3.3333	3.5098	-0.1765
X2	Neutral/odorless smell and taste of water	3.6569	3.5784	0.0785
X3	Sufficient water pressure for household needs	3.402	3.5882	-0.1862
X4	Timeliness and availability of water supply	3.4902	3.5294	-0.0392
X5	Minimal disruption to water supply	3.1373	3.4608	-0.3235
X6	PDAM reliability in new connection processes and in responding to customer complaints	3.2157	3.451	-0.2353
X7	The PDAM water tariff is comparable to the quality of water obtained	3.2059	3.5098	-0.3039
X8	Transparency and clarity of PDAM in water bills	3.2843	3.4902	-0.2059

The variable with the lowest gap value is the variable of neutral/odorless water taste and smell, which is 0.0785. This indicates that the quality of water in terms of taste and smell received by customers has met and even slightly exceeded expectations. The variable with the highest negative gap value is the variable of minimal disruption to water supply (X5), which is -0.3235. This shows that water supply disruptions still occur and the performance value is below the importance value.

Based on the CSI calculation results, a value of 83.560% was obtained. This value is in the "81-100" interval, which means that service users are very satisfied with the overall service.

$$\text{Nilai CSI} = \frac{WS_j}{HS} = \frac{334,239}{4} = 83,560\%$$

The results of the analysis method between interests and performance are shown in the Cartesian diagram below.

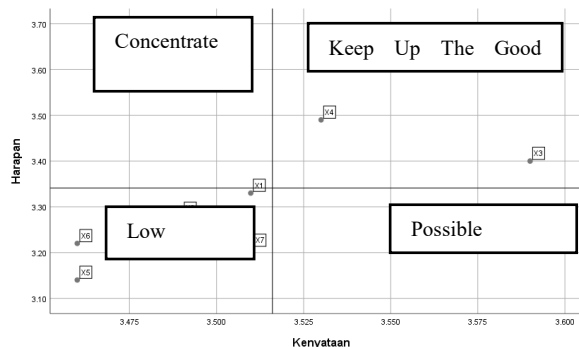


Figure 2. IPA Quadrant for Long-Term Customers of PDAM Tirtanadi Diski Branch

In the Keep Up The Good Work quadrant, there are variables X2 (The water does not have a noticeable smell or taste), X3 (Sufficient pressure ensures that water can flow smoothly throughout the house), and X4 (Consistency of water distribution). In the Low Priority quadrant, there are variables X1 (The water received is still not clear, has color, and appears cloudy), X5 (Frequency and duration of water distribution disruptions), X6 (PDAM service in responding to customer requests is still lacking), X7 (Customers feel that the costs charged are not commensurate with water quality), and X8 (Information on tariffs and billing calculations is conveyed in an unclear and non-transparent manner)

Analysis of the Influence Between Passenger Satisfaction (Y) and Water Product Quality (X1) and Water Service Quality (X2) using the Multiple Regression Analysis method

The t-test results based on the output of X1 on Y show a Tcount of 9.041 > Ttable 1.660, and the output of X2 on Y shows a Tcount of 10.199 > Ttable 1.660, which can be concluded that Water Product Quality and Water Service Quality have an influence on Customer Satisfaction

The F test results for the simultaneous influence of X1 and X2 on Y are 0.000 < 0.10 and the Fcount value is 162.875 > 2.36, which means that Water Product Quality and Water Service Quality simultaneously affect Customer Satisfaction.

The results of the multiple determination coefficient test obtained an R2 value of 0.767, meaning that Water Product Quality and Water Service Quality simultaneously affect Customer Satisfaction by 76.7%.

Table 2. Results of Multiple Regression Analysis for Long-Term Customers of PDAM Tirtanadi Diski Branch

Model	Unstandardized Coefficients		Standardized	t	Sig	
	B	Std. Error	Beta			
1	(Constant)	-1.020	.262		-3.894	.000
	X1	.737	.081	.486	9,041	.000
	X2	.553	.054	.548	10,199	.000

Multiple Linear Regression Equation  $Y = -1.020 + 0.737X1 + 0.553X2 + e$

Based on the data from the multiple regression analysis above, the effect of variable X1 (Water Product Quality) and X2 (Water Service Quality) on variable Y (Satisfaction of Existing Customers of PDAM Tirtanadi Diski Branch) is as follows: A 100% increase in water quality (X1) will increase customer satisfaction by 73.7%, and a 100% increase in service quality (X2) will increase customer satisfaction by 55.3%.

### New Customers of PDAM Tirtanadi Diski Branch

The number of new customers at the Diski Branch from April 2024 to April 2025 is 1033 SR. Using the Slovin formula, the sample size is 91 samples. The responses of new customers at the Diski Branch to the water quality of SPAM Mebidang can be seen in the table below

Table 3. Results of the New Customer Questionnaire for PDAM Tirtanadi Diski Branch

No	Statement	MSS	MIS	Total
X1	Water clarity and color that is not cloudy	3.3297	3.6484	-0.3187
X2	Neutral/odorless smell and taste of water	3.5385	3.6813	-0.1428

X3	Sufficient water pressure for household needs	3.3407	3.6154	-0.2747
X4	Timeliness and availability of water supply	3.3736	3.6154	-0.2418
X5	Minimal disruption to water supply	3.1319	3.5385	-0.4066
X6	PDAM reliability in new connection processes and in responding to customer complaints	3.2747	3.5385	-0.2638
X7	The PDAM water tariff is comparable to the quality of water obtained	3.3187	3.5824	-0.2637
X8	Transparency and clarity of PDAM in water bills	3.4176	3.7802	-0.3626

Based on the analysis of satisfaction and interest in the quality of Mebidang SPAM water, all variables have low negative total scores, indicating that the performance of water quality and service is good but does not yet meet the expectations of new customers of the Diski branch.

To determine the user satisfaction index, the Customer Satisfaction Index (CSI) method was used. Based on the CSI calculation results, a value of 83.5557% was obtained. This value falls within the "81-100" interval, which means that users are very satisfied with the overall service.

$$\text{Nilai CSI} = \frac{WS_j}{HS} = \frac{334,229}{4} = 83,557\%$$

The results of the analysis method between interests and performance are shown in the Cartesian diagram below.

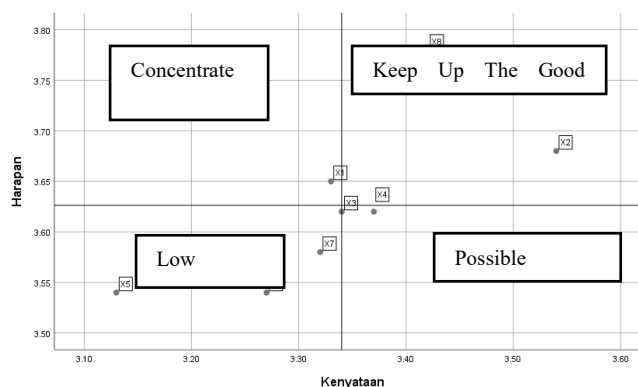


Figure 3. IPA Quadrant for New Customers of PDAM Tirtanadi Diski Branch

In the Keep Up The Good Work quadrant, there are variables X2 (The water does not have a noticeable smell or taste) and X8 (Information on tariffs and billing calculations is not communicated clearly and transparently). In the Possible Overkill quadrant (Excessive Service), there are variables X3 (Sufficient pressure to ensure water flows smoothly throughout the house) and X4 (Consistency of water distribution). In the Low Priority quadrant, there are variables X1 (The water received is still not clear, is colored, and appears cloudy), X5 (Frequency and duration of water distribution disruptions), X6 (PDAM's service in responding to customer requests is still lacking), and X7 (Customers feel that the fees charged are not commensurate with the quality of the water).

Analysis of the Influence Between Passenger Satisfaction (Y) and Water Product Quality (X1) and Water Service Quality (X2) using the Multiple Regression Analysis method

The t-test results based on the output of X1 against Y show a Tcount of 7.937 > Ttable 1.660, and the output of X2 against Y shows a Tcount of 8.294 > Ttable 1.660, which can be concluded that Water Product Quality and Water Service Quality have an influence on Customer Satisfaction.

The F test results for the simultaneous influence of X1 and X2 on Y are 0.000 < 0.10 and the Fcount value is 174.232 > 2.36, which means that Water Product Quality and Water Service Quality simultaneously influence Customer Satisfaction.

The results of the multiple determination coefficient test obtained an R2 value of 0.98, meaning that Water Product Quality and Water Service Quality simultaneously affect Customer Satisfaction by 79.8%.

Table 4. Results of Multiple Regression Analysis for New Customers of PDAM Tirtanadi Diski Branch

Model	Unstandardized Coefficients		Standardized	t	Sig
	B	Std. Error	Beta		
1	(Constant)	-1.090	.251		
	X1	.740	.093	.485	7,937
	X2	.574	.069	.507	8,294

Multiple Linear Regression Equation  $Y = -1.090 + 0.740X1 + 0.574X2 + e$

Based on the data from the multiple regression analysis above, the effect of variable X1 (Water Product Quality) and X2 (Water Service Quality) on the variable Y (New Customer Satisfaction of PDAM Tirtanadi Diski Branch) is as follows: A 100% increase in water quality (X1) will increase customer satisfaction by 74%, and a 100% increase in service quality (X2) will increase customer satisfaction by 57.4%.

### Existing Customers of PDAM Tirtanadi Sei Agul Branch

The number of existing customers of the Sei Agul Branch as of April 2024 is 41,550 SR. Using the Slovin formula, the sample size is 101 samples. The responses of existing customers of the Sei Agul Branch to the water quality of SPAM Mebidang can be seen in the table below.

Table 5 Results of the Questionnaire for Existing Customers of PDAM Tirtanadi Sei Agul Branch

No	Statement	MSS	MIS	Total
X1	Water clarity and color that is not cloudy	3.1373	3.402	-0.2647
X2	Neutral/odorless smell and taste of water	3.4608	3.4804	-0.0196
X3	Sufficient water pressure for household needs	3.3922	3.5588	-0.1666
X4	Timeliness and availability of water supply	3.4608	3.5784	-0.1176
X5	Minimal disruption to water supply	3.3725	3.4804	-0.1079
X6	PDAM reliability in new connection processes and in responding to customer complaints	3.2059	3.3333	-0.1274
X7	The PDAM water tariff is commensurate with the quality of water obtained	3.1765	3.549	-0.3725

X8	Transparency and clarity of PDAM in water bills	3.2745	3.598	-0.3235
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Based on the analysis of satisfaction and interest in the quality of Mebidang SPAM water, all variables have low negative total scores, indicating that performance has not met the expectations of long-time customers of the Sei Agul branch. The variable with the lowest gap value is the variable of neutral/odorless water taste and smell, at -0.019. The variable with the highest negative gap value is the PDAM water tariff value variable, which is comparable to the water quality obtained (X7), at -0.3725. This shows the perception of long-time customers of the Sei Agul branch that the PDAM water tariff value is not yet comparable to the water quality obtained.

To determine the service user satisfaction index, the Customer Satisfaction Index (CSI) method was used. Based on the CSI calculation results, a value of 82.784% was obtained. This value is in the "81-100" interval, which means that service users are very satisfied with the overall service.

$$\text{Nilai CSI} = \frac{WS_j}{HS} = \frac{331784}{4} = 82,784\%$$

The results of the analysis method between interests and performance are displayed in the Cartesian diagram below.

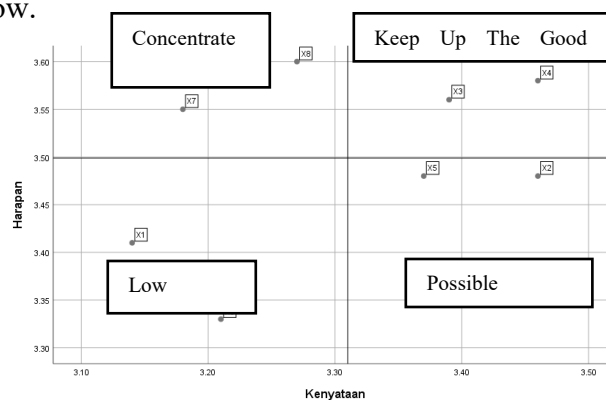


Figure 4. IPA Quadrant for Existing Customers of PDAM Tirtanadi Sei Agul Branch

In the Keep Up The Good Work quadrant, there are variables X3 (Sufficient pressure to ensure water flows smoothly throughout the house) and X4 (Consistency of available water distribution). In the Possible Overkill quadrant, there are variables X2 (Water has no noticeable smell or taste) and X5 (Frequency and duration of water distribution disruptions). In the Low Priority quadrant, there are variables X1 (the water received is still not clear, is colored, and appears cloudy) and X6 (PDAM's service in responding to customer requests is still lacking). In the Concentrate Here quadrant, there are variables X8 (Information on tariffs and billing calculations is not clearly and openly communicated) and X7 (Customers feel that the costs charged are not commensurate with water quality).

Analysis of the Influence Between Passenger Satisfaction (Y) and Water Product Quality (X1) and Water Service Quality (X2) using the Multiple Regression Analysis method.

The t-test results based on the output of X1 on Y show a Tcount of 9.840 > Ttable 1.660, and the output of X2 on Y shows a Tcount of 3.568 > Ttable 1.660, which can be concluded that Water Product Quality and Water Service Quality have an effect on Customer Satisfaction.

The F test results for the simultaneous influence of X1 and X2 on Y are  $0.000 < 0.10$  and the Fcount value is  $121.421 > 2.36$ , which means that Water Product Quality and Water Service Quality simultaneously affect Customer Satisfaction.

The results of the multiple determination coefficient test obtained an R2 value of 0.710, meaning that Water Product Quality and Water Service Quality simultaneously affect Customer Satisfaction by 71%.

Table 6. Results of Multiple Regression Analysis for Long-Term Customers of PDAM Tirtanadi Sei Agul Branch

Model	Unstandardized Coefficients		Standardized	t	Sig	
	B	Std. Error	Beta			
1	(Constant)	-.521	.259		-2.012	.047
	X1	.809	.082	.672	9,840	.000
	X2	.333	.093	.244	3,568	.001

Multiple Linear Regression Equation  $Y = -0.521 + 0.809X1 + 0.333X2 + e$

Based on the data from the multiple regression analysis above, the effect of variable X1 (Water Product Quality) and X2 (Water Service Quality) on variable Y (Satisfaction of Existing Customers of PDAM Tirtanadi Sei Agul Branch) is as follows: A 100% increase in water quality (X1) will increase customer satisfaction by 80.9%, and a 100% increase in service quality (X2) will increase customer satisfaction by 33.3%.

#### New Customers of PDAM Tirtanadi Sei Agul Branch

The number of new customers connected to the Sei Agul Branch from April 2024 to April 2025 is 680SR. Using the Slovin formula, the number of samples is 92. The responses of new customers connected to the Sei Agul branch regarding the water quality of SPAM Mebidang can be seen in the table below.

Table 7. Results of the New Customer Questionnaire for PDAM Tirtanadi Sei Agul Branch

No	Statement	MSS	MIS	Total
X1	Water clarity and color that is not cloudy	3.7065	3.1957	0.5108
X2	Neutral/odorless smell and taste of water	3.75	3.5217	0.2283
X3	Sufficient water pressure for household needs	3.6522	3.0761	0.5761
X4	Timeliness and availability of water supply	3.6848	3.1196	0.5652
X5	Minimal disruption to water supply	3.6196	2.8152	0.8044
X6	Reliability of PDAM in the process of new connections and in responding to customer complaints	3.6413	2.9565	0.6848
X7	The PDAM water tariff is commensurate with the quality of water received	3.6413	3.1196	0.5217
X8	Transparency and clarity of PDAM in water bills	3.8043	3.2609	0.5434

Based on the analysis of satisfaction and importance regarding the water quality of Mebidang SPAM, all variables have positive total scores, indicating that the level of satisfaction/performance is higher than the level of importance of the variables. The water quality of Mebidang SPAM has exceeded customer expectations.

To determine the user satisfaction index, the Customer Satisfaction Index (CSI) method was used. Based on the CSI calculation results, a value of 92.260% was obtained. This value is in the "81-100" interval, which means that users are very satisfied with the overall service.

$$\text{Nilai CSI} = \frac{WS_j}{HS} = \frac{369041}{4} = 92,260\%$$

The results of the analysis method between importance and performance are shown in the Cartesian diagram below.

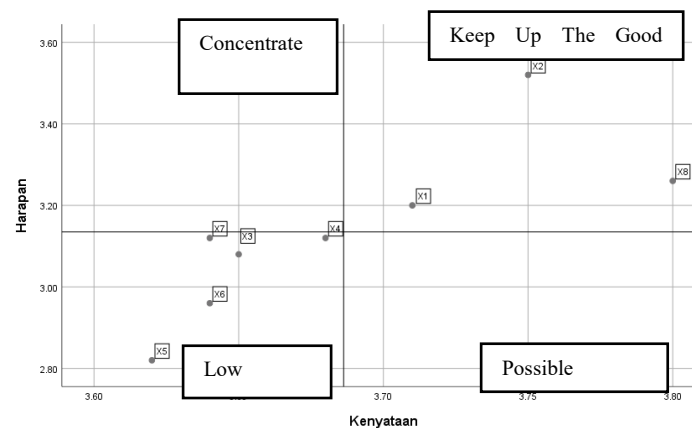


Figure 5. IPA Quadrant for New Customers of PDAM Tirtanadi Sei Agul Branch

In the Keep Up The Good Work quadrant, there are variables X1 (The water received is still not clear, discolored, and appears cloudy), variable X2 (The water does not have a noticeable smell or taste), and X8 (Information on tariffs and billing calculations is conveyed in an unclear and non-transparent manner). In the Low Priority quadrant, there are variables X5 (Frequency and duration of water distribution disruptions), X6 (PDAM's service in responding to customer requests is still lacking), and X7 (Customers feel that the costs charged are not commensurate with the quality of the water), variable X3 (Sufficient pressure to ensure that water can flow smoothly throughout the house), and X4 (Consistency of available water distribution).

Analysis of the Influence Between Passenger Satisfaction (Y) and Water Product Quality (X1) and Water Service Quality (X2) using the Multiple Regression Analysis method

The t-test results based on the output of X1 against Y show a t-calculated value of 12.262 > t-table 1.660, and the output of X2 against Y shows a t-calculated value of 2.259 > t-table 1.660, which can be concluded that Water Product Quality and Water Service Quality have an influence on Customer Satisfaction

The F test results for the simultaneous influence of X1 and X2 on Y are 0.000 < 0.10 and the Fcount value is 119.665 > 2.36, which means that Water Product Quality and Water Service Quality simultaneously affect Customer Satisfaction.

The results of the multiple determination coefficient test obtained an R2 value of 0.729, meaning that Water Product Quality and Water Service Quality simultaneously affect Customer Satisfaction by 72.9%.

Table 8. Results of Multiple Regression Analysis for New Customers of PDAM Tirtanadi Sei Agul Branch

Model	Unstandardized Coefficients		Standardized	t	Sig
	B	Std. Error	Beta		
1 (Constant)	-.122	.286		-.428	.670

	X1	.872	.069	.781	12,622	.000
	X2	.176	.078	.140	2,259	.026

Multiple Linear Regression Equation  $Y = -0.122 + 0.872X1 + 0.176X2 + e$

Based on the data from the multiple regression analysis above, the effect of variable X1 (Water Product Quality) and X2 (Water Service Quality) on variable Y (New Customer Satisfaction of PDAM Tirtanadi Sei Agul Branch) is as follows: A 100% increase in water quality (X1) will increase customer satisfaction by 87.2%, and a 100% increase in service quality (X2) will increase customer satisfaction by 17.6%.

### Conclusion

Based on the results of research on the analysis of water product quality and water services on customer satisfaction at the Diski and Sei Agul branches, it can be concluded that PDAM Tirtanadi customers at the Diski and Sei Agul branches are satisfied with the water products, especially the quality of drinking water sourced from Mebidang (Medan, Binjai, and Deli Serdang). The variable that can be improved at the Diski branch of PDAM Tirtanadi is the variable of water supply disruptions, while for customers of the Sei Agul branch, the variables with the highest priority for improvement are the variable of costs incurred, which are still not commensurate with the quality of water received, and the variable of tariff information and billing calculations, which are not yet clearly and openly communicated. The results show that the variables of Water Product Quality and Water Service Quality have a positive partial and simultaneous effect on influencing the Satisfaction of Existing Customers and New Connections at PDAM Tirtanadi's Diski and Sei Agul branches.

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