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Quality Initiatives as QFD-Kano Technical Responses: a Conceptual Model

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ABSTRACT

In a product development process using QFD-Kano approach, setting technical response depends highly on the ability and creativity of the product development team. Many papers on QFD-Kano reported the way to classify the technical responses and to merit the expectation of the customer satisfaction. However, only a few of them explained the factors that should be considered during the technical response setting and limited guidance provided for this purpose. This paper intends to develop a conceptual model that proposes Quality Initiatives as an alternative in developing technical responses in the QFD-Kano method. The Quality Initiatives consist of three ideas; the Fixing, Improving, and Innovating activities. Each idea corresponds to Kano's product attributes i.e. must-be, one dimensional, and attractive attributes. Determining of each idea depends on the capacity of the company, the maturity of the company's management system, and the aggressiveness behavior of company management. This conceptual model results an output in the form of defensive technical response or offensive technical response. Several research opportunities are also outlined at the end of this paper.

Keywords: *Quality Initiative; QFD-Kano; Technical Respond; Product Development.*

1. Introduction

Customer focus is one of the elements of total quality management (TQM) principles. To be competitive a company should be responsive to their customer. Most of companies adopt these principles by conducting a customer survey when the companies want to develop their products, besides every year they also want to know their company's performance. Developing a new product using QFD approach requires input from customer. These customer requirements can be identified by conducting a customer survey. Then, a product development team translates these requirements into technical responds, parts specification, process design parameter, and production control system sequentially. QFD-Kano approach has the same mechanism to the traditional QFD except the technical response category.

Kano (1984) in [1] has classified product attributes into 5 categories; must-be attributes, one-dimensional attributes, attractive attributes, reverse attributes, and indifferent attributes. Each category has a difference influence to customer. The absent of must-be attributes will be greatly annoying customer but it present will be perceived as a take for granted. One-dimensional attributes have a proportional influence. The higher the product attribute performance will lead to higher customer satisfaction. Attractive attributes are the exciters for customer. The absence of these attributes does not matter to customer and their present will be exponentially delight customer. Reverse attributes have inverse characteristics of one-dimensional attributes. Customer will be happy when the product attributes absent. The last category, Indifferent attributes are the product attributes that do not have clear relation to customer perception. Many papers on QFD-Kano have been published [2–4] but only a few of them explained how to get the technical response [5].

Basically, a technical response is a deployment or a translation of the customer's requirement. A customer requirement usually uses social language. It is difference from language that is used in engineering field. Therefore, using QFD approach, the customer requirement should be translated to the technical response[6]. Ranceschini in [6] has explained the deployment mechanism in detail but not address the product as the deployment destination. Additional deployment mechanism was given by introducing the functional requirements [7]. Functional requirement is the result of the customer requirement translation on a product feature. Thus, with this additional mechanism, the deployment process becomes clearer than that before. Nevertheless, the deployment process needs to improve because the previous deployment process assumes that there is no reference work. The product development team seems work from the scratch. This paper intends to provide a new insight of the deployment process. Both historical and plan data, called the quality initiatives, will be used as a reference point of the deployment process. Quality initiatives comprise 3 initiative data; fixing, improving, and innovating. The first 2 data are historical data and the last is plan data. This paper also develops a conceptual model explaining factors affecting the quality initiatives determination.

Structure of this paper will be arranged as follows: The next section (section 2) explains how the QFD-Kano works and how to determine the technical response; section 3 gives definition of the quality initiatives; then section 4 describes the conceptual model development; discussion will be written at section 5; and finally conclusions are presented at section 6.

2. QFD-Kano Method

It is for years, some experts believed that technical responds have a proportional impact on satisfying customer but after introducing Kano's category (1984), they realize that technical responses have different impact. For this reason research on QFD has been blended with Kano' category and then becomes QFD-Kano Method. Moreover, the deployment process has also been changed.

According to Kano's category, a product development team should understand their technical response characteristics. They should check the technical response characteristics by asking them to their customer in the form of customer survey using Kano's questioner. Kano's questioner consists of two fold questions, functional question and dysfunctional question. Functional question asks the customer attitudes if technical respond is well functioning. Otherwise, dysfunctional question is a question that asks the customer perception if the technical respond does not work or does not exist. The technical response category can be determined by considering customer's answer combination. Figure 1 explains the steps needed to determine the technical response category.

Question for TR_i	Respondent Answer
Functional TR_i If the product has this feature and well function how do you feel?	1. I am very happy. 2. It takes for granted 3. I am Neutral 4. It does not matter 5. I do not like.
Disfunctional TRi If the product does not have this feature how do you feel?	1. I am very happy. 2. It takes for granted 3. I am Neutral 4. It does not matter 5. I do not like.

Customer Requirements		Dysfunctional 1. like	2. must-be	3. neutral	4. live with	5. dislike
Functional	1. like	Q	A	A	A	O
	2. must-be	R	I	I	I	M
	3. neutral	R	I	I	I	M
	4. live with	R	I	I	I	M
	5. dislike	R	R	R	R	Q

Technical Response	A	Q	O	M	I	R	Total Score	Category
TR 1								
TR 2								
TR n								

Figure 1. Steps for categorizing the technical response

The next step is to calculate the technical response contribution on the customer satisfaction using the following formulae.

$$\text{Satisfaction Coefficient} = \frac{A+O}{A+O+M+I} \quad \text{(1)}$$

$$\text{Dyssatisfaction Coefficient} = \frac{O+M}{(A+O+M+I)x(-1)} \quad \text{(2)}$$

Technical response selection should consider several factors besides the above coefficient, such as cost, time, and company objectives [8]. Technical response selection involves mathematical modeling to optimize the expected result. Selected technical response will become product design requirements.

3. Quality Initiatives

Practices to obtain a good product have been done since people are able to appreciate a product quality. But Quality Initiatives at that time is merely in the form of a quality inspection of products that have been created by the employees. The discovery of measuring instruments was used intensively to assist the operation of product inspection. Industrial revolution in the 19th century supported a surge in demand for products. Because of this reason the Quality Initiatives had been developed. At that moment quality control department appeared which job was to keep the quality of the products made by the company. Statistical methods have been used as decision tools in the department. Acceptance sampling and control charts have been widely used to control the process of receiving materials and production processes respectively. In further developments, the practitioners began to realize that the quality problems will not be solved only by inspecting the final products. It is too late when the quality inspection is only performed on the final products. Each stage of the production process must be examined. The idea of a Company Wide Quality Control (CWQC) has begun at that moment led by Japanese firms. Quality control was done at the entire process in a plant related to the production process. Quality Initiatives appeared in the form of Quality Control Circle (QCC) which aims to improve the quality of the results of each process that they own handle.

Along with the practice of CWQC, Europe was introducing initiative of the quality assurance (QA). This idea is very useful to get a consistent product quality. The emergence idea is based on the logic that consistent product quality needs a consistent process operation. Concrete form of this idea is the initiative of implementing standard operating procedures (SOP) for carrying out a certain process. British Standard 570 (BS 570) is one example of the quality initiatives at that time. Later on, the BS 570 was became the forerunner of the ISO 9000 quality management standard which was launched in 1984.

Another Quality Initiative that very famous is the Total Quality Management (TQM). The Initiators who considered to be have a good credit in developing TQM are among: Dr. Edward Deming, Joseph Juran, Philip Crosby, Genichi Taguchi, Shigeosingo, and so forth [9]. The basic idea of TQM is the change of process control to the process management and the shift of quality responsibility from the worker (employee) to the management). Besides, some new concepts are also included in TQM such as quality policy and strategy, customer focus, employee involvement, supplier partnerships, continuous improvement, the data analysis, performance appraisal, and so on [10].

At present days, the term 'Quality Initiative' is widely used in several publications ([11–14]. The purpose of using the term can refer to a variety of concepts that have been described above. Although it has a different meaning, the use of the term 'Quality Initiative' is always accompanied by an attempt to take the quality level higher, either by way of repairing (fixing), improving, or replacing it with a much better (Innovating). The quality level can be increased using approach of customer focus, employee's involvements or supplier partnership. It also can be done with a quality improvement project of process changes, service changes, standard changes, design changes and others.

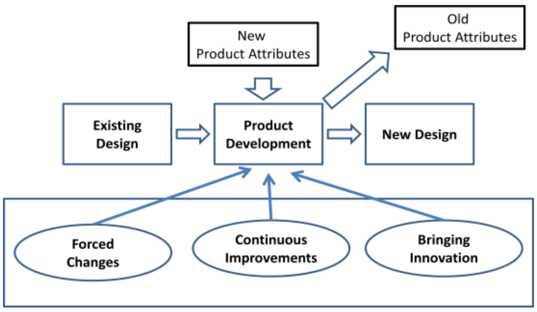


Figure 2. Reasons for developing new products.

Currently, quality improvement projects through design changes get a greater attention. Understanding that *'quality can only be obtained if it is planned properly from the beginning'* have raised the quality improvement projects focused on product design phase [15], [16]. On a product design and development ac activity, it always strives to improve the quality of the product. The need to improve quality is the driving force and rationale behind the development of the product [17]. Gautam and Singh in [17] mentions three (3) product development reasons, Figure 2, namely: Forced Changes, Continuous Improvement, and Bringing Innovation.

In this study the 'Quality Initiative' is used to represent the reasons for the changes made to the product development process. Slight adjustments were made to reinforce the meaning of the terms used. The term 'Forced Changes' is replaced by the term 'Fixing'. So for the next, the whole reasons for the development of these products become 'Fixing', 'Improving', and 'Innovating'. This adjustment is done deliberately to align with the idea of Kano classification of product attributes i.e. the must-be, one-dimensional, and satisfier attributes.

4. Conceptual Model Development

Basically, technical response is the translation of the customer's needs. From the company side, technical response must to be more concrete than the customer needs. Good technical response must be able to provide insight to the company about what should be done. Unfortunately it is not always the case. It is because of the previous way the product development team considers the customer voice only. To be more concrete, the existing product must be referred and considered as a customer voice deployment domain [18]. The existing product may involve product structure, process technology, and production system, see Figure 3. Design requirements do not come from the customer only. Company, government, and environment also have a demand to the new product design, see Figure 2. Developing new product means that the next product must be better or higher quality than that the previous one. Better product can be achieved by adapting the historical fixing activities, improvement project activities and the innovation ability, called the Quality Initiatives. So the technical response then can be formulated from the Quality Initiatives.

Furthermore deciding the technical response is not merely deploying the customer needs. There are some other considerable factors such as capacity of the company, maturity of company management system, and management aggressiveness behavior. It is align with the Quality Initiatives practices. Fixing product with respect to customer claim or complaint is always performed in capacity of the company. It is also the case of the improvement project and innovation.

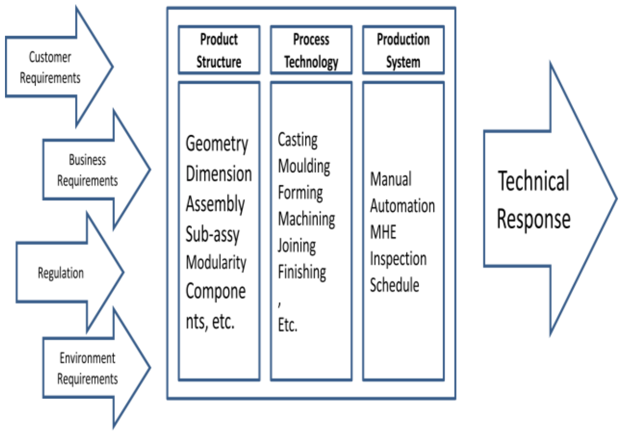
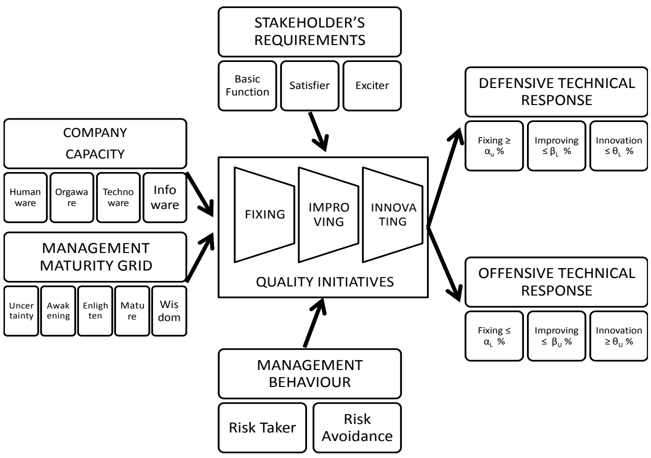


Figure 3. Production system as domain of the stake holder requirements

Quality Initiative can be seen as a construct. This construct is an endogenous latent variable that is not free. The value of this construct is influenced by other 4 constructs, figure 2, i.e. constructs of: (1) Stake holder's requirements, (2) capacity of the company, (3). Magnitude of the quality Initiatives constructs cannot be directly measured. In order to determine it the indicator variable is needed. Indicator variable which can be used to assess this construct is the number of corrections, improvements and innovation activities.



The stake holder's requirements construct is an exogenous latent variable. Indicators that can be used to measure this construct are the number of requirements: basic function, satisfier, and exciter. Similarly, construct of the corporate capacity, the maturity of company management systems and management behaviors are exogenous latent variables. Indicators for the corporate capacity are: human-ware, orga-ware, techno-ware, and info-ware. Indicators for the construct of company management system maturity are: uncertainty, awakening, enlighten, mature, and wisdom. Management aggressiveness behavior can be risk taker or risk avoidance, see Figure 4.

Figure 3. Conceptual model of the Quality Initiative and its factors

5. Discussion and Future Research

Previous technical response setting assumed that there is no limitation. Any option chosen by the product development team must be agreed by the company. This practice might be end up with problem of implementation because of some constraints. Compare to the previous one the proposed deployment process i.e. the technical response setting using the Quality Initiative is more comprehensive. There are factors that should be taken into account. These factors are important to consider avoiding implementation difficulties such as capability to implement and management support. However, other difficulties may arise. Some companies may have no data on their own capability and management system maturity. Technical response setting using the Quality Initiative requires that the company maintain the correspond data. Otherwise, the proposed model of deployment process will not work properly.

In general, the proposed model of deployment process can be implemented in many areas. But the usage intensity may vary among companies. Company producing low quality impact products may be focused on maintaining their basic function likes electricity power supply company, drinking water company, etc. This kind of company does not need either an aggressive management or a high level of management system maturity. It is predicted that the low quality impact product company tends to select defensive technical responses. Therefore the product development team must be aware of choosing the basic function product attributes as a prime option in deploying the stake holder requirements into technical responses.

On the other hand, there are strong reasons for the company producing high quality impact product to innovate their products much more times than that the low one. During deployment of stakeholder requirements, the basic function product attributes may have a little attention compared to the exciter product attributes. Product development will be dominated by some innovation. This company needs to ensure that the intension to change be supported by its capability and its management system maturity. An aggressive management style is also important consideration for the company. The offensive technical response is an appropriate selection for case.

Furthermore, an empirical study is needed to prove the model structure. Study on developing mathematical model for selecting the technical response is a very challenging research since it will help product designers to optimize their works. Mapping techniques are also useful to classify technical response option regarding the influencing factor.

6. Conclusions

The Quality Initiative model consists of three fold activities i.e. Fixing, Improving and Innovating. This model can be used as an alternative way to deploy stake holder requirements into technical responses. Deployment using this model considers not only the design requirements but also the company capability, management system maturity, and management aggressiveness behavior. The system results a defensive technical response or an offensive technical response. Implementing this model requires company historical data. It is predicted that company with low quality impact product tend to focus on the product basic function and therefore do not need an aggressive management behavior. Defensive technical response will be fit for this company. On the other hand, company with high quality impact has to release some innovation and therefore do need an aggressive management behavior and high level of management system maturity. This company needs to select the offensive technical response

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