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Combining Servqual and Kano: Justification for Best Action and Its Selection Process

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ABSTRACT This study aims to enhance the existing literature on the integration of Servqual and Kano concepts by providing a comprehensive justification for recommending improvement actions to service attributes. By utilizing a theoretical service model that considers factors previously overlooked, such as the impact on revenue and cost, performance variability, diminishing marginal utility in consumption, and diminishing marginal product of resources, this study offers propositions and proofs for the best actions in each paired category of service attributes within the combined Servqual and Kano assessments. The findings are presented in the form of an evaluation table, which links each paired category of attribute with its respective optimal action. Importantly, this study introduces novel perspectives on the definition of the best action and the basis for its selection. Unlike previous works that solely focus on customer satisfaction, this research defines the best action from the perspective of the service provider whose primary goal is to maximize profit. The proposed procedure for determining the best action obtained in this study is more justifiable, as it relies less on the ambiguous process of correctly identifying the final categories of attributes in both models. To illustrate the new integration process, an example based on simulated data is also provided. Overall, this study contributes to the field by offering a comprehensive and justified approach to improving service attributes through the integration of Servqual and Kano concepts..

KEYWORDS *Servqual; Kano; Servqual and Kano Integration; Service Quality.*

INTRODUCTION

Previous studies, such as Dewi (2019), Fauziyah et al. (2019), Patel & Bhatt (2017), Suryawardani et al. (2022), and Tarigan et al. (2019), have proposed the integration of the Servqual and Kano models as an effective approach for service firms to identify areas for improvement. The method utilizes a two-part instrument to evaluate the attributes of a service in accordance with each model. The Servqual assessments classify service attributes as either strong or weak, based on the current levels of customer satisfaction. Meanwhile, the Kano assessments categorize attributes as Must be, One dimensional, Attractive, Indifference, or Reverse, depending on how performances affect customer satisfaction. Consequently, specific actions can be recommended for attributes based on their positions within the paired categories of the Servqual and Kano models. Notably, attributes that fall into the weak category in the Servqual model and simultaneously belong to the Must be, One dimensional, or Attractive categories in the Kano model are suggested for performance improvement.

The prior studies lacked comprehensive explanations regarding the suitability of certain actions for specific paired categories of attributes in the Servqual and Kano models. Moreover, those works failed to consider the interests of service owners, who strive to maximize profits. Additionally, the integration procedure often relied on questionable categorizations of attributes in both models, which further undermined its credibility. Besides, crucial details such as the extent of discrepancies between perceived and expected performances in the Servqual assessment, as well as the distribution of potential attribute categories in the Kano assessment, were overlooked. Those works also neglected to consider the impacts of natural phenomena that frequently occur in service environments. Therefore, there is a need for a more rigorous and comprehensive approach to integrating these models in order to address these limitations and enhance the academic understanding of service quality assessment.

The present study aims to provide a comprehensive and justified guidance for determining the optimal actions in various paired categories of the integrated Servqual and Kano models. In contrast to traditional approaches that prioritize customer satisfaction, this study introduces a novel perspective by emphasizing profit maximization as the primary criterion for selecting the right action for a service attribute. The proposed best actions for attributes are derived from an evaluation of a theoretical service process that takes into account the impact of changes in attribute performance and customer satisfaction on revenue and cost. The service model incorporates realistic conditions commonly encountered in real-life situations, i.e., performance variabilities, diminishing marginal product of resources, and diminishing marginal utility in consumption. Furthermore, this study introduces a fresh approach to selecting the best action for an attribute, shifting the focus from previously dependent upon the exact identification of the attribute's final position in the paired-categories of Servqual and Kano models to contingent on the number of customers supporting a particular action.

Table 1

The basic construct of service quality in the Servqual model from Pasuraman et al. (1994)

Dimension	Attribute
Reliability	Providing services as promised
	Dependability in handling customers' service problem
	Performing services right the first time
	Providing services at the promised time
	Maintaining error-free record
Responsiveness	Keeping customers informed about when services will be performed
	Prompt service to customers
	Willingness to help customers
	Readiness to respond to customers' requests
Assurance	Employees who instill confidence in customers
	Making customers feel safe in their transactions
	Employees who are consistently courteous
	Employees who have the knowledge to answer customer questions

Dimension	Attribute
Empathy	Giving customers individual attention
	Employees who deal with customers in a caring fashion
	Having the customer's best interest at heart
	Employee who understand the needs of their customers
	Convenient business hours
Tangibles	Modern equipment
	Visually appealing facilities
	Employees who have a neat, professional appearance
	Visually appealing materials associated with the service

This paper begins by offering succinct explanations of the Servqual model, the Kano model, and the typical integration process. It then proceeds to outline the research methodology and the theoretical service process under analysis. Subsequently, it presents propositions for optimal actions and provides arguments supporting the adoption of a new selection mechanism. Furthermore, it illustrates and describes the recommended procedure for integrating Servqual and Kano assessments. Towards the conclusion, it incorporates an example based on simulated data and a comprehensive discussion that compares the previous and revised processes.

Servqual model

Parasuraman et al. (1985) developed the Servqual model to provide an elaborate description and a standard measurement for the abstract concept of quality in service. The basic construct consisted of five quality dimensions and 22 service attributes as presented in Table 1 (Parasuraman et al., 1994). The initial goal was to create a general model that could be used in a variety of service environments, but many later works, including Aydin & Pakdil (2008), Kumar et al. (2010), Abu-El Samen et al. (2013), Hamzah et al. (2017) and Rojas & Coluccio (2021), made their own modifications to better reflect the distinctive qualities of the evaluated service processes.

A method for evaluating the quality of each service attribute was put out by Parasuraman et al. (1985) by contrasting the customers' expected and perceived levels of performance. A satisfactory level of quality is obtained when the perceived performance (P) is equal to or higher than its expected level (E). Otherwise, it is necessary to enhance the attribute performance to increase customer satisfaction.

Customers' expectations and perceptions of the performance of attributes were often collected through questionnaires with Likert-style response formats. Customers would probably have different opinions regarding the P and E values for a specific attribute, which might result in various evaluations of its quality levels. The means of each variable, P □ and E □, should be calculated prior to comparison in this scenario (Dewi, 2019; Suryawardani et al., 2022). If P □ is less than E □, the attribute is considered weak or inadequate and requires improvement; otherwise, it is considered strong. In contrast to the Servqual model, which holds that increasing an attribute's performance at all times leads to higher levels of customer satisfaction, the Kano model does not always support this assertion.

Kano model

The initial Kano model sought to investigate the relationships between the fulfillment of requirements in physical products with customer satisfaction (Malinka et al., 2022). However, several works (Andriani et al., 2021; Fauziyah et al., 2019; Suryawardani et al., 2022) have shown that the concept may also be employed in service environments. According to the Kano model, an attribute may be categorized into five groups based on how its performance would effect customer satisfaction: Must be (M), One dimensional (O), Attractive (A), Indifference (I), and Reverse (R).

For a M category attribute, its absence or poor performance would result in discontent, while an improvement above the necessary level would not further boost customer satisfaction. A diminished performance for an attribute in the O category would always result in lower satisfaction, whereas an enhanced performance would always result in higher contentment. For an A category attribute, its absence would not result in consumer complaints, but its presence and increased performance would greatly raise customer happiness. There was no connection between the performance of an attribute in the I category and customer satisfaction. Finally, given an attribute in the R category, a decreased performance would always enhance satisfaction, whereas an increased performance would always decrease satisfaction (Andriani et al., 2021). Figure 1 shows the relationships between performance fulfillment and customer satisfaction for each category. Recognize that the category of an attribute may change over time. Most notably, it might shift from the A category to the O category and then the M category (Shen et al., 2000).

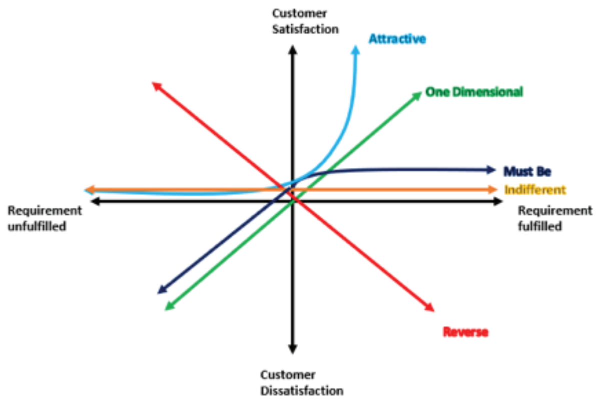

Figure 1 Kano model

For each attribute, there were typically two questions on the Kano assessment instruments. The first query addressed how users would feel if the attribute worked as intended (functional form). The second inquiry focused on the customers' reactions in the event that the identical attribute failed to work properly (dysfunctional form). Examples of these questions are shown in Table 2 and come from the study of Kermanshachi et al. (2022). Responses to both questions were paired using an evaluation table, like that in Table 3, to identify the category of each attribute (Kermanshachi et al., 2022). Observe that customers could respond inconsistently to the two queries. For instance, customers may assert that they prefer it when a particular attribute performs well, but the same customers may also assert that they prefer it when the attribute performs badly. As a result, a sixth category, Questionable (Q), has been added to the evaluation table.

Customers' perspectives on the category of an attribute would naturally vary, leading to a range of possible categories for the attribute. For example, a given attribute might have a distribution of possible categories such that 30% of customers rated it as belonging to the M category, 25% of customers thought it belonged to the O category, 25% of customers thought it belonged to the A category,

Table 2 An example of Kano's assessments from Kermanshachi et al. (2022)

Attribute 1: Having modern looking equipment	
1a. If the store has modern-looking equipment, how would you feel?	1. I like it that way 2. It must be that way 3. I am neutral 4. I can live with it that way 5. I dislike it that way
1b. If the store doesn't have modern-looking equipment, how would you feel?	1. I like it that way 2. It must be that way 3. I am neutral 4. I can live with it that way 5. I dislike it that way

Table 3 Kano evaluation table from Kermanshachi et al. (2022)

Question type	Dysfunctional: "If [the service] did not satisfied [requirement x], ow would you feel?"					
	Response Option	I like it that way	It must be that way	I am neutral	I can live with that way	I dislike it that way
Functional: "If [the service] satisfied [requirement x], how woould you feel?"	I like it that way	Questionable	Attractive	Attractive	Attractive	One-dimensional
	It must be that way	Reverse	Indifferent	Indifferent	Indifferent	Must-be
	I am neutral	Reverse	Indifferent	Indifferent	Indifferent	Must-be
	I can live with it that way	Reverse	Indifferent	Indifferent	Indifferent	Must-be
	I dislike it that way	Reverse	Reverse	Reverse	Reverse	Questionable

10% to the I category, 5% to the R category, and 5% of customers may not have given a consistent response, i.e., the Q category. In cases like this, a number of approaches were put out to choose the attribute's ultimate category (Kermanshachi et al., 2022; Masamran & Supawong, 2022; Suryawardani et al., 2022). The most straightforward option was to simply place the attribute in the category with the highest percentage of consumers.

There were more complex methods for making decisions, but none could rule out the chance that the majority of customers did not genuinely choose the final category for an attribute. In keeping with the preceding illustration, if M was selected as the final category for the attribute, then just 30% of customers agreed with the choice. In actuality, there was no category in that scenario that the vast majority of customers would choose. This is why identifying the final category for an attribute in the Kano model may not be as easy as it seems. Assessments utilizing the Kano model often produced a list of attributes along with the corresponding final categories. The information might then be used by the service owners to plan various actions to attributes, depending on the category (Fauziyah et al., 2019; Suryawardani et al., 2022).

It is important to note that the Kano assessments' conclusions did not give information concerning the performance levels of the various attributes, customer satisfaction levels, nor the minimal threshold levels required to satisfy customers. The model offered a broad course of action for an attribute, but it was unaware of whether the action was at this point required. A deeper comprehension of an attribute's situation, including the necessity for an action and its course, would be made possible by combining the Kano model with the Servqual model.

Typical integration process

The conventional integration process was initiated with concurrent assessments of attributes using the combined Servqual and Kano questionnaires, as in Devi et al. (2019) and Dewi (2019). The Servqual assessment would yield the final categories of attributes in the model, i.e., strong or weak, by employing the previously outlined techniques. Similar to this, the Kano evaluations would define the model's final categories of attributes, i.e., the M, O, A, I, R, or Q categories. Through these procedures, each service attribute would be classified according to the Servqual and Kano models in pairs. Typical studies would concentrate on attributes that are both members of the Kano model's M, O, or A category and the Servqual model's weak group. It was advised to improve performances for such kinds of attributes, while others were mostly overlooked. The reason that only those paired-categories were regarded suitable for improvement measures was not, however, explained in such studies.

Some works (Devi et al., 2019; Suryawardani et al., 2022) would additionally produce a ranking of attributes based on the priority for improvement efforts. Other publications (Apornak, 2017; Chen et al., 2018; Shen et al., 2000) linked the results with the Quality Function Deployment (QFD) technique to identify the specific components within the attributes that needed to be improved.

METHODOLOGY

This theoretical study comprises of five analytical stages. The initial step involves constructing a model that accurately represents the conditions in a typical service process. Assumptions that imitate natural phenomena present in most service settings are applied, encompassing variations in service performance, variations in customer expectations and judgments, variations in the way performance impacts customer satisfaction, the correlation between customer satisfaction and willingness to pay, the diminishing marginal utility of consumption, the relationship between service performance and cost, as well as the diminishing marginal product of resources. At the heart of the formulated model lies a series of mathematical equations that elucidate how changes in service performance would influence customer willingness to pay and cost under different circumstances.

In the second phase of the analysis, the focus lies on establishing a comprehensive set of paired-categories that can be derived from the combined Servqual and Kano assessments. Subsequently, in the succeeding phase, a mathematical proof is employed to propose the optimal course of action for each group of paired-categories, aiming to maximize the service owner's payoff. Moving on to the fourth step, a novel procedure is devised to determine the most suitable action for a service attribute based on the distribution of customers' evaluations. Finally, in the last stage, a simulated assessment data is generated to demonstrate the operational mechanism of the new procedure and to compare its outcomes with the existing approach.

Model for the service process

Without sacrificing generality, this paper examines a service process with just one attribute. It is assumed that the attribute's performance is unstable, i.e., there is some degree of unpredictability that might occasionally cause the performance to increase or drop. Customers may have different perceptions of the actual performance level even while they are experiencing the attribute concurrently. In particular, it is assumed that the performance level as perceived by the client takes the form shown in Equation 1, where P_i is the actual level of performance perceived by customer i, p_i is a non-negative constant, P_0 is the intended or designed performance level of the attribute, and Δ_P represents the magnitude of variability in performance, which can be positive or negative but is assumed to have a negatively skewed distribution.

$$P_i = p_i \, (P_0 + \Delta_P) \qquad \text{(Eq. 1)}$$

Every action to improve performance will require additional resources and extra costs. On the other hand, every action to reduce performance will save some resources and costs. The law of diminishing marginal product of resources is assumed to be applicable to the attribute, such that a further improvement will be more costly. In particular, it assumed that the cost per unit assigned to each customer follows the form as stated in Equation 2. In that equation, C is the cost per unit for having and operating the attribute, $c_0>0$ is a constant, $c_1>1$ is also a constant, and P_0 is the intended or the designed performance level of the attribute.

$$C = c_0 \, P_0^{c1} \qquad \text{(Eq. 2)}$$

It is assumed that all customers are equally important and relate their willingness to pay for the service with satisfactions, i.e., higher satisfaction means higher willingness to pay, and vice versa. There are three factors affecting customer satisfaction, i.e., the expected performance level for the service attribute, the perceived performance level of the service attribute, and the attribute's role in the service. As in the Kano model, customers may see the attribute as Must be (M), One dimensional (O), Attractive (A), Indifferent (I), and Reverse (R), however some adjustments are made due to the law of diminishing marginal utility. The next paragraphs explain how performance affects customer satisfaction and willingness to pay in each category.

A customer who considers the attribute as Must be (M) will be dissatisfied if the perceived level of performance is lower than expected. The higher the discrepancies, the higher the dissatisfaction will be, which will negatively and significantly affect willingness to pay. The customer will only be satisfied when the perceived level of performance is equal to the expected level. If there is an effort to further improve the performance beyond this level, then it will neither increase the customer's satisfaction nor his willingness to pay any further. In particular, it assumed that the willingness to pay follows the forms as stated in Equation 3 and Equation 4. In those equations, W_i is the willingness to pay of customer i, m_0 & $m_2>0$ are constants, $m_1>1$ is also a constant, E_i is the customer's expected level of performance for the attribute, and P_i is the customer's perceived level of performance. The values of the constants are such that $m_0 (E_i)^{m1} = m_2 E_i$, hence there is no sudden jump in the willingness to pay. Moreover, the marginal willingness to pay is assumed to be much higher than the marginal cost when the perceived performance is lower than expected, i.e., $m_1 \ m_0 \ (P_i)^{m_1-1} > c_1 \ c_0 \ P_0^{c_1-1}$ for $P_i < E_i$. Figure 2 illustrates how willingness to pay and cost change with performance when $P_i = P_0$.

$$W_i = m_0 (P_i)^{m_1} \ ;\forall \ P_i<E_i \quad \text{(Eq. 3)}$$

$$W_i = m_2 \ E_i \ ;\forall \ P_i \geq E_i \quad \text{(Eq. 4)}$$

A customer who regards the attribute as One dimensional (O) will be dissatisfied if the perceived level of performance is lower than expected. The higher the discrepancies, the higher the dissatisfaction will be, which will negatively affect willingness to pay. The customer will start to feel satisfied when the perceived level of performance is equal to the expected level.

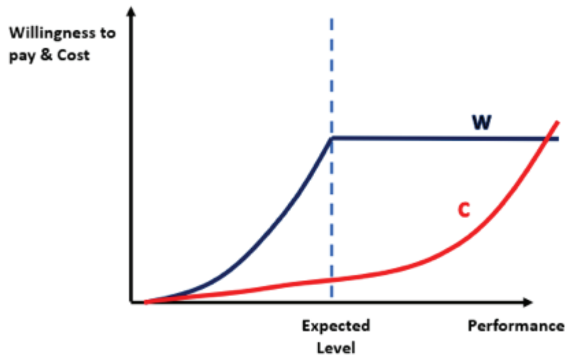

Figure 2 Changes in customer's willingness to pay and cost for attribute in M category

Thus, A further improvement to the performance will further increase the satisfaction and the willingness to pay. However as performance continues to increase, the law of diminishing marginal utility applies, i.e., the additional increases in satisfaction and willingness to pay will be smaller. Subsequently, this will eventually make the marginal revenue be smaller than the marginal cost to improve performance. In particular, the willingness to pay is assumed to follow the forms as stated in Equation 5 and Equation 6. In those equations, W_i is the willingness to pay of customer i, o_0 & $o_1>0$ are constants, $0 \leq o_2 \leq 1$ is also a constant, E_i is the customer's expected level of performance for the attribute, and P_i is the customer's perceived level of performance for the attribute. The values of the constants are such that $o_0\ E_i = o_1\ (E_i)^{o_2}$, hence there is no sudden jump in the willingness to pay. Moreover, it is assumed that for $P_i < E_i$ the marginal willingness to pay is higher than the marginal cost, i.e., $o_0 > c_1 c_0 P_0^{c(1-1)}$. Figure 3 illustrates how willingness to pay and cost change with performance when $P_i = P_0$.

$W_i = o_0\ P_i \ ;\forall\ P_i < E_i$ (Eq. 5)

$W_i = o_1\ (P_i)^{o_2} \ ;\forall\ P_i \geq E_i$ (Eq. 6)

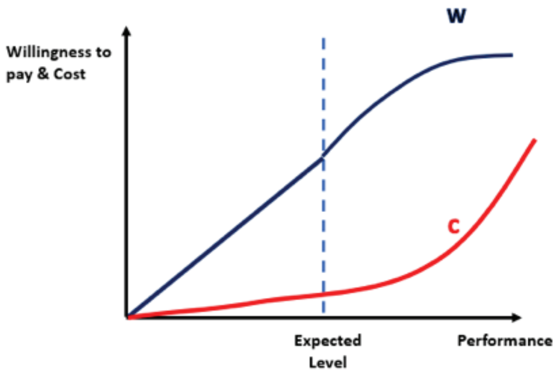

Figure 3 Changes in customer's willingness to pay and cost for attribute in O category

A customer who thinks the attribute as Attractive (A) will not be dissatisfied if the perceived level is lower than expected, so it will not affect his or her willingness to pay. However, when the performance reaches its expected level then the customer will be greatly satisfied, which will exponentially increase his willingness to pay. A further improvement to the performance is assumed to still significantly increase the satisfaction and the willingness to pay, such that the marginal revenue will still be higher than the marginal cost to increase the performance. In particular, the willingness to pay is assumed to follow the forms as stated in Equation 7 and Equation 8. In those equations, W_i is the willingness to pay of customer i, $a_0>0$ is a constant, $a_1>1$ is also a constant, E_i is the customer's expected level of performance for the attribute, and P_i is the customer's perceived level of performance for the attribute. Moreover, it is assumed that the marginal willingness to pay higher than the marginal cost when the perceived performance is higher than expected, i.e., $a_1\ a_0\ (P_i\ )^{a_1-1} > c_1\ c_0\ P_0^{c_1-1}$ for $Pi \geq E_i$. Figure 4 illustrates how willingness to pay and cost change with performance when $P_i = P_0$.

$W_i = 0 \ ;\forall\ P_i < E_i$ (Eq. 7)

$W_i = a_0\ (P_i\ )^{a_1} \ ;\forall\ P_i \geq E_i$ (Eq. 8)

A customer who sees the attribute as Indifference (I) will not feel any satisfaction or dissatisfaction, whatever the attribute's level of performance is.

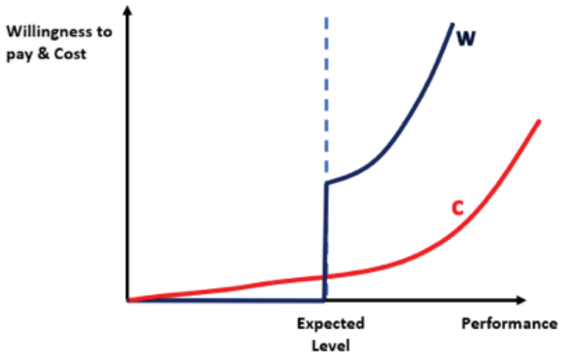

Figure 4 Changes in customer's willingness to pay and cost for attribute in A category

Thus, there is no relationship between performance and willingness to pay. Any further action to improve or reduce performance also will not affect the customer's satisfaction or willingness to pay. In particular, the willingness to pay is assumed to follow the form as stated in Equation 9. Figure 5 illustrates how willingness to pay and cost change with performance when $P_i = P_0$.

$W_i = 0$; for all P_i (Eq. 9)

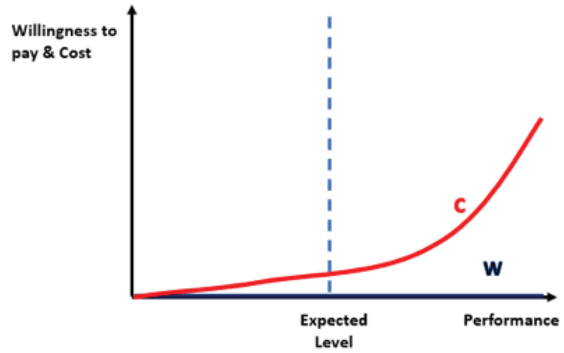

Figure 5 Changes in customer's willingness to pay and cost for attribute in I category

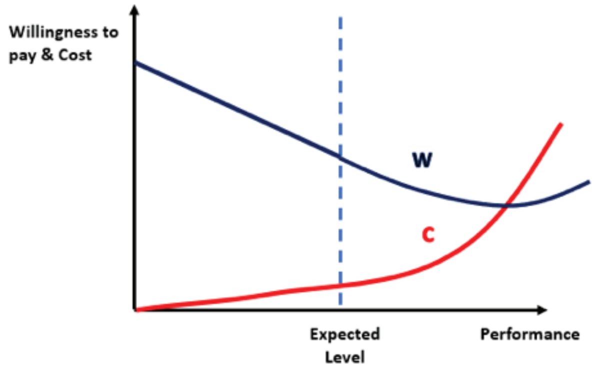

Figure 6 Changes in customer's willingness to pay and cost for attribute in R category

A customer who views the attribute as Reverse (R) will be satisfied when the perceived level of performance is lower than expected. The higher the discrepancies, the higher the satisfaction will be. On the other hand, when the performance level is higher than expected, then this customer will be dissatisfied. A further improvement to the performance will further increase the dissatisfaction, as well as lower the willingness to pay. In particular, the willingness to pay is assumed to follow the forms as stated in Equation 10 and Equation 11. In those equations, W_i is the willingness to pay of customer i, $(r_0, r_1, r_2, r_3) > 0$ are constants, $0 \leq r_4 \leq 1$ is also a constant, E_i is the customer's expected level of performance for the attribute, and P_i is the customer's perceived level of performance for the attribute. The values of the constants are such that $r_0 > r_2$ and $r_0 - r_1 E_i = r_2 - r_3 (E_i)^{r_4}$, hence there is no sudden jump in the willingness to pay. Moreover, it is assumed that $r_0 - r_1 P_i > c_0 P_0^{c_1}$; for $P_i < E_i$. Figure 6 illustrates how willingness to pay and cost change with performance when $Pi = P_0$.

$$W_i = r_0 - r_1 P_i \;\; ; P_i < E_i \qquad \text{(Eq. 10)}$$

$$W_i = r_2 - r_3 (P_i)^{r_4} \;\; ; \forall P_i \geq E_i \qquad \text{(Eq. 11)}$$

Data collection and analysis

It is assumed that there exists an unbiased instrument to extract from each customer three assessments regarding the attribute, i.e., the customer's expected level of performance (E) for the attribute, the customer's perceived level of the attribute's performance (P), and whether the customer regards that the attribute belongs to the M, O, A, I or R categories in the Kano model, as described earlier. Customers are assumed to be consistent in providing their assessments, hence there is no response assigned to the Q category.

The values of E and P from each customer can then be combined into the value of *(P − E)*, i.e., the discrepancy between perceived and expected levels of performances. Let further assume that the range of available values for (P − E) from all customers is quite large, such that it is possible to form five classes of intervals. The first class is for (P − E)<<0, i.e., the perceived performance is much lower than expected. The second class is for (P − E) < 0, i.e., the perceived performance is lower than expected. The third class is for (P − E) = 0, i.e., the perceived performance is as expected. The fourth class if for (P−E)>0, i.e., the perceived performance is higher than expected. The fifth class is for (P − E) >> 0, i.e., the perceived performance is much higher than expected. Notice that there are essentially two categorical variables obtained from the data collection process. The first categorical variable is the performance discrepancy category from the Servqual assessment with five possible values, i.e., (P − E) << 0, (P − E) < 0, (P − E) = 0, (P − E) > 0 or (P − E) >> 0. The second variable is the attribute category in the Kano model, which also has five possible values, i.e., M, O, A, I or R. Subsequently, the two variables can be combined into a contingency table with a set of 25 pairs of categories, as illustrated in Table 4.

Notice that each cell in Table 4 represents a group of customers with similar assessments related to the service attribute. For example, Group 1 is for customers who consider the attribute as Must be (M) and perceive that its current performance level is much lower than expected or (P − E)<< 0. Meanwhile Group 8 is for customers who regard the attribute as One dimensional (O) and perceive that its current performance level is equal to the expected or (P − E)= 0. The number of customers in each group can be calculated from the obtained data and presented as a frequency table, such an example in Table 5.

Table 4 Paired categories of Servqual dan Kano

Performance Discrepancy Category (Servqual Model)	Attribute Category (Kano Model)				
	M	O	A	I	R
(P − E) >> 0	Group 5	Group 10	Group 15	Group 20	Group 25
(P − E) > 0	Group 4	Group 9	Group 14	Group 19	Group 24
(P − E) = 0	Group 3	Group 8	Group 13	Group 18	Group 23
(P − E) < 0	Group 2	Group 7	Group 12	Group 17	Group 22
(P − E) << 0	Group 1	Group 6	Group 11	Group 16	Group 21

Table 5 An example of frequency table

Performance Discrepancy Category (Servqual Model)	Attribute Category (Kano Model)				
	M	O	A	I	R
(P − E) >> 0	5	1	0	2	0
(P − E) > 0	12	23	3	4	1
(P − E) = 0	22	14	0	2	1
(P − E) < 0	10	7	1	3	0
(P − E) << 0	3	4	0	0	0

Propositions for best actions

The following propositions suggest the best action for each group in Table 4. The best action is defined as the one that would result in the maximum payoff to the owner of the service process. This definition differs from previous works that considered customer satisfaction as the main objective.

Proposition 1. For an attribute that belongs to the M category and has a negative value of (P-E), the best action is to improve performance. Proof. In the M category, if P_i<E_i then the marginal willingness to pay is higher than the marginal cost, i.e., $m_1 m_0 (P_i^{m_1 - 1}) > c_1 c_0 P_0^{c_1 - 1}$. Meanwhile, P_i is a strictly increasing function of P_0. Hence, increasing P_0 will increase profit. ■

Proposition 2. For an attribute that belongs to the paired categories of M and (P-E)=0, the best action is to improve performance. Proof. There is a variability in performance, i.e., $P_i = p_i\ (P_0 + \Delta_P)$, wherein Δ_P is negatively skewed such that it if (P-E)=0 then it can go down to (P-E)<0 and create a significant loss in profit due to $m_1\ m_0\ (P_i\ )^{m_1 - 1} > c_1\ c_0\ P_0^{c_1 - 1}$ in the M category. Hence, increasing P_0 will provide a buffer that prevents the condition of (P-E)<0. ■

Proposition 3. For an attribute that belongs to the paired categories of M and (P-E)>0, the best action is to maintain performance. Proof. In the M category, if $P_i > E_i$ then the marginal willingness to pay is zero while the marginal cost is positive. Increasing P_0 will decrease profit, while decreasing P_0 will make (P-E)=0 and face the possibility of losing profit, i.e., see Proposition 2. Hence, maintaining P_0 is the best choice. ■

Proposition 4. For an attribute that belongs to the paired categories of M and (P-E)≫0, the best action is to reduce performance. Proof. In the M category, if $P_i \gg E_i$ then the marginal willingness to pay is zero while the marginal cost is positive. Increasing P_0 will decrease profit, while decreasing P_0 will save cost and it is still safe from the negative effect of process variability. ■

Proposition 5. For an attribute that belongs to the O category, the best action is to improve performance, unless when it is already very high, i.e., (P-E)≫0, wherein it is better to maintain performance. Proof. In the O category, the marginal willingness to pay, i.e., o_0 for $P_i < E_i$ or $o_2\ o_1\ (P_i)^{o_2 - 1}$ for $P_i \geq E_i$, is higher than the marginal cost, i.e., $c_1\ c_0\ P_0^{c_1 - 1}$, unless when P_0 or P_i is very high. Hence, it is better to increase P_0 until its perceived value is very high, i.e., $P_i \geq E_i$, and maintain afterward. ■

Proposition 6. For an attribute that belongs to the A category and for any value of (P-E), the best action is to improve performance. Proof. In the A category, if (P-E) is positive then the marginal willingness to pay is continuously higher than the marginal cost, i.e., $a_1\ a_0\ (P_i\ )^{a_1 - 1} > c_1\ c_0\ P_0^{c_1 - 1}$ for $P_i \geq E_i$. While an increase in profit can also be obtained through a cost saving by reducing performance to its minimum level, the magnitude is much lower. Hence, it is better to increase P_0. ■

Proposition 7. For an attribute that belongs to the I category and for any value of (P-E), the best action is to reduce performance. Proof. In the I category, the willingness to pay stays at zero level, while the cost is a strictly increasing function of P_0. Hence, it is better to reduce P_0. ■

Proposition 8. For an attribute that belongs to the R category and for any value of (P-E), the best action is to reduce performance. Proof. In the R category, the willingness to pay is a strictly decreasing function of P_0, while the cost is a strictly increasing function of P_0. Hence, it is better to reduce P_0. ■

Evaluation table

Table 6 summarizes the propositions for best actions in the form of an evaluation table for Servqual and Kano integrations. The cells in the table can further be organized into three clusters of actions. The first cluster is for customer groups in which improving performance is the best action. There are 12 customer groups or paired categories in the first cluster, i.e., Group 1 (P – E << 0,M), Group 2 (P – E < 0,M), Group 3 (P – E = 0,M), Group 6 (P – E << 0,O), Group 7 (P – E < 0,O), Group 8 (P – E = 0,O), Group 9 (P – E > 0,O), Group 11 (P – E << 0,A), Group 12 (P – E < 0,A), Group 13 (P – E = 0,A), Group 14 (P – E > 0,A) and Group 15 (P – E >> 0,A). The second cluster is for customer groups or paired categories in which maintaining performance is the best action. There are two groups in the second cluster, i.e., Group 4 (P – E > 0,M) and Group 10 (P – E >> 0,O). The third cluster is for groups or paired categories in which reducing performance is the best action. There are 11 groups in the cluster, i.e., Group 16 (P – E << 0,I), Group 17 (P – E < 0,I), Group 18 (P – E = 0,I), Group 19 (P – E > 0,I), Group 20 (P – E >> 0,I), Group 21 (P – E << 0,R), Group 22 (P – E < 0,R), Group 23 (P – E = 0,R), Group 24 (P – E > 0,R), Group 25 (P – E >> 0,R) and Group 5 (P – E >> 0,M). Tabel 7 provides an illustration for the clusters.

Notice that the service owner can only select one action for the attribute, while there are three alternatives available, i.e., improve, maintain or reduce performance. In determining the right action, the previous works (Fauziyah et al., 2019; Suryawardani et al., 2022) would first decide on the final categories of the attribute both in the Servqual model and the Kano model. We argue that such a process is not only unnecessary but also unjustifiable, because in reality customers always have different opinions for the same attribute. Since all customers are assumed to be equal, i.e., no one is more important than the others, then it is more fair and presumably more optimal if the decision is based on the number of customers supporting a certain action. Thus, the service owner needs only to count and compare the number of customers in each cluster. For example, if the number of customers in the Improve cluster is the highest among the three, then it is recommended to improve the attribute's performance.

Table 6 Evaluation table for Servqual and Kano integration

Performance Discrepancy Category (Servqual Model)	Attribute Category (Kano Model)				
	M	O	A	I	R
(P – E) >> 0	Reduce	Maintain	Improve	Reduce	Reduce
(P – E) > 0	Maintain	Improve	Improve	Reduce	Reduce
(P – E) = 0	Improve	Improve	Improve	Reduce	Reduce
(P – E) < 0	Improve	Improve	Improve	Reduce	Reduce
(P – E) << 0	Improve	Improve	Improve	Reduce	Reduce

Table 7 Clustered evaluation table for Servqual and Kano integration

<table>
<tr><th rowspan="2">Performance Discrepancy Category (Servqual Model)</th><th colspan="5">Attribute Category (Kano Model)</th></tr>
<tr><th>M</th><th>O</th><th>A</th><th>I</th><th>R</th></tr>
<tr><td>(P – E) >> 0</td><td>Reduce</td><td>Maintain</td><td rowspan="2">Improve</td><td colspan="2" rowspan="5">Reduce</td></tr>
<tr><td>(P – E) > 0</td><td>Maintain</td><td>Improve</td></tr>
<tr><td>(P – E) = 0</td><td colspan="3" rowspan="3">Improve</td></tr>
<tr><td>(P – E) < 0</td></tr>
<tr><td>(P – E) << 0</td></tr>
</table>

Proposed procedure for integration

The proposed mechanism to combine the Servqual model with the Kano model consists of several steps, as illustrated in Figure 7. The first step is to simultaneously conduct assessments based on each model to obtain, for every attribute and customer, the values of expected performance level (E), perceived performance level (P) and category in Kano model, i.e., M, O, A, I, R or Q. Remove from further analyses all customers whose assessments are resulted in the Q category. The next step is to calculate, for each attribute and each customer, the values of performance discrepancies, i.e., values of (P – E). Look at the range of these values and construct classes of intervals or categories for the (P – E) values. Afterward, transform the (P – E) value for each customer into one of the setup categories, e.g., (P – E) << 0, (P – E) < 0, (P – E) = 0, (P – E) > 0 or (P – E) >> 0. Then for each attribute and each customer, evaluate the paired categories in the integrated Servqual and Kano models to determine the best action. Use Table 6 or Table 7 for guidance in determining the best actions.

Finally, calculate the total number of customers that belong to each cluster of action. The best action for the attribute is the one supported by the highest number of customers. Repeat the steps for other attributes.

In this procedure, an action is chosen as the final decision if it is supported by the highest number of customers. Notice that the proposed process is similar to a voting system where in each individual can choose by himself or herself the best action.

Like the common voting system, the final decision is decided by the most votes. However, instead of directly asking customers about their preferred actions, here the process indirectly reveals their opinions through Servqual and Kano assessments. Hence, the process is dubbed as an indirect voting approach.

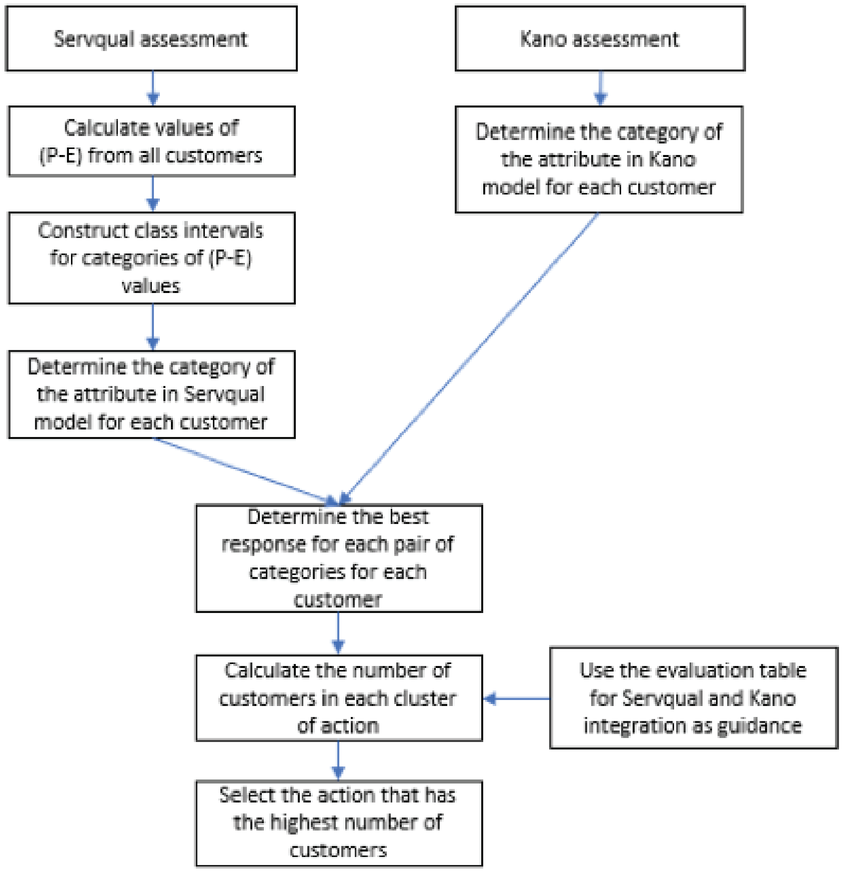

Figure 7 Proposed integration procedure

Simulated example

Column 1 until column 4 in Table 8 presents a simulated result of Servqual and Kano assessments on a single attribute from 30 customers. Assume that the possible values of E and P in the data collection instrument are discrete numbers from 1 to 5. Column 5 of the table presents the calculated values of (P – E) for each customer. Column 6 then transforms the (P – E) values into Servqual categories. In constructing the class intervals in column 6, the following rules are applied, i.e., if (P – E) < -2, then it belongs to the category of (P – E) << 0; if -2 ≤ (P – E) < 0, then it belongs to the category of (P – E) < 0; if (P – E) = 0, then it belongs to the category of (P – E) = 0; if 0 < (P – E) ≤ 2, then it belongs to the category of (P – E) > 0; and if 2 < (P – E) then it belongs to the category of (P – E) >> 0. To fill in the column 7 of the table, use Table 6 as guidance while simultaneously evaluating the paired values in column 4 and column 6 of each row.

The next step is to calculate the total number of customers who support a certain type of action. From column 7 in Table 8, the customers can be divided into three clusters. The first cluster consists of 16 customers, for whom improving performance is the best action. The second cluster consists of 7 customers, for whom maintaining performance is the best action. The third cluster consists of 6 customers, for whom reducing performance is the best action. Beside those three groups, there is one customer who provides an unreliable response. In this case, the customer's opinion is not taken into account. The final decision for the attribute is to improve its performance, because the act is supported by a higher number of customers than other actions. Table 9 presents the same data in the form of a clustered frequency table.

Table 8 Simulated data

Customer ID (1)	Expected Performance Level (2)	Perceived Performance Level (3)	Kano Category (4)	Performance Discrepancy (P - E) (5)	Servqual Category (6)	Best Actions (7)
1	5	3	I	-2	(P-E)<0	Reduce
2	4	3	M	-1	(P-E)<0	Improve
3	4	2	M	-2	(P-E)<0	Improve
4	1	1	O	0	(P-E)=0	Improve
5	1	3	Q	2	(P-E)>0	NA
6	3	4	O	1	(P-E)>0	Improve
7	2	4	M	2	(P-E)>0	Maintain
8	1	3	R	2	(P-E)>0	Reduce
9	2	3	O	1	(P-E)>0	Improve
10	5	1	M	-4	(P-E)<<0	Improve
11	1	2	M	1	(P-E)>0	Maintain
12	3	5	R	2	(P-E)>0	Reduce
13	4	4	M	0	(P-E)=0	Improve
14	1	5	O	4	(P-E)>>0	Maintain
15	3	3	A	0	(P-E)=0	Improve
16	3	4	M	1	(P-E)>0	Maintain
17	5	5	M	0	(P-E)=0	Improve
18	1	4	O	3	(P-E)>>0	Maintain
19	3	5	M	2	(P-E)>0	Maintain
20	5	2	M	-3	(P-E)<<0	Improve
21	5	2	M	-3	(P-E)<<0	Improve
22	1	2	M	1	(P-E)>0	Maintain
23	1	1	A	0	(P-E)=0	Improve
24	5	2	M	-3	(P-E)<<0	Improve
25	2	1	I	-1	(P-E)<0	Reduce
26	4	4	M	0	(P-E)=0	Improve
27	1	5	M	4	(P-E)>>0	Reduce
28	2	3	O	1	(P-E)>0	Improve
29	5	5	O	0	(P-E)=0	Improve
30	1	1	R	0	(P-E)=0	Reduce

Table 9 Clustered frequency table of the simulated data

Performance Discrepancy Category (Servqual Model)	Attribute Category (Kano Model)				
	M	O	A	I	R
(P – E) >> 0	1	2	0	0	0
(P – E) > 0	5	3	0	0	2
(P – E) = 0	3	2	2	0	1
(P – E) < 0	2	0	0	2	0
(P – E) << 0	4	0	0	0	0

Comparison with the old procedure

Based on the simulated data in Table 8, the proposed new integration process has determined that improving performance is the best action to take for the attribute. However, if instead the typical integration process is employed, the result may be different. In the existing approach, the categories for the attribute in each the Servqual model and the Kano model should first be decided prior to integration. Since the average value of (P – E) in column 5 of Table 8 is 0.267, then the attribute belongs to the strong category in the Servqual model. Meanwhile, applying the majority rule, the attribute's category in the Kano model is M. Hence according to some previous works (Fauziyah et al., 2019; Suryawardani et al., 2022), the best action is to maintain performance, which is a different recommendation from the new procedure. Notice from Table 8 or Table 9, that there are only 7 customers out of 30 for whom the decision to maintain performance is considered optimal.

DISCUSSION

One main output of this study is an evaluation table as shown in Table 6 or Table 7. This table can be used as guidance to determine the appropriate action to an attribute based on its position in the paired categories of Servqual and Kano assessments. Such guidance might be implicitly extracted from the previous works (Dewi, 2019; Suryawardani et al., 2022), however none offered justifications for the recommended actions. This study presents the justifications in the forms of propositions, which are developed based on certain assumptions on the analyzed service process and its customers. Assumptions regarding the service process include the revenue and cost impacts of changes in performance, the diminishing marginal product of resources and the variability in performance. Assumptions on customers include the impact of changes in satisfaction to willingness to pay and the heterogeneity in valuations to the attribute's performance and its role in the service.

Revenue and cost impacts become the main considerations since this study argues that the best action should be defined as the act that will maximize profit rather than maximize customer satisfaction.

Another main output of this study is a new procedure to combine Servqual with Kano. The major distinction between the typical integration process and the proposed new mechanism is on its points of focus. The old process focuses on the attribute, hence it was mandatory that the final categories for an attribute in the Kano model and in the Servqual model be determined prior to deciding on the best action to do. Meanwhile, the new integration process has a premise that there is no such thing as the real or the correct category for an attribute in each model. At an instance of time, an attribute may simultaneously have multiple categories depending on the views of customers who are experiencing it. Thus, it is deemed not only unnecessary but also misleading to assign a single category for an attribute either in the Kano model or in the Servqual model. The new mechanism focuses on the customers instead of the attribute. The ultimate objective in the new procedure is to decide on the most optimal action for the owner of the service, given the condition that customers may have dissimilar judgments for an attribute. Unlike the old process, here the distributions of customer' assessments in both models need to be brought into the integration process. In the situation wherein customers are diverse but equally important, this study argues that it is more justifiable to make a decision based on the highest proportion of customers who support it.

The old and the new integration processes also differ in the number of performance discrepancy categories that could be constructed from the results of Servqual assessments. The old process had only two categories, i.e., the strong category for an average value of (P – E) > 0 and the weak category for an average value of (P – E) < 0. Meanwhile the new process has five categories, i.e., (P – E) << 0, (P – E) < 0, (P – E) = 0, (P – E) > 0 and (P – E) >> 0. Notice that there are three categories which were not available in the old process, i.e., (P – E) = 0, (P – E) >> 0, (P – E) << 0. There are reasons for the existence of those extra categories in the new procedure.

First look at the category of (P – E) = 0, which could not exist in the old process since it was almost impossible to have the average value of (P – E) from all customers to be precisely zero. This category can instead exist in the new process since it is possible to have some customers who feel that the perceived performances of the attribute are equal to their expectations. As a matter of fact, if this category is not prepared then the constructed classes intervals of (P – E) values are not collectively exhaustive. Moreover, the existence of this class interval makes it possible to accommodate the possibility of different best actions between the condition of (P – E) = 0 and the condition of (P – E) > 0, which is needed to accommodate the assumption of performance variability.

The other two categories, i.e., (P – E) >> 0 and (P – E) << 0, are set to accommodate the possibility of different best actions between the condition of "having performance a little bit higher (lower) than expected" and the condition of "having performance much higher (lower) than expected". Nonetheless, as shown in Table 6, the category of (P − E) << 0 is actually redundant since the recommended best actions are the same as the category of (P − E) < 0, irrespective of its category in the Kano model. Thus, there are only four categories of performance discrepancy that need to be considered, i.e., (P − E) < 0, (P − E) = 0, (P − E) > 0 and (P − E) >> 0. The possibility of different best actions between (P − E) > 0 and (P − E) >> 0 emerge as the consequences of diminishing marginal utility in consumption and diminishing marginal product of resources, such that if the performance is continuously improved then the marginal revenue will be lower than the marginal cost. Thus, the category of (P − E) >> 0 can only exist if the range of values for (P − E) is wide enough and if we can identify the right value that differentiate between (P − E) > 0 and (P − E) >> 0, which is not necessarily the same for all categories of attribute in Kano model. When it is difficult to determine the boundary that differentiate those conditions, or if there is no necessity to impose the three assumptions, i.e., performance variability, diminishing marginal utility and diminishing marginal product, then the evaluation table can be simplified. Table 10 presents the new guidance for best actions which is based on the simplification.

CONCLUSION

This study provides justifications on why certain actions are recommended to service attributes based on assessments using the integrated Servqual and Kano models. A new perspective is offered by shifting the definition of best action from the one that maximizes customer satisfaction to the one that maximizes profit. Rather complete assumptions are imposed on the object service process including the revenue and cost impacts of changes, the variability in performance, the diminishing marginal utility in consumption and the diminishing marginal product of resources. The choices for best actions in multiple settings of combined Servqual and Kano categories are summarized in the form of an evaluation table that can be easily used as guidance in future works. Moreover, the existence of clear assumptions and detailed propositions in this study open ways for effective communications between academics and practitioners who are interested in the integration works of Servqual and Kano models. Any disagreement on the suggested actions can later be directed to the appropriateness of the assumptions in the service model or the rigorousness of the developed propositions.

Table 10 Simplified evaluation table

Performance Discrepancy Category (Servqual Model)	Attribute Category (Kano Model)				
	M	O	A	I	R
(P − E) ≥ 0	Maintain	Improve	Improve	Reduce	Reduce
(P − E) < 0	Improve	Improve	Improve	Reduce	Reduce

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