

# Customer Satisfaction Analysis of PDAM Surya Sembada Water with Customer Satisfaction Index, Importance Performance Analysis, and Kano Methods

Melin Dwi Safitri<sup>1</sup>, Ardi Kurniawan<sup>2</sup>, Sediono<sup>3</sup>, Suliyanto<sup>4</sup>, Elly Ana<sup>5</sup>

<sup>1,2,3,4,5</sup>Statistics Study Program, Departement of Mathematics, Airlangga University  
Surabaya, Indonesia

<sup>1</sup>melin.dwi.safitri-2018@fst.unair.ac.id

Corresponding author: <sup>2</sup>ardi-k@fst.unair.ac.id, <sup>3</sup>sediono101@gmail.com, <sup>4</sup>yanfit@yahoo.com, <sup>5</sup>elly-a@fst.unair.ac.id

**Abstract:** Recorded by Dinkominfo Surabaya during 2021, PDAM Surya Sembada received many complaints from customers. The service performance of PDAM Surya Sembada is still considered poor in dealing with issues of quality and distribution of water to the people of Surabaya. Some complaints are still very often experienced by the community related to poor water quality; odor and cloudiness, unstable duration and discharge of running water, and water accessibility that has not fully met the needs. The PDAM is also considered to have not provided quick and responsive action in handling public complaints. This problem can be minimized if PDAM Surya Sembada continues to innovate to improve its services, one of which is by knowing the level of customer satisfaction with the accessibility, quality, and quantity of water distributed. Therefore, in this study the authors want to analyze the priority of improvement strategy according to customer satisfaction of PDAM Surya Sembada water using the Customer Satisfaction Index (CSI), Importance Performance Analysis (IPA), and Kano methods. The level of customer satisfaction for water from PDAM Surya Sembada is obtained from the results of the CSI calculation of 75.064%. This value is in the value interval of 66-80 (%) which means that the customer is satisfied with PDAM Surya Sembada water. Furthermore, the IPA and Kano analysis were carried out on the dimensions of Water Quality, Water Continuity, Water Pressure and Quantity, Integrity of Pipe Network, Cost of Water, Professionalism, and Information which consisted of 24 variables in 124 respondents. The results of the IPA analysis show that 7 variables are in quadrant I, 5 variables are in quadrant II, 9 variables are in quadrant III, and 3 variables are in quadrant IV. Based on Kano's analysis, there are 5 variables included in the One dimensional (O) category, 1 variable including the Attractive category (A), and 18 variables including the Must be category (M). Furthermore, the IPA-Kano integration is carried out to determine strategic priorities that must be carried out by the PDAM, namely maintaining performance on the variable Smooth flow at minimum hours of night use (20.00 – 04.00), PDAM staff are friendly and responsive, Ease of listing new installations, and Information related to water outages.

**Keywords**—Customer Satisfaction; PDAM Surya Sembada Kota Surabaya; Customer Satisfaction Index; Importance Performance Analysis; Kano; IPA-Kano Integration

## 1. INTRODUCTION

Water is one of the most important elements for living things on earth, because water is needed by all living things; humans, plants, and animals as supporting sources of energy and various other needs. For humans the need for water is absolute, almost all human activities require water, the need for water for humans is not only for the purposes of daily life such as eating and drinking but also as a means of transportation, power generation, agriculture, animal husbandry and many other things [1]. Again the importance of water, so that the need for raw water is a top concern and priority. According to the Indonesian Directorate General of Human Rights (2012), Indonesia has approved a United Nations (UN) resolution on the Right to Water, in which the government must carry out the obligation to take steps to ensure that every Indonesian citizen has access to clean water and sanitation [2]. The right to water for Indonesian citizens is guaranteed in the 1945 Constitution of the Republic of Indonesia Article 33 Paragraph (3) and Law Number 7 of 2004 concerning Water Resources.

PDAM Surya Sembada in an effort to fulfill raw water also first reviews several aspects of the management system design. The design of a water supply and distribution system from raw water sources must meet the requirements of quality, quantity, and continuity to the community. However, along with the rapid development of settlements and the development of the industrial sector, water pollution is increasing so that it affects the decline in water quality due to organic pollutants from domestic waste and industrial waste. The population continues to grow but the water supply is relatively the same, which also results in a decrease in the quantity of water distributed to the community. These things cause PDAM Surya Sembada to often receive criticism and complaints about water problems from customers.

Recorded by Dinkominfo Surabaya during 2021, PDAM Surya Sembada received many complaints from customers [3]. The service performance of PDAM Surya Sembada is still considered poor in dealing with issues of quality and distribution of water to the people of Surabaya. Some complaints are still very often experienced by the community

related to poor water quality; odor and cloudiness, unstable duration and discharge of running water, and water accessibility that has not fully met the needs. The PDAM is also considered to have not provided quick and responsive action in handling public complaints. This problem can be minimized if PDAM Surya Sembada continues to innovate to improve its services, one of which is by knowing the level of customer satisfaction with the accessibility, quality, and quantity of water distributed.

In this study, we will discuss and measure the level of water customers satisfaction of PDAM Surya Sembada. There are advantages to the CSI method, namely efficiency in measuring universal satisfaction. The IPA method can display product/service attributes that need to be improved or reduced in the form of quadrants. The Kano method can divide service priority levels into functional categories and dysfunctional categories. The Customer Satisfaction Index, Importance Performance Analysis and Kano methods used in this study are expected to provide a thorough analysis of customer satisfaction levels and identify service attributes that are priority improvements and features which is less than optimal and provide suggestions for improving the water quality of PDAM Surya Sembada.

The purpose of this research:

- a. Analyzing the level of customer satisfaction with PDAM Surya Sembada water in Surabaya City based on the Customer Satisfaction Index (CSI) method.
- b. Identify what attributes/indicators need to be improved and maintained by PDAM Surya Sembada Surabaya City based on the Importance Performance Analysis (IPA) method.
- c. Classify the water service attributes/indicators of PDAM Surya Sembada Surabaya City based on categories in the Kano method.
- d. Analyzing attributes/indicators of service dimensions that need priority to be improved and maintained by integrating the Importance Performance Analysis (IPA) and Kano methods.

## 2. RESEARCH METHOD

### a. Method and Data Source

The method used in this study is the Customer Satisfaction Index, Importance Performance Analysis, and the Kano method, while the data source is primary data obtained by conducting a direct survey of water customers of PDAM Surya Sembada.

### b. Research Variable

The variables used in this research are water customers satisfaction variables of PDAM Surya Sembada.

**Table 1:** Satisfaction Variables

Attributes		Dimension
A1	Water clarity	Water Quality

A2	Smell of Water	
A3	Water Taste	
B1	Smooth water flow during peak hours in the morning (05.00 AM - 08.00 AM)	Water Continuity
B2	Smooth water flow at peak hour afternoon (03.00 PM - 07.00 PM)	
B3	Smooth water flow at the minimum hour of use during the day (09.00 AM – 03.00 PM)	
B4	Smooth water flow at minimum hours of night use (08.00 PM – 04.00 AM)	
C1	Smooth water flow on the faucet near the water meter	Water Pressure and Quantity
C2	Smooth water flow to the kitchen or bathroom	
C3	Sufficient daily water needs	
D1	There is no pipe network leakage in the house	Integrity of Pipe Network
D2	No leakage of pipe network outside the house	
E1	Affordable water price	Cost of Water
E2	The suitability of the cost of the bill with the quality obtained	
E3	The cost of increasing the meter in the next grade is reasonable or appropriate	
F1	Complaints and complaints service at the call center	Professionalism
F2	PDAM staff are friendly and responsive	
F3	PDAM staff ensure that there are no significant cost overruns every month	
F4	Ease of registering a new install	
F5	Implementation of recording water meters every month or in the same period on a regular basis	
G1	Information regarding water outage	Information
G2	Information regarding pipe repair or network normalization	
G3	Information regarding rising water bills	
G4	Information regarding new install discount	

c. Step of the Research

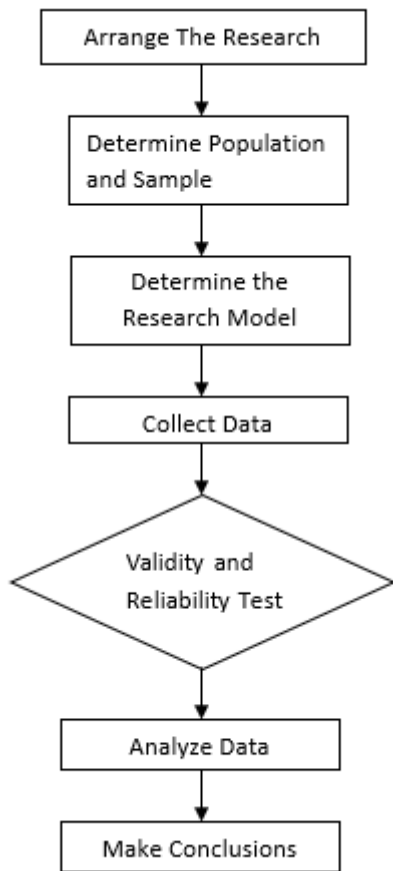


Fig. 1. Step of the Research

3. RESULT AND DISCUSSION

a. Validity Test

Validity test was done to acquire the validity of statement attributes of the questionnaire. It can be valid if the data can represent the research variable data that will be measured [4]. The hypothesis used in the validity test can be seen as follows:

$H_0 : \rho = 0$  (Invalid question items)

$H_1 : \rho \neq 0$  (Valid question items)

The results of the validity test in Table 2.

Table 2: Validity Test

Attributes	P-Value	Conclusion
Water Quality	A1	0.000 Valid
	A2	0.000 Valid
	A3	0.000 Valid
Water Continuity	B1	0.000 Valid
	B2	0.000 Valid
	B3	0.000 Valid

Water Pressure and Quantity	B4	0.000	Valid
	C1	0.000	Valid
	C2	0.000	Valid
Integrity of Pipe Network	C3	0.000	Valid
	D1	0.000	Valid
Cost of Water	D2	0.000	Valid
	E1	0.000	Valid
	E2	0.000	Valid
Professionalism	E3	0.000	Valid
	F1	0.000	Valid
	F2	0.000	Valid
	F3	0.000	Valid
	F4	0.000	Valid
Information	F5	0.000	Valid
	G1	0.000	Valid
	G2	0.000	Valid
	G3	0.000	Valid
	G4	0.000	Valid

Based on the table above, all of the variables have P-Value smaller than  $\alpha = 0.05$ , which means REJECT  $H_0$ . So it can be concluded that all the questions on the questionnaire are valid. They can measure what is desired and can reveal data from the variables appropriately.

b. Reliability Test

The reliability test is used to determine the consistency of the measuring instrument, whether the measuring device used is reliable and remains consistent if the measurement is repeated [5]. High and low reliability is indicated by a number called the reliability coefficient. The SPSS program provides facilities for measuring reliability with the Cronbach Alpha ( $\alpha$ ) statistical test.

The results of the reliability test on all component variables in every dimension are presented in the following table:

Table 3: Reliability Test

Dimension	Cronbach's Alpha	Conclusion
Water Quality	0.826	Very High Reliability
Water Continuity	0.870	Very High Reliability
Water Pressure and Quantity	0.830	Very High Reliability

Integrity of Pipe Network	0.896	Very High Reliability
Cost of Water	0.767	High Reliability
Professionalism	0.840	Very High Reliability
Information	0.835	Very High Reliability

Based on the table above, it can be concluded that the dimensions of Water Quality, Water Continuity, Water Pressure and Quantity, Integrity of Pipe Network, Professionalism, and Information have very high reliability with Cronbach's Alpha value is more than 0.8. While the Cost of Water dimension has high reliability, Cronbach's Alpha values obtained between 0.6 to 0.8. This means that respondent answers to a question is consistent and stable over time.

c. Customer Satisfaction Index

The customer satisfaction index or Customer Satisfaction Index (CSI) is a measurement of the overall level of customer satisfaction by comparing the performance of services or products with customer needs in obtaining services [6].

1. Mean Importance Score (MIS)

$$MIS_j = \frac{\sum_{i=1}^n Y_{ij}}{n}; i = 1,2, \dots, 124; j = 1,2, \dots, 24$$

$$MIS_1 = \frac{\sum_{i=1}^{124} Y_{1i}}{124}; i = 1,2, \dots, 124; j = 1,2, \dots, 24$$

$$MIS_1 = \frac{4.6 + \dots + 4.6}{125} = 4.652$$

2. Weight Factors (WF)

$$WF_j = \frac{MIS_j}{\sum_{r=1}^p MIS_r} \times 100\%; p = 1,2, \dots, 24$$

$$WF_1 = \frac{MIS_1}{\sum_{j=1}^{24} MIS_j} \times 100$$

$$WF_1 = \frac{4.61}{108.70} \times 100\% = 4.24$$

3. Mean Satisfaction Score (MSS)

$$MSS_j = \frac{\sum_{i=1}^n X_{ij}}{n}; i = 1,2, \dots, 124; j = 1,2, \dots, 24$$

$$MSS_1 = \frac{\sum_{i=1}^{124} X_{1i}}{124} = \frac{4.0 + \dots + 3.2}{124} = 3.70$$

4. Weight Score (WS)

$$WS_j = WF_j \times MSS_j; j = 1,2, \dots, 24$$

$$WS_1 = WF_1 \times MSS_1$$

$$WS_1 = 4.24 \times 3.70 = 15.69$$

Table 4: Customer Satisfaction Index (CSI)

Attribute	Mean Importance Score (MIS <sub>j</sub> )	Weight Factor (WF <sub>j</sub> )	Mean Satisfaction Score (MSS <sub>j</sub> )	Weight Score (WS <sub>j</sub> )
A1	4.61	4.24	3.70	15.69
A2	4.68	4.31	4.03	17.33
A3	4.60	4.23	4.12	17.43

Attributes	Mean Importance Score (MIS <sub>j</sub> )	Weight Factor (WF <sub>j</sub> )	Mean Satisfaction Score (MSS <sub>j</sub> )	Weight Score (WS <sub>j</sub> )
B1	4.50	4.14	3.53	14.59
B2	4.49	4.13	3.43	14.18
B3	4.54	4.18	3.52	14.68
B4	4.62	4.25	4.29	18.22
C1	4.57	4.20	3.74	15.70
⋮	⋮	⋮	⋮	⋮
G2	4.46	4.10	3.63	14.88
G3	4.42	4.07	3.06	12.46
G4	4.46	4.10	3.73	15.32
Total	108.70	100.00	90.00	375.32

$$CSI = \frac{\sum_{j=1}^p WS_j}{High Scale} \times 100\% = \frac{375.32}{5} = 75.064\%$$

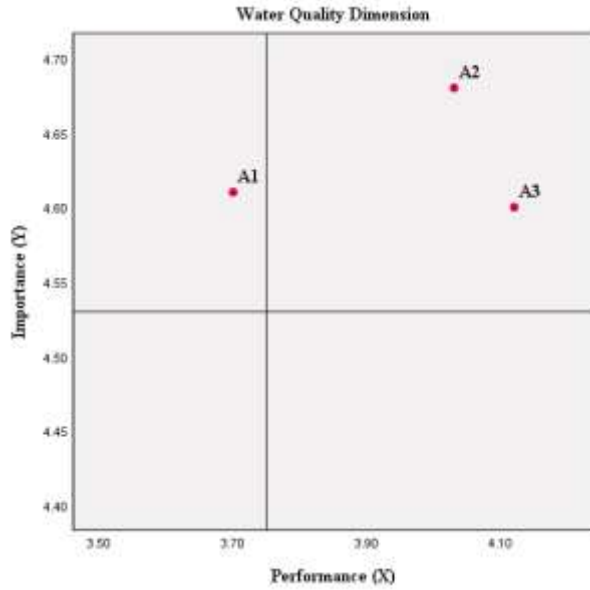
Based on the results of the CSI value obtained a value 75.064%. This value is in the "66 – 80 (%)" interval, which means that PDAM Surya Sembada water customers are overall satisfied.

d. Importance Performance Analysis

Importance-Performance Analysis (IPA) was first introduced by Martilla and James in 1977 in their article entitled "Importance Performance Analysis" in the Journal of Marketing [7]. Importance Performance Analysis (IPA) is used to compare consumer ratings between importance and performance.

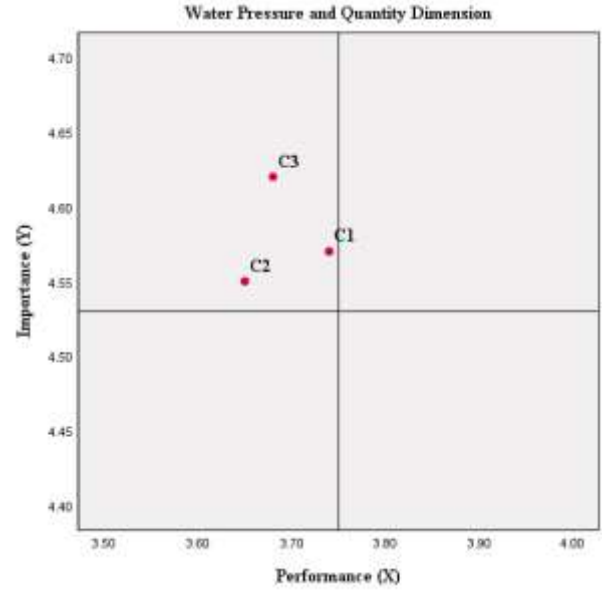


Fig. 2. Importance Performance Analysis (IPA) of Seven Dimensions



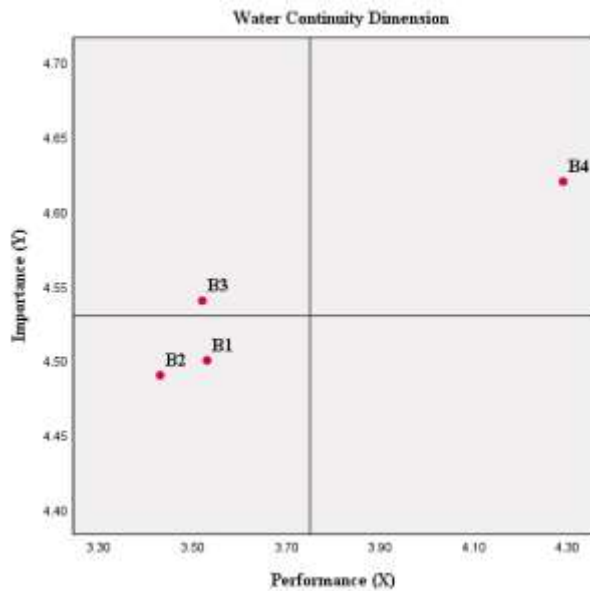
**Fig. 3.** Importance Performance Analysis (IPA) of Water Quality Dimension

Based on Figure 3, the variables included in quadrant I which are superior services that need to be maintained are A2 and A3. In quadrant II which is a high-priority and needs improvement is A1.



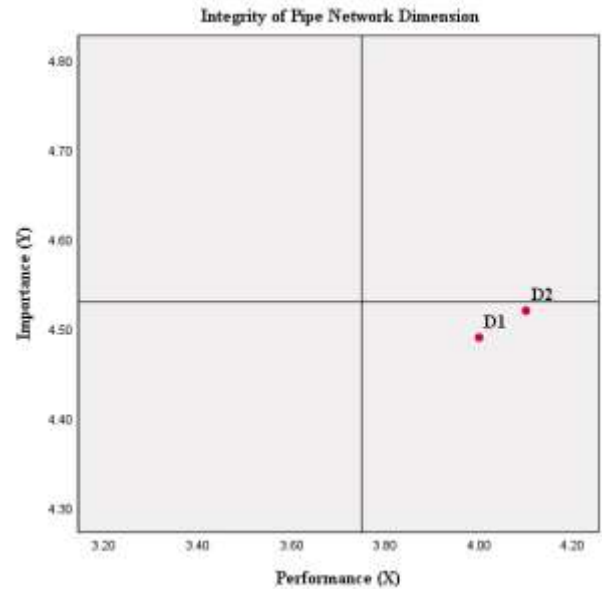
**Fig. 5.** Importance Performance Analysis (IPA) of Water Pressure and Quantity Dimension

Based on Figure 5, the variable that is included in quadrant II which is a superior service so it needs to be maintained are C1, C2, and C3.



**Fig. 4.** Importance Performance Analysis (IPA) of Water Continuity Dimension

Based on Figure 4 the variables included in quadrant I which is superior services so that they need to be maintained is B4. In quadrant II, high priority and needs improvement is B3. In quadrant III, which is a service that the PDAM Surya Sembada does not pay attention and service quality is low are in B1 and B2.



**Fig. 6.** Importance Performance Analysis (IPA) of Integrity of Pipe Network Dimension

Based on Figure 6, the variables included in quadrant IV there are elements of service that are considered less important but in fact, satisfactory service are D1 and D2.

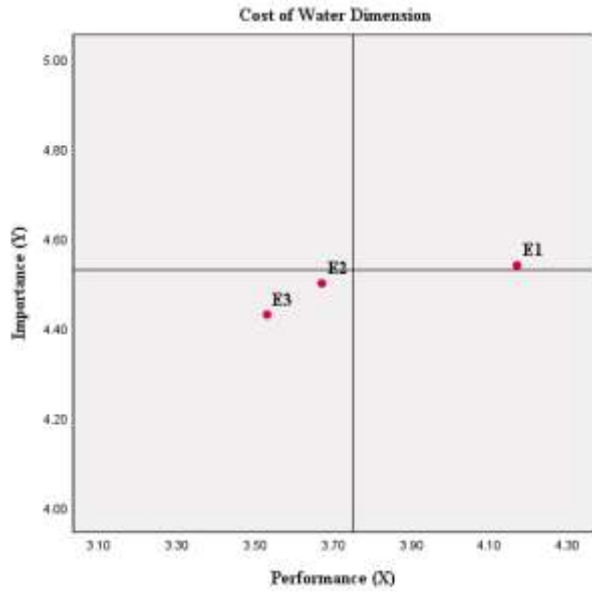


Fig. 7. Importance Performance Analysis (IPA) of Cost of Water Dimension

Based on Figure 7, the variables included in quadrant I which are superior services that need to be maintained is E1. In the low priority quadrant III, the service element is not paid attention to by PDAM Surya Sembada customers and the quality of service is also low are in E2 and E3.

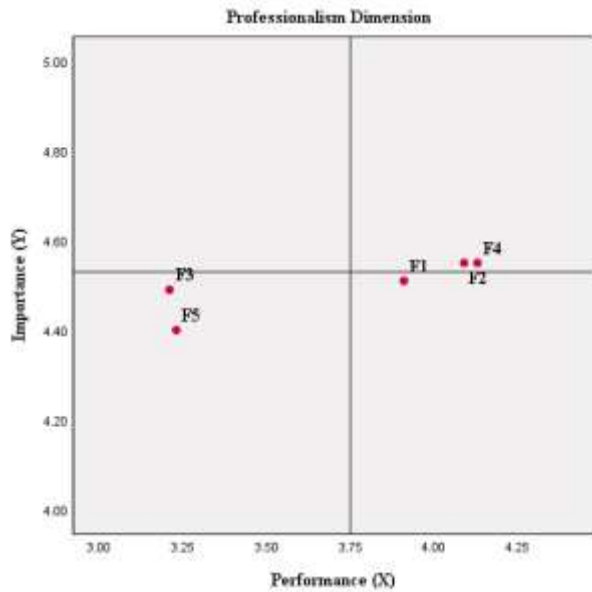


Fig. 8. Importance Performance Analysis (IPA) of Professionalism Dimension

Based on Figure 8, the variables included in quadrant I which are superior services that need to be maintained are F2 and F4. In the low priority quadrant III, the service element is not paid attention to by PDAM Surya Sembada customers and the quality of service is also low are in F3 and F5. In

quadrant IV, there are elements of service that are considered less important but in fact, satisfactory service is F1.

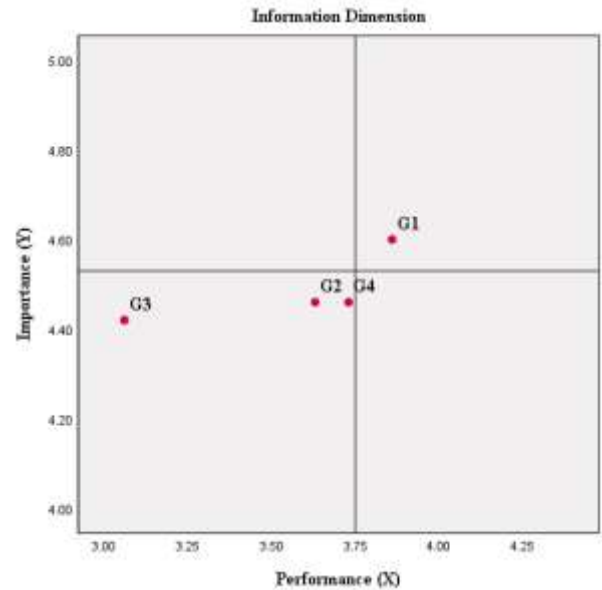


Fig. 9. Importance Performance Analysis (IPA) of Information Dimension

Based on Figure 9, the variables included in quadrant I which are superior services that need to be maintained is G1. In the low priority quadrant III, the service element is not paid attention to by PDAM Surya Sembada customers and the quality of service is also low are in G2, G3, and G4.

e. Kano Method

The Kano method is a method that aims to categorize attributes of a product or service based on the ability of the product/service to provide satisfaction to customers or service users. Based on Kano's analysis, the following results were obtained:

Table 5: Kano

Cod e	O	A	M	I	R	Q	O+A+ M	I+R+ Q	Kan o
A1	48	15	75	0	0	0	124	0	M
A2	63	19	59	1	0	0	123	1	O
A3	67	0	54	3	0	0	121	3	O
B1	30	0	87	6	0	1	117	7	M
B2	31	27	73	13	0	1	110	14	M
B3	39	47	67	14	0	0	110	14	M
B4	31	65	85	2	0	0	122	2	M



C1	3 8	3 1	8 1	2 0	0 0	122	2	M
C2	2 8	0 3	9 3	2 0	0 1	121	3	M
C3	4 3	1 4	7 4	6 0	0 0	118	6	M
D1	2 5	0 8	8 8	1 1	0 0	113	11	M
D2	3 3	1 7	7 3	1 0	0 0	111	13	M
E1	7 0	9 4	4 4	0 1	0 0	123	1	O
E2	2 7	1 5	9 5	1 0	0 0	123	1	M
E3	3 2	1 3	8 3	7 0	0 1	116	8	M
F1	5 9	1 7	5 7	7 0	0 0	117	7	O
F2	2 8	7 3	7 6	1 0	0 0	108	16	M
F3	3 6	2 0	8 0	6 0	0 0	118	6	M
F4	3 5	3 1	7 5	1 0	0 0	109	15	M
F5	6 2	3 8	5 8	0 0	0 1	123	1	O
G1	3 7	1 0	7 6	0 0	0 1	123	1	M
G2	4 2	5 7	7 7	0 0	0 0	124	0	M
G3	2 8	2 9	8 9	5 0	0 0	119	5	M
G4	2 1	5 5	4 7	1 0	0 0	123	1	A

From the results of calculations using the Kano method, it is found that attributes A2, A3, E1, F1, and F5 are included in the One Dimensional (O) category, which indicates that the increase in customer satisfaction increases proportionally when this variable is increased. On the other hand, satisfaction will decrease if the service on this variable decreases.

Meanwhile, the G4 variable is included in the Attractive (A) category, where customer satisfaction increases if the performance of the variable increases, but customer satisfaction will not decrease if the performance of the variable decreases.

The other variables from the Table 5 are in the Must Be (M) category, which is a basic need if this variable can be met, then customer do not increase their satisfaction. On the other hand, because consumers consider this category to be appropriate, then the fulfillment of this category will not increase customer satisfaction. However, if this variable is not sufficient to meet basic needs, customers will be dissatisfied.

#### f. Integration of IPA and Kano

IPA-Kano integration is used to complete the shortcomings of each method. The integration of the IPA-Kano method can formulate strategic priorities for the development of each service indicator. In addition, the IPA-Kano method can provide the right strategic decisions as well as firm and avoid wrong decisions [8].

**Table 6:** IPA-Kano Integration

Code	Kano	IPA	Strategy Priority
A1	Must be	II	Performance Improvement
A2	One dimensional	I	Maintain Performance
A3	One dimensional	I	Maintain Performance
B1	Must be	III	Performance Improvement
B2	Must be	III	Performance Improvement
B3	Must be	II	Performance Improvement
B4	Must be	I	Maintain Performance
C1	Must be	II	Performance Improvement
C2	Must be	II	Performance Improvement
C3	Must be	II	Performance Improvement
D1	Must be	IV	Maintain Performance
D2	Must be	IV	Maintain Performance
E1	One dimensional	I	Maintain Performance
E2	Must be	III	Performance Improvement
E3	Must be	III	Performance Improvement
F1	One dimensional	IV	Maintain Performance
F2	Must be	I	Maintain Performance
F3	Must be	III	Performance Improvement
F4	Must be	I	Maintain Performance
F5	One dimensional	III	Performance Improvement
G1	Must be	I	Maintain Performance
G2	Must be	III	Performance Improvement
G3	Must be	III	Performance Improvement

G4	Attractive	III	Performance Improvement
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Based on the results of the IPA-Kano Integration in the table above, the order of priority strategies that must be carried out by the PDAM Surya Sembada is as follows:

1. Maintain performance on attributes B4, F2, F4, and G1.
2.
  - a. Improve performance on attributes A1, B3, C1, C2, and C3.
  - b. Improve performance on attributes B1, B2, E2, E3, F3, G2, and G3.
3.
  - a. Maintain performance on attributes D1, D2, A2, A3, and E1.
  - b. Improve performance on attributes F5 and F4.
4. Maintain performance on attribute F1.

#### 4. CONCLUSION

Based on research on PDAM Surya Sembada water customers, it can be concluded as follows:

1. The level of customer satisfaction of PDAM Surya Sembada water is based on the calculation of the Customer Satisfaction Index (CSI) of 75.064% which indicates that PDAM Surya Sembada water customers are satisfied.
2. Based on the results of the Importance Performance Analysis (IPA) that must be carried out by PDAM Surya Sembada, Surabaya City are as follows.
  - a. Attributes included in quadrant I, among others, A2, A3, B4, E1, F2, F4, and G1, which means these attributes are superior variables so that their performance needs to be maintained so as not to disappoint customers.
  - b. Attributes included in quadrant II, among others, A1, B3, C1, C2, and C3, which indicate that these attributes are a top priority for performance improvement, because the performance provided is less than optimal in meeting customer expectations.
  - c. Attributes included in quadrant III include B1, B2, E2, E3, F3, F5, G2, G3, and G4. These attributes are considered less important by customers and in fact the performance is not too special or ordinary. Improving the performance of attributes included in this quadrant can be reconsidered because its effect on the benefits felt by customers is very small.
  - d. Attributes included in quadrant IV, among others, D1, D2, and F1, which means that the performance of all attributes in this quadrant is considered inadequate by the customer, but in fact these attributes have satisfied the customer. The company should not focus too much on the attributes included in this quadrant so that the company does not allocate too many related resources.
3. Based on the analysis using Kano method, it can be concluded that:
  - a. Attributes A2, A3, F1, and F5 are included in the One dimensional (O) category which indicates that the increase in customer satisfaction increases proportionally if the performance of these attributes is

improved. Conversely, customer satisfaction will decrease if the performance of these attributes decreases.

- b. Attribute G4 is included in the Attractive (A) category where customer satisfaction increases if the performance of the attribute increases, but customer satisfaction will not decrease if the performance of the attribute decreases.
  - c. Other attributes are included in the Must be (M) category which indicates that if the performance of these attributes is constant or normal then customer satisfaction is also normal. However, if the performance is low, then customer satisfaction will decrease. So the performance on these attributes must run properly.
4. Based on the results of the integration between Importance Performance Analysis (IPA) and Kano, the main strategic priorities that must be carried out by the PDAM Surya Sembada are:
    - a. Maintain performance on attributes A2, A3, B4, D1, D2, E1, F1, F2, F4, and G1.
    - b. Improve performance on attributes A1, B1, B2, B3, C1, C2, C3, E2, E3, F3, F5, G2, G3, and G4.

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