

Improving Patient Needs By House Of Quality Model

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Abstract

The quality function deployment (QFD) is a procedure to determine customers' needs and evaluate, manage, and design a mechanism to enhance the current system (ReVelle, Moran, & Cox, 1998). The research will present a case study of applying the quality function deployment (QFD) model to enhance the healthcare processes and the customers' satisfaction at a private hospital (Pandian Heart Centre, Madurai, Tamilnadu) in India, compared to other hospitals of the region. The identification of the customers' needs is towards applying the quality function deployment (QFD) and focuses on defining, clarifying, and identifying the customer's demands. The customers' requirements are the drivers of the house of quality (HoQ) model. The study will use an organized method based on hospital customer-surveys to assess their current satisfaction level and will identify detailed actions that can be done to improve the overall quality of hospital services. To introduce and understand the quality function deployment (QFD) application and the tools associated with its use in the real world, to help design and improve a product or a service, to define the strategic and technical requirements through this method usage to help fulfil the customers' demands and the other steps in product planning and to show how the quality function deployment (QFD) can be implemented and what are the benefits of using such method in the chosen scenario are the objectives of this research.

Keywords: Quality Function Deployment (QFD), House of Quality (HoQ) model, Patient need

Six Sigma is one of the most famous quality methods used all over the world. It focuses on the customer needs for continuous improvement and development. It also helps in minimizing (3.4) defects per million in products and process designs. It is used to endorse excellence in companies' processes with strong target sets. Six Sigma method was invented by Bill Smith, an engineer at Motorola Company in (1984). It is based on the statistical methods to determine the standard deviation and is used to detect the amount of variation in any process. Six Sigma has five steps which are (1) Define, (2) Measure, (3) Analyze, (4) Improve and (5) Control (DMAIC). These steps are used for continuance improvement and focus on customer satisfaction to reduce the cost by decreasing the variation in the processes. The aims of the five steps (DMAIC) are to identify the problem, measure the service or the process

performance, examine the process to determine the root causes, enhance the process or the service by removing the root causes, and then using the identified measures to improve the performance of the process (Pyzdek, 2003).

The basic element that helps any organisation to implement Six Sigma is the 'Voice of the Customers'. The company needs to understand what the customer wants and needs as a first step of the process. This will help to identify, structure, and arrange the customers' requirements. It will also allow the companies to understand the customers' expectations at the start of the project and act accordingly. The companies need to understand what quality means to the customers and how they define it. To do that, a data collection is required using methods, for example, surveys or interviews. This will help get the customer feedback, and the quality function deployment (QFD) will be used to

measure the product requirements according to the customer needs. The companies need to promptly respond to the customers' needs to stay in business (Ficalora, Cohen, & Cohen, 2010).

The quality function deployment (QFD) is widely used as it helps to determine the voice of the customers and interprets it into the technical requirements that should be fulfilled in the product or service design to achieve customer satisfaction. The quality function deployment (QFD) was developed by Yogi Akao in (1966) and was presented in Japan between (1960 and 1970). Later, it was used by Mitsubishi's Kobe shipyard in (1972). Since then, the quality function deployment (QFD) was introduced worldwide, especially in the manufacturing sector of the United States of America. The use of quality function deployment (QFD) was not limited to manufacturing, it has been used in all process designs, starting with customers' needs analysis, process design, product design, quality management, and other engineering areas (Hunt & Killen, 2004).

The quality function deployment (QFD) can be used in any service or business. It has been applied to improve many service features in the manufacturing and design industry, aviation sector, healthcare service, and many other businesses. The quality function deployment (QFD) helps to achieve customers' satisfaction by determining their exact requirements and needs to help the company survive in the competitive market. The advantages of using the quality function deployment (QFD) at any process is that it does not inspect the quantity and only focuses on the quality of the design, which will help to reduce the time of process development and will lower the cost of starting a design. It helps in fulfilling the customer requirements and can be used for future improvements in the design (Hunt & Killen, 2004). The quality function deployment (QFD) is a process used to incorporate customers' requirements into the design of the products or the services. Understanding the customer requirements and needs are critical to the success of the design of the products. The customers' requirements and needs will be used to populate the quality table to ensure that these requirements are implemented at all design levels and are used to determine the company's requirements. Nowadays, the quality function deployment (QFD) is implemented in the strategic planning processes to focus on the voice of the customers to help achieve the company's goals and visions. The quality function deployment (QFD) is a process different than the other quality tools that helps to minimize the quality glitches. A cross-functional team is responsible for

implementing the quality function deployment (QFD) process within the organization (Forster Cornejo, 1998).

Research Methodology (Quality Function Deployment QFD)

The main objective of this research is to increase the hospital's operational quality. To start the process, customers' needs should be identified to determine the improvement actions. An online survey will be conducted to determine the needs and wants of the customers. The research can be summarized in four steps (Bhattacharyya, 1998):

- Step 1: Define and prioritize customer needs;
- Step 2: Use the hospital reports and the survey to determine the customer satisfaction level.
- Step 3: Use the quality function deployment (QFD) to analyze and define the area that requires enhancement and design the improvement process (House of Quality Matrix).
- Step 4: Implement the analysis outcomes, and monitor the process.

HOUSE OF QUALITY METHODOLOGY Customer's Needs (Voice of Customers)

The identification of the customers' needs is the first step towards applying the quality function deployment (QFD) and focuses on defining, clarifying, and identifying the customer's demands. The customers' requirements are the drivers of the house of quality (HoQ) model. It will lay out the foundation to ensure that the process will be designed according to the customers' needs. A survey was conducted and was designed to determine the needs of the customers and focused to gather information about the patients' demands at the selected hospital (112) patients did take the survey in total.

The survey context showed that the quality requirements are (1) Receiving fast and professional help, (2) Doctors communicate professionally with the patients, (3) Nursing staff communicate professionally with the patients, (4) Pain controlled with the right procedures, (5) Medicine using instructions explained clearly, (6) Clean rooms and facilities, (7) Quite facilities at night, and (8) Follow-up care at home recovery (Akao, 2004). The customers' requirements lay at the left side of the house of quality (HoQ) model, and the first four columns consist of (1) Demand quality, (2) Weight/importance, and (3) Maximum relationship value row. The weight/importance column will be filled with a number from (0 to 100) to show how important this requirement is (Figure 1). The most important factors with high weight is a fast and

professional help, while the communication between the doctors and the nurses with the patients has the second priority. On the other hand, clean rooms and facilities are more important than the follow-up care (Akao, 2004).

The next column will be filled with relative weights, which will be affected by their importance to the patients. The comparative weight will affect the hospital procedures when they deal with the patients. The hospital management will give a high priority to control the pain with the right procedures against other requirements, keeping in mind the improvement of each requirement according to its importance to the patient (Figure 1) (Akao, 2004).

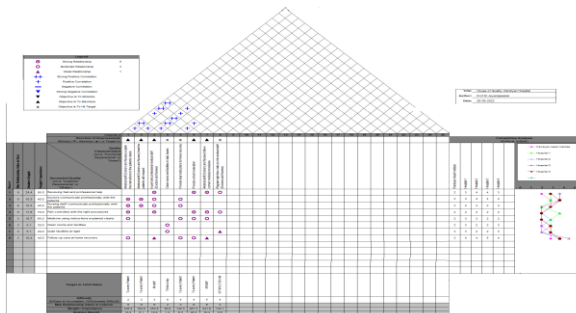


Figure 1 House of quality model for Pandian Hospital

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Technical Requirements (Voice of the Engineers)

The identification of the technical requirements is the second step to construct the house of quality (HoQ). These requirements will be designed on the basis of the customers’ requirements to help the hospital design the right system to meet the customers’ needs. The technical requirements are: (1) Medical staff (Doctors and Nurses) explain the instructions to the patients clearly, (2) Medical staff (Doctors and Nurses) treat the patients with respect, (3) Expert and professional medical staff (Doctors and Nurses), (4) Clean rooms and facilities in daily bases, (5) Provide clear instructions for home recovery, (6) Provide correct medication, (7) Medical staff (Doctors and Nurses) follow correct medical procedures, and (8) Regular night time

visits by the medical staff (Doctors and Nurses) (Figure 1) (Akao, 2004).

Competitive Analysis

The third step in designing the house of quality matrix is to focus on comparing the selected hospital with other hospitals (Hospital B, C, D and E). Nevertheless, an across-hospital comparison will also be conducted with respect to the customers’ requirements as a reference. The hospital will be ranked from (0 to 5), where (0) is being the lowest rank, and (5) is being the highest one. The selected hospital will be ranked using the patients’ survey outcomes, which are used to determine the patients’ requirements. The rating for the requirement will be done using the following system (0%-49%, 50%-59%, 60%-69%, 70%-79%, 80%-89%, 90%-100%), which is equivalent to (0, 1, 2, 3, 4, and 5) respectively. This step will help the management to understand how the patients see the hospital compared to other hospitals. It will help the hospitals to provide better services against their competitors by using them as a benchmark (Figure 1) (Akao, 2004).

To analyze the survey outcomes, the eight patients’ requirements will be ranked according to the benchmark. Some of the requirements got high scores for good feedback. However, these requirements also got a high percentage, which may cause damage in a long-term. These requirements will be prioritized according to this analysis. The following table (Table 1) shows patients’ requirements with the estimated rank using the chart (Figure 2) from the survey outcomes (Akao, 2004).

No	Patient Requirement	Very Poor	Poor	Fair	Good	Very Good	Competitive advantage	Weight
1	Receiving fast and professional help	0.0 %	3.6 0%	35. 7%	41. 2%	19. 6%	2	95
2	Doctors communicate professionally with the patients	0.0 %	3.9 0%	15. 2%	47. 6%	33. 3%	3	40
3	Nursing staff communicate professionally with the patients	0.0 %	3.2 %	16. 1%	52. 7%	28. 0%	3	40
4	Pain controlled with right procedures	0.0 %	3.6 %	34. 8%	46. 4%	15. 2%	2	70
5	Medicine using instructions explained clearly	1.2 %	9.5 %	21. 4%	41. 1%	26. 8%	2	65
6	Clean rooms and facilities	0.0 %	7.0 %	18. 0%	52. 7%	22. 4%	2	20
7	Quite facilities at night	1.8 %	12. 5%	33. 9%	37. 5%	14. 3%	3	20

8	Follow-up care at home recovery	0.0 %	8.9 0%	34. 9%	47. 3%	8.9 0%	3	40
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Table 1 Patients requirements weights

The patients’ requirements will be weighted in accordance with the competitive rank. The lowest rank will have the highest weight. The most important requirement of receiving fast and professional help (Requirement 1) will be weighted (95), while the second important requirement that is the pain controlled with right procedures (Requirement 4) will be weighted (70) and medicine-dosage instructions explained clearly (Requirements 5) will be weighted (65). Other requirements including, communication of the hospital staff (Doctors and Nurses) with the patients and follow-up care at home recovery (Requirement 2, 3, 8) will be weighted (40). The last two requirements (Requirement 6, 7) will be weighted (20) (Figure 1) (Akao, 2004).

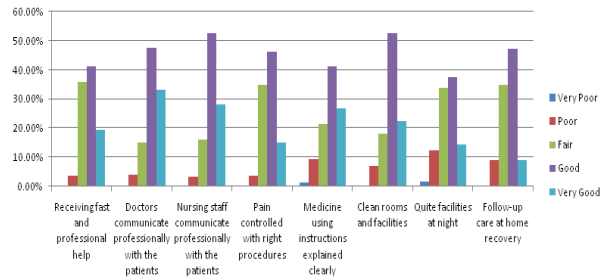


Figure 2 Patients requirements survey analysis

Relationship Matrix

The relationship matrix is the fourth step in the house of quality (HoQ) (Figure 1). It is used to show the relationship between the patients’ requirements and the technical requirements, and how strongly they relate to each other. The relationship between them will be shown using symbols, illustrating a strong, moderate, and weak relationships, with a given value of (9, 3, and 1). The aim of this strategic step is to improve the service to fulfil the patients’ demands. The competitive analysis between the hospitals showed the strengths and weaknesses of the selected hospital, which can help to show the areas that require improvements and the changes to compete. The relationship matrix has to align at least one patient’s requirement with one from the technical requirements (Akao, 2004).

For example, the analysis for the patients and the technical requirements showed that the medical staff (Doctors and Nurses) explains the instruction to the patients clearly. Furthermore, if the staff treats the patients with respect, there is a better chance that the professional communication between the staff and the patients will be improved.

The reason for this strong relationship is that the patients expect the medical staff to communicate clearly with them and to deal with any issues professionally. Medical staff (Doctors and Nurses) explains the instruction to the patients clearly, and a follow-up care at home also builds a moderate relationship. The matrix will be filled using the same method by defining a rational connection between the patients’ requirements and technical requirements (Akao, 2004).

Technical Correlation Matrix

The technical correlation matrix step represents the roof of the house of quality (HoQ) (Figure 1), and its uses to show the relationship between the technical requirements and the way they affect each other. The relationship is shown as a symbol. There are four symbols which represent strong positive correlation, positive correlation, negative correlation, and a strong negative correlation. For example, if there is a strong or strong positive relationship between two requirements, any changes have to be made by the management to ensure a positive impact. If there is a negative or strong negative relationship between two requirements, the management needs to make sure that there is no change in the requirements to avoid a negative impact on them (Akao, 2004).

The management has to implement the required changes if there is a negative correlation. Nevertheless, some changes may have a negative impact because the technical requirements have a strong relationship with each other. In this case, the management will not apply any changes to improve these requirements. The matrix (Figure 1) shows that there are no negative or strong negative relationships between the technical requirements, which mean that no changes are needed to the requirements. If all the requirements have positive and strong positive correlation, these correlations are linked to each other and have the potential to affect each other to a major extent (Figure 1). For example, the technical requirement experts, and professional medical staff (Doctors and Nurses) follow the correct medical procedures to ensure a strong positive correlation. Since the expert medical staff (Doctors and Nurses) will provide the correct medication with correct dosages, each one is expected to have a positive impact on each other. The use of correct medical procedures by the medical experts is a good example of a positive correlation between the requirements (Akao, 2004).

Technical Properties and Targets

The technical properties and targets identification is the final step is the designing of the house of quality (HoQ) matrix. It focuses on ranking the technical requirements by using the following methods: target or limit value difficulty, maximize the relationship value, weight/importance, and relative weight. The reason for using these methods in the management is to determine the most important problems to work on to gain a higher customer satisfaction. As a first step, the management has to set the target for each technical requirement. The management gives the most difficult requirement the high importance to achieving that goal. For example, the hospitals should achieve the ultimate patients' satisfaction by having an expert medical staff (Doctors and Nurses) to explain the instructions to every patient clearly and treat them with respect. The numbers showing the difficulty to achieve the target values are (0) Easy to Accomplish, (10) Extremely Difficult (Figure 1) (Akao, 2004).

HOUSE OF QUALITY ANALYSIS

The current house of quality (HoQ) shows the current position of the chosen hospital compared to other hospitals. To improve its position and increase patients' satisfaction, the current house of quality (HoQ) model requires some improvements. The design will give each quality characteristic a weight according to its importance to define the characteristics preferred by the patients. A relationship matrix showed the correlation between the patients' demands and the technical requirements that will also help in defining the required weights. It also showed the level of efforts put in the quality characteristics.

Step (1) Relative Weights Analysis for Technical Requirements

The weight will be selected according to the importance of the technical requirement to the hospital and will be given a numerical number. The most important technical requirement is 'expert and professional medical staff (Doctors and Nurses)'. Although the other requirements are also significant for the hospital, 'expert and professional medical staff (Doctors and Nurses)' is a major characteristic, which ensures the success of other requirements. This requirement will be used to determine the weights for other technical requirements. A relative weight will be determined using the weight/importance (Table 2) (Bernal, Dornberger, Suvelza, & Byrnes, 2009).

Quality requirements	Weight/Importance	Relative Weight
Medical staff (Doctors and Nurses) explain the instruction to the patients clearly	65	14.4
Medical staff (Doctors and Nurses) treat patients with respect	50	11.1
Expert and professional medical staff (Doctors and Nurses)	95	21.1
Clean rooms and facilities In dally bases	20	4.4
Provide clear instruction for home recovery	50	11.1
Provide correct medication	80	17.8
Medical staff (Doctors and Nurses) follow correct medical procedures	65	14.4
Regular night time visits by the medical staff (Doctors and Nurses)	25	5.6
Total	450	100

Table 2 Quality requirements weight/importance and relative weight

Step (2) Relative Weights Analysis for Customers' Requirements

A relative weight for the quality characteristics will be used to calculate the relative weight of the customers' requirements. This will be done to determine a numerical relationship between the quality requirements and the customers' requirements, and it will be shown how important they are to each other. To determine the relative weights of the customers' requirements, the relative weight for the quality requirements will be multiplied with the weight/importance score for the customers' requirements (Table 3) (Bernal, Dornberger, Suvelza, & Byrnes, 2009).

A percentage score will be calculated using the relative weight of the customers' requirements (Table 3). This step is important to help conduct a comparative analysis between the information collected from the selected hospital and other comparative hospitals (Bernal, Dornberger, Suvelza, & Byrnes, 2009).

In the table 3, the percentages show the importance of each customer's requirements that will help the hospital to give keen attention to them in order to improve their quality of services. For example, 'receiving fast and professional helps' has the highest percentage (30.09%). It indicates that the hospital needs to give more importance to this service to get patients' satisfaction. On the other hand, 'Follow-up care at home recovery' has the lowest percentage (4.87%) indicating that this requirement is not as significant as 'receiving fast and professional help'. The percentages will help the selected hospital to get a better understanding of the patients' requirements. They will also be able to assess how much effort should be put in each requirement to increase customers' satisfaction (Bernal, Dornberger, Suvelza, & Byrnes, 2009).

Customers' requirements	Weight/Importance	Relative Weight	Percentage score
Receiving fast and professional help	95	1372.2	30.09
Doctors communicate professionally with the patients	40	444.4	9.74
Nursing staff communicate professionally with the patients	40	844.4	18.51
Pain controlled with right procedures	70	311.1	6.82
Medicine using instructions explained clearly	65	722.2	15.83
Clean rooms and facilities	20	355.6	7.81
Quite facilities at night	20	288.9	6.33
Follow-up care at home recovery	40	222.2	4.87

Table 3 Customers' requirements relative weights and Percentage Score

In the table 3, the percentages show the importance of each customer's requirements that will help the hospital to give keen attention to them in order to improve their quality of services. For example, 'receiving fast and professional helps' has the highest percentage (30.09%). It indicates that the hospital needs to give more importance to this service to get patients' satisfaction. On the other hand, 'Follow-up care at home recovery' has the lowest percentage (4.87%) indicating that this requirement is not as significant as 'receiving fast and professional help'. The percentages will help the selected hospital to get a better understanding of the patients' requirements. They will also be able to assess how much effort should be put in each requirement to increase customers' satisfaction (Bernal, Dornberger, Suvelza, & Byrnes, 2009).

4.3. Step (3) Competitive Analysis for Customers' Requirements

This step will determine the customers' requirement ratings within the selected hospital as a comparison to other competitor hospitals. In the house of quality (HoQ) matrix (Figure 1), the competitive analysis graph shows how well each customer requirement is doing and which area needs improvements. From (Figure 1), some of the customers' requirements have a value of (3) and above while others are below (3). These results coordinate with the competitive analysis graph. The tendency starts from the top of the graph between 2 and 4 and stays like this to the bottom of the graph to reach (5). A calculated average score will be compared with the percentage score of the last step (Table 4) (Bernal, Dornberger, Suvelza, & Byrnes, 2009).

Customers' requirements	Average score
Receiving fast and professional help	3.2
Doctors communicate professionally with the patients	3.6
Nursing staff communicate professionally with the patients	2.6
Pain controlled with right procedures	2.4
Medicine using instructions explained clearly	2.4
Clean rooms and facilities	2.6
Quite facilities at night	2.6
Follow-up care at home recovery	4
Total	23.4

Table 4 Customers' requirements average hospitals score

The table above (Table 4) illustrates that the hospital can work on many complexities and improves its average rating. Furthermore, the conducted survey can also help the hospital to improve its service quality compared to its competitors. The percentage score is a measurement tool to observe and decide what needs to be done, and it works as a standard to be followed. A high percentage means the more effort is needed to improve the requirement score. The management needs to decide which area requires improvement according to the percentage score. For example, the requirement of 'nursing staff communicate professionally with the patients' has a percentage of (18.51%) with (2.6) score. Therefore, the hospital management needs to decide how much resources should be allocated to this effort. If the management puts (18.51%) effort to improve the 'nursing staff's professional communication with the patients', it might get a satisfactory rating (Bernal, Dornberger, Suvelza, & Byrnes, 2009).

The percentage score will help the hospital to dedicate its efforts for the improvement of patients' satisfaction. If the average score needs improvement, the hospital management should perfect its efforts to achieve a high average. Quite the opposite, if the average score is high, it will be reasonable to reduce the efforts spent on one specific area and increase it in another one. While it is important to fulfil all customer requirements, it is also essential to get enough understanding of the customers' requirements before trying to improve their rating (Bernal, Dornberger, Suvelza, & Byrnes, 2009).

Recommendations

The hospital management should work on necessary changes to improve its service. Hospital has to design a proper plan in order to get to the required customers' satisfaction. The management

needs to adopt the most important technical requirements that are achievable within their capability and strategy. At the moment, a suitable plan is to implement a systematic approach using a lean system. Additionally, a quality officer should be there to monitor the service quality and solve the quality issues.

The reason to adopt lean system is that it is time saving and can help reduce the predicament in attracting more patients. The new system will take at least two to three years to be fully implemented after the hospital management accepts and approve the new plan. This will happen due to the wide range of departments within the hospital and a large number of employees. The survey needs to be run for long period of time to measure the hospital performance, for example the survey can run at least for two months and the performance can be analyzed in weekly bases to determine when the hospital is performing well or bad. Finally, for the further improvement, the financial aspect should also be considered to enhance the quality plan. The below table (Table 5) shows the steps that will help the hospital management to prove the technical requirements linked to the customers' requirements.

Importance	Rational	Target/objective	Expected duration
Systematic Method	To adopt a new system that has the likelihood to increase the efficiency and decrease time lost.	That will help to decrease the time to help the patient.	Two years.
Quality officer and team	A devoted officer's full time with quality experience. Employees from each departments in the hospital are required to assemble a quality team.	That will help to monitor the quality procedures within each department and over the hospital	To be decided within departments.
Customers' feedback	A feedback system with to the increase of customers' awareness of using it for future developments.	That will help the hospital management to monitor the hospital service based on the customer feedback.	Approximately one year.
Soft skills training (Communication)	Provide a suitable training to enhance the communication methods between the medical staff and the patients.	That will help the medical staff to communicate professionally with the patients.	Approximately one year.

Table 5 Priorities - implementation plan

Conclusion

Over the years, the total quality management proved its vibrant role in improving the companies' services or products. For the quality management, each company uses quality techniques that serve its organizational strategies. The quality functional deployment (QFD) is one of the most popular tools in the total quality management and proved to be

useful in improving services or products for an ultimate customers' satisfaction. In the case study, the competitor hospitals are ahead of the chosen hospital in some areas, and the hospital management needs to focus on those areas to improve its customer satisfaction. The analysis started by gathering customers' feedback with the help of a survey about the current services provided by the hospital. These survey outcomes helped to fill the rooms in the house of quality (HoQ) and showed how the customers' feel about the hospital. The results will help the hospital management determine customer and technical requirements and priorities these requirements according to their importance to the customers.

The analysis continued by adding some weights of importance to the customers' and technical requirements, which helped the hospital management determine the areas that need an improvement. The final house of quality model helped explain to the hospital management the relations between different parts of the hospital and a direct association with how good the hospital responds to the patient's requirements. The results helped make few changes to the quality functional deployment (QFD) and the house of quality (HoQ) plan.

The percentage scoring system put light on the areas that are strong and helps in exploring the hospital services that can be made better. Although the percentage scores helped in allotting a required effort to attain a customer's satisfaction, it did not show the other parts of the hospitals can be managed. For example, it is obvious that funding is required to help improve the services with the help of staff training, but this information could not be gathered from the survey results. A short-term plan has been initiated to help improve the areas that are necessary for the quality improvement.

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