MEASURING E-SERVICE QUALITY & WEBQUAL 4.0 IN ICMS THROUGH KANO METHOD & IMPORTANCE-PERFORMANCE ANALYSIS FOR DEVELOPMENT STRATEGIES

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Abstract. This research focuses on the Palm Oil Company (POC), operating in Indonesia's palm oil industry, and its implementation of the Integrated Calibration Management System (ICMS) application. The study aims to analyze the quality of the ICMS application and propose alternative solutions based on the quality evaluation. POC utilizes sensors to measure production parameters crucial for product quality, and the ICMS application facilitates the calibration process through functions like documentation, scheduling, and result calculations. However, after eight years of implementation, the application continues to receive complaints, prompting the need for evaluation and improvement. The research employs E-service quality (E-Servqual) and WebQual methods to determine variables and uses Importance Performance Analysis (IPA) and KANO methods to identify priority attributes requiring improvement. The findings suggest that 19 out of 23 attributes need improvement, while 13 should be maintained. The study provides specific attributes in need of improvement or maintenance, highlighting areas such as Privacy (X2.2), Usability Quality (X3.2 and X3.5), Responsiveness (X1.1), and Service Interaction Quality (X5.2 & X5.5) as requiring improvement and Usability Quality (X3.3 & X3.6), Information Quality (X4.1, X4.2, X4.3, X4.4, X4.5 and X4.6), Service Interaction Quality (X5.3, X5.7, and X5.1), Responsiveness (X1.2), and Usability Quality (X3.1) as requiring excellent performance maintenance.

Keywords: Importance Performance Analysis, WebQual, KANO, E-Servqual

1 Introduction

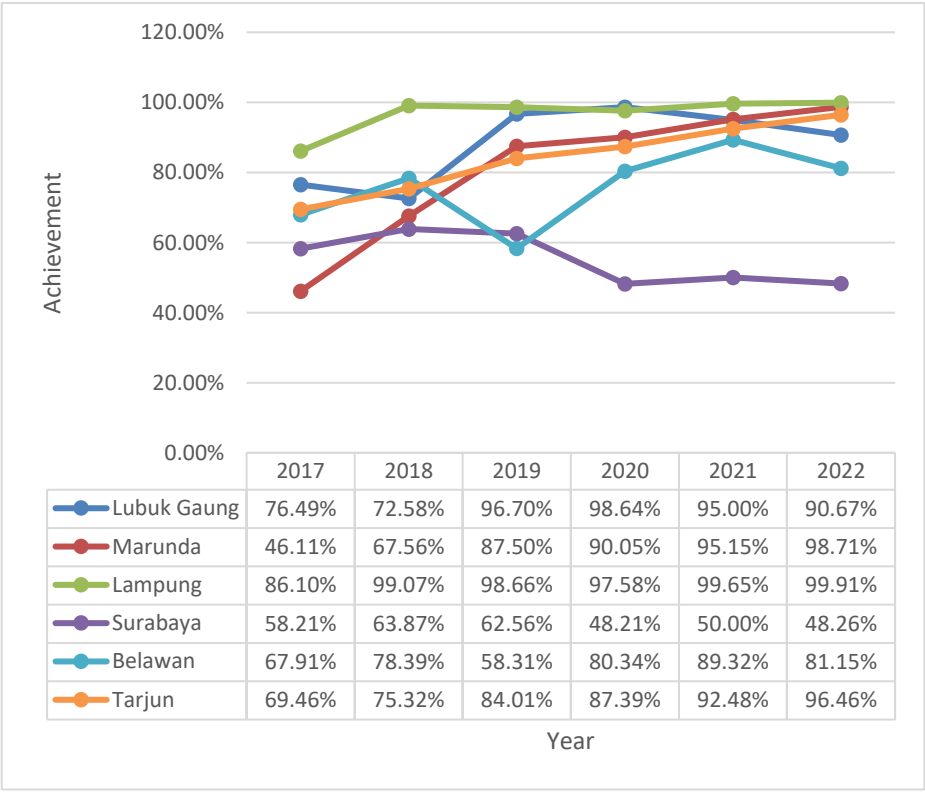
POC is one of the companies operating in the palm oil industry producing and selling various palm oil derivatives. In the process of making a product, several essential parameters have a role in developing and improving the production process. These

M. Hartono et al. (eds.), *Proceedings of the 4th International Conference on Informatics, Technology and Engineering 2023 (InCITE 2023)*, Atlantis Highlights in Engineering 21,
https://doi.org/10.2991/978-94-6463-288-0_4

parameters need to be monitored and controlled to ensure that the quality produced is following the appropriate quality. How to monitor all essentials parameter? That role has been replaced by sensors, where the use of sensors in industrial manufacturing makes it easier for humans to work [1].

To ensure that the sensor still has good readings, it is necessary to calibrate where calibration allows determining whether there are indications of deviations from measuring instruments from the measurement value compared to the standard value of the measuring instrument for measurement uncertainty [2]. In this case, the procedure is yearly calibration. In addition, measurement traceability is a requirement or something that the organization considers an important part of providing confidence in the validity of measurement results [3]. Along with digital transformation, POC started implementing information technology to manage all calibration procedures for visibility, documentation, and calculation in calibration procedures. That is called Integrated Calibration Management System (ICMS).

After implementing ICMS, POC still struggles with conformity to 100% calibration achievement. Fig. 1 shows that the calibration in the last 6 years is under 100% achievement.



	2017	2018	2019	2020	2021	2022
Lubuk Gaung	76.49%	72.58%	96.70%	98.64%	95.00%	90.67%
Marunda	46.11%	67.56%	87.50%	90.05%	95.15%	98.71%
Lampung	86.10%	99.07%	98.66%	97.58%	99.65%	99.91%
Surabaya	58.21%	63.87%	62.56%	48.21%	50.00%	48.26%
Belawan	67.91%	78.39%	58.31%	80.34%	89.32%	81.15%
Tarjun	69.46%	75.32%	84.01%	87.39%	92.48%	96.46%

Fig. 1 Calibration Achievement 2017-2022

There are some complaints and enhancements to ICMS every year. In the objective to manage the calibration procedure, the complaint and enhancement also affect the

calibration achievement. The further effect will be on the quality of the product. This research aims to analyze the quality of ICMS applications to be able to provide alternative solutions for the development of ICMS applications based on quality evaluation. This research uses the E-service quality (E-Servqual) & WebQual methods to determine variables and analyze the variables using Important Performance Analysis (IPA) & KANO methods to determine priority attributes that need to be improved.

2 Literature Review

ICMS is a web-based application that provides electronic service to manage the calibration procedure. Electronic Service Quality, or E-Servqual, is a new version of Service Quality. E-Servqual was developed to evaluate a service provided on the Internet network [4]. E-Servqual is defined as the ability of a site to provide effective and efficient facilities for online shopping, purchases, and obtaining goods or services [5]. There are 7 dimensions of E-Servqual there are Efficiency, Fulfillment, Reliability, Privacy, Responsiveness, Compensation, and Contact [5].

Moreover, Web-based applications can be measured the quality by using WebQual dimensions. WebQual is a highly validated instrument that can provide a broad, refined measurement of an organization's Web site [6]. WebQual has improved from WebQual 1.0 to the latest WebQual 4.0. Where WebQual 4.0 have 3 dimensions, there are Usability, Information Quality, and Service Interaction Quality [7]. Both E-Servqual and WebQual can determine the variable that will be analyzed in this research due to similar characteristics with ICMS, in this case, web-based applications.

KANO is the method to determine the importance of each part, and the results that are used to obtain quality and work guidelines from construction management that can maximize customer satisfaction [8]. Also, The Kano model is an idea and technique that helps determine customer satisfaction and prospects for product features [9]. The Kano model brings a different perspective to analyze the possibility of improving the quality of products and services by calculating the nonlinear relationship between performance and satisfaction [10]. Three categories affect customer satisfaction that is Attractive, One-Dimensional, and Must-be. Consumer response to the requirements or requirements of the service also has three points that are Indifferent, Reverse, and Questionable. In compiling Kano's questionnaire, each service attribute is structured as a positive statement (functional) and a statement that is negative (dysfunctional) to know the effect or impact on customer or respondent satisfaction if this service is provided or not provided. The result will be combined in the Kano evaluation table.

Table 1 KANO Evaluation Table

Customer needs		Dysfunctional				
		Like	Must-be	Neutral	Live with	Dislike
Functional	Like	Q	A	A	A	O
	Must-be	R	I	I	I	M

Functional	Neutral	R	I	I	I	M
	Live with	R	I	I	I	M
	Dislike	R	R	R	R	Q

Importance Performance Analysis offers several benefits or advantages to evaluate consumer/customer acceptance of a marketing program[11]. However, IPA is a beneficial assessment instrument for the current organizational situation, and it is constructive for managers to make accurate decisions. IPA can also assist quality policymakers in detecting service/product elements whose resource allocation may contribute to more satisfied users. It also aims to determine which prioritized attributes for improvement[12], [13]. There are four quadrants based on Fig. 2 in IPA that indicate four categories, that are Concentrate these (high importance and low performance), Keep up the Good Work (high importance and high performance), Low Priority (low importance and low performance), and Possible Overkill (low importance and high performance). Based on the four categories, the category "Concentrate these" is the highest priority to be concerned in improvement.

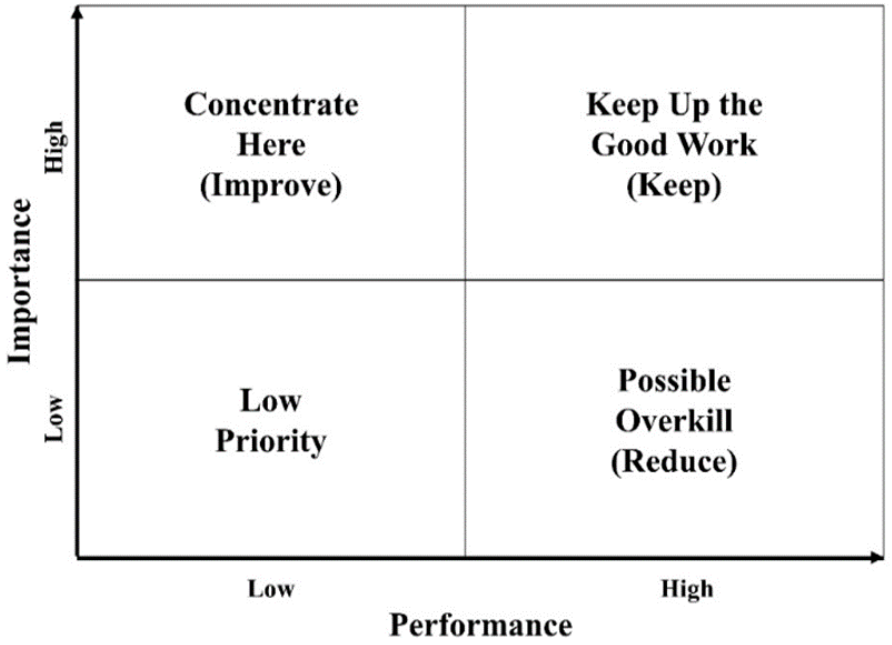


Fig. 2 Quadrant IPA

Furthermore, integrating IPA and KANO will avoid the limitations of the Kano model in ignoring attribute performance and importance. On the other side, it eliminates the weaknesses of the IPA model in considering the quality of only one dimension[14]. The Twelve categories in IPA-KANO integration help to prioritize the attribute for improvement. The categories are Survival, Fatal, Chronic Disease, Fitness, Major Weapon, Defenseless Strategy Point, Defenseless Zone, Supportive Weapon, Precious

Treasure, Dusty Diamond, Rough Stone, and Beginning Jewelry. The detail is explained in Table 2.

Table 2 IPA - KANO Integration

KANO	Integration Category	Importance	Performance	Quadrant IPA	Priority	
					Improve	Keep
Hygiene (Must-be)	Survival	High	High	II	-	1
	Fatal	High	Low	I	1	-
	Chronic disease	Low	Low	III	2	-
KANO	Integration Category	Importance	Performance	Quadrant IPA	Priority	
					Improve	Keep
Hygiene	Fitness	Low	High	IV	-	2
War (One Dimensional)	Major Weapon	High	High	II	-	3
	Defenseless Strategy Point	High	Low	I	3	-
	Defenseless Zone	Low	Low	III	4	-
	Supportive Weapon	Low	High	IV	-	4
Treasure (Attractive)	Precious treasure	High	High	II	-	5
	Dusty Diamond	High	Low	I	5	-
	Rough Stone	Low	Low	III	6	
	Beginning Jewelry	Low	High	IV		6

3 Methods

The study was conducted on POC, which engages in the business of the Palm Oil Industry, headquartered in Jakarta, and the calibration team with the most frequent interaction with ICMS currently has around 22 employees. The method used in this research is IPA, KANO, and the integration with the following stages:

1. Set the Total of responders. The total respondents will be twenty-two, consisting of all team calibrations, including the Automation Head Office Department.
2. Determine the variables from E-Servqual and WebQual dimensions that align with a characteristic of ICMS. In this research, the variables are:

Table 3 Research Variables

Variable	Indicator Description	
Privacy	X1.1	The ICMS application protects the user's employee data information.
	X1.2	The ICMS application protects information about calibration activity between units.
Responsiveness	X2.1	HO Automation Team handles problems/complaints related to calibration and application usage immediately.
	X2.2	The ICMS application provides information if there is an error in the calibration process or if the input data is incorrect.
Usability Quality	X3.1	Users find it easy to learn to operate the ICMS web-based application
	X3.2	User interaction with the website is clear and easy to understand
	X3.3	Users find it easy to operate the ICMS web-based application
	X3.4	The ICMS application has an attractive appearance
	X3.5	ICMS application design according to the type of site
	X3.6	The ICMS app creates a positive experience
Information Quality	X4.1	How ICMS can provide reliable information
	X4.2	How ICMS can provide timely information
	X4.3	How ICMS can provide relevant information
	X4.4	How ICMS can provide easy-to-understand information
	X4.5	How ICMS can provide information at an appropriate level of detail
	X4.6	How ICMS can present information in the right format
Service Interaction Quality	X5.1	The ICMS website has a good reputation
	X5.2	ICMS's users feel safe regarding their personal information
	X5.3	ICMS's users feel safe completing transactions
	X5.4	ICMS creates space for personalization
	X5.5	ICMS provides space for community
	X5.6	ICMS makes communication easy with organizations
	X5.7	Users feel confident that the goods/services will be delivered as promised.

3. Provide the questionnaire with a Likert scale, distribute it through the online platform, and collect all the responder's responses. This research will have 22 responses in total. Continue to reliability and validity check before the analysis.
4. Then, start analyzing using Importance Performance Analysis which will help to identify the quadrant of priority as consideration for the company's actions.
5. Next is an analysis using the KANO Method to prioritize features on a product roadmap based on the degree to which they will likely satisfy customers. The result is the understanding of the customers' needs and desires.
6. Integrate IPA-KANO to know the priority of improvement and stabilities of performance.
7. Finally, the integration result considers the best alternative combination to improve suggested attributes.

4 Result and Discussion

4.1 Reliability and Validity

Furthermore, an assessment of measurement reliability and validity was conducted. Reliability evaluation was performed utilizing Cronbach's Alpha, consistently yielding coefficients exceeding 0.70, affirming the reliability of the measurement scale under scrutiny. To ascertain validity, we employed a method of convergent validation, employing Pearson's correlation coefficients. The observed high and statistically significant correlation coefficients within each factor confirm the presence of convergent validity.

Table 4 Reliability Test

Questionnaire	Total Question	Total of Varian	Varian Total Score	Cof	Interpretation
Importance	23	10.09	123.98	0.96	Reliable
Performance	23	13.01	156.45	0.96	Reliable
Functional	23	13.84	171.75	0.96	Reliable
Dysfunctional	23	32.67	596.83	0.988	Reliable

4.2 Importance Performance Analysis

At this juncture, the objective was to assess the balance between Importance and Performance. Through the utilization of Importance-Performance Analysis (IPA) for identifying Service Attributes, the table labeled Table 5 displays the averaged outcomes of expectation and performance levels associated with each attribute.

Table 5 The Result of the Calculation Importance vs Performance

Indicator	Importance	Performance	GAP	Quadrant	Remark
X1.2	4.455	4.500	0.05	4	Possible Overkill

Indicator	Importance	Performance	GAP	Quadrant	Remark
X3.1	4.500	4.455	-0.05	4	Possible Overkill
X5.1	4.545	4.455	-0.09	4	Possible Overkill
X1.1	4.545	4.364	-0.18	3	Low Priority
X3.4	4.364	4.000	-0.36	3	Low Priority
X3.5	4.455	4.091	-0.36	3	Low Priority
X5.4	4.455	4.182	-0.27	3	Low Priority
X5.5	4.409	4.045	-0.36	3	Low Priority
X5.6	4.455	4.091	-0.36	3	Low Priority
X3.3	4.591	4.500	-0.09	2	Keep Up the Work
X3.6	4.727	4.455	-0.27	2	Keep Up the Work
X4.1	4.773	4.682	-0.09	2	Keep Up the Work
X4.2	4.682	4.409	-0.27	2	Keep Up the Work
X4.3	4.591	4.591	0.00	2	Keep Up the Work
X4.4	4.773	4.591	-0.18	2	Keep Up the Work
X4.5	4.727	4.636	-0.09	2	Keep Up the Work
X4.6	4.636	4.500	-0.14	2	Keep Up the Work
X5.3	4.636	4.455	-0.18	2	Keep Up the Work
X5.7	4.636	4.500	-0.14	2	Keep Up the Work
X2.1	4.682	4.227	-0.45	1	Concentrate Here
X2.2	4.682	4.182	-0.50	1	Concentrate Here
X3.2	4.591	4.273	-0.32	1	Concentrate Here
X5.2	4.591	4.364	-0.23	1	Concentrate Here
AVERAGE	4.587	4.372			

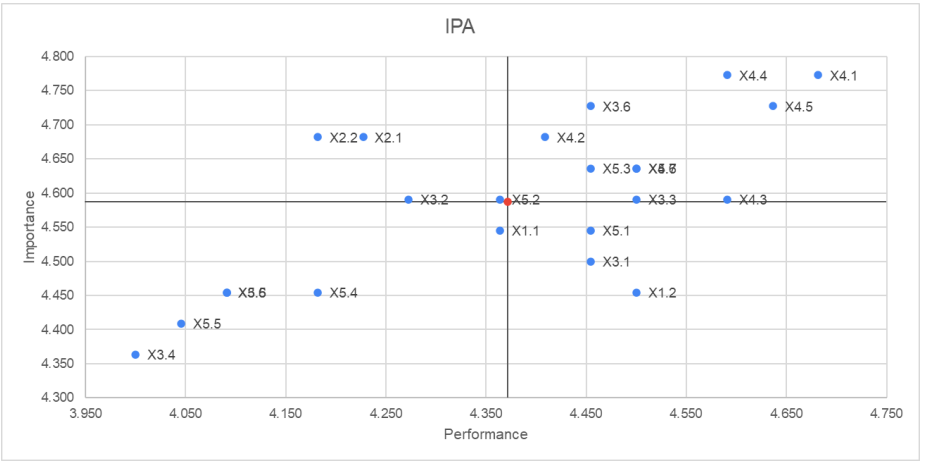


Figure 3 Importance-Performance Matrix Result

By analyzing, the figure above it can be verified that most of the attributes ICMS is located in quadrant two which needs to maintain the performance, there are 4 attributes in quadrant one that necessary to be improved.

4.3 KANO Analysis

The KANO calculation combines functional and dysfunctional to the evaluation table of KANO. The result of the combination will provide the classification category KANO.

Table 6 Results of Classification of Service Attributes in The KANO Category

Attribute	Q	R	A	I	M	O	Total	MAJOR
X1.1	1	0	2	6	5	8	22	O
X1.2	1	0	2	8	1	10	22	O
X2.1	0	1	3	7	4	7	22	I
X2.2	0	0	4	6	2	10	22	O
X3.1	1	0	5	6	1	9	22	O
X3.2	1	0	3	5	1	12	22	O
X3.3	1	1	5	5	2	8	22	O
X3.4	2	0	4	8	1	7	22	I
X3.5	2	0	6	6	2	6	22	A
X3.6	2	0	4	6	0	10	22	O
X4.1	2	0	1	3	2	14	22	O
X4.2	2	0	3	3	1	13	22	O
X4.3	2	0	2	3	1	14	22	O
X4.4	1	0	5	4	0	12	22	O
X4.5	1	0	3	4	2	12	22	O
X4.6	1	1	2	3	0	15	22	O
X5.1	1	0	3	8	1	9	22	O
X5.2	1	0	3	5	4	9	22	O
X5.3	1	0	3	4	3	11	22	O
X5.4	1	0	4	8	1	8	22	I
X5.5	1	0	5	6	1	9	22	O
X5.6	1	0	4	9	1	7	22	I
X5.7	1	0	2	7	1	11	22	O

Derived from the outcomes revealed by the KANO model, it is evident that there are 18 attributes categorized within the one-dimensional classification, 4 attributes placed in the indifferent classification, and a solitary attribute categorized as attractive.

4.4 Integration IPA-KANO

The fusion of IPA (Importance-Performance Analysis) and the Kano model results in the IPA-Kano integration. This integration amalgamates the findings from both methods. In this phase, the classification and the sequence of importance for each chosen service attribute within ICMS are presented in Table 7.

Table 7 Sequence of Priority Integration Importance-Performance Analysis (IPA) and the KANO Model

Code	Question	IPA	KANO	Category	Priority	
X1.1	The ICMS application protects the user's employee data information.	3	O	Defenseless Zone	Improve	2
X1.2	The ICMS application protects information about calibration activity between units.	4	O	Supportive Weapon	Maintained	2
X2.1	HO Automation Team handles problems/complaints immediately.	1	I	-		
X2.2	The ICMS application provides information if there is an error in the calibration process or if the input data is incorrect.	1	O	Defenseless Strategy Point	Improve	1
X3.1	Users find it easy to learn to operate the ICMS web-based application	4	O	Supportive Weapon	Maintained	2
X3.2	User interaction with the website is clear and easy to understand	1	O	Defenseless Strategy Point	Improve	1
X3.3	Users find it easy to operate the ICMS web-based application	2	O	Major Weapon	Maintained	1
X3.4	The ICMS application has an attractive appearance	3	I	-		
X3.5	ICMS application design according to the type of site	3	A	Rough Stone	Improve	3
X3.6	The ICMS app creates a positive experience	2	O	Major Weapon	Maintained	1
X4.1	Provide reliable information	2	O	Major Weapon	Maintained	1
X4.2	Provide timely information	2	O	Major Weapon	Maintained	1
X4.3	Provide relevant information	2	O	Major Weapon	Maintained	1
X4.4	Provide easy-to-understand information	2	O	Major Weapon	Maintained	1
X4.5	Provide information at an appropriate level of detail	2	O	Major Weapon	Maintained	1
X4.6	Present information in the right format	2	O	Major Weapon	Maintained	1
X5.1	The website has a good reputation	4	O	Supportive Weapon	Maintained	2
X5.2	Users feel safe regarding their personal information	1	O	Defenseless Strategy Point	Improve	1

Code	Question	IPA	KANO	Category	Priority	
X5.3	Users feel safe completing transactions	2	O	Major Weapon	Maintained	1
X5.4	Websites create space for personalization	3	I	-		
X5.5	Websites provide space for community	3	O	Defenseless Zone	Improve	4
X5.6	Websites make communication easy with organizations	3	I	-		
X5.7	I feel confident that the goods/services will be delivered as promised.	2	O	Major Weapon	Maintained	3

The numerical value following the priority explanation denotes the level of importance. The application of both the Importance-Performance Analysis (IPA) and Kano methodologies reveals that, in quadrant one, there exists an imperative requirement to prioritize enhancement for the attribute X2.2, which pertains to responsiveness. Users have expressed that there is an absence of notifications in cases of errors during the calibration process or when incorrect input data is entered. Enhancing this attribute has the potential to elevate user satisfaction and harmonize with attribute performance. Users consider this attribute crucial, although there remains a need for actual implementation.

Other attributes that need to be improved are in quadrant one, namely X3.2 usability and X5.2 service interaction quality. Both attributes in quadrant one are in the one-dimension KANO category, so if both attributes have an excellent performance, that will increase customer satisfaction.

The rest improvement attributes with lower priority in quadrant three, namely, X1.1 privacy, X3.5 usability, and X5.5 service interaction quality. These attributes in quadrant three are in one dimension and attractive KANO category that's not important but will affect customer satisfaction.

The maintained attributes in quadrant two are X3.3, X3.6, X4.1, X4.2, X4.3, X4.4, X4.5, X4.6 usability quality, X5.3, and X5.7 service interaction quality. These ten attributes are in one dimension KANO category, so if these ten attributes have an excellent performance, customer satisfaction will also be high.

The remaining attributes in quadrant four are X1.2 privacy, X3.1 usability quality, and X5.1 service interaction quality. These attributes are in one dimension KANO category that will increase customer satisfaction if we maintain excellent performance.

There are four attributes in the indifferent KANO category that are not included in the improvement or maintained strategy priority.

4.5 Discussion and Managerial Implication

4.5.1 Discussion

The research findings using Importance-Performance Analysis (IPA) and Kano methods provide insights into the priority attributes for improvement and maintenance

in the Integrated Calibration Management System (ICMS) application. In quadrant one, attribute X2.2 (responsiveness) stands out as a priority for improvement. Users have expressed dissatisfaction with the lack of notifications for errors or incorrect input data during the calibration process. Enhancing responsiveness in this aspect will significantly increase user satisfaction and align with their expectations.

Two other attributes in quadrant one, namely X3.2 (usability) and X5.2 (service interaction quality), also require attention. Improving these attributes, which fall within the one-dimension Kano category, will further enhance customer satisfaction. Addressing usability issues and enhancing the quality of service interaction will contribute to a positive user experience.

In quadrant three, lower-priority attributes for improvement include X1.1 (privacy), X3.5 (usability), and X5.5 (service interaction quality). Although these attributes are not considered critical, they can still impact customer satisfaction. Therefore, maintaining a satisfactory level of performance in these areas is important.

The attributes in quadrant two, including X3.3, X3.6, X4.1, X4.2, X4.3, X4.4, X4.5, X4.6 (usability quality), X5.3, and X5.7 (service interaction quality), are considered well-performing and should be maintained. These attributes, falling within the one-dimension Kano category, play a significant role in ensuring high levels of customer satisfaction.

Lastly, the attributes in quadrant four, namely X1.2 (privacy), X3.1 (usability quality), and X5.1 (service interaction quality), should be maintained at an excellent performance level. These attributes, falling within the one-dimension Kano category, contribute to customer satisfaction when maintained effectively.

4.5.2 Managerial Implication

Based on the research findings, the management of the ICMS application should prioritize improving the attributes in quadrant one, such as responsiveness (X2.2), usability (X3.2), and service interaction quality (X5.2). Allocating resources and implementing strategies to enhance these attributes will result in higher user satisfaction and improved overall performance.

For the attributes in quadrant three, including privacy (X1.1), usability (X3.5), and service interaction quality (X5.5), maintaining their current performance levels is essential. While they are not the highest priority, ensuring that they meet customers' expectations will contribute to their overall satisfaction.

The attributes in quadrant two, namely usability quality (X3.3, X3.6, X4.1, X4.2, X4.3, X4.4, X4.5, X4.6) and service interaction quality (X5.3, X5.7), have been performing well. It is crucial to continue maintaining their excellence to sustain high levels of customer satisfaction.

Lastly, the attributes in quadrant four, including privacy (X1.2), usability quality (X3.1), and service interaction quality (X5.1), should also be maintained at an excellent performance level to ensure customer satisfaction.

Overall, these findings guide the management of the ICMS application in prioritizing improvement efforts, maintaining satisfactory performance, and ultimately enhancing customer satisfaction and the achievement of higher calibration results.

5 Conclusions

Based on the results of the research, the following conclusions and implication managerial can be drawn:

1. ICMS needs to improve and maintain 19 of 23 attributes. 6 must be improved, and 13 must be maintained. The four attributes in the indifferent KANO category are not included in the improvement or maintained strategy priority.
2. The attributes X2.2, X3.2, and X5.2 are the main priority attributes to be improved in quadrant one IPA diagram and one dimension KANO category. These attributes are related to interaction, usability, and responsiveness. Make sure the application is easy to use, secure, and communicative. Improving the user interface by adding tutorial guidance will help users to use the application more efficiently. Even new users will easy to use the application. To improve privacy, beginning with reviewing the authorization of users makes it more complicated and affects the system. Responsiveness is necessary to make the application more communicative. More information and notification will also help to increase efficiency in application usage. The lower priority of improvement is awarded to X1.1 privacy, X3.5 usability, and X5.5 service interaction quality. To improve interaction quality by adding a forum discussion feature in the application. Forum discussion will be able to accommodate discussion between users ICMS. This improvement is not critical as the main priority, so it needs to be reviewed and analyzed according to the objective of the application.
3. The attributes that fall into the category two/three/four quadrants must be maintained. The attributes are X1.2 privacy, X3.1, X3.3, X3.6, X4.1, X4.2, X4.3, X4.4, X4.5, X4.6 usability quality, X5.1, X5.3, and X5.7 service interaction quality. That means the data from ICMS is in the range of reliable, on time, and relevant. ICMS needs to maintain excellent performance to make user will keep using the application to achieve higher calibration achievement by evaluating the system frequently and providing troubleshooting immediately.

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