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Application of Kano Model in Identifying Attributes – A Case Study on School Bus Services

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ABSTRACT

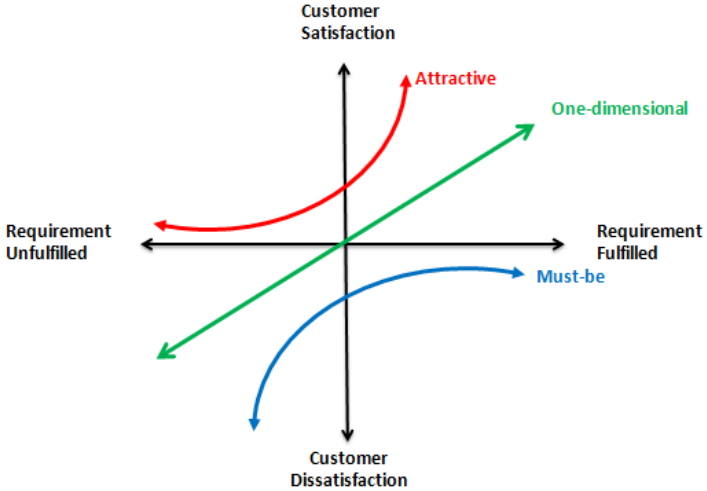
Now a days use of school buses are becoming more and more extensive. So schools and bus service providers begin to pay more attention to the development of school buses, they need to improve the school buses to meet students' requirements. Analysing the factors which affect satisfaction or dissatisfaction of students and finding ways to improve satisfaction as well as to reduce dissatisfaction is the key. Kano model is used to analyse school buses of DAV, Pokhariput, Bhubaneswar to find out students' needs and classify attributes of school buses. Three approaches to Kano model are used to categorize the school buses attributes as must-be quality, one-dimensional quality, attractive quality and indifferent quality. By using the rule M>O>A>I, schools and bus service providers could decide the priorities of different attributes to improve satisfaction of students according to the result.

Keywords: Kano Model, Attribute, Customer Satisfaction, Bus, Bhubaneswar.

INTRODUCTION:

It's difficult to ascertain customers' ideas about quality and is often confused and difficult to get clarity. Marketers have to spare no effort to satisfy the customer needs while planning a product or service, A specific list of customers' need is a determining factor. Many methods are available for investigating the characteristics of customer requirements. The particular method we will discuss here is based on the work of Professor Noriaki Kano of Tokyo Rika University. The ideas which the Professor Kano and his colleagues developed are as follows.
I. Making abstract ideas about quality into concrete It is really tough for customers to express their needs or express their needs to manufacturers clearly. As all customers' ideas made, many requirements emerge, and they finally fall into several groups.

Figure 1: Kano Model



(http://design-cu.jp/iasdr2013/papers/1835-1b.pdf)

Elements:
Kano model divides the product attributes into six types:

- Must-be attribute (M). These attributes are considered as product's basic requirements. It's essential to the product or service. If it is well fulfilled, the satisfaction of customers will not be improved; but if it is not fulfilled, customers will be extremely dissatisfied with the product.
- One-dimensional attribute (O). These are attributes that are told by the customers and the ones in which companies compete .If it's not fulfilled, customers will be dissatisfied with the product and if these types of requirements are fulfilled, they can become a strong source of customer satisfaction and should therefore be given much more importance in designing product and service Such a type of attributes has a linear relationship with customer satisfaction.
- Attractive attribute (A). These are the attributes that are not expected normally .Such a type of attribute unexpectedly delight the customer and cause satisfaction. But if it doesn't exist, it will not cause dissatisfaction.
- Indifferent attribute (I). The attribute doesn't have significant influence on the satisfaction. Customers will not pay attention to this type of attributes.
- Reverse attribute (R). The customer doesn't expect this attribute. Its presence will cause dissatisfaction.
- Questionable attribute (Q). The customer gives conflicting answers to this type of attributes.

Questionnaires can be used to classify the customers 'requirements:
Professor Kano and his colleagues were strongly in favour of the One-dimensional, Attractive, Must-be, Indifferent, Reverse and Questionable customer requirements which can be classified through a customer questionnaire. From the responses to the results of questionnaires, the product feature can be divided into six categories.

REVIEW OF LITERATURE:

This literature review aim at investigation the important contribution which made use of the Kano methodology. It summarizes and tries make a linkage to suitable school of thought. All the scientific research start with analyzing the existing literature to get a border picture of the world as reported by Cooper (1998). It's described in three phases.
First Phase (1984-1999)
Kano and Takahashi (1979) studied the concept of the motivator-hygiene (MH) property of quality on the basis of Herzberg´s two factor theory and found that factors crating job satisfaction and job dissatisfaction are different. Kano et al. (1984) introduced their theory of "attractive quality and must-be quality" in the Western world. A new field of research was born with the conceptual basis and the development of the Kano methodology, which comprises a specific questionnaire to categorize quality attributes. Publication of some research papers (Kano 1995; Yamada 1998), which reinforced the dissemination of the theory of attractive quality also took place. Berger at al. (1993) contributed a collection of ideas of using theory in practices in this field. A case study from NASA was executed by Lee and Newcomb (1997) which presented new means and measures to simplify the classification of quality attributes and suggested alternative statistical test and procedures for their use in practice. Matzler (Matzler et al. 1996; Matzler and Hinterhuber 1998) strengthens the foundation for the theory of attractive quality strengthen through a wide empirical investigation in the ski industry (over 1500 customers).
The initial 15 years after Kano's theory of attractive quality depended on couple of solid scholarly papers that opened the field of research. Other than the theory of attractive quality itself, including the Kano methodology and proposals to incorporate the theory in to practice, approaches for estimating and testing were added to the given construct of quality attributes to enhance the practical application of it.
Second Phase (2000-2008)
The number of papers gradually increases as lot of research were going on application of Kano methodology in different product and services.
In 2001 Noriaki Kano presented a paper titled "Life cycle and creation of attractive quality" in a conference in Sweden (Kano, 2001). In this paper he examines available remote controls for television in the years 1983, 1989 and 1998. His conclusion out of this research was that a remote control was an attractive quality feature (attribute) in 1983, a one-dimensional feature (attribute) in 1989 and a must-be quality feature (attribute) in 1998. Nilsson-Witell and Fundin released a research paper in 2005, which examines the early stage of the life

cycle of the attractive quality. They found that new attributes are firstly aphetically before they become attractive. Nilsson-Witell and Fundin (2005) compared the answer possibilities of a Japanese (Kano et. al., 1984) questionnaire with an American (Berger et al., 1993) questionnaire. On the basis of this comparison, Nilsson-Witell and Fundin ensured that confusing classifications portions were dropped. The satisfaction of customers with a TV service analyzed by Jacobs (1999) and the staff satisfaction was evaluated Martensen and Grönholdt (2001). Both the researches classified the attributes based on their importance with the help of a dual-importance grid while a three-level questionnaire was released by Kano (2001). Emery and Tian (2002) and Zhang and von Dran (2002) employed direct questions approach.

The traditional method to categorizing attributes was conceived by Kano et. al. (1984) and Löfgren and Witeel (2008) compared this method with some substitute methods in an empirical study. (Martensen and Grönholdt, 2001; Emery and Tian, 2002). However, the study shows, that none of the other methods led to an outcome, which has any parallels with the outcome of the traditional Kano methodology. Moreover, the results from the three-level questionnaire steadily differ from the results of the five-level Kano questionnaire (Löfgren and Witell, 2007). With this knowledge it's concluded by, Löfgren et. al., (2013), in their literature review, that more exploration of other methods are required and for which they recommended to use the traditional five-level Kano questionnaire.

Matzler and Hinterhuber's (1998) studied the relation between Kano methodology and other methods, like FMEA, QFD and SERVQUAL. Mostly a combination of the Kano methodology and QFD is used. Tan and Shen (2000) priorities must be quality attributes whereas Tan and Pawita (2001) priorities attractive quality attributes.

The research which has been sought after in this stage, examined different methodologies and investigated new fields for the work of the Kano philosophy. The substitute wordings, methodologies and sorts of investigations ended up being advantageous in light of the fact that they offer assortment in the order of quality attributes. Be that as it may, the distinction between the options to the traditional Kano methodology is the result since it frequently separates from one another. But the issue is, that the best technique still has not been identified.

Third Phase (2009-2016)

The number of paper published each year increased profoundly as compared to the second Phase (2000 and 2008). One of the reason for the augmented outcome of papers was due to the establishment of new channels for publishing. While the number of research in other areas increased the research on the methodological foundations of the theory was scarce. A large number of papers instead are using Kano´s model and modify it like the fuzzy approach for a more objective questionnaire (Lee and Huang, 2009) and the modified cross axis of Kano´s model from Shyu et al. (2013). The wording used in questions, alternative answers and the evaluation table was challenged by Högström in 2011.

Gruber et al. (2011) revisited the study of life cycle of quality attributes, which was introduced by Kano (2001), concluding that the attributes of service employees varies from country to country in an orderly pattern.

Löfgren et al. (2011) studied the dynamics of quality attributes in terms of the existence of the life cycle of quality attributes .Their research proved the existence of three life cycles of quality attributes, which supports the significance of the theory of attractive quality.

Conclusively it can be said that the number of papers increased however the content remained mostly the same. The number of papers which are questioning and pushing the research on the theory of attractive quality is limited.

RESEARCH METHODOLOGY:

Step-I: There are lots of factors which affect consumer satisfaction. It is necessary to distinguish the key attributes of school buses. One way to confirm potential customer requirements which included in the questionnaire is to do much literature collecting and summarizing.

Step-II: It involves surveying respondents (through questionnaires) about the function through a pair of questions (functional and dysfunctional). Functional questions are asked in a positive way and dysfunctional questions are asked in a negative way. The respondents are asked to choose from among five choices for each question. In this case, a total of 12 questions regarding four dimensions of the Bus Service were asked to 100 students who take the bus service. An example of a Kano model question used in the questionnaire is presented below.

Functional Question:

1a. If the bus is on time, then how 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

Dysfunctional Question:
1b. If the bus is not in time, then how you feel? 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

Step-III:

Table 1: Kano Evaluation Table

Customer Requirement ⇒ / ⇓		Dysfunctional				
		Like	**Must Be**	**Neutral**	**Live With**	**Dislike**
Functional	Like	Q	A	A	A	O
	Must Be	R	I	I	I	M
	Neutral	R	I	I	I	M
	Live With	R	I	I	I	M
	Dislike	R	R	R	R	Q

It is to use the Kano Evaluation Table (Table 1) to count and summarize the results. The abbreviations used in the evaluation table are as follows- A: Attractive O: One- Dimensional, M: Must-Be, I: Indifferent, R: Reverse and Q: Questionable
For instance, if one respondent choose "I like it" for a functional question and responded "I like it" for a dysfunctional question and vice versa, the tested product or service feature would be classified as a Questionable requirement (Q).A requirement is classified as Attractive (A),If the respondent chooses "I like it" for a functional question and chooses "Must- Be" or Neutral" or "I can live with it" for a dysfunctional question. A requirement would be classified as One -Dimensional (O), if the respondent chooses "I like it" for a functional question and chooses "I dislike it" for a dysfunctional question. If the customer is neither satisfied nor dissatisfied with the requirements, then it's classified as Indifferent (I) . If the respondent choose "Must Be" for a functional question and answered "Must- Be" for a dysfunctional question, then the feature would be classified as Must- Be (M). If the is not wanted by customers and that they strongly expect the reverse, then it's considered as Reverse (R). In Kano Model, We are primarily investigating One-dimensional (O), Must-Be (M) and Attractive requirements (A), together with indifferent requirements (I).

Step-IV:
Based on the data collected from the questionnaire, we will analyze the results by three methods. The first method is decided according to the frequency of response given by the respondent called "Frequency-based Attributes Category". This method is the traditional way to categorize these attributes based on the mode statistic, which modifies the mode statistic as follows:
Grade = Max {M, 0, A, I, R, Q}
The second method developed from the first method to decrease the noise level to a point where all "requirements "are considered indifferent. Hence, it is suggested that if (O+A+M)> (I+R+Q), the maximum value of (O, A, M) should be adopted. Otherwise, the maximum value of (I, R, Q) should be used. In addition, when the results have the same two frequency requirements, the classification that would have the greatest impact on the product or service should be chosen. The priority order should follow M > O > A > I
The third method proposes two indexes to define final classification, called "Index-based Category", defined as follows:
Satisfaction Index (SI) = (A+O)/ (A+O+M+I)
Dissatisfaction Index(DI) = (M+O) / (A+O+M+I)
The Satisfaction Index ranges from 0(zero) to 1(one); the value is closer to 1 means higher influence on customer satisfaction and when the value is closer to 0 means little influence on customer satisfaction. Similarly, value of dissatisfaction index is greater means the impact is greater on customer dissatisfaction.

- If Satisfaction Index < 0.5, Dissatisfaction Index < 0.5, the attribute is indifferent.
- If Satisfaction index < 0.5, Dissatisfaction index ≥ 0.5, the attribute is must-be.
- If Satisfaction index ≥ 0.5 and Dissatisfaction index ≥0.5, it is one-dimensional.
- If Satisfaction index ≥ 0.5 and Dissatisfaction index < 0.5, the attribute is attractive.

Case Study: School Bus of DAV, Pokhariput:

The School is away from the Bhubaneswar City, and lot of students are reading, therefore, it is important to research the attributes with respect to the customer satisfaction. By summarizing a large number of relevant literatures and considering realities in the school campus, 12 attributes of school buses are identified as shown in Table 2.

Table 2: Summary of Kano Model Questionnaire Result

Dimension	Attribute	Description of the Attribute	M	O	A	I	R	Q	Total
Benefit	a 1	Low Price	**0**	0	5	9	**86**	0	100
Cheerful	a 2	Happy Internal Environment	**50**	40	9	1	0	0	100
	a 3	Good Attitude of Attendants	21	22	**45**	12	0	0	100
	a 4	Good Communication Skills of Drivers	4	3	9	**82**	2	0	100
Convenience	a 5	Ways of Ticket Buying	6	41	1	**51**	1	0	100
	a 6	Frequency	**45**	35	9	11	0	0	100
	a 7	Number of Stops	7	2	5	**83**	2	1	100
	a 8	Number of Routs	2	10	**45**	40	2	1	100
	a 9	Runs on Schedule	**33**	25	12	30	0	0	100
Safety	a 10	Safety Facilities	**57**	35	5	3	0	0	100
	a 11	Good driving habits of Drivers	28	**64**	7	1	0	0	100
	a 12	Control on Speed & Freight	32	**58**	6	2	1	1	100

The Customer Satisfaction Index for bus service is calculated in Table 3.

Table 3: Customer Satisfaction Index

Dimension	Attribute	Description of the Attribute	M	O	A	I	R	Q	SI	DI
Benefit	a 1	Low Price	0	0	5	9	86	0	0.36	0
Cheerful	a 2	Happy Internal Environment	53	37	9	1	0	0	0.46	0.9
	a 3	Good Attitude of Attendants	21	22	45	12	0	0	0.67	0.43
	a 4	Good Communication Skills of Drivers	4	3	9	82	2	0	0.12	0.07
Convenience	a 5	Ways of Ticket Buying	6	41	1	51	1	0	0.42	0.47
	a 6	Frequency	45	35	9	11	0	0	0.44	0.8
	a 7	Number of Stops	7	2	5	83	2	1	0.07	0.09
	a 8	Number of Routs	2	10	45	40	2	1	0.57	0.12
	a 9	Runs on Schedule	33	25	12	30	0	0	0.37	0.58
Safety	a 10	Safety Facilities	57	35	5	3	0	0	0.4	0.92
	a 11	Good driving habits of Drivers	28	64	7	1	0	0	0.71	0.92
	a 12	Control on Speed & Freight	32	58	6	2	1	1	0.65	0.92

After the data were collected, three Kano methods can be used to process and analyse the customer needs of school buses. With the principle of frequency-based and comparison-based category, we can get the classification of the attributes, which is shown in Columns 2-3 of Table 4. By using the index-based method, classifications of the school bus attributes are available, as shown in Column 4 of Table 4 . To get the end result, we choose to compare the results of three methods and use the "majority rule" to obtain the final categorizations of the school buses attributes, which is given in Column 5 of Table 4.

Table 4: Kano Categorization of School Buses Based on Three Methods

Attribute	Description of the Attribute	Frequency-Based	Comparison-Based	Index-Based	Category
a 1	Low Price	R	R	I	R
a 2	Happy Internal Environment	M	M	M	M
a 3	Good Attitude of Attendants	A	A	A	A
a 4	Good Communication Skills of Drivers	I	I	I	I
a 5	Ways of Ticket Buying	I	I	I	I
a 6	Frequency	M	M	M	M
a 7	Number of Stops	I	I	I	I
a 8	Number of Routs	A	A	A	A
a 9	Runs on Schedule	M	M	M	M
a 10	Safety Facilities	M	M	M	M
a 11	Good driving habits of Drivers	O	O	O	O
a 12	Control on Speed & Freight	O	O	O	O

The attributes “happy internal environment”, frequency”, “runs on schedule" and “safety facility” are categorized as must-be type(M). This kind of attributes provides diminishing returns in terms of customer satisfaction and the absence or poor performance of these attributes results in extreme customer dissatisfaction. If the internal environment of the school bus is not good which make students feel very dissatisfied; however, if the internal environment of school bus is good , students' satisfaction cannot be increased.

The attributes “good driving habits of drivers" "no over-speed or over-freight" are regarded as one-dimensional type(O). Products with these functions will improve customer satisfaction; by contrast, products which do not have or have little of these attributes will reduce customers' satisfaction.

The attributes “good attitude of attendants” and “number of routs” are regarded as attractive type (A). If it’s there, customers are satisfied, but if it’s not there, then customers are not dissatisfied.

The attributes "good communication skills of drivers"," ways of ticket-buying" and "number of stops" are viewed as indifferent type (I). These attributes have little influence on students and do not factor into their decisions, so the school bus service provider now doesn't need to focus more on these attributes. For instance, students will choose to take school bus no matter what kind of communication skill of drivers.

The attribute "low price" is classified as reserve(R) which means the service provider is thinking about this attribute in the reverse of the way that most customers are thinking about it. It means that higher price will decrease customer satisfaction and lower price will increase customer dissatisfaction.

To sum up, according to the strategic rule M>O>A>I, the school bus service provider should perfect all the must-be attributes, without these attributes, students can be extremely dissatisfied with the school bus; to improve student satisfaction and be competitive with competitors, the service provider should pay more attention on one-dimensional attributes and include attractive elements as much as possible.

According to the strategic rule M>O>A>I, the priorities of efforts towards promoting the adoption of school buses are identified. Finally, the customers will be very satisfied if the attractive requirements are fulfilled.

CONCLUSION:

I took the school buses in DAV, Pokhariput, as a case study, and follow the steps which include the small sample survey, Kano questionnaire, Kano classification and ranking of analysis, to demonstrate the feasibility and effectiveness of the method proposed. From this case, I got the four kinds of school bus attributes. The school bus service providers should adhere to the result and act accordingly.

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