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Distribution service performance optimization of PDAM Tirta Taman Bontang City East Kalimantan Province

Aviantara Wahyu Nugraha[a*], M. Ruslin Anwar[a], Eko Andi Suryo[a]

[a] *Civil Engineering Department, Universitas Brawijaya, Malang, 65145, Indonesia*

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ABSTRACT

To achieve the level of service performance from PDAM Tirta Taman Kota Bontang, obtained based on user perceptions of PDAM Taman Tirta obtained from the results of a questionnaire with a Likert scale using the Importance Performance Analysis (IPA) method. From the IPA analysis results, interviews were conducted using the Strength Weakness Opportunities Threats (SWOT) method. The results of the IPA analysis were used in quadrant I, namely service to the registration process (X11), a survey of prospective customer locations (X12), time of survey implementation (X13), Payment orders before installation (X15), Notice the length of the installation process (X15). Registration up to installation (X16), the supplied water meets health standards, attributes (X21), the quality of the supplied water (color, smell, taste) (X22), report to PDAM Tirta Taman if there is a disturbance or it doesn't work smoothly (X33), the duration of handling the damage house connection (X43), customer or prospective customer database of PDAM Tirta Taman (X71). Then the SWOT quadrant matrix with the SO (Strengths-Opportunities) strategy, namely development with IT and social media Periodic pipe rejuvenation to avoid pipe leaks that can affect quality, Providing Customer Service via WhatsApp for service notifications, disruptions, and payment orders, Issuing SOPs new and regular schedule for maintenance., Continue to perform security updates on the database storage system, and use official forms for prospective customers with the interest of installing a new connection.

1. Introduction

Water resources are resources in the form of water that are useful or have the potential to be used by humans. Water has many uses, including its use in agriculture, home industry, recreation, and also other environmental activities. [1] likens the water on earth to a spherical model with a total content of about 332,500,000 cubic miles as much as 72% of the earth's surface is covered by water, but 97% of the water is salty and not good for drinking, among 70% of drinking water is in the form of ice, less than 1% of the world's drinking water is ready for direct use. In fact, there are 6 countries (Brazil, Russia, Canada, Indonesia, China, and Colombia) that have 50% of the world's drinking water supply. Meanwhile, a third of the world's population lives in areas with minimal levels of drinking water supply. Unfrozen fresh water can be found on the ground and in the air [2]. The distribution of water depends on the topographical conditions of the water source and the position of the consumers [3].

Clean water has benefits as a vital need for society and must be available to maintain its survival [4]. In order to obtain clean water needs, good planning, transmission, and distribution are needed [5], this condition depends on the variety of activities/activities of the community [6]. Differences in the use of different water occur due to differences in local conditions which cause non-uniformity of water use, this water use is estimated based on the average daily water requirement (liters/person/day) [7], therefore the central government has established an institution called PDAM through the local government with the aim of exploring the potential of the area, especially clean water which can later contribute to the area itself. In rule [8], the role of PDAM is as regional government-owned business units that provide services and provide public benefits in the field of drinking water.

* Corresponding author
E-mail address: blingbel@student.ub.ac.id (A.W. Nugraha)
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PDAM is really needed by the community, especially in urban areas, to meet the need of clean water that is suitable for consumption. Because groundwater in urban areas is generally polluted. Excessive use of groundwater can lower groundwater levels and seawater intrusion, affecting groundwater quality.

Clean water supply must be carried out by PDAM Tirta Taman to meet the needs of clean water which can be improved by improving the quality of the water sent, increasing the amount of production capacity and also by improving the distribution network system [9]. The city of Bontang is dominated by the sea. Botang City has a land area of 147.8 km (29.70%), while the total area is 497.57 km. The population of Bontang City is around 187,346 people [10]. With a domestic water demand rate of 110 liters/person/day, Bontang City's water needs are at least 20.6 million liters/day or 238.52 liters/second.[11]

The area of Bontang City includes the equator and is influenced by a wet tropical climate with the characteristic of rain occurring throughout the year with an average of 24°-33°C. Water sources for Bontang City can come from groundwater, rivers, and rainwater reservoirs (reservoirs or reservoirs). In the last few decades, groundwater has been used as a mainstay for industrial and part of the community's water sources, the rest use river water and rainfed water. The demand for water in large quantities by industry forces the extraction of groundwater in large quantities due to limited surface water sources. There are three sub-districts in Bontang City, namely West Bontang District, North Bontang District, and South Bontang District. Bontang District is served by clean water from PDAM through piping. However, due to the limited supply of electricity from PLN, the PDAM is often disrupted in water production. This study aims to evaluate the existing condition of the clean water distribution system of PDAM Tirta Taman and increase the level of customer satisfaction of clean water users in the city of Bontang.

2. Materials and methods

2.1 Study location

Bontang City is ± 90 km from the Capital of East Kalimantan Province, Samarinda. Geographically as explained in Figure 1, the City of Bontang is located at coordinates 117°23' - 117°38' East Longitude and 0°01' - 0°12' North Latitude, with administrative boundaries as follows:

- To the north: Bay Pandan District, East Kutai Regency
- To the east: Makassar Strait
- To the south: Marangkayu District, Kutai Kartanegara Regency
- West side: Bay Pandan District, East Kutai Regency

Bontang City has an area of 497.57 km ^{2} , most of which is water area, where the land area is 147.8 km ^{2} or 29.70% of the total area. Bontang City is divided into 3 sub-districts and 15 sub-districts.

2.2 The types of data

The types of data in this study are primary data and secondary data. The explanation of the two data is as follows

- Primary Data, is data generated to meet the needs of the investigation being handled. Primary data sources were obtained through interviews, and data collection through questionnaires to the parties involved in this study.
- Secondary Data, is data that is used for other purposes, not with the aim of solving the problem being handled at this time. Secondary data were obtained from related agency documents and other publications containing information to support this research.

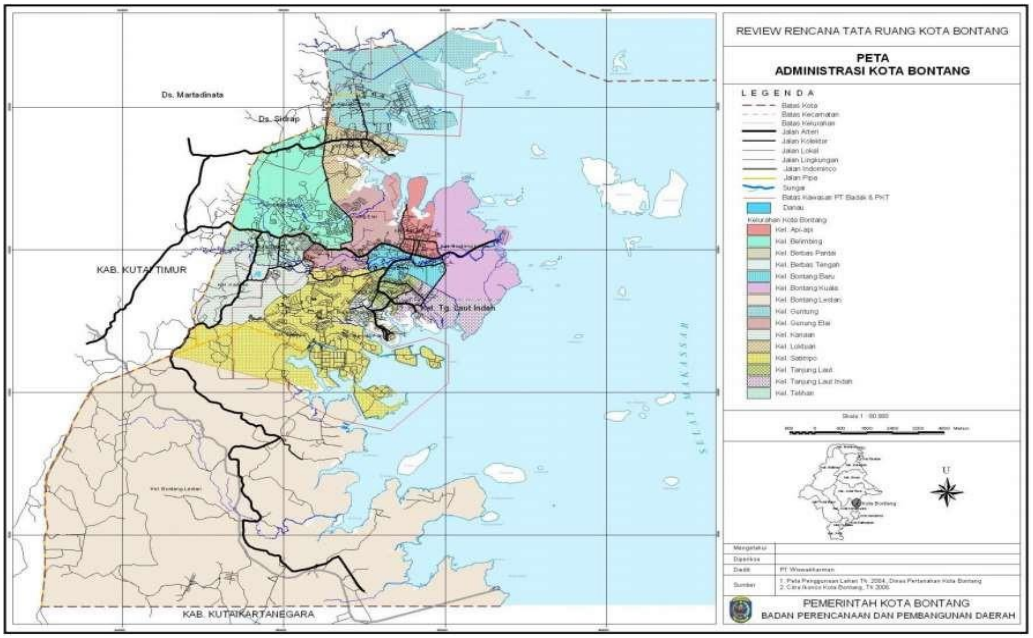

Fig. 1. Study Location.

2.3 Data collection

Data collection from various sources was carried out by means of interviews and questionnaires.

- Interview
  The interview method is carried out by asking questions to relevant *Stakeholders* in accordance with the guidelines that have been made before.
- Questionnaire
  After the interviews were held, the researchers also provided several questions regarding the quality of special services for the City of Bontang. Several questions are specifically for respondents who are directly related to the quality of service provided by PDAM Tirta Taman.
- Study of Literature
  Theories come from literature related to the research subject, besides that the literature study is carried out by analyzing several existing regulations.

2.4 Variable measurement technique

The measurement scale was used to ask respondents from customers with the perception approach and views of 2 (two) groups of respondents involved in the Likert scale [12]. Respondents will choose one of the responses and provide reasons and efforts if any, with a scale of the order of levels (levels) as follows:

- Very Important (SP) : 5
- Important (F) : 4
- Important enough (CP) : 3
- Not Important (TP) : 2
- Very Not Important (STP) : 1

2.5 Validity and reliability test

2.5.1 Validity test

Validity test is the ability of a scale to measure what must be measured, a measurement scale is said to be valid if it can reveal the variable data that has been studied correctly. To test the validity of the measuring instrument, first look for the correlation value between the parts of the measuring instrument as a whole by correlating each measuring instrument item with a total score which is the sum of each item's score, with the following formula [13]:

$$r = \frac{n(\sum XY) - (\sum X)(\sum Y)}{\sqrt{(n\sum X^2 - (\sum X)^2)(n\sum Y^2 - (\sum Y)^2)}} \quad (1)$$

With: r = correlation of item scores with total scores; X = item score;Y = total score (all items); n = number of samples. If the correlation coefficient shows the number 0.3, it can be said that the instrument is valid. The significant level used is 5% (0.05).

2.5.2 Reliability test

Test reliability is the degree to which an error-free measurement cannot provide consistent results. Reliability indicates the consistency and stability of the results of a certain measurement scale, with the following formula [13]:

$$a = \frac{k}{k-1}\left(1 - \frac{\sum {\sigma_1}^2}{\sum \sigma y^2}\right) \quad (2)$$

With : α = reliability coefficient; α^2 = score variable for question i with i = 1 ,2,3 ,...; σy^2 = total score variable; k = number of questions (items), with the question score variable i using the formula [13]:

$$\sigma i^2 = \frac{\sum xi^2 - \frac{(\sum xi^2)}{n}}{n} \quad (3)$$

With: σi^2 = score variable for question i, with i = 1,2,3,...; xi = question score to i; n = number of samples/respondents Instrument reliability testing, using *Alpha Cronbach.* Instrument reliability is considered good enough to be used as a research questionnaire if it has a reliability coefficient ≥0.6.

2.6 Data analysis

2.6.1 Descriptive analysis

Descriptive analysis, this analysis is used to describe the characteristics of the respondents and the distribution items from each variable with a descriptive is the numbers and both in the number of respondents are in percentage figures.

2.6.2 Importance Performance Analysis (IPA)

The data used for analysis is the result of a questionnaire on public perception of the performance of a service based on predetermined assessment indicators. In this analysis, the variable x shows the level of performance satisfaction and for the variable "Y" shows the level of importance of performance [13]. Meanwhile, the level of conformity is used to compare the score of the level of satisfaction and the score of the level of importance. The formula used is [13]:

$$Tki = \frac{Xi}{Yi} x100\% \quad (4)$$

With: Tki = Respondent's conformity satisfaction level; Xi = performance appraisal score (satisfaction); Yi = importance rating score

The average score of the level of satisfaction will be placed on the Cartesian diagram with the horizontal axis (x axis) which is the average score of the satisfaction assessment $\bar{X}$, and the vertical axis (y axis) is the average score of the interest $\bar{Y}$assessment. The Cartesian diagram is divided into 4 quadrants with intersections axis value average level of assessment satisfaction $\bar{X}$, and the average value of the level of interest $\bar{Y}$with the following formula [13]:

$$\bar{X} = \frac{\sum X_i}{n} \text{ and } \bar{Y} = \frac{\sum Y_i}{n} \quad (5)$$

With: $\bar{X}$ = average score of implementation performance level (satisfaction); $\bar{Y}$ = average score of importance level; n = number of respondents (the subjects who answered the question). Furthermore, mapping is carried out into the Cartesian diagram to see the position of each element using the following formula [13]:

$$\bar{X} = \frac{\sum \bar{X}}{k} \text{ and } \bar{Y} = \frac{\sum \bar{Y}}{k} \quad (6)$$

With K is the number of elements that affect people's satisfaction.

2.6.3 SWOT (Strength, Weakness, Opportunity, and Threat)

SWOT analysis is a model that can direct and act as a catalyst in the strategic planning process. This framework is used to build and operate or implement information from both internal and external situation analysis. Internally, this model positions the company's strengths and weaknesses, while externally, this analysis identifies the opportunities and threats faced by the company [14]. The SWOT matrix is prepared based on the identification results of the company's internal and external factors, including the company's strengths and weaknesses as well as the opportunities and threats faced by the company. The integration of the company's internal and external factors in the SWOT matrix will produce several alternative strategies that can be used by the company. The SWOT matrix can produce four sets of possible alternative strategies, namely SO strategy, ST strategy, WO strategy and WT strategy.

3. Result and discussion

3.1 Research variables and indicators

Research variables are used with the aim that the process of identification and analysis carried out in this study will later become more focused and directed. Determination of the research variables used for the preparation of satisfaction and interest surveys. The variables used in this study were the interest variable (Y) and the satisfaction variable (X). The indicators used in the two variables in this study are as shown in Table 1.

Table 1.
Indicators used in research [15].

Indicator	Question Items
Procedures or requirements to become a customer of PDAM Tirta Taman Kota Bontang (X1)	Services for the registration process (X11) Survey the location of prospective customers (X12) Survey implementation time (X13) Payment orders before installation (X14) Notification of processing time (X15) Registration up to installation (X16)
Quality of clean water produced by PDAM Tirta Taman Kota Bontang (X2)	The water supplied meets health standards (X21) Quality of water supplied (color, smell, taste) (X22) Water smoothness (X23) Water needs and adequacy of each house (X24)
Availability/continuity of clean water throughout the day (X3)	Water is supplied for 24 hours (X31) Continuous water flow (X32) Report to PDAM Tirta Taman if there is a disturbance or not smooth (X33) Significance change after report of disturbance (X34)
Addressing problems and complaints submitted by PDAM Tirta Taman customers (X4)	The length of time for handling after a disturbance report (X41) Length of time handling damage or pipe leaks (X42) The length of time to handle damage to house connections (X43) If the cost of damage is borne by the consumer, is it appropriate? with PDAM Tirta Taman regulations (X44)
Tariff system and other fees charged to customers (X5)	Existing tariffs burden customers with continuity which is not maximized (X51) PDAM tariff increase with service quality improvement during 24 hours (X52) Total tariff increase for PDAM Tirta Taman (X53) The difference in tariffs between households and offices and industry (X54)
The condition of piping facilities is more towards guaranteeing piping infrastructure which is prone to damage because it can disrupt service (X6)	Type of network pipe installed (X61) Standard pipe specifications (X62) Pipe strength/durability (X63) Pipe strength guarantee/certificate (X64) New pipe connection with old pipe (X65) Maintain pipe pressure at start, middle and end of service (X66)
Services for PDAM Tirta Taman Kota Bontang officers (services for technical and administrative purposes) (X7)	PDAM Tirta Taman customer or prospective customer data base (X71) New customer connection installation must be authorized (X72) Provision of customer usage record cards (X73) Improvement of water quality when it is cloudy (X74) There are payment counters in several areas so as not to focus on one region (X75)

3.2 Test the validity and reliability of the existing condition of PDAM Tirta Taman Kota Bontang

3.2.1 Validity test

The data validity test was carried out to measure whether the questionnaire that was distributed to the respondents was valid or not. Validity tests can be done with the SPSS application and can also be done manually. In this study uses the *Corrected Correlation technique* using the SPSS application program version 21. The following are the steps in testing the validity of the data.

- Determine the hypothesis
  H0 = invalid questionnaire statement items.
  H1 = valid questionnaire statement items.
- Determine the r table value
  Determination of the value of r table can be seen in Table 2 Attribute Validity Test. The value of r table with level α = 5% and *degree of freedom* (df) = N-2 = 100 -2 = 98, then the value of r table = 0.197.
- Look up the calculated value of r
  The calculation of r count is obtained after processing the data with the help of SPSS 25.0 software for Windows. The value of r count can be seen from the output of SPSS 25.0 on the *corrected* item-total value. If r count ≥ r table then H0 is rejected (Valid). To see the results of the comparison of values with all the questionnaire questions that have been calculated using the SPSS 25.0 for Windows software, it can be seen in Table 2.

The results of the validity test used 100 questionnaires using *SPSS* 25.0 *for windows software*. It can be seen that the r_{count} is greater than the r_{table}, so it can be concluded that the statements in the questionnaire are valid.

3.2.2 Reliability test

The reliability test technique used is analysis using *Cronbach's Alpha* with the help *of SPSS* 16.0 *for windows software*. The reliability of the instrument is considered good enough to be used as a research questionnaire if it has a reliability coefficient of ≥ 0.6 [16]. The results of the calculations on the SPSS 16.0 *software for windows* can be seen from the *Cronbach's Alpha value.*

The results of interest and satisfaction test calculations were declared reliable because the interest has scored 0.947 and the satisfaction has scored 0.939.

3.3 Average level of interest and customer satisfaction level of PDAM Tirta Taman Kota Bontang

Before determining the value of interest and the value of consumer satisfaction in the Cartesian diagram, first find the average of each attribute from the value of interest and customer satisfaction value (See Table 3).

3.4 Existing performance of PDAM Tirta Taman Kota Bontang

Then from the results of the score of the level of interest and satisfaction of the research variables, the research continued to the Cartesian diagram which is determined from the intersection of two perpendicular lines $\bar{X}$) and ($\bar{Y}$) (See Figure 2).

Table 2
Attribute validity test table.

Items	R Compute Interest	R Compute Satisfaction	R table	Status
X1	0.625	0.678	0.197	Valid
X2	0.631	0.663	0.197	Valid
X3	0.658	0.598	0.197	Valid
X4	0.618	0.612	0.197	Valid
X5	0.507	0.695	0.197	Valid
X6	0.610	0.667	0.197	Valid
X7	0.524	0.645	0.197	Valid
X8	0.602	0.631	0.197	Valid
X9	0.613	0.674	0.197	Valid
X10	0.683	0.587	0.197	Valid
X11	0.560	0.526	0.197	Valid
X12	0.583	0.599	0.197	Valid
X13	0.633	0.676	0.197	Valid
X14	0.528	0.561	0.197	Valid
X15	0.657	0.503	0.197	Valid
X16	0.619	0.532	0.197	Valid
X17	0.646	0.734	0.197	Valid
X18	0.564	0.689	0.197	Valid
X19	0.578	0.497	0.197	Valid
X20	0.581	0.499	0.197	Valid
X21	0.448	0.459	0.197	Valid
X22	0.627	0.658	0.197	Valid
X23	0.676	0.476	0.197	Valid
X24	0.631	0.441	0.197	Valid
X25	0.711	0.439	0.197	Valid
X26	0.616	0.433	0.197	Valid
X27	0.676	0.510	0.197	Valid
X28	0.776	0.574	0.197	Valid
X29	0.688	0.631	0.197	Valid
X30	0.604	0.524	0.197	Valid
X31	0697	0.612	0.197	Valid
X32	0.583	0.529	0.197	Valid
X33	0.576	0.736	0.197	Valid

Table 3
The average value of each attribute for handling problems and complaints submitted by PDAM Taman customers.

Indicator	Attribute	Average value	
		Interest Level	Satisfaction level
Procedures or requirements to become a customer of PDAM Tirta Taman Kota Bontang (X_1)	Services for the registration process (X11)	4.55	4.07
	Survey the location of prospective customers (X12)	4.55	4.14
	Survey implementation time (X13)	4.57	4.20
	Payment orders before installation (X14)	4.52	4.28
	Notification of processing time (X15)	4.54	4.18
	Registration up to installation (X16)	4.50	4.22
Quality of clean water produced by PDAM Tirta Taman Kota Bontang (X_2)	The water supplied meets health standards (X21)	4.54	3.83
	Quality of water supplied (color, smell, taste) (X22)	4.49	3.91
	Water smoothness (X23)	4.77	3.65
	Water needs and adequacy of each house (X24)	4.55	3.58
Availability/continuity of clean water throughout the day (X_3)	Water is supplied for 24 hours (X31)	4.09	3.48
	Continuous water flow (X32)	4.37	3.45
	Report to PDAM Tirta Taman if there is a disturbance or it doesn't work smoothly (X33)	4.51	3.94
	Significance change after report of disturbance (X34)	4.22	3.46
Handling of problems and complaints submitted by customers of PDAM Tirta Taman (X_4)	The length of time for handling after a disturbance report (X41)	4.74	3.46
	Length of time handling damage or pipe leaks (X42)	4.53	3.49
	The length of time to handle damage to house connections (X43)	4.55	4.27
	If damage costs are borne by consumers, is it in accordance with PDAM Tirta Taman regulations (X44)	4.08	4.08
Tariff system and other fees charged to customers (X_5)	The existing tariffs are burdensome for customers who have not maximized continuity (X51)	4.09	3.44
	PDAM tariff increase with service quality improvement for 24 hours (X52)	4.37	3.41
	Total tariff increase for PDAM Tirta Taman (X53)	4.23	3.14
	The difference in tariffs between households and offices and industry (X54)	4.34	4.29
The condition of piping facilities is more towards guaranteeing piping infrastructure which is prone to damage because it can disrupt services (X_6)	Type of network pipe installed (X61)	4.72	3.50
	Standard pipe specifications (X62)	4.70	3.61
	Pipe strength/durability (X63)	4.79	3.50
	Pipe strength guarantee/certificate (X64)	4.34	3.88
	New pipe connection with old pipe (X65)	4.72	3.51
	Maintain pipe pressure at start, middle and end of service (X66)	4.79	3.57
Services for PDAM Tirta Taman Kota Bontang officers (services for technical and administrative purposes) (X_7)	PDAM Tirta Taman customer or prospective customer data base (X71)	4.65	3.88
	New customer connection installation must be authorized (X72)	4.56	3.88
	Provision of customer usage record cards (X73)	4.28	4.01
	Improvement of water quality when it is cloudy (X74)	4.51	3.95
	There are payment counters in several areas so that they are not focused on one area (X75)	4.12	4.27

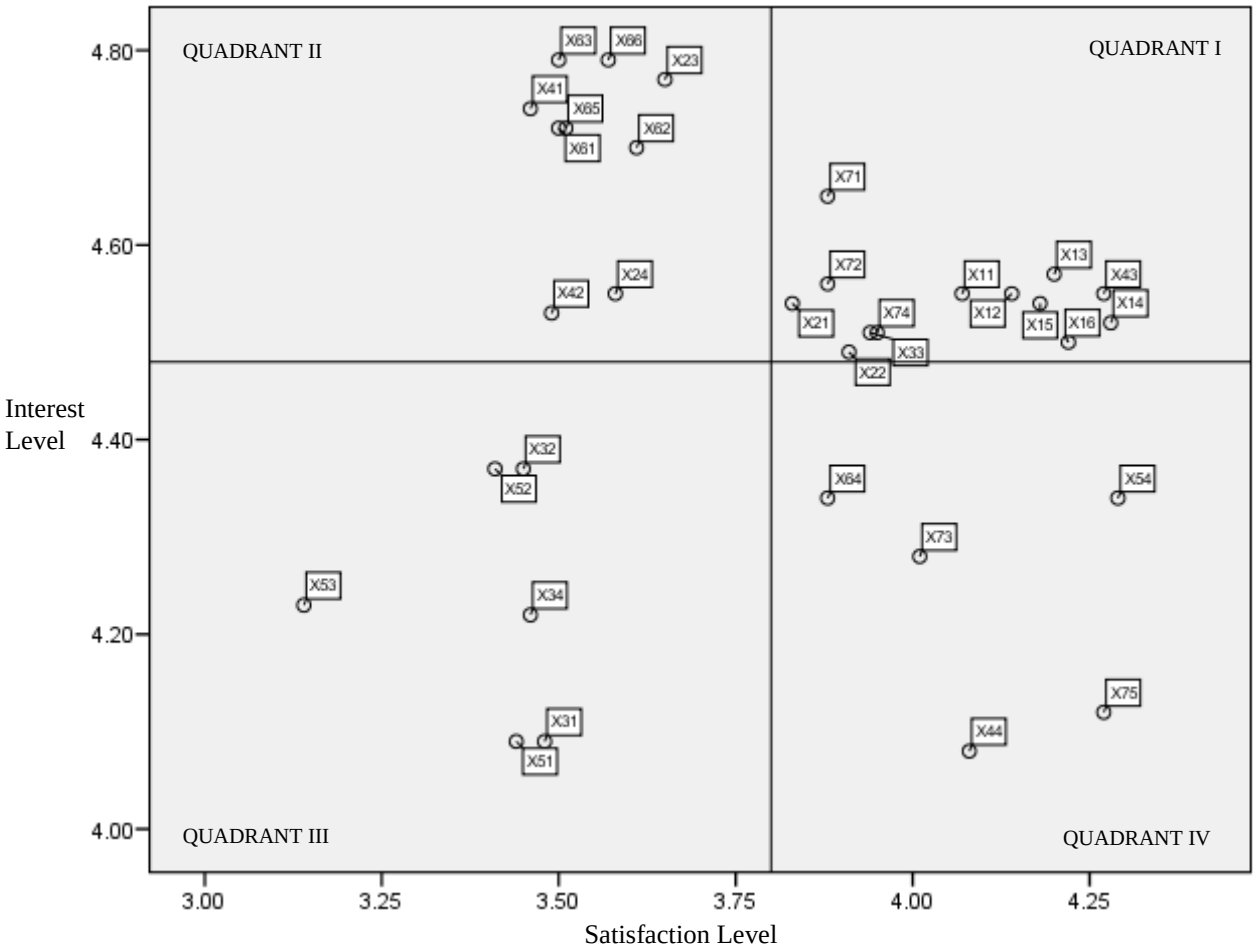

Fig. 2. Cartesian diagram.

The following describes the service attributes shown in Figure 2. Quadrant I shows the indicators/attributes that affect passenger terminal user satisfaction and their handling needs to be prioritized by the company; because these indicators/attributes are considered very important by users, while the level of implementation is still not satisfying to service users.

- Service to the registration process (X11)
- Survey the location of prospective customers (X12)
- Survey implementation time (X13)
- Payment order before installation (X14)
- Notification of the duration of the installation process (X15)
- Registration up to installation (X16)
- The water supplied meets health standards; attributes (X21)
- Quality of water supplied (color, smell, taste) with attributes (X22)
- Report to PDAM Tirta Taman if there is a disturbance or it doesn't work smoothly (X33)
- The length of time to handle damage to house connections (X43)
- PDAM Tirta Taman customer or prospective customer database (X71)

Quadrant II describes the indicators/attributes that influence passenger terminal user satisfaction and their handling needs to be maintained by the company; because these indicators/attributes are implemented in accordance with the interests and expectations of users, so as to satisfy service users).

- Water smoothness (X23)
- Water needs and adequacy of each house (X24)
- The length of time for handling after a disturbance report (X41)
- Length of time handling damage or pipe leaks (X42)
- Type of network pipe installed (X61)
- Pipe specification standard (X62)
- Pipe strength/resistance (X63)
- New pipe connection with old pipe (X65)

Quadrant III explains the indicators/attributes that influence passenger terminal user satisfaction and in this quadrant are considered to be less important to users, while the quality of their implementation is still ordinary or sufficient.

- Aspects of the availability/continuity of clean water throughout the day (X31)
- Continuous water flow (X32)
- Significant change after report of disturbance (X34)
- The existing rates are burdensome to customers with not optimal continuity (X51)
- PDAM tariff increase with service quality improvement for 24 hours (X52)
- Total tariff increase for PDAM Tirta Taman (X53)

Quadrant IV shows indicators/attributes that affect the satisfaction of passenger terminal users and in this quadrant is considered to still tend to be excessive in its implementation, this is because service users consider this indicator not too important but its implementation is done properly

- If damage costs are borne by consumers, is it in accordance with PDAM Tirta Taman regulations (X44)
- Provision of customer usage record cards symbolized in attributes (X73)
- There are payment counters in several areas so that they are not focused on one area (X75)

For the preparation of service recommendations, taken. Quadrant I, namely "Maintain Achievement" in which this quadrant has the highest score level both in terms of the level of customer interest and the level of performance to proceed to SWOT analysis.

3.5 Recommended strategy for improvement of PDAM Tirta Taman Kota Bontang Service

The SWOT matrix is prepared based on the identification results of the company's internal and external factors, including the company's strengths and weaknesses as well as the opportunities and threats faced by the company. The integration of the company's internal and external factors in the SWOT matrix will produce several alternative strategies that can be used by the company. The SWOT matrix can produce four sets of possible alternative strategies, namely SO strategy, ST strategy, WO strategy, and WT strategy. The strategy generated from the SWOT matrix

3.5.1 S – O Strategy (Strengths – Opportunity)

SO strategy is a strategy that uses the strengths of the company to take advantage of existing opportunities. The resulting SO strategy is:

- Development with IT and with social media
- Rejuvenate pipes periodically to avoid pipe leaks that can affect quality.
- Provide *Customer Service* via *WhatsApp* for service notifications, interruptions, and payment orders.
- Issuing new SOP and routine schedule for *maintenance.*
- Continuing to perform *security updates on the database* storage system.
- Use of official blanks for prospective customers with the interest of installing a new connection.

This strategy is carried out by using the internal strength of PDAM Tirta Taman Kota Bontang and taking advantage of existing opportunities.

3.5.2 W – O (Weakness – Opportunity) strategy

The WO strategy is a strategy that overcomes or minimizes the company's weaknesses to take advantage of opportunities that exist outside the company. The resulting WO strategy is:

- Expand clean water production enough to exceed customer demand
- Issuing SOPs for supervision and control of disturbance report handling.
- Issuing new SOPs and routine schedules for pipe *maintenance* and pipe rejuvenation with appropriate specifications.
- Recalculating the principle of fair tariffs (which people are eligible for subsidies).

This strategy is carried out to overcome or minimize the weaknesses of PDAM Tirta Taman Kota Bontang.

3.5.3 S – T Strategy (Strengths – Threats)

ST strategy is a strategy that uses the company's strengths to overcome the threats faced by the company. The resulting ST strategy is:

- Facilitate registration of new customers through the new install menu on the PDAM Tirta Taman Bontang *web access web*
- Protecting the upstream area of raw water sources by way of outreach to the community and proposals for law enforcement to the competent authorities
- Customer complaints via *WhatsApp* during operational business hours
- Implementation of payment at the beginning after a survey of problems at the customer's home is aimed at facilitating the handling of house connections
- Use of vendors and selection of competent human resources.
- Issuance of an SPK (Work Order) by PDAM Tirta Taman Kota Bontang as proof that the installation of the connection is official.

This strategy was taken based on the strengths and threats faced by PDAM Tirta Taman Kota Bontang.

3.5.4 W-T Strategy (Weakness-Threat)

WT strategy is a strategy that minimizes the company's internal weaknesses and avoids threats. The resulting WT strategy is:

- Pipe rejuvenation and routine control to prevent leaks
- Utilization of regional operational funds to carry out emergency programs such as pipe leaks
- Replacement of several pipes that are more than 20 years old using regional operational funds.
- Re-adjustment of tariffs for several types of customers who carry out business activities.

This strategy was taken based on the strengths and threats faced by PDAM Tirta Taman Kota Bontang.

3.6 *Taking the recommendation strategy of PDAM Tirta Taman Kota Bontang*

From the SWOT analysis, interviews were then conducted with stakeholders, namely PDAM Tirta Taman Kota Bontang, based on the alternative strategies given above it was found that the most interesting strategies for companies to carry out were:

- Rejuvenate pipes periodically to avoid pipe leaks that can affect quality.
- Expand clean water production enough to exceed customer demand
- Issuing SOPs for supervision and control of disturbance report handling.
- Issuing new SOPs and routine schedules for pipe maintenance and pipe rejuvenation with appropriate specifications.
- Recalculating the principle of fair tariffs (which people are eligible for subsidies)
- Utilization of regional operational funds to carry out emergency programs such as pipe leaks
- Replacement of several pipes that are more than 20 years old using regional operational funds.

Quality of drinking water service for customer satisfaction because the existence of the strategy above will make it easier for PDAM Tirta Taman Kota Bontang to carry out the following strategy, this will support an increase in better service quality.

4. Conclusion

Based on the results of research that has been carried out at PDAM Tirta Taman Kota Bontang, the following conclusions are obtained:

- The existing condition of PDAM Tirta Taman clean water distribution system management is the value of consumer satisfaction with the quality of services provided by PDAM Tirta Taman is 3.80 and the value of consumer interest in the quality of services provided by PDAM Tirta Taman is 4.48.
- Factors that are the top priority in the management of the clean water distribution system that needs to be considered by PDAM Tirta Taman to run optimally are the smooth running of water, the need and adequacy of water for each house, the duration of handling after reports of disturbances, the duration of handling damage or pipe leaks, type of network pipe installed, standard pipe specifications, pipe strength/durability, the connection of new pipes with old pipes, and maintaining pipe pressure at the beginning, middle, and end of service.
- Efforts to improve clean water supply system services by PDAM Tirta Taman are a new network construction plan, an increase in the number of customers addition of WTP points in the new area plan, an increase in clean water production to enough to exceed customer demand, company efficiency to anticipate fluctuating global economic conditions, managing raw water from other spring sources, for example sourced from river water with the WTP method, and finding investors for development in new regions.

References

[1] US Geological Survey; Cadmium statistics and information. 2013. http://minerals.usgs.gov/minerals/pubs/commodity/cadmium/index.html-myb. Accessed October 2021.
[2] Haq, Bariqul and Ali Masduqi. "Sistem Distribusi Air Siap Minum PDAM Kota Malang." Jurnal Teknik Pomits 3(2): 182-87. 2014.
[3] H. S. Peavy, & D. R. Rowe, Environmental Engineering. Singapore: McGraw-Hill. 1985.
[4] A. Lolon, "Kajian Penilaian Kinerja PDAM Kota Palangka Raya" (PDAM Performance Assessment Study of Palangka Raya City), *Jurnal Pembangunan Wilayah dan Kota*, vol. 13, no. 3, pp. 269-285, 2017.
[5] J. Izquierdo, M. Herrera, I. Montalvo, and R. Pérez-García, "Agent-Based Division of WaterDistribution Systems into District Metered Areas." *ICSOFT 2009 - 4th International Conference on Software and Data Technologies, Proceedings* 2, pp. 83–90, 2009.
[6] W. A. Sianipar and H. Wahyono, "Kinerja Pelayanan Publik PDAM Kabupaten Mempawah Berdasarkan Kepuasan Pelanggan" (PDAM Mempawah Regency Public Service Performance Based on Customer Satisfaction). *Jurnal Pembangunan Wilayah dan Kota*, vol. 14, no. 3, pp. 213–224, 2018.
[7] A. Romdloni. "Evaluasi *District Meter Area* (DMA) Zona Mojolangu Dalam Penurunan *Non Revenue Water* (NRW) PERUMDA Air Minum Tugu Tirta Kota Malang." Yntax Literate: Jurnal Ilmiah Indonesia p-ISSN:2541-0849. e-ISSN: 2548-1398. Vol. 7, No. 9, September 2022.
[8] F. Lisna, "Analisis Kandungan Sisa Klor Dan Escherichia Coli Dalam Jaringan Distribusi Di District Meter Area (DMA) 2 Zona Bukit Surungan Perusahaan Umum Daerah (PERUMDA) Air Minum Kota Padang Panjang" (Analysis of Residual Chlorine and Escherichia Coli Content in Distribution Networks in District Meter Area (DMA) 2 Zone Bukit Surungan Regional Public Company (PERUMDA) Drinking Water in Padang Panjang City). B. S. thesis. Environmental Engineering, Univ. Andalas, Padang, Indonesia. 2018.
[9] Y. Heryanto. "Kualitas Pelayanan dalam Meningkatkan Kepuasan Pelanggan pada Perusahaan Daerah Air Minum (PDAM) Tirta Darma Ayu Kabupaten Indramayu (Studi Kasus di Kelurahan Margadadi)" (Service Quality in Improving Customer Satisfaction at The Regional Drinking Water Company (PDAM) Tirta Darma Ayu, Indramayu Regency (Case Study in Margadadi Village), *Jurnal Ilmiah Indonesia*, vol. 3, no. 10, October, 2018.
[10] Central Bureau of Statistics. Bontang in Figures 2021. http://bontang.bps.go.id. Accessed September 11, 2022.
[11] Z. A. Syahidah and B . Suprapti. "Identifikasi Kebocoran Pipa PDAM Kota Malang Dengan Metode Step Test" (Identification of Pipe Leaks in PDAM Malang City Using the Step Test Method), *Jurnal Infrastruktur Direktorat Jenderal Cipta Karya*, vol. 02, no. 02, 2016.
[12] J. A. Martilla and J. C. James, "Importance-Performance Analysis," *The Journal of Marketing*, vol. 41, no. 1, pp. 77-79, 1977.
[13] Sugiyono, "Research Methods", Bandung: CV Alfa Beta. 2015.
[14] A. Riyanto, "Implikasi Kualitas Pelayanan Dalam Meningkatkan Kepuasan Pelanggan Pada PDAM Cibadak Sukabumi" (Implications of Service Quality in Improving Customer Satisfaction at PDAM Cibadak Sukabumi), *Jurnal Ecodemica*, vol. 2, no. 1, April, 2018.
[15] Rambe, Nurhaminah, Rajagukguk, Kiki Pratama, & Habib, Mustafa. Dampak Pandemi Covid-19 Terhadap Bisnis Pendidikan Non-Formal dan Strategi Beradaptasi di Era New Normal. Jurnal Sintaksis, 3(2), 34-43. 2021.
[16] Regulation of the Minister of State Apparatus Empowerment and Bureaucratic Reform of the Republic of Indonesia No. 14 of 2017 concerning Guidelines for Compiling a Public Satisfaction Survey on the Implementation of Public Services.