

Improving the quality of public transportation using Quality Function Deployment and Kano's Model

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Abstract—This paper attempts to examine how the level of customers satisfaction of transportation industry and what attributes that contribute to customers satisfaction. The subjects are passengers of city bus operated in Yogyakarta, one of cities in Indonesia which is famous for its title as city of education and culture. The quality of services was assessed using an instrument developed from combined literature review and focus group discussion. The responses of the instrument, which were distributed to subjects using questionnaires, were used to develop house of quality. To identify service attributes that contribute to customer satisfaction, this paper uses Kano's model. Service attributes are categorized based on their contribution to customers' satisfaction. Using the model, service attribute that receive highest priority from the perspective of customers should be given highest attention from the company. Using the categorisation, company can identify what attributes that are critical for customer satisfaction and which are less important. Implications for theory and practices as well as direction for future research are also presented.

Keywords—service quality, Kano's model, Quality Function Deployment, House of Quality, public transport

I. INTRODUCTION

Quality Function Development (QFD) has been extensively used to design product and services. There have been beliefs that applying QFD for designing products is easier in comparison for that of services. This is due to the fact that physical characteristics of products are much easier to measure. On the other hand, despite difficulties to measure the characteristics of services, the use of QFD for designing them still becomes interest for academia.

One of the QFD methodologies is House of Quality (HOQ), which is also known as A-1 matrix. The basic concept of HOQ is that it attempts to match the need of customers, known as voice of customers, with the manufacturing specification, which is called as voice of company. Due to the importance of customers' voice in designing service, the design is driven by customers [1]. To enable integration between the voice of customers and voice of company, different functions within organisations should work together. For example, marketing people who gather information regarding customers' requirements should collaborate with production staffs to translate the requirements into manufacturing specifications.

Voice of customers can be collected using both quantitative and qualitative methods. In some cases, the qualitative nature services attribute should be accompanied with the quantitative one. This is due to the fact that qualitative attributes of a service have different level of importance from the perspective of customers. Using the quantitative method, one can identify which of the attribute that contributes most to customer satisfaction. Identifying customers want alone is not sufficient; company should go further by prioritizing based on the importance of the attributes.

The Kano model is an effective method to categorise the characteristics of service attributes required by customers [2]. In order to better use of QFD for satisfying customers wants, this paper attempts to integrate QFD and Kano's model to achieve customers satisfaction. Despite the need to integrate QFD and Kano model, there is no example of study that attempts to integrate QFD and Kano's model in public transportation service. In addition to integrating QFD and Kano's model, existing concept related to service quality [3] will be incorporated into the model development.

This remainder of this paper is organised into six sections. Next section will describe the object of the study. Then, on Section III there will Literature Review that discusses existing studies in this field. Section IV discusses the Research Method adopted in this study. These include how to develop the instrument, how to adopt responses from customers into QFD and how to integrate GFD into Kano's model. On Section V, Result and Analysis, there will be discussion on the result of the analysis, and finally on the last section, Conclusion will present the key findings of this study and future research directions.

II. CASE STUDY AND SUBJECT

Public transportation has been major concern for governments in many countries [4]. In Indonesia, the fourth largest of populous country in the world, the use of public transportation is strongly encouraged to reduce traffic jam. Jakarta, as the

capital of the country, ranked first in terms of the traffic jam [5]. Other cities in have better condition but the problems related to transportations remain. Many transportation experts from the country argued that the future of transportation facilities in other cities in Indonesia will be similar with Jakarta.

This study is carried out in Yogyakarta, one of the main cities in Indonesia. The city has been mentioned as one of the fastest growing city in Indonesia that has received attention pertaining to its public transportation facilities. The city is famous with its title as city of education and culture where a large number of tourists visit the city and an abundant number of students come to it for studying. As the city of education, the composition of the population mainly consists of students that have high mobility within the city. As a consequence, transportation that can support the need of students for mobility purposes is highly demanded.

To fulfill the need of mobility, students mostly use motorcycle and cars. The use of these transportation modes are mainly due to the increase of buying power of society driven by high economic growth during the last decade. In addition, more city cars with affordable prices are offered to the market causes the number of cars has increase dramatically during the last decade. These are the main cause of traffic jam in the city; these causes are identical with those in other developing countries [6].

Government in collaboration with private sectors has attempted to reduce the traffic jam by means of public transportation. TransJogja is one of the outputs of the collaborations. TransJogja is an alternative method of transportation targeted for students, tourists and local people who have high mobility to travel within the city. Since its launch in March 2008, the buses have attracted a large number of people. However, in comparison to overall populations of the commuters and the target of passenger numbers, the figure is still far below expectation. This indicates there are some problems with the services offered by the company. This study attempts to address this issue by investigating the design of the services offered by TransJogja. QFD and Kano's model are utilised to investigate how the design of appropriate services offered to society as the customers.

III. LITERATURE REVIEW

A. *Service Quality: An overview*

Transportation can be categorised as a service rather than a product. Many scholars argue that in many cases, there is no either product or service offered customers. Most services offered to customers are mixed between some elements of products. In the case for transportation, as mentioned previously, the portion of services in transportation is much larger than the portion of products. For this reason, it is therefore relevant to review existing concept in service quality for services.

Service quality measurements can be traced back with service quality method (SERVQUAL) developed by Parasuraman and his colleagues ([3], [7], [8]). The concept consists of five dimensions: tangibles, reliability, responsiveness, assurance and empathy. This method mainly focuses on comparing of what the expectation from customers and what the real experience they receive. From the comparison, one can measure service gaps, which are the foundation for improving services offered to customers. Its application to measure quality has been used in many different industries such as hotel ([9], [10]), banking [11], [12] restaurant [13], grocery stores [14] and many others. Another method for measuring service quality is service performance (SERVPERF) proposed by Cronin and Taylor [15], which is just a variant of SERVQUAL.

Despite the popularity of the two methods just discussed above, critics emerge. First, the models were developed in the west cultural context. Thus, there might be some cultural differences that can undermine the usefulness of the model if they are applied in different cultures. This can be easily understood since people from different cultures appreciate different values [16]. Second, the methods use generic concepts that might be less relevant if they are applied in different industries. In addition, specific concepts that are critical in certain services industries might not be captured by the both methods – i.e. SERVQUAL and SERFPERF. As an example, Garibay [17] point out critical elements in library services such as search engines, website searching, and maintenance links are not covered by the methods. These critical elements must be explicitly measured in order to better measure the services offered by companies.

B. *Quality Function Deployment*

Quality Function Deployment (QFD) is a tool to design products to meet customers' needs. Using the method, customers' requirements are converted into technical specifications during product development stage. Its first use can be traced back in 1972 when Mitsubishi used it to identify the 'voice of customers' and in the next decade it was introduced in the USA. Since then, its applications are not only on physical products but also on services, for example airlines [18], health care [19], hotel [20] and many others. A literature review carried out by Sharma et al. [21] who analysed 400 applications of QFD across different organisations along with with softwares, tools and web resources concluded that it has been widely accepted across sectors. Similarly, another literature review by Chan and Wu [22] showed that there is an abundant number of conferences, special issues, and articles devoted on the use of QFD. These all indicates that its application have been well accepted across different industries by an abundant number of scholars.

C. Kano's Model

There had been beliefs stating that the customers' satisfaction is linear with quality of service. In this belief, it is assumed that a certain amount of increase in service quality will lead to improved customers' satisfaction. The higher the service quality improvement, the higher the increase of customers' satisfaction. This is not true from the standpoint of Kano's Model. In his model, Kano identifies attributes of products and services that can satisfy customers' needs. The model demonstrated that for certain attributes customers satisfaction could be greatly improved by increasing a small percentage of service attributes. The model identifies three categories of product attributes that are critical to customers' satisfaction [23].

Basic needs refer to the 'must-be-attributes' or compulsory characteristics of products that are wanted by customers. The presence of these attributes does not lead customer satisfaction; rather, its presence only can avoid dissatisfaction. However, their absence causes dissatisfaction.

Attractive attributes are intended to fulfill excitement needs. Absence of these attribute does not create dissatisfaction because customers think that their presences are not compulsory; however, the absence can hinder customers for being excited. This is because offering these attributes to customers increase satisfaction, and therefore they are delighted. The relationship between the attributes and customers' satisfaction is not linear; rather it is non-linear as presented in Figure 1. The satisfaction increases super-linearly as the presence of attribute increases. These are: basic needs, attractive attributes and one dimensional.

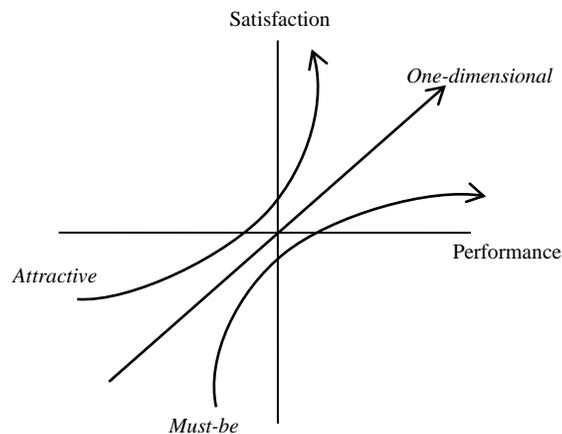


Fig. 1. The Kano model

One dimensional attributes are associated with performance of the service. In the Kano Model presented in Figure 1 above, the position of these attributes is between attractive and must-be attributes. Different from the two previous attribute categories, whose relationships with satisfaction are not linear, the relationship of attributes in this category is linear. The attributes create satisfaction or dissatisfaction in proportion of their presence.

In addition to the three categorization just discussed above, there is also an opportunity that the attributes shift from a category to another. For example, an attribute categorised as an attractive attribute can diminish and become basic needs. ATM used to be considered as an attractive attribute in the early of 1990s for customers banking in some countries. However, it is no longer categorised as an attractive attribute, rather it is a basic need.

IV. RESERCH METHODS

A. The instrument

The instrument used in this study was developed in a series of stages. First of all, defining Voice of Customers (VoC). In QFD model, defining customers' requirements is a critical task as this reflects the VoC. Once the requirements have been defined, one must assign priorities indicating to what extent they are important. Kano's model is an excellent tool that can be used to identify what priorities that can satisfy customers need. In addition, Kano's model assist service companies to understand what service attributes that can meet basic and excitement need as well as one dimensional attributes [2]. Due to the usefulness of Kano's model to understand how service attributes can meet different customers need, integrating it with QFD will result in a powerful tool design services. The combination of Kano's model and QFD can overcome weaknesses found in both SERVQUAL and SERVPERF.

The design of the instrument starts with existing methods in service quality measurements – i.e. SERVQUAL and SERVPERF. The concepts from the methods were used as the basis for focus group discussion (FGD) with the purpose of

capturing the critical dimensions of service quality in public transportation. The results of the FDG were then converted into questionnaires and pre-tested before it was used in the real respondents. Some modifications were made using the feedback from the pre-test. The final questionnaires were distributed to 113 respondents consisting of university students. The development process of the instrument is presented graphically in Figure 2.

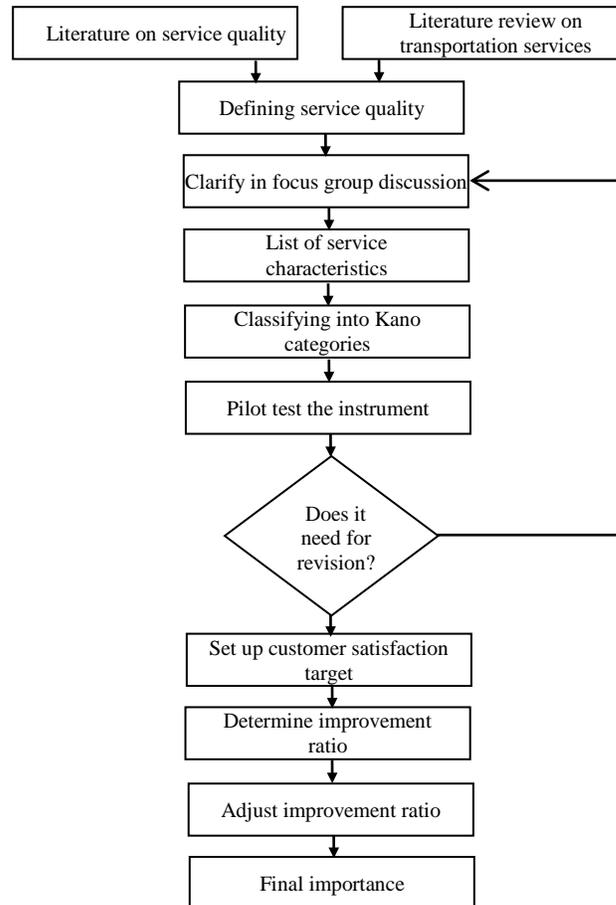


Fig. 2. The procedures of this research

As presented in Table 1, the attributes that are important from the perspective of customers are specific for public transportation. These attributes are different from the items developed in Parasuraman et al ([3], [7], [8]). The author does not argue that the instrument in Parasuraman et al ([3], [7], [8]) is not useful, rather the author believes that the relevance of the attributes is lower if it is applied in a specific service or context. The items presented in the table might be represented by items proposed by Parasuraman et al ([3], [7], [8]) in generic terms and less explicit. As such, the subjects of the research cannot capture important and specific attributes entirely whereas in this research the attributes are measured explicitly. For example, item number 2 – i.e. closeness of bus stop location to home – is a specific attribute found only for bus services. Due to its specificity, the terms used in this research could be used more easily by the service provider to improve its services. The service provider can understand what need to be improved (*What* – Voice of Customers) and how to improve it (*How* – from service providers’ standpoint).

TABLE I. SUMMARY OF RESPONSES FROM SUBJECTS

No.	Attributes	Average
1.	Reliable journey schedule	4.27
2.	Closeness of bus stop location to destinations and point of departure	4.05
3.	Convenience during waiting time on the bus stop	3.98
4.	Reliability of journey duration	3.80
5.	Convenience during the journey	3.78
6.	Clear direction about the route	3.70
7.	Safety and security of the journey	3.56

B. Integrating QFD and Kano Model

As has been discussed previously, the purpose of using Kano’s model is to identify the priority of attributes from the perspective of customers. Using the model, the attributes can be classified in term of their importance so that which one is more important than others can be understood. According to Tan and Shen [24], companies can measure service attributes representing customers’ requirement using the following formula:

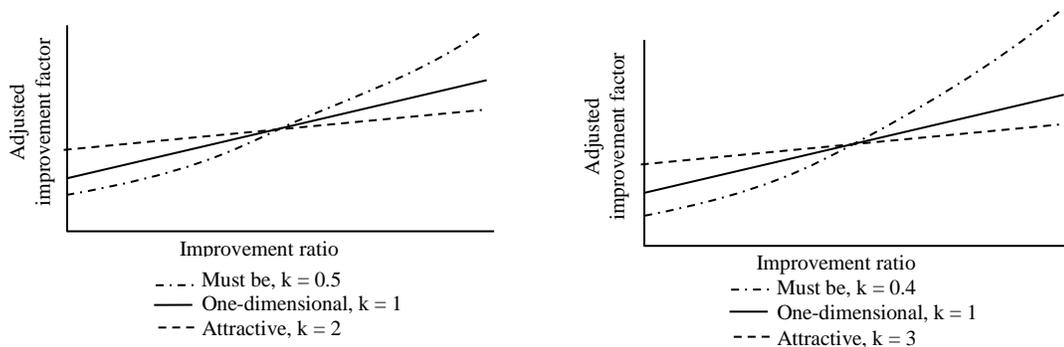
$$IR_{adj} = (IR_0)^{1/k} \tag{1}$$

In the above formula, IR_{adj} represent adjusted improvement factor whereas IR_0 represents improvement ratio and k is the parameter of is the Kano for the three different categories. Original improvement ratio (IR_0) is calculated using the following equation [24]:

$$IR_0 = S_1/S_0 \tag{2}$$

where S_1 is the target of customer satisfaction that the company attempt to achieve, while S_0 is the current state of customer satisfaction.

As an example, the value of k for different customers’ requirement can be '1/2', '1' and '2' for must-be, one-dimensional and attractive attributes respectively. Then, the value of improvement ratio can be calculated using the above equation. Figure 3 demonstrates the value of original improvement ratio (IR_0) and the adjusted improvement ratio (IR_{adj}) for a series of k values. From the figure above, it can be concluded that the process is bad when the value of $IR_0 > 1$. The value of IR_0 is below 1 because the value of S_0 is lower than S_1 ($S_0 < S_1$).



a. Lower difference between must-be and attractive b. Higher difference between must-be and attractive

Fig. 3. The changes of adjusted improvement ratio on different k values

Based on the Figure 3 above, it can be concluded that the must-be attributes should receive first attention, followed by one-dimensional and attractive attributes. On the other hand, when the value of IR_0 is lower than 1 ($IR_0 < 1$). The performance of corresponding attributes is good because the actual services delivered to customers higher than the expectation of customers. In this condition, the current customer satisfaction (S_0) is higher than customer expectation (S_1). In this model, the attractive attributes should receive attention before one-dimensional and must-be attributes. As depicted in the Figure 3b, it can be seen that $IR_{adj} < 1$.

Figure 3b demonstrates how the initial figure of Kano model shifts. Once the company undertakes assign prioritisation of customer requirements, the k moves. From the figure above it can be seen that for particular 'k' value of '1', '3' and '4', the value

of IR_{adj} are higher than those in the previous figure, in which company has not prioritized the attributes. From this result, it can be said that equation (1) is a beneficial tool for companies to assign priority of customers' requirements, which is useful in product development using QFD.

V. RESULTS AND ANALYSIS

A. Questionnaires

This study utilised survey to collect data from university students and the descriptive statistics of the responses are presented in Table 1. Of the 113 returned questionnaires, which used five-point Likert Scale, 7 were omitted from further analysis due to incomplete.

As can be seen on the table, Reliability of journey schedule received the highest attention from the respondent. Reliability of journey duration comes next. Both these attributes are concerned with the schedule and time. These findings confirm public opinion regarding the time issues of the journey. In addition, these are also related to traffic jam that make the travel time less predictable.

Some of the respondents stated that traffic jam using bus services is longer in comparison to using other transportation mode such as motor bike or car. Safety and security issues during the journey is the least important for the respondents. To ensure reliability of the instrument, Cronbach's alpha test was employed. It was found that all construct results in Cronbach's alpha above 0.60 so that they all can be categorised as reliable [25].

B. Adopting responses from customers into QFD

There are several stages of designing services that meet customers' specifications using QFD. The first stage is defining what customers requirements, which is called as the 'What' in QFD model. In this study, the customers' requirements were identified using two stages. First, using literature review, and second, using focus group discussion. The two stages are sequential as the results of first stage were used as the material for the second stages. Some of the influential past studies are dell'Olio et al. [26], Beirão and Cabral [27], and Joewono et al. [28]. The results from literature review are mostly confirmed during focus group discussion, some new concepts emerged and some others are not relevant. Some of the concepts that are not relevant are due to context differences as all the studies that were referred were undertaken in developed countries. The result of the development is presented in green colour in Figure 3.

The technical requirements, what so called 'How' in QFD, specify the methods and techniques to provide service attributes required by customers. 'How', which is presented in Figure 5 below in green colour, in this term refers to 'How to satisfy customer wants'. To do this, 'What the customers wants' that have been identified are translated into engineering specifications. In order to be able to design appropriate 'Hows', one must have a good understanding of the 'What'. For this reason, 'What' is a prerequisite to design 'How'.

A good understanding of both 'What' and 'How' does not necessarily the success of developing 'How'. The critical point to design appropriate 'How' is understanding of the *interrelationship* between 'What' and 'How'. The failure to understand the relationship will lead to incorrect services designs. In such case, company services with attributes that are not considered important from the standpoint of customers. This is because the company 'translate incorrectly' what the customers want into services specifications.

To ensure that this study develop service designs to meet the service attributes needed by customers, the 'How' is determined using interview and focus group discussion with staffs of the bus service operator. The author leads the discussions and explains to participants of the group discussion and interviewees the results of the questionnaires. The results of the discussions can be seen at the bottom of the Figure 4 with yellow colour. Of the eight technical requirements, Establishing a reliable journey time table receives highest importance, which is followed with Training for the bus driver. The remaining of service attributes required by customers and how they are translated into technical requirements are presented in the figure along with the scores. They are all presented in yellow colour at the bottom of the figure. These all technical requirements are intended to improve the quality of services provided by bus service company. Once this step has been completed, the overall analysis of QFD has finished.

C. Integrating QFD and Kano Model

As mentioned in the literature review and research method, Kano model attempts to categorise service attributes based on their level of importance. Company should be able to identify and assign priority to service attributes that are important from the standpoint of customers. To do this, responses from customers were analysed to identify service attributes that need to be addressed first. To do this classification, opinions from the staffs of service providers and customers were used. The results of the classification are presented in the first column of the right hand side of the graph with blue colour. Of the seven service attributes, three attributes are categorized into attractive, two factors are classified as one-dimensional and the other two as must-be. The factors are assigned score of 2, 1 and 0.5 for attractive, one-dimensional and must-be respectively.

On the next column, the second column, the average score of current customer satisfaction is presented. The figure is obtained from the responses of questionnaires distributed to subjects. All responses from the subjects are averaged and presented in ascending order from the highest to the lowest. The third column presents the customer satisfaction target intended to be achieved by the service provider. To obtain the values in this column, a group of people consisting staffs of the service provider work together with the research. All the participants agreed that attributes categories into attractive group should be assigned with maximum score. On the other hand, must-be attribute should be provided to customers until they achieve a certain level of satisfaction. Too much satisfaction on these attributes does not lead to customers excitement. The fulfillment of these attributes is intended to avoid customers dissatisfaction. For this reason, the score of the attributes are assigned at medium level – i.e. 3 out of maximum 5.

On the fourth column, the original improvement ratio (IR_0) is presented. The values are obtained using equation (2) proposed by Tan and Shen [24]. Using the equation, the results show that five out of seven service attributes have the value of IR_0 above 1. As the value of IR_0 above 1 indicates low satisfaction level from current service, all these five attributes need for improvement. Of the five attributes with IR_0 above 1, Convenience during waiting time on the bus stop has the highest value (1.37). Other attributes with IR_0 above 1 in ascending order are as follow: Closeness of bus stop location to destinations and point of departure (1.36), Reliable journey schedule (1.33), Convenience during the journey (1.23), and Reliability of journey duration (1.20).

It is important to emphasis here that these all values are still raw and have not considered the value of k . Therefore, it is necessary to consider how the categorization (i.e. attractive, one dimensional and must-be) affects customer satisfaction by considering k . To do this, IR_{adj} is calculated using the equation (1) presented in Section IV.B. The value of IR that have considered k value, what so called as IR_{adj} , is presented in fifth column.

The value of IR_{adj} offers insights for manager regarding which service attributes that need priority for improvement. The value of IR_{adj} larger than 1 indicates that it requires improvement whereas the value below 1 suggests that it has met or exceeded the customers' requirements. The larger the value of IR_{adj} suggests the higher the need for improvement. The ranking of IR_0 for all service attributes consistently the same as IR_{adj} .

Of all the seven service attributes, Convenience during waiting time on the bus stop has the highest IR_{adj} value (1.153) and therefore should be given the first priority for improvement. Despite it has the third highest score of current satisfaction level from customers, it needs improvement desperately as it has the highest IR_{adj} score. This is due to the fact that the attribute is categorized as attractive so that customers have high expectation from the service providers. The other two attributes categorized in attractive – i.e. Closeness of bus stop location to destinations and point of departure and Convenience during waiting time on the bus stop – the former should be given higher priority rather than the latter considering its higher IR_{adj} than the other.

The value of IR_{adj} showed service attributes requiring for improvement. However, it does not show how important an attribute requiring improvement from the perspective of customers. Failure to identify the priority of importance from the standpoint of customers will lead to incorrect strategy. For this reason, it is necessary to consider the weight of the attributes from the standpoint of customers. To consider the opinion from the customers, the value of IR_{adj} is multiplied with the importance of 'Whats', which is presented in the first column in green colour. The results of this calculation provide a clear picture of what attribute should be addressed first; these are presented in the sixth column. The results of IR_{adj} values are then converted into percentage to provide a clearer picture of how important an attribute in comparison to others. This is presented in the last column in blue colour. From the figure it is clear that the urgency to address the most important attribute – i.e. Reliable journey schedule (21.22%) – is more than three times than the least important – i.e. Clear direction about the route (6.81%). From these figures, it can be concluded that the importance of addressing the latter attributes is very low compared to the former. This might be partly due to the fact that most passengers are local citizens who have well informed about the route journey.

Other two attributes with high percentages are Closeness of bus stop location to destinations and point of departure (17.16%) and Convenience during waiting time on the bus stop (17.26%). Despite both attributes are categorized as attractive according to Kano categorization with value of k equal to 2, the percentage is slightly different. This is because there is a difference in term of current satisfaction level. Convenience during waiting time on the bus stop is higher than the other because it has lower current level of satisfaction, and therefore, there is more room for the company to carry out service improvement. Despite both of the attributes are categorized in the same group with attribute with highest percentage – i.e. Reliable journey schedule – and both are assigned the same value of k factor, the percentage of the first two is significantly lower than the latter. One of the explanation could be that the factor with highest percentage of importance is ranked first by customers, which is indicated with maximum value of 'importance of the what'. In this case, the voice of customers does matter. Other values in the same column depict how important an attributed in comparison to others. The percentage presented in the last column of blue colour present clearly what attribute that should be given higher priority than others after considering the voice of customers.

		Planning matrix														
Technical requirements (Hows)	Customer requirements (Whats)	Importance of the 'whats'	Set-up more realistic schedule	Build bus stop in strategic position	Equip the bus with air conditioners	Recruit skillful bus driver	Limit the number of passengers on the bus	Provide map and journey direction	Install security camera on the bus	Kano category	Current customer satisfaction	Customer satisfaction target	Original improvement ratio	Adjusted improvement factor	Adjusted importance	Percent importance
		Reliable journey schedule	5	5	3	0	3	3	1	0	2	3.76	5	1.330	1.153	5.77
Closeness of bus stop location to destinations and point of departure	4	3	5	0	0	0	0	0	2	3.68	5	1.359	1.166	4.67	17.16%	
Convenience during waiting time on the bus stop	4	0	3	0	0	0	0	0	2	3.64	5	1.374	1.172	4.69	17.26%	
Reliability of journey duration	3	5	3	5	5	0	0	0	1	3.32	4	1.205	1.205	3.61	13.30%	
Convenience during the journey	3	3	0	0	5	5	0	0	1	3.24	4	1.235	1.235	3.70	13.63%	
Clear direction about the route	2	0	0	0	0	0	5	0	0.5	3.12	3	0.962	0.925	1.85	6.81%	
Safety and security of the journey	3	1	0	1	5	5	0	5	0.5	3.06	3	0.980	0.961	2.88	10.61%	
Importance of 'Hows'		75	67	23	70	50	20	15	Total							100%
Relative importance (in percentage)		23.44	20.94	7.19	21.88	15.63	6.25	4.69								
Importances of 'Hows' using Kano		74.88	65.52	20.96	68.31	50.23	15.01	14.42								
Relative percentage (%)		24.21	21.18	6.77	22.08	16.24	4.85	4.66								

Fig. 4. The changes of adjusted improvement ratio on different k values

Once the importance service attributes from customers standpoint have been considered, it is now time to further analyse the importance of technical specification (*Hows*). Technical specification to design service is on the service provider so that the analysis is carried out from the perspective of company. To obtain the value of the *Hows* or technical requirements, the value of each item the technical requirements is multiplied with adjusted importance. As has been explained in previously in this section, the adjusted importance has considered the value of *k*; and, therefore, it has taken into account the categorisation of service attributes. The result is presented on the second row from bottom of the area with yellow colour. As example, to obtain the value of Set-up more realistic schedule is calculated using this data: $(5 \times 5.77) + (3 \times 4.67) + (0 \times 4.69) + (5 \times 3.61) + (3 \times 3.70) + (0 \times 1.85) + (1 \times 2.88)$. Using the same method, other technical requirements is has been calculated and presented in the Figure 3. At this point, the process of developing service design that consider non-linear customer satisfaction using QFD method has been completed.

VI. DISCUSSION

One might argue that the results of this study might be confined within specific context and service. This can be understood as service is difficult to be standardised due to background differences of the customers – such as culture, industry and country – require companies to define service quality differently. However, this does not mean that the results of this study is not useful in other context. There are results of this study that are assured to be relevant for other context regardless of the customers background differences. These are the service attributes that are generic regardless of the customers differences, such as punctuality of the journey schedule, safety of the journey, and clear direction about the journey. All these attributes are required by customers with any cultural background.

A unique feature of QFD is that it can identify service attributes needed by customers (*Whats*) and then translated into technical requirements (*Hows*). Using the method proposed by QFD, there can be a direct link between the attributes of service demanded by customers and the design of service offered by service provider.

In addition to several insights just discussed, this study offers key learning points. First, this study does not incorporate competitor analysis into QFD model for several reasons. If companies considering the service attributes offered by competitors, the design of services directly or indirectly is driven by the service attributes offered by competitors. In fact, not all service attributes offered by competitors are wanted by customers. Or, in other cases, there might be some attributes that might be needed by customers but they are not recognised by competitors. Thus, using competitors into the analysis is not always beneficial.

Second, not all industries or companies have direct competitors for comparison. In this case study, the bus service provider is the only company offering public transportation service in the city. In case one interested to carry out comparison with other service quality providers, he should compare with service substitutes such as taxi service, personal car, or motorbike, that might reduce the relevance of the analysis. Using a single case company that offer the only service in the region is a contribution of this research that has never been conducted in existing research.

Third, in this study customised service attributes are identified using a set of combination between focus group discussion, literature review and questionnaires. The customised service attributes used to develop QFD in this study is customised for bus service provider. The attributes are explicitly mentioned in the questionnaires and house of quality model. Due to their specificity, it has high practical relevancies as it addresses specifically what should be done by managers to improve the service quality.

VII. CONCLUSION

A. Future research recommendation

This study has successfully integrated Kano's model into QFD to design service for public transportation industry. Instead of using a model of service quality developed by Parasuraman ([3], [7], [8]), concepts that has been widely used in academia, instrument used in this study is developed using a series of steps. It was developed using a comprehensive literature review, focus group discussion and questionnaires ensuring that the attributes are of high relevance.

Several research avenues regarding the use of Kano's model for future research are identified from this study. The first issue is regarding categorization. In the Kano's model, there are three basic categories: 'must-be', 'one-dimensional' and 'attractive'. In addition to these three categories, it is possible that other categories emerge such as 'indifferent', 'reverse', and 'skeptical' [23]. This study only considers the three categories while they might be categorised into any of these three categories. Future research could address these categories and examine how the service attributes can be categorised into these additional groups.

The second issue is still related to attributes categorisation. The three categorization can be further divided into more details grouping to better represent the real conditions of customers satisfaction. The additional categories could be 'slightly attractive', 'very attractive', 'slightly must-be' and 'highly must-be'. The breakdown of categories into more detail groups can provide better information pertaining to customers preferences and offer deeper insight for service providers.

Third, k function in the Kano's model in this study is simplified. The value of k in this study is 0.5, 1, and 1.5 respectively for 'must-be', 'one-dimensional' and 'attractive'. In reality, the value of k can be any number depends on various factors such as customers' attitude, the relationship between the attributes expertise of the researchers, practitioners experience and so forth. Different investigators might assign different k values for the same object of investigation. This is due to the differences of personal opinion of the researchers. Future research should use weighted k value obtained from a number of investigators to increase the objectivity of the k value.

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