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Decision Making On Laboratory Technicians Performance Appraising Through Applying Quality Function Deployment; A Case Study in Jordan

Esmat Almaita, Prince Hashem Hospital, (Jordan); Azeza Alzyoud, Prince Hashem Hospital, (Jordan); Najah Alzyoud, Prince Hashem Hospital, (Jordan); Basma Alhyari, Institute Of Biomedical Technology, (Jordan)

Abstract

Quality Function Deployment (QFD) is anadministrative tool that supplies a visible connective operation to help teams focusing on the necessities of the clients throughout the overall improvement cycle of a product. It supplies the means for translating customer necessitiesinto suitable technical needs for each stage of a product improvement lifecycle. It helps developing more clients-oriented products. In spite of QFD benefits, it is not aneasy tool to use. This article outlines howa technique such as QFD is utilized to improve the performance of lab technicians in an infirmary.A model representing the variables dealing with lab technicians was build and a lot of suggestions for performance enhancement were suggested.

Key words: Critical duty quality, House Of Quality (HOQ), performance, Quality Function Deployment (QFD).

Introduction

Clients haveanticipations about the product fineness. If their actually assay was more than their anticipations, then they will feel content. If not, thenthey will sense not content. As a result, gratification is atool to measure in each field of people's feelings of product fineness, and it is widely used and is also anapproval measure index.

Thebrisk changes in the environment have exertedworthy pressures on healthcare suppliers to reappraise their strategies. Furthermore, it is a paradox that the best clinicians are themselves, not the best directors in the healthcare services like medical laboratories in infirmaries. So, anadministrative model is set up using QFD where strategies are developed through a partnership between directors and clinicians for the frugality of overall fineness healthcare in the dramatic changes in the health care environment.

In related service quality studies, most literature on service quality is based upon the traditional one-dimension quality model. That is, the result is restricted that if a service provider delivers what consumers expected well, the consumers are satisfied. If not, the consumers are not satisfied [1].

In 2010, Hamidullah investigated the using of QFD as a tool for development the car dashboard of Toyota and Honda motor cars. He used a questionnaire to get the VOC which translated to customers' needs which were then converted into technical specifications. The output from House Of Quality (HOQ) was used in concept generation. Pugh chart was used for concept selection. Computer Aid Drawing (CAD) models of the selected concepts were presented [2].

Xiong Wei et al, in "Teaching Design of University Courses based on QFD" analyzed the university curriculum, and developed the teaching quality function deployment model (TQFDM) with its own unique characteristics, which set an initial example for the later researchers. Whereas they merely concerned on the needs of students when they are in school, the situation when they face the employment is not included [3].

There were a few articles with the application of QFD in the service industries. For example a QFD system for police services was implemented at a federal police station in Belgium in order to match better the demands and needs of the general public and authorities to the activities deployed by the police station [4].

Most of the early studies on QFD in medical sector were primarily conducted from the viewpoint of medical duties and medical safety. In 1990, Puritan-Bennett, a medical equipment company, successfully used QFD to help redesigning its spirometry business in order to regain their market share [2].

In 2006 Moores presented a study of the potential for applying QFD method to the analysis of the frameworkfor safety management contained in the Ionising Radiation (Medical Exposure) Regulations of 2000 [5].

In 2009, Eatock et al, wanted to examine the extent to which mainstream tools and strategies are applied in the medical devices sector, which is highly fragmented and contains a high percentage of small companies, and to determine if company size impacts on manufacturing strategy selection [6].

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In 2013, Gremyr et al, provided a literature review on the use of QFD in healthcare and a case study in order to provide contextual knowledge as a means of improving applications of QFD in healthcare [7].

Methodology

Case study methodology was utilized in this study by a group of lab technicians and biomedical engineers in two infirmaries: Prince Hamza Infirmary (PHI) and Jordan University Infirmary (JUH). It started from identifying the customers (specific set of medical turfs dealers)needs (Voice Of Customer) (VOC) to get their finding on the QFD matrix which called also HOQ case study pattern as illustrated in figure 1.

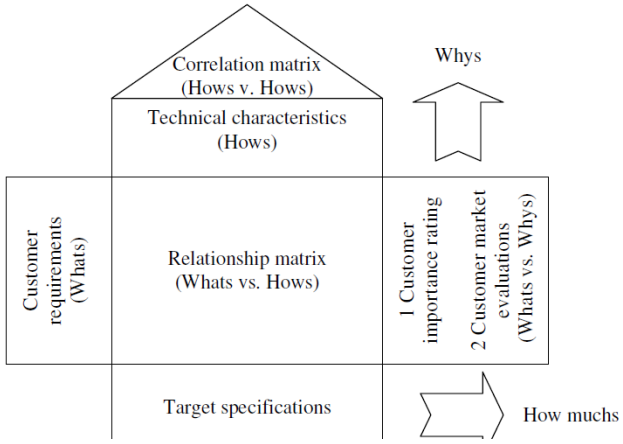

Figure 1. House Of Quality (HOQ) [3]

The HOQ is the primary planning tool in the QFD approach. It isa conceptual map that provides the means for inter functional planning and communication of customer needs and technical responses. In the HOQ, The steps to build the HOQ are:

- List customer needs (whats),
- List technical characteristics (hows),
- develop a relationship matrix between whats and hows,
- develop an interrelationship matrix between hows,
- develop prioritized customer needs,
- develop prioritized technical characteristics

Constructing customer needs is the most crucial stage in QFD operation. In this study, the main customer needs (WHATs) have been prospered from thresher written by the biomedical engineers and lab technicians group and interviews. In these two situations, infirmaries were visited physically to get direct annotations of the different types of duty quality characteristics problems they were encounter. Second, it is crucial to construct technical specifications in QFD operation.

In order to achieve customers' needs, the infirmaries personnel had determined the technical specifications (HOWs). Other parameters for QFD pattern had also been determined. These parameters included the importance weight of customers' needs and competitive evaluation. They were evaluated using the case study model; the relative and absolute weights of the customer needs and technical specifications were enumerated from QFD equations.

In this study, dutyexecution characteristics and deliberates that need to be developed were determined by the biomedical engineer during data dissection and assessment. The data gathered from case study model has been integrated and analyzed to the QFD pattern. Then, the technical specifications were determined. These shall have the highest relative and absolute weights that the infirmary personnel should concentrate on it and enhance it in order to achieve or overtake customer anticipations and enhance the duty performance supplied by the infirmary. The last stir was measuring the duty performance of the case study infirmary. Finally, the quantitative amount in % of the infirmary's quality performance was deliberated by dividing the actual performance grade to the maximum performance grade.

Results and Discussions

As mentioned earlier, the two main objectives of this study are to deliberate duty performance and identify duty characteristics that need to be enhanced in order to improve the studied infirmary's customer satisfactions. This can be achieved by constructing QFD matrix.

In building our QFD pattern, we commenced the first stage which was determining the customer (lab technicians and patients) needs as shown in table 1:

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Table1. Customers (lab technicians and Patients)needs Voice Of Customer (VOC)

			Importance weight
	Operator's related factors	Devices hard duty	9
		Lab technicians treatment of patients	6
		Existence of devices with ability to perform all medical tests	8
	Technical affairs	Existence of telemetry data transferring system	3
	Availability factor	Existence of lab technicians personnel	10
		Existenceof manylab medical pieces of equipment	4
	Reliability factor	Crew with best training	9
	Location related factor	Easiness of accessing the laboratory department in the infirmary	5

In this stage the data gathered from PHI and three experienced persons representing the major sectors of infirmaries in Jordan were utilized to assess the magnitude of importance weighting for each performance directory. This magnitude was put on the Customers' needs on the left side of HOQ as shown in table 1.

It was noticed that devices hard duty was the most important performance part in the operator's related factors and lab technicians' treatment of patients was the least important performance part in the operator's related factors.

It was also remarked that Existence of telemetry data transferring system was the least important performance part in all importance weights.

It was also observed that existenceoflab technicians' personnel was the most important performance part in the availability factor and existenceof manylab medical pieces of equipment was the least important performance part in the availability factor.

It was also observed that crew with best training in the reliability part had high important weight and the part of easiness of accessing the laboratory department in the infirmaryhad moderate important weight in the location factor.

The following step was constructing the duty characteristics as illustrated in table2; this information was inspired by determining all the commensurable characteristics of the PHIcrew which they were perceive they were related to achieve the specified customers' needs.

Affinity diagrams were utilized to interpret the PHI characteristics; an additional row was put to demonstrate the direction of variation in each of these fickle which was considered to be as a result of an improvement in PHI performance as demonstrated in figure 2.

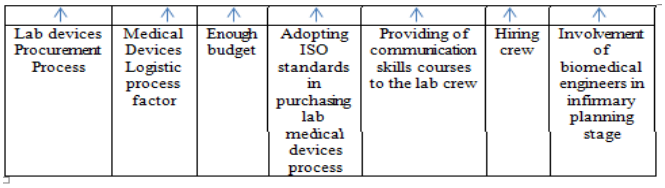

Figure 2. Technical needs and its direction of changes

The roof matrix then established, it was utilized to determine where the technical needs that characterized technical needs supported or impeded one other. It has been preceded through the cells of the roof asking the question: Does improving one need cause a deterioration or improvement in the other technical need? [1].

The roof emphasized where a focused lab technicians performance improvement could yield a range of benefits to technical needs. It focused attention on the negative relationships in the technicians' performance. This represented occasions for innovative dismissals to be applied.

To establish the roof, the roofs for PHI, JUH and five experienced persons' matrices were found and then brainstorming was conducted to establish the average roof that represents all of them as shown in figure 3:

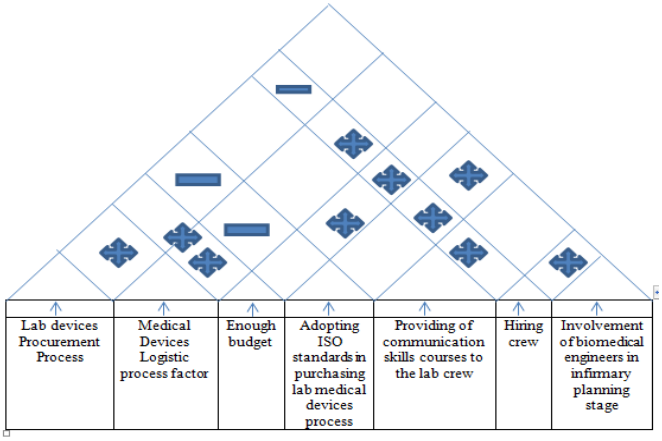

Figure 3. The roof

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The planning matrix cleaved to the right side of HOQ was then established. It quantified the customers' needs priorities and the performance of PHIcrew. The measures used here were generated by questionnaires distributed in the infirmary.

Table 2. Performance deliberate for PHI

			Performance deliberate
	Operator's related factors	Devices hard duty	4.5
		Lab technicians treatment of patients	2.7
		Existence of devices with ability to perform all medical tests	4.1
	Technical affairs	Existence of telemetry data transferring system	1.2
	Availability factor	Existence of lab technicians personnel	5
		Existenceof manylab medical pieces of equipment	1.6
	Reliability factor	Crew with best training	4.5
	Location related factor	Easiness of accessing the laboratory department in the infirmary	2.5

The planning matrix was established through quantifying the performance of PHI and JUH which acquired by finding the performance deliberate of performance fickle in each category. The interpolation procedure was utilized to acquire the weighting ranking for each variable. The results were shown in table 2:

After the mean value for each performance indicator was snaffled, the performance indicator existence of lab technicians' personnel was assigned a magnitude of 5 because it had the highest mean value; the performance indicator (existence of telemetry data transferring system) was assigned a value of 1 because it had the lowest mean magnitude. The interpolation method was used to find the weight of each performance indicator.

The other deliberates of HOQ was interrelation matrix, the interrelations matrix combining the technical needs and VOC should be constructed. The level of interrelation discerned was weighted on a four point scale (High, Medium, Low and None which represent with space) and a symbol representing this level of interrelation was entered in the matrix cell [1]. To construct it, the matrices for PHI,JUH and five experienced people's matrices were found and then brainstorming was made to construct the average matrix that represented all of them as shown in table 3.

Table 3. Interrelation matrix

	Involvement of biomedical engineers in infirmary planning stage	Hiring crew	Providing of communication skills courses to the lab crew	Adopting ISO standards in purchasing lab medical devices process	Enough budget	Medical Devices Logistic process factor	Lab devices Procurement Process
Devices hard duty				H	H		M
Lab technicians treatment of patients		M	H	L	M		

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Existence of devices with ability to perform all medical tests				M	H	M	M
Existence of telemetry data transferring system	H	L	L	H	H	L	L
Existence of lab technicians personnel		H	L		H	H	L
Existenceof manylab medical pieces of equipment		L		L	H	M	H
Crew with best training		M	M	M	H	L	
Easiness of accessing lab depart. in infirmary	H	L	L				

Each grade of interrelation weighting was devoted a magnitude, e.g. High=9, Medium=3,
Low =1 and none =0. It was remarked from the table that the relationship between the enough budget and lab technicians' treatment of patients is high because the enough budge enhances the existence of such courses.

The relationshipbetween hiring crew and lab technicians' treatment of patients is moderate. The hiring of crewincreases the probability of existing crew that is able to treat the patients well.

The relationship between hiring more crew and existence of telemetry data transferring system is low because the more crew size not necessary means existence of telemetry data transferring system.

- Planned satisfaction rating

The planned satisfaction rating quantified the level that PHIcrew plan to arrive it to achieve the grade of operators' satisfaction. They were snaffled from its crew. The results of planned satisfaction rating were illustrated in table 4:

Table 4. Planned satisfaction rating, improvement factor and the overall weighting of the performance indicators.

	planned satisfaction rating	improvement factor	overall weighting
Devices hard duty	5.0	0.1	0.9
Lab technicians treatment of patients	4.0	0.26	1.56
Existence of devices with ability to perform all medical tests	5.0	0.18	1.44
Existence of telemetry data transferring system	4.0	0.56	1.68
Existence of	5.0	0.0	0.00

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lab technicians personnel			
Existenceof manylab medical pieces of equipment	4.0	0.48	1.92
Crew with best training	5.0	0.1	0.9
Easiness of accessing the laboratory department in the infirmary	4.0	0.3	1.5

Regarding the planned satisfaction rating, it was observed that the lowest operators' satisfaction was found in a lot of performance parts like Lab technicians treatment of patients, existence of telemetry data transferring system, existenceof manylab medical pieces of equipment, crew with best training, easiness of accessing the laboratory department in the infirmary. The rest of performance parts achieved the satisfaction.

The improvement factor shown in table 4 was calculated by subtracting the performance score of the PHIcrewfrom its planned performance score. This difference was divided by 5 to give the improvement factor, for example: the improvement factor for easiness of accessing the laboratory department in the infirmary was:

$$(4-2.5) / 5 = 0.3 \qquad (1)$$

Regarding the improvement factor, it was noted that the highest improvement needed to be done was found in existence of manylab medical pieces of equipment.. The lowest improvement needed to be done was found in existence of lab technicians personnel.

The overall weighting has been calculated by multiplying the importance weighting by the improvement factor as illustrated in the table 4, For example; the overall weighting for crew with best training was:

$$0.1* 9 = 0.9 \qquad (2)$$

Regarding the overall weighting, it was remarked that the existenceof manylab medical pieces of equipment had the highest priority to begin with because it had the highest overall weighting. The Existence of lab technicians' personnel was the performance parts had the lowest priority to begin with because they had the lowest overall weighting.

The final part of HOQ which was the targets was constructed. The targets summarized the conclusions drawn from the data contained in the entire HOQ. They were made up from three parts:

- Technical priority
- Competitive benchmarking
- Targets

The technical priority was scored by accumulating the product of the overall weighting shown in table 4 and the interrelations value shown in table 3 as shown in table 5. For example; the technical priority for involvement of biomedical engineers in infirmary planning stage was calculated as follow:

$$[(0.0*0.0)+(1.8*0.0)+(1.0*0.0)+(0.0*9)+(0.0*0.0)+(0.0*1.46)+(9.0*0.0)+(0.9*0.0)+(1.45*0.0)+(0.0*0.0)=0.0 \qquad (3)$$

Table 5.Technical priority, competitive benchmarking and targets

		Involvement of biomedical engineers in infirmary planning stage	Hiring crew	Providing of communication skills courses to the lab crew	Adopting ISO standards in purchasing lab medical devices process	Enough budget	Medical Devices Logistic process factor	Lab devices Procurement Process
Technical Priority		00.00	32.49	22.01	10.05	48.69	20.29	12.56
Benchmarking	PHI	Low 20 %	Need hiring 2 more engineers	No communication skills courses provided to the lab	Adopted	Do not have enough budget	Taking long time (More	Taking long time (More than 2 months)

				crew			than 3 months)	
	JUH	Medium50 %	Need hiring 3 more engineers	No communi-cation skills courses pro-vided to the lab crew	Adopted	Do not have enough budget	Taking long time (More than 3 months)	Taking long time (More than 2 months)
Targets		High 100 %	Hiring 3 more engineers	Providing of communication skills courses to the lab crew	Adopted	Enough budget	Taking less time (less than 1 month)	Taking less time (less than 2 weeks)

It was remarked from the table that the enough budget performance part had the highest technical priority so it should be thought of it firstly and trying to solve its problems like finding ways of financing the purchasing of lab medical devices and training of lab crew, it was also noticed that the involvement of biomedical engineers in infirmary planning stage performance part had the lowest technical priority so it was not critical one.

The competitive benchmarking explained the deliberate of the technical needs identified for the Performance Deliberates of PHI and JUH in table 5. This illustrated the relative technical position of Performance Deliberates of PHI and identified the target grades of performance to be achieved. The competitive benchmarking was snaffled through direct observations of the performance part. For example; regarding the involvement of biomedical engineers in infirmary planning stage, it was found that there were 20% in PHI and 50% in JUH. Table 5 illustrates the competitive benchmarking.

It was remarked from table 5 that, the situation of PHI in all performance parts was not better than that in JUH but there were some cases like the adopting ISO standards in purchasing lab medical devices process, where both situations were the same.

The final stage of HOQ was a set of engineering target magnitudes to be met by the desired performance deliberates. The procedures of building this matrix enabled these targets to be set and prioritized based on an understanding of the operators' needs, the competitor's performance and infirmary current performance. It was needed to draw on all this information when deciding on these values [1].

The targets were obtained by watching the performance of PHI and JUH in each performance part and comparing it to the typical situation known by the expertise perspectives.

For instance; regarding the hiring of morecrew, it was found that it is needed to hire 2 more engineers in PHI and 3 engineers in JHU.Table 5 shows the targets.

It was remarked from the table that some targets were not achieved like enough budget. On the other hand a lot of targets were achieved like adopting ISO standards in purchasing lab medical devices process. Some targets needed a lot to do to be met like involvement of biomedical engineers in infirmary planning.

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