The Use of Kano Model to Find the Satisfaction Assessment on the Attributes of an Infant Incubator Product: A Case Study of A Private Hospital

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Abstract. The postneonatal standard procedure states that newborns must be put in an incubator for a certain period of time according to the infant's health level. From survey data obtained at hospitals in "X" City, it is known that the number of babies born and prematurely in public hospitals every month from April to September 2014 was 51 babies. It is concluded that the use of infant incubator is quite high, then the quality of available infant incubator will certainly affect the service quality. However, we found complaints from doctors and nurses. It indicates customer dissatisfaction with infant incubator products in the hospital. Generally, complaints about the infant incubator is in an inappropriate design. In order to understand the source of complaints from users, researchers try to find out firsthand how the user views the attributes of baby incubator products. Therefore, Kano model was used to determine the customer satisfaction. Through the distribution of questionnaires obtained seven product attributes that are considered crucial. From the calculation results seen that there are one attributes that are in the category Attractive, three attribute that is in the category One dimensional, and three attributes that are in Must be category. Improvements to the next phase can be focused on important attributes assessed to be improved.

1. Introduction

Like normal babies, premature babies also get immunity from their mothers. However, the immune system acquired is less than normal babies, because before that resistance is formed enough, the baby must have been born. This is what causes premature babies to be very susceptible to infectious diseases. In hospital, babies born prematurely will be placed in a special device, namely the infant incubator.
It is a device equipped with temperature control and air humidity to keep the baby warm. If a premature baby is born with a weight below 2000 grams, then the temperature in the incubator must be between 32 degrees Celsius. If the weight is less than 2500 grams, then the temperature must be around 30 degrees Celsius. The temperature will be gradually reduced every 10-14 days by one degree Celsius, then the baby can finally adapt to the outside environment. In addition to functioning as a heater, the incubator also functions to protect the baby from the danger of infection. In this place, there is also a blue light irradiation tool for premature babies who have increased levels of bilirubin in their blood (yellow baby/jaundice) due to the baby's heart failure. Usually, babies in an incubator will be left bare to facilitate monitoring, which can be seen from breathing movements and skin color. Therefore, if there is an abnormality, it can be immediately known.

The current problem is the high price of imported infant incubator equipped with various technological advantages needed in the care of premature babies such as monitoring system, skin sensor, humidity, temperature control, and alarm. While local incubator is made with low technology only with lamp heaters without any control of temperature-controlled lighting and humidity, sensors and alarms. This local infant incubator is very lacking in supporting the care of acute premature babies. Moreover, the complexity of design of the standard incubators are difficult to maintain and complicated to use, and only special trained technicians are capable of repairing the incubator.

Based on these problems, Kano model was used in this paper to identify the crucial attributes from the design of infant incubator. Kano can indicates that product development should understand the response of customer needs and technical responses by examining the technical characteristics using Kano model. It is used to identify attributes in accordance with the customer requirements and satisfactions. The application of the Kano model that was used in this paper is expected to provide the ability to analyze customer needs more effectively, and focus of improvements will have a significant impact to improve customer satisfaction, especially the satisfaction assessment of an infant Incubator attributes.

2. Literature

Dr. Noriaki Kano is a lecturer, consultant, and writer who is involved in the quality management field. He was born in 1940 has developed a model for measuring customer satisfaction which is now known as Kano Model or Kano Analysis. Kano analysis is initiated to help the team uncover, classify, and integrate three groups of customer needs in the product or service developed by the company. The three groups of needs are classified based on their ability to create customer satisfaction or dissatisfaction.

Kano’s model has also been incorporated into the decision-making process by classifying the customer requirements into three categories (Xiaolong, et al, 2014). Moreover, Kano (1984) in Sanja, et al (2014) added another three categories of customer needs based on Kano model.

The analysis of Kano model as seen in Figure 1 can describe as follows:
- Attractive (A), describing there will be an increase in customer satisfaction if the product functions better than usual, but the satisfaction will not decrease if the product does not function better than normal. Customers assume that the attributes that are contained in this product are attributes that must be present in the product, but if the attribute performance is met, it will not affect the increase in customer satisfaction.
- Must-be (M), describing the more a product does not function properly, then customer satisfaction will decrease, but customer satisfaction will not increase even though the product works well.
- One dimensional (O), describing customer satisfaction will increase if a product is function better, and conversely customer satisfaction will decrease if a product does not function properly.
- Indifferent (I), customer satisfaction is not affected by the functionality of a functioning or non-functional product.
- Reverse (R), Reverse is the determination of the company that is inverted with the feeling of the customer. In other words, Customers will be dissatisfied if the attributes in this category are provided, otherwise, customer satisfaction will appear if the attribute absence.
Questionable (Q) is the answer from the consumer (respondent) is unclear or not in accordance with the existing questions. This category indicates that there is a confusion and misunderstanding between the questions asked and the answers given.

Several studies have conducted Kano model to understand what customer needs that affected in satisfaction. Sanja, et al (2014), presented Kano combined Web Based Learning System in Blended Learning Environment with implementation of new web technologies and tools in learning process. Their study was to identify critical elements of web based learning system within blended environment using Kano (dys)functional model. This study have positive impacts to individual learner, and also, university. Ishardita, et al (2015) used the combination of Kano and Kansei Engineering of improved the ceramic souvenir design. Their research resulted two factors based on the combination results with Kansei conjoined analysis, that is, appearance and performance factors. Appearance factors are more prioritized for further design development and performance. The conjoined analysis were used to find out the relationship between design attributes.

Rashid, et al (2011), used Kano model to studied basic linguistic, Kano model, fuzzy methods and their applications in product design. Linguistics application for determining probability for the input of the Monte Carlo simulation in Product design. Further, Sudha and Manohar (2018), used Kano model; in feed products. They Categorize the requirements and prioritize them based on the expectation of the customer needs and satisfaction level using Kano model. Get the product requirements from the customers or users with all its functionalities and features of project using Kano model. Qingliang, et al (2015) proposed a Fuzzy Kano model in machinery industry to develop a mathematical calculation performance of a product or service and the classification of service quality elements.

3. Methodology

This study was conducted at several Private Hospitals (RS) and General Hospital in North Sumatera Province that using infant incubator machine. Meanwhile, the type of this research that carried out is a descriptive research in the form of survey research. It is an investigation aimed to obtain facts from existing symptoms and seeking factual information to get the truth.

The sampling technique that used in this study were a non-probability sampling, where each element of the population to be drawn into the sample is not based on the probability attached to each element but based on the inherent probability of each element. The sampling method used in this study is sampling judgment. it is a sampling technique used by researchers if have particular consideration in taking samples. Only those experts should consider the required sampling. Doctors and nurses were used as the sample, because of they know more about the technical attributes of the product characteristics. The number of samples will be determined based on the availability of hospital and medical staff who were targeted of this study.

This study was carried out with the following steps, as follows:
1. The initial stage is carried out a preliminary study to determine the condition of the hospital, supporting information needed as well as literature studies on problem solving methods used and other supporting theories.
2. The next stage is data collection; data were collected in two types, namely:
   - Primary data in the form of perceptions and expectations of medical personnel, and also their anthropometry.
   - Secondary data in the form of data obtained from hospital.
3. Processing of primary and secondary data that has been collected.
4. Analysis of the results of data processing.

4. Result and Discussion

Data survey were done by distributing the functional and dysfunctional questionnaires. Questionnaires were distributed in 2 stages, the first stage was an open questionnaire. This questionnaire is a form of question asked to the respondent about the expectation of infant incubator operator (doctor and child nurse).
Respondents' answers contained in the open questionnaire resulted in several modes that support the attribute of the question in the second stage questionnaire, namely Kano questionnaire. Respondents in this closed questionnaire numbered eight respondents doctors and nurses of children. Determination of the number of respondents as shown in Table 1 is based on the sampling method used in the study of total sampling (population research).

| Table 1. The Attributes of Customer Needs |
|------------------------------------------|
| Atribut                                  |
| Additional Functions of Infant Incubator is the Place of Oxygen Tube |
| The size of the door hole is 15 cm |
| Infant Incubator Price Rp 10.000.000 |
| The Infant Incubator dimension is 70 cm x 50 cm x 40 cm |
| The floor distance from the base of the compartment is 100 cm |
| Compartment infant incubator materials are Acrylic |
| The controller’s position on the infant incubator is on the top right side. |

The result of functional dan dysfunctional questionnaire were processed to determine the categories of each attribute based on the Kano model. Traditional Kano model survey results are calculated on the number or each attribute. This categories were determined by Kano category using Blauth's formula.

1. The value number (O + A+ M) > the total value (I+ R +Q) then the grade obtained is the maximum value of (one dimensional, attractive, must be).
2. The value number (O + A + M) <number of values (I + R +Q) then the grade obtained is the maximum value of (I, R,Q).
3. The value number (O + A+ M) = total value (I+ R+ Questionable) then graded is the maximum value among all categories of Kanos (O, A, B and I, R,Q).

The calculation result and classification analysis as seen in Table 2 were used for mapping the categories of Kanos of each consumer attribute (CR) to all respondents, and then using formula Blauth's formula to determine of each Kano categories. For example for attribute 1 (O+ A+ M) = 5 and (I+ R + Q) = 3, and then the category of 1 is “Must-be” (M).

| Table 2. Kanos’ Category of Incubator Attributes using Blauth’s Formula |
|---------------------------------------------------------------------|
| No | Attribute | A | O | M | I | R | Q | Blauth’s formula |
|----|-----------|---|---|---|---|---|---|-----------------|
| 1  | 70 cm x 50 cm x 40 cm is the the incubator dimension | 1 | 1 | 3 | 3 | 0 | 0 | M |
| 2  | 100 cm is the compartment range from the floor | 0 | 2 | 3 | 3 | 0 | 0 | M |
| 3  | Acrylic is the material of incubator | 4 | 3 | 0 | 1 | 0 | 0 | A |
| 4  | Oxygen Tube is Available | 0 | 4 | 1 | 3 | 0 | 0 | O |
| 5  | 15 cm is the door hole size | 0 | 4 | 3 | 1 | 0 | 0 | O |
| 6  | The Price of Incubator is Rp 10.000.000 | 0 | 4 | 2 | 2 | 0 | 0 | O |
| 7  | The incubator controller is on the upper right side | 0 | 2 | 5 | 1 | 0 | 0 | M |

As shown in Table 2, it shows there is one attribute in the Attractive category, three attributes that are in the One dimensional category, and 3 attributes that are in the Must be category.
5. Conclusion
Kano category mapping produces one attribute that is in the Attractive category, three attributes that are in the One-dimensional category, and three attributes that are in the Must be category. By looking at the Kano category on each attribute, the manufacturer can prioritize the development of the product. For example, the attributes that fall into the category of must be better if they are not developed further with high investment. This is because these attributes are indeed attributes that must be present. It is better to develop attributes in the one-dimensional category.

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Acknowledgement
This study was funded by Directorate of Research and Community Service, Directorate General for Research and Development at the Ministry of Research, Technology and Higher Education of Indonesia, in accordance with Research Contract No. 003/SP2H/LT/DRPM/IV/2018 dated 20 April 2018.