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A Conceptual Kano and Quality Function Deployment (Qfd) Framework For Healthcare Service

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ABSTRACT

Healthcare organization is struggling to provide customer driven quality service. The key success of healthcare service is the ability to develop a comprehensive healthcare service and deliver the best service direct to customer as required. Coherently, the measure of customer feedback should definitely show good perception of service fulfillment and satisfaction. As part of quality improvement process, an outstanding healthcare organization should practice an effective complaint management system (CMS) as the main voice of customer (VOC) source, which directly mirror the quality of healthcare service. The CMS will act as an essential decision support tool by providing seamless handling of complaints, introduces systematic improvement process, thus enabling hospitals to turn weakness into opportunities. However, Malaysian top public healthcare organizations are implicitly not really put much efforts to have a kind of proper CMS to treat complaints as critical and need immediate resolution. In other words, the VOC might not be heard in right way and account as the customer demand, expect and desire. This scenario may be the evident and reason why the present states of public Malaysian healthcare service providers are still unable to fully incorporate the customer requirement or complaint in to their strategic agendas, which account all the customer needs and expectations. This paper presents the current scenario of local public healthcare service with special focus to their implementation of CMS or similar system, in conjunction with healthcare constraints and VOC. Based on recent healthcare literature, an inclusive comparison is made and discussed to justify the gap of improvement in healthcare service. From findings, it is identified that complaint management practice is lacking of systematic procedure to prioritize complaints by customers. To be competitive, an alternative customer prioritizing approach mainly incorporates the Quality Function Deployment (QFD) and Kano's Model is proposed conceptually. The new mechanism concept is hope to effectively address a complaint which not only satisfies the customer but also an opportunity to create positive experience with customers, building a healthier foundation, stronger brand value and avoiding legal penalties. It also provides fair balance information for decision making while facing constraints such as operational, legal, human resource and market pressures.

Keywords: Complaints, Quality Function Deployment, Kano's Model, Healthcare service, Main voice of customer.

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1. INTRODUCTION

Healthcare tourism is becoming a recent national agenda to be one of economic catalyst and promotes healthier lifestyle to public. Therefore, public healthcare organization has to set high quality and outstanding service delivery to customer. To achieve such performance, healthcare barriers and challenges are demanded to be overcome instantly. However, at present, the poor service delivery by healthcare organization has become a national healthcare crisis since public are keep complaining and voice up their dissatisfaction in media. According to (Hill & Powell, 2009), national healthcare crisis is initiated by three major problems: accessibility, quality and cost. All three problems are interrelated in nature. Besides inadequate accessibility and accelerating cost, design of quality service is remain the key solution and player to lead for customer satisfaction. In fact, healthcare organization is still struggling to provide customer driven quality service. The role of general hospitals has changed from being the universal unit of source care and most economic hub for community to a public entity that able to give society impact in terms of comparative excellent service with private hospitals and able to cope with the multitude challenges ranging from physician involvement to service planning and delivery as well as continuously work towards customer satisfaction attainment. It is huge challenges for 135 governmental hospitals around Malaysia to cope with all the limitations in resources to best delivering the services. The current economic pressure continues to add weight to this challenge, to adequately satisfy the 28 million Malaysia populations. This scenario is sufficient enough to prove how important service design is. The need of qualitative and quantitative approach to design and quantify the optimum service delivery framework regards to customer satisfaction is a must. The key success of healthcare service is the ability to develop a comprehensive healthcare service and deliver the best service direct to customer as required. Coherently, the measure of customer feedback should definitely show good perception of service fulfillment and satisfaction. In other perspective, customer complaints are well handled and fulfilled, continuously. As part of quality improvement process, an outstanding healthcare organization should practice an effective complaint management system (CMS) as the main voice of customer (VOC) source, which directly mirror the quality of healthcare service. The CMS will act as an essential decision support tool by providing seamless handling of complaints, introduces systematic improvement process, thus enabling hospitals to turn weakness into opportunities. This scenario may be the evident and reason why the present states of public Malaysian healthcare service providers are still unable to fully incorporate the customer requirement or complaints in to their strategic agendas, which account all the customer needs and expectations. This paper presents the current scenario of local and international public healthcare service with special focus to their

implementation and handling of CMS or similar system, in conjunction with healthcare constraints and VOP. The issues of prioritizing and analyzing the complaints are critically discussed to formulae the issues into problem statement model. A part of that, a new possible optimization approach is proposed using QFD and Kano model integration.

2. HEALTHCARE SERVICE SCENARIO AND ISSUES

Healthcare service providers need to reassess their strategies to cope with more challenging task with respond to continuation of customer demand. The healthcare challenging tasks are discussed in details by (Lim & Tang, 2000). As a healthcare service provider, systematic reprogrammed and renewed assessments are the most significant step forward to cope with customer demand uncertainties. This is the only way to repositioning themselves in future. This scenario is true elsewhere. For example, an empirical study by (Lim & Tang, 2000) have observed that in 1999, 40% of respondents have rated the Singapore hospitals' service quality as poor or very poor, definitely below patients' expectations. These findings have taken seriously by hospitals and 80% of them have absorbed TQM philosophy and develop customer oriented strategy. The same scenario is also true to our public healthcare service delivery and it is reported to be an international phenomenon (Wal & Lens, 1995). In healthcare organization practice, patients' dissatisfaction is translated into complaint, as a formal channel to deliver their feedback or respond towards service delivery quality. To achieve fair satisfaction of customer requirement, any complaints are needed to be treated as critical and demanded immediate resolution. Only best class complaints management solution able to turn healthcare service weaknesses into opportunities.

The effective complaint management in healthcare is depended on how complaints handling is managed regards to regulatory perspective and customer service standpoint. It includes some major drivers such as regulatory compliance, competition, costs and customer litigation. (Wal & Lens, 1995) have conducted an intensive study on handling complaints in 18 hospitals which covered all hospital in North-Holland. Overall, some hospitals are much more successful to ensure that complaints are dealt with adequately. Some hospitals do not give sufficient opportunity to the complainant to complaint orally and discuss the complaint in details. However, all hospitals provided individuals have easy access to the CMS to address their complaints. From individual perspective, the definitions of complaints are adequate. Complaints can be made orally, fill in specific form manually or via email, full access to direct phone call to top management and can obtained assistance from lawyer with no time limit at all. Some hospitals provided a formal discussion session with patients to deal with complaints. This can be a fast action but time consuming and the interviewing needs expert advice and repetitions. To decide

whether the complaints have the foundation or not, the complaints handling is expected to operate independently, adequate administrative support and less excessive bureaucracy. A mutual interaction and involvement of healthcare management and complainant or VOP must exist and play important role in the complaints committee. The complainant representative can be a regional patient's association. This is the best functioning committee suggested by (Wal & Lens, 1995).

In terms of complaints categories and complaints presentations, (Alcantara, 2008; Scott, 2003) presented a broad clinician's view of understanding and coping with complaints. The complaints are expressed based on clinicians feeling when faced with a complaint, puts complaints into context and recommends how to deal with them, prevent them and provide suggestions for good practice. As a record, Accident and Emergency (A&E) experienced the highest complaints distributions (34%) and standard of care (49%) is observed to be the most critical complaints classification to deal with. To support the statement locally, by author's initial observation and interview, this condition is found true in nearest public state hospitals (e.g. Hospital Tunku Fauziah and Hospital Sultan Abdul Halim) and distric hospital (e.g. Hospital Jitra). Based on the complaints handling scenario and CMS practices, the operational and management limitations are identified mostly affect much the complaint handling efficiency. When the complaints are unable to solve, it creates poor communication, raised the unfulfilled expectations and formed a different perceptions to new and existing services. When complaints are failed to answer well or the healthcare management not able to respond the complainant with an explanation, an apology or an assurance to what happened to them, the cycle of complaints handling will only worst the complaint scenario and affect the healthcare institutional credibility.

The fast solution is needed to initiate the positive improvement of complaint handling. The solution should be incorporated with detail mechanism to quantify the complaints prioritization and analyze the complaints in regards to complainant and healthcare constraint perspective. To author's knowledge and support by literatures, there are no single model to incorporated with. A new optimization decision model needs to be developed comprehensively to incorporate and unite the prioritizing and analyzing element in a model. QFD and Kano model is found the best in its categories. Unfortunately, both are well success in product development but not in service sector as well as healthcare services. In this paper, the new optimization decision model using QFD and Kano model is proposed and the related formulation in product development is replicated and modified to adapt with healthcare services.

3. PROPOSED QFD AND KANO MODEL INTEGRATION

3.1 Review Quality Function Deployment (QFD) and Kano Model

Quality Function Deployment (QFD) has been practiced by leading companies around the world since 1966. In early stage, QFD is narrowly defined as step-by-step deployment of a job or operation that embodies quality, into their details through systematization of targets and means. In other words, QFD is a service planning and development support method, which able to provide systematic way for service providers to assure quality and customer satisfaction while maintaining a sustainable competitive advantage (Akao & Mazur, 2003). QFD has been very successful in product development application (Chan & Wu, 2002, 2005; Franceschini, 2002; Matzler & Hinterhuber, 1998). Historically, QFD for customer or *hinshitsu tenkai* has been practised by leading companies around the world since 1966. The main purpose is to assure that true customer needs are properly deployed through design, build and delivery of a new product. QFD was born in late 1960s, during an era of Japan post-Second War mode where product development has experienced through imitation and copying from the original, then moved to product development based on originality(Akao & Mazur, 2003). QFD was introduced as a method or concept for new product development under the umbrella of total quality management (TQM). In 1978, Shigeru Mizonu and Akao have published a very first book on the topic of QFD, which entitle 'An Approach to Total Quality Control added to Quality Function Deployment'. QFD has been successfully proven implemented in Japanese and non-Japanese companies especially US companies, and its application has been extended to various field may related to end user or customer needs as the top priorities. One of the earliest QFD review by (Prasad, 1998) has put a strong emphasis for extension QFD or HOQ for different kind of application and environment. In this case, the Extended House of Quality (EHOQ) is suggested for more convenient organizing product, process and production planning information and customer requirements processing. The work is basically originate from limitation of conventional Akao's QFD approach, which identified as too quality focused, only a phased process and one dimensional in practice. The conventional QFD cannot account for the increasing complexities of a product and the conflicting requirements that need to be addressed. To solve the above limitations, Concurrent Function Deployment (CFD) is invented based on parallel deployment and integrated with conventional QFD to form House of Value (HOV).

Recent QFD review by (Chan & Wu, 2002) have categorised the QFD according to functional fields (e.g. product development, quality management, customer need analysis, product design, planning, engineering, decision making, management, teamwork, timing and costing), applied industries (e.g.

transportation and communication, electronic and electrical utilities, software systems, manufacturing, services, education and research),and methodological development (quantitative method, extension and implementation issues, comparative studies, surveys and review on QFD). The review is conducted based on the various publications from 1980s to 2001. From the both recent QFD reviews in year 1998 and 2002, more than 650 QFD publications through searching various main international sources which cover Japan, US, Europe and Asia countries including major QFD societies. It's observed that service industries are still lack behind in research; hence provide plenty of space and opportunity to be venture for research. It is result with only twelve publications on QFD applications that relates to service industries. Historically, QFD for customer or *hinshitsu tenkai* has been practised by QFD is a customer oriented quality management and product development technique originally used for hard products, but the ideas are no means inapplicable to soft services (Chan & Wu, 2002). American Supplier Institute reported that QFD was gradually introduced into service sector to design and develop quality services starting in 1992 and started get wide acceptability to various service area such as marketing and R&D (Griffin & Hauser, 1992, 1995), accounting, administration, banking, contracting process, engineering services, food distribution, government services, hotels, on-line bookshops, mortgage, professional services, public sectors, real estate appraisal, retail, library(Bayraktaroglu & Ozgen, 2008), wholesale, healthcare(Djikstra & Bij, 2002).

Table 1 illustrates the fraction summary of QFD services research. Up to year 2000, there were only 17 articles published on the area of healthcare services, out of 56 articles in services and total 650 articles in QFD study. It means, 2.6 % research works on healthcare area had been published and peer reviewed in journals. In a view of smaller scope, healthcare publications are only 30% out of the whole QFD in service articles. Both statements are actually too little fraction compared to others field. This again motivated this research for success and contributes to this small percentage.

Table 1 QFD recent research classification in service sector

Industries	Type of services	*Healthcare and related application
Services	Accounting & Banking	1. Healthcare process improvement and cost reduction
	Administration & Contracting process	2. Application to rehabilitation services
	Government & Engineering services	3. A prototype computer network service for occupational therapists
	Food distribution	4. Understanding healthcare customer
	Hotels & On-line bookshops	5. Development of total quality healthcare model
	Mortgage & Real estate appraisal	6. Rehabilitation engineering (designing customized seating
	Professional services & Public sectors	7. Care planning
	Retail & Wholesale	8. Nursing service planning
	Technical library &Information services	9. Develop healthcare system
	*Healthcare	

Since the focus of this research is concern on hospital services. The above lists are further refined into more genuine hospital services study. Finally, only three articles are appeared to be directly related to hospital services in healthcare service system. A most recent QFD review by (Carnevailli & Miguel, 2008) has notified 19 articles which related to QFD application to develop services. Most of the articles being reviewed are previously included in review by (Chan & Wu, 2002) excluded two recent work on presented methods for meeting customer requirements in redesign and renewal services in healthcare using QFD (Djikstra & Bij, 2002) and building an activity-based costing hospital model using QFD and benchmarking(Gonzalez, Quesada, Mack, & Urrutia, 2005).

QFD and Kano's model integration has been widely applied to product development purposes. Basically the integration is made to assess and evaluate customer requirement for more competitive advantages in customer satisfaction regards to their product or services being offered. (Matzler & Hinterhuber, 1998) has proposed the Kano steps to assess and evaluate customer requirement. Meanwhile, (Shen, Tan, & Xie, 2000) has presented a more innovative product development process using Kano model. Based on the works by (Matzler & Hinterhuber, 1998; Shen et al., 2000; Tan & Shen, 2000) on the exploring the potential of QFD and Kano model for product development. Those successful frameworks is adapted and modified for optimization model design and evaluation in healthcare service.

3.2 Proposed Conceptual QFD-Kano Model Framework

Customer requirement identification: The first step in QFD-Kano optimization is to define the issues of complainant addressed. There are many definitions of complaints which have been defined according to the specific case they referred to. For ease of definition in further formulation, complaint is defined in general as an expression of dissatisfaction or unacceptable elements (e.g. action and rules) by individuals (first party) to second party who delivered the services with intention to give the best service and continuously improve the service to meet the customer satisfaction. There are various kinds of applicable methods to identify customer requirement (e.g. formal surveys, focus group, direct customer contact, complaint analysis, internet monitoring and etc). In typical study by (Griffin & Hauser, 1993) suggested that approximately 10~30 customers are adequate to develop almost 90~95% all possible customer requirements. The customers are interviewed for approximately one hour in a one-on-one setting. The interview method is chosen to explore the hidden needs which not explicitly expressed by the patients. Therefore, the same amounts of respondents and interview setting are used in this study. For better understanding on customer requirement, the affinity diagram or tree diagram is used to construct the customer requirement structure. Furthermore, Kano's model is adopted to classify the customer attributes in to Kano categories (Tan & Shen, 2000).

Construction of Kano questionnaire: According to Kano model, a customer attributes can be described as an attractive (*A*), must be (*M*), one-dimensional (*O*), indifferent (*I*), reverse (*R*) and questionable (*Q*) quality requirements. To design the questionnaire, each quality criterions above is provided in a pair of functional and dysfunctional for question. Functional question is about the reaction of service can satisfy the requirement and the dysfunctional question refers to service dissatisfaction matter. Based on the pair questions and related answer, the Kano evaluation table is created to classify the quality criteria into six categories. All questions are focused into assessing the level of satisfaction which relates to doctor care, nursing care, surgery care, attitude and personality, appointment, medical communication, discharge, admission and bereavement.

1. If the doctors really care about you, how do you feel?	☐ I must have it that way
	☐ I like it that way
	☐ I am neutral
	☐ I can live with it that way
	☐ I dislike it that way

1. If the doctors do not really cares about you, how do you feel?	☐ I must have it that way
	☐ I like it that way
	☐ I am neutral
	☐ I can live with it that way
	☐ I dislike it that way

Figure 1: Sample of medical care question based on Kano model

Qualitative and quantitative evaluation of Kano questionnaire: Kano questionnaire evaluation process is defined into two steps, qualitative and quantitative analysis. The first step involves how to qualitatively classify the customer requirement. Table 3 shows the example of how the customer requirements (CRs) are classified according to frequency, which depends on the six categories. The frequency analysis will clearly indicated the best category based on the highest frequency (e.g. *A, O, R*). Quantitatively, the second step consists of how to quantify the satisfaction coefficient (CS) and dissatisfaction coefficient (DS).

Table 2 Kano questionnaires result

Customer requirements		Dysfunctional form				
		I like it that way	It must be that way	I am neutral	I can live with it that way	I dislike it that way
Functional form	I like it that way	*Q*	*A*	*A*	*A*	*O*
	It must be that way	*R*	*I*	*I*	*I*	*M*
	I am neutral	*R*	*I*	*I*	*I*	*M*
	I can live with it that way	*R*	*I*	*I*	*I*	*M*
	I dislike it that way	*R*	*O*	*A*	*R*	*Q*

The customer satisfaction coefficient indicates whether satisfaction can be increased by meeting requirement, or whether fulfilling this product requirement merely prevents the customer from being dissatisfaction (Chiou & Cheng, 2008). The customer dissatisfaction coefficient indicates the other side(Lai, Xie, & Tan, 2004).
Both can be expressed as:

Extent of satisfaction

$$CS = \frac{f_A + f_O}{f_A + f_O + f_M + f_I} \tag{1}$$

Extent of dissatisfaction

$$DS = -\frac{f_O + f_M}{f_A + f_O + f_M + f_I} \tag{2}$$

where f_A, f_O, f_M, f_I represents the frequency of *A,O,M,I* respectively. The minus sign in Eq.2 means that it is dissatisfaction. Eq.1 and Eq.2, *CS* and *DS* for each customer requirement can be calculated.

Table 3 Example of categories frequency

Customer requirement (CR)	*A*	*O*	*M*	*I*	*R*	*Q*	Best category
CR1	40	30	4	3	2	0	*A*
CR2	7	9	2	5	1	1	*O*
CR3	5	2	6	4	26	4	*R*

QFD or HOQ building and mathematical optimization model: There are many QFD modified phases as reported in literature and some adjustment to existing modified phases are made to suit the service design requirement. In this case, the QFD is composed to form of nine phases based on QFD outline by (Hauser & Clausing, 1988; Ulrich & Eppinger, 2007), as depicted in Fig.1.

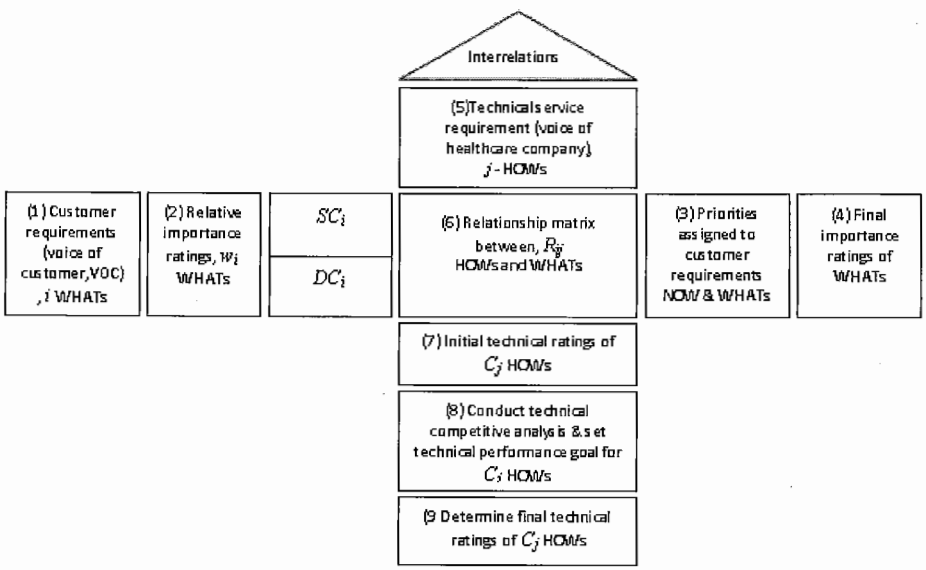

Figure2: Proposed Kano-QFD phases

The left region of HOQ consists of list of VOC and relative importance rating r_i. The satisfaction coefficient SC_i and dissatisfaction coefficient DC_i are relatively included as part of importance weight r_i evaluation. The upper side of HOQ defines the list of service characteristics, j. The roof side presents the interrelationship between service lists. The main body contains the

interrelationship, R_{ij} between list of customer requirement i and list of service characteristics j. The bottom side consists of three phase which deal with costing index subjected to unit improvement in services, C_j. Any improvement in healthcare services will increase the cost; therefore value of healthcare service is defined as S_j (j=1,2,….n). It can be noted as normalized value of healthcare service characteristic, s_j.

$$s_j = S_j / \max\{S_j\} \tag{3}$$

Eq. 3 also defines that with certain amount of money or C_j, spend to improve the healthcare services, the optimum of service characteristic can be occasionally achieved. At this stage, service delivery by healthcare institutions need to be optimized and a comprehensive formulation is essential to produce the optimization model. In previous section, Kano questionnaire is constructed based on benchmark service by the competitors. Therefore, optimization model is aimed to maximize difference customer satisfaction between the possible healthcare services to be designed and the benchmark services. A special weight function is defined to quantify the different of customer requirement i. The weight function is expressed as W_i:

$$W_i = \begin{cases} r_i SC_i(a_i - b_i) & when \quad a_i \geq b_i, i = 1,2,...m \\ r_i DC_i(b_i - a_i) & when \quad b_i \geq a_i, i = 1,2,...m \end{cases} \tag{4}$$

where, a_i = the extent of satisfaction, b_i = benchmark value of satisfaction and , m = number of customer requirements. It is aimed to maximize possible service design to be equal to ideal service design. Comparatively, it is assumed that ideal service design is achievable when equal or exceeds the benchmarking service design. Therefore, to design or improve the service exceeds the benchmark service, W_i is set to be positive and the optimum model can be expressed as Eq.5.

$$Max \quad a = \sum_{n}^{m} W_i \tag{5}$$

Subjected to:

$$a_i = \sum_{j=1}^{n} R_{ij}^{norm} s_j \tag{6}$$

$$CL \geq \sum_{j=1}^{n} C_j s_j \tag{7}$$

$$0 \leq s_j \leq 1, \quad j = 1,2,....,n \tag{8}$$

where, R_{ij}^{norm} = normalized relationship between i customer requirement and j service characteristic, CL = cost limit, n = number of service characteristics.

The proposed model has analytically defines the VOC into satisfaction coefficient and dissatisfaction coefficient by using Kano model. The model needs to be improved further to minimize the gap between possible service design and ideal service design. Based on the VOC principles, complaint is more regards to dissatisfaction factor and can be extracted from Kano evaluation. Further enhancement on optimization model will improve the existing CMS practice in local healthcare service delivery to improve the existing service standard. Furthermore, the model is potential to be used as decision model to introduce the new service to fulfill the customer or patients needs subjected to healthcare constraints (e.g. operational, legal, human resource and market pressures).

4. CONCLUSION

Despite the intention on improving healthcare service scenario through optimization modeling, we have outlined a new modified approach to optimize the healthcare service delivery design. The algorithm is optimized subjected to related constraint and trying to direct the formulae to cost involved in service improvement. The main framework is started with defining the Kano model through qualitative and quantitative analysis, and expressed as satisfaction and dissatisfaction coefficient. The satisfaction coefficient is treated to formulate the optimization output for new improved healthcare service going to be introduced and dissatisfaction coefficient is purposely to quantify the direct and indirect complaint for further improvement in existing service delivery. All parameters are subjected to cost constraint and embedded in House of Quality (HOQ) or Quality Function Deployment (QFD). This basic framework will be further defined for more actual condition in healthcare services design and delivery.

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