

House of Quality

Case Study Developed on Voice of Customer of Petroleum Retail Outlets Indian Oil Corporation Limited

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The Background

House of Quality refers to a well known process for product development that is inspired by customer desires for product or process development and anchored by the capabilities and resources of the organization seeking to meet those desires. It is a process of listening to customers, translating their desires into a written plan, prioritizing steps of execution based on what is most important to the customer, and putting a realistic plan on paper.

House of Quality is a part of a larger process called Quality Function Deployment (QFD). This represents quality-monitoring, a focus on the function of execution of a quality plan, and the application of resources for deployment of that plan. While the name, QFD, does not encapsulate all that QFD covers, it is a name that has been around for quite some time. It is familiar, so organizations continue to use it. The House of Quality name comes from the very useful diagram used to make this plan that resembles a house, which we will dig into shortly.

Primary Purposes of QFD and House of Quality

- **Understand Customer Desires**

Many times, customers need an outside perspective to discover what they really need to build their product or process. The goal is to understand customers perhaps even better than they understand themselves so as to open their eyes to ideal solutions.

- **Understand Customer Priorities**

During the interview stage, get to know customer needs, but then break those needs down into prioritized parts. For example, if a customer is building drones for media production, how important is battery life compared to camera quality? How important is aesthetic compared to quality of the drone body? Weights are assigned to each quality based on what is most important to the customer. How well each need is met is ultimately how the customer will judge your solution's value.

- **Departmental Buy-In**

Often, disagreement or misunderstanding between departments of a customer's organization can occur in relation to what is actually needed. Marketing may think that a drone with trending features is top priority, but engineering

may think that overhaul of a problematic part is top priority. The process helps create a plan that addresses all true priorities and to which all departments can agree.

- **Translate Customer Desires Into Goals & Technicalities**

This is the heart of the QFD process where the recorded desires of the customer are ranked by priority and specific process and resource planning takes place. They are laid out onto a useful diagram labeled the House of Quality.

- **Specify Traceable Requirements**

Specific requirements for the execution of the customer's product or process should be laid out. The *how* and *why* questions should be answered in the plan—*how* are we meeting the client's requirements and *why* are we doing it this way? The written requirements should be specific enough that their completion and success are traceable. One should be able to work forward and backward in the plan and determine easily whether or not the overall plan is being executed successfully. For example, if there is a question on *why* something is done a certain way, one should be able to trace back to the beginning of the process to the initial requirement that determined the process needed to meet that requirement.

- **Provide Structure**

It is easy for customers to jump all over the place stating what they desire and tossing out ideas. But, at the end of the day, your role is to hone in on what they want and provide a logical, executable, traceable structure to organize their ideas.

- **Allocate Resources**

Whether developing a physical product or creating a process for a customer, resources are needed to do so. Humans, machines, computers, construction materials, disposable materials and more must be accounted for. What do we have available to us and what do the available resources allow us to do? Answering these questions is a critical part of execution.

House of Quality Diagram

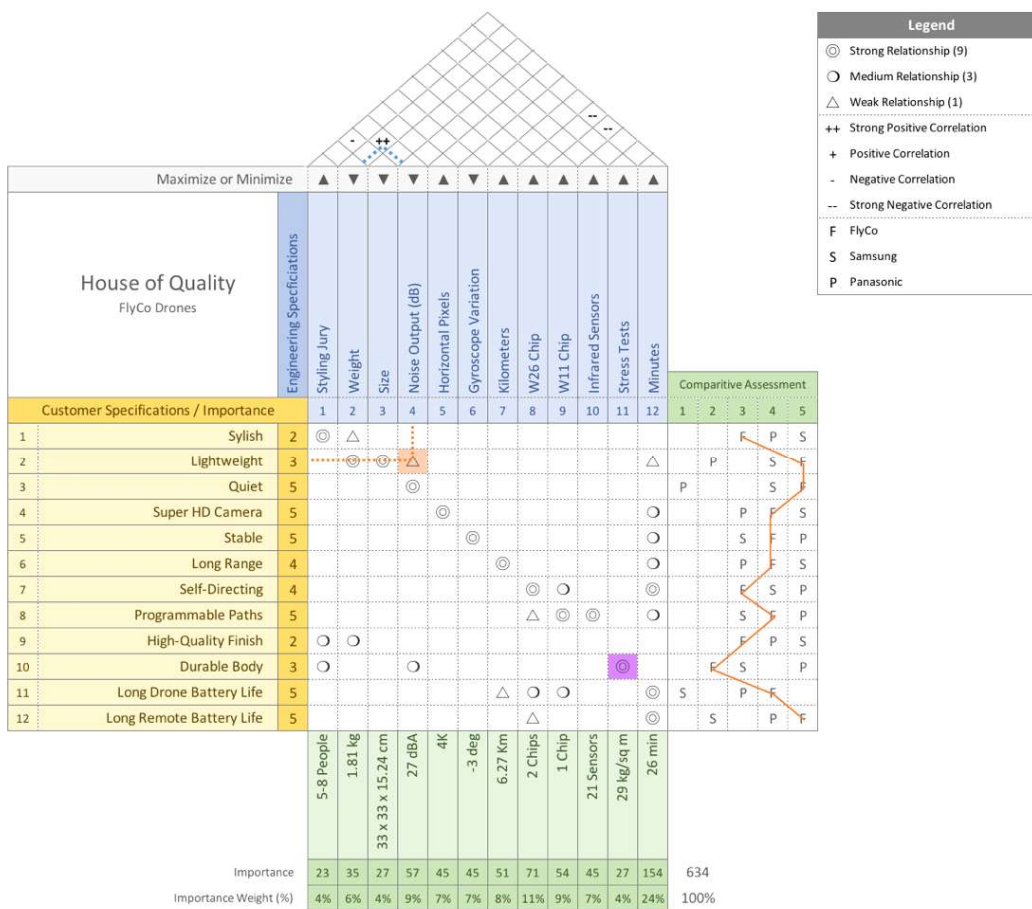
Below is an example of a **House of Quality Diagram**. There is a summary overview of its various parts. Here is an example of a media-production drone manufacturer.

The **Customer Specifications** section to the left lays out the specific priority features on which the customer has set focus. The numbers just to the right represent their importance to the customer on a scale of one to five. The **Engineering Specifications** section displays engineering methods needed to measure and execute production. At the base, the engineering specifications are detailed in **specific measurements**.

The center grid containing symbols displays how strong a relationship each customer specification has to each engineering piece. Referring to the **Legend**, a ⊙ indicates a strong relationship with a weight of 9, a ○ is a medium relationship with a weight of 3, and a △ is a weak relationship with a weight of only 1. For example, if you cross-

reference the **Lightweight** specification with the **Noise Output (dB)** engineering specification (refer to the orange dotted line, you will find a medium relationship between how heavy the drone is and how much noise it puts out. A cross-reference of **Durable Body** and **Stress Tests** shows a strong relationship between how durability is judged and in-house stress tests.

The top portion, the “roof” of the house, displays potential conflicts between engineering specifications. Referring to the blue dotted line, it is seen that there is a strong positive correlation between the unit’s weight and the noise output. When the weight goes up, the propellers must work harder to keep the drone suspended, so the noise level also goes up. Just below the roof, the up and down arrows indicate which direction the customer would like each engineering specification to go. For example, they want style up, noise level down, and battery run time up



Source: <https://www.whatissixsigma.net/house-of-quality-qfd/>

The **Importance** numbers and **Importance Weights** at the bottom are the overall importance after evaluating customer importance and engineering relationships. To obtain these numbers, the product of each customer importance weight and the value of the relationship symbol for each specification and engineering specification is calculated. For example, the overall importance of minimal noise output is obtained as follows:

Specification / Weight		Relationship to Noise Output (dB)		Product
Lightweight	3	△	x 3	= 9
Quiet	5	◎	x 9	= 45
Durable Body	3	○	x 1	= 3
TOTAL				57

The total of all importance weights (634) is shown to the right. Per the above calculation, minimal noise holds an importance in the group of engineering specifications of 57. This number (57) divided into the total weight of 634 gives minimal noise output a percentage importance weight of 9%, shown below the weight numbers.

Referring to the weight numbers and percentages at the base shows that runtime **Minutes** is the most-important specification to focus on at 154 or 24%. **Style**, **Size**, and **Stress Tests** are the least important area of focus at 23, 27, and 27, which all round to 4%.

Lastly, the **Comparative Assessment** section to the right displays a trending line indicating where the model stands in the market compared to other brand models of similar specifications. Three brands are represented with **F** representing FlyCo (your brand), **S** for Samsung, and **P** for Panasonic drones. Each brand's effectiveness in executing each specification is rated on a scale of 1 (poor) to 5 (excellent). For example, refer to the **Stable** specification. Going to the right under **Comparative Assessment**, it is seen that Samsung (S) drone stability is mediocre, FlyCo (F) is good, and Panasonic (P) is at the top with an excellent rating of 5. For **Drone Battery Life**, Samsung rates poor, Panasonic is in the middle, and FlyCo (product under analysis) are rated good with a rating of 4.

There are various levels of detail into which one can go using the House of Quality diagram. Some might include ratings for each engineering specification that indicate technical difficulty of execution, and so forth. But the example above is widely applicable and fairly detailed.

Case Study: Voice of customer: Petroleum Retail Outlets

When the customer takes the car for refueling in a retail outlet, which parameters are important to her? The study attempts to gather round the customer preferences and incorporate the parameters of importance in the designing of a retail outlet, constructing a House of Quality.

The following questionnaire is administered on randomly chosen 11 customer to rate their preferences on a five point scale.

Questionnaire

Voice of customer: Petroleum Retail

Outlets

When you take your car for refueling in a retail outlet, which of these parameters are important to you? Rank in a scale of 1-5

(1 is most important and 5 is least important).

Proximity of the retail outlet relative to your place of work or residence

How important is it to you that the outlet is near to your place of residence or workplace?

1 2 3 4 5

Most Important Least Important

Reputation of the outlet for delivering quality product

How important is it to you that the outlet appears to deliver correct quality and quantity?

1 2 3 4 5

Most Important Least Important

Prompt service, minimum queue buildup

How important is response time and queue management to you?

1 2 3 4 5

Most Important Least Important

Cleanliness and decor

How important is the appearance of the outlet to you?

1 2 3 4 5

Most Important Least Important

Availability of clean toilet and drinking water

How important is it to you that the outlet has basic facilities for personal needs?

1 2 3 4 5

Most Important Least Important

Availability of lubricant, free air and vehicle care services

How important is associated car services important to you?

1 2 3 4 5

Most Important Least Important

Reliability and assured availability of product

How important is it to you that the outlet never runs out of inventory?

1 2 3 4 5

Most Important Least Important

Round the clock availability of services

How important is it to you that the outlet operates 24x7?

1 2 3 4 5

Most Important Least Important

Analysis of Responses

The ratings of the customers for the following attributes are collected:

- Proximity of the retail outlet relative to your place of work or residence
- Reputation of the outlet for delivering quality product
- Prompt service, minimum queue buildup
- Cleanliness and decor
- Availability of clean toilet and drinking water
- Availability of ATM and convenio stores
- Availability of lubricant, free air and vehicle care services
- Reliability and assured availability of product
- Round the clock availability of services
- Any other important parameter(s)

Summary of Responses

Respondents	Proximity of the retail outlet relative to your place of work or residence	Reputation of the outlet for delivering quality product	Prompt service, minimum queue build up	Cleanliness and decor	Availability of clean toilet and drinking water	Availability of ATM and convenience stores	Availability of lubricant, free air and vehicle care services	Reliability and assured availability of product	Round the clock availability of services	Total
1	1	1	2	2	5	2	2	2	3	
2	1	1	1	2	2	3	2	1	1	
3	1	1	1	2	1	3	1	1	1	
4	4	1	2	2	3	2	2	2	2	
5	2	1	2	3	1	1	1	1	1	
6	2	1	3	4	4	5	3	2	4	
7	1	1	1	2	1	1	1	1	1	
8	3	1	1	1	2	2	1	1	2	
9	1	3	1	2	3	4	2	1	1	
10	2	3	1	2	1	3	1	1	1	
11	2	2	1	1	2	1	2	2	2	
Average Score	1.82	1.45	1.45	2.09	2.27	2.45	1.64	1.36	1.73	16.28
Importance	3.18	3.55	3.55	2.91	2.73	2.55	3.36	3.64	3.27	28.73
%Importance	11.08%	12.34%	12.34%	10.13%	9.49%	8.86%	11.71%	12.66%	11.39%	100.00%

Importance and Percentage Importance of an attribute:

- The average score (rating on the 5 point scale) of all the customers is calculated.
- Importance of the corresponding attribute is calculated as 5-Score, as the scale was 1-Highest Importance and 5- Lowest Importance.
- The relative importance of each of the attributes is calculated as a percentage of the total importance (sum of all the importance)

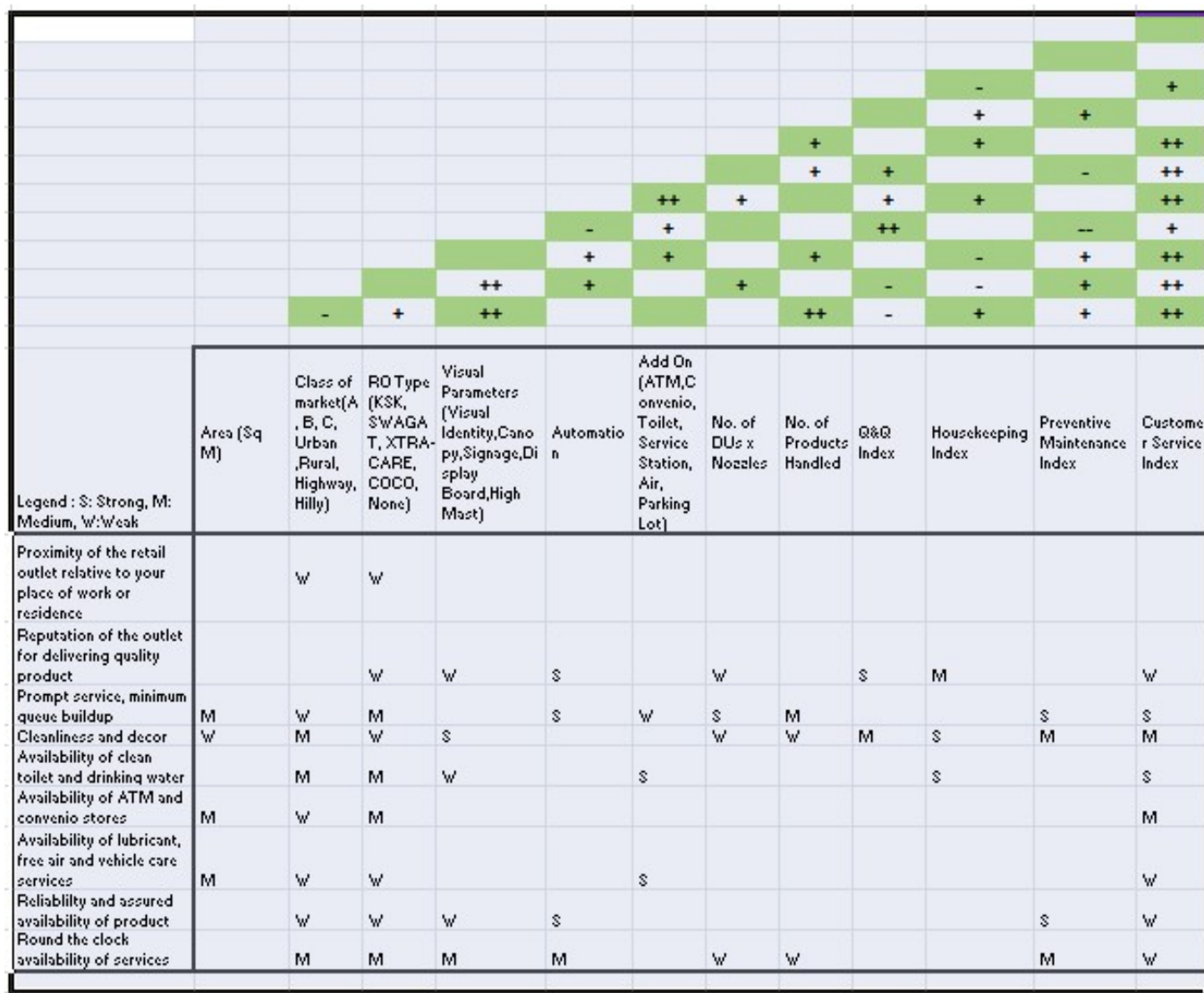
Voice of Customer Table		
Attribute	Rank	% Importance
Reliability and assured availability of product	1	12.66%
Reputation of the outlet for delivering quality product	2	12.34%
Prompt service, minimum queue buildup	3	12.34%
Availability of lubricant, free air and vehicle care services	4	11.71%
Round the clock availability of services	5	11.39%
Proximity of the retail outlet relative to your place of work or residence	6	11.08%
Cleanliness and decor	7	10.13%
Availability of clean toilet and drinking water	8	9.49%
Availability of ATM and convenio stores	9	8.86%

The following Design Parameters are identified to match with the attributes:**Measurable Design Parameters**

- Area (Sq M)
- Class of market(A,B,C, Urban,Rural,Highway,Hilly)
- RO Type (KSK, SWAGAT, XTRA-CARE, COCO, None)
- Visual Parameters (Visual Identity,Canopy,Signage,DisplayBoard,High Mast)
- Automation
- Add On (ATM,Convenio, Toilet, Service Station, Air, Parking Lot)
- No. of DUs x Nozzles
- No. of Products Handled
- Q&Q Index
- Housekeeping Index
- Preventive Maintenance Index
- Customer Service Index

Correlation between Customer Preference Attributes and Measurable Design Parameters												
Customer Preference Attributes	Measurable Design Parameters											
	1	2	3	4	5	6	7	8	9	10	11	12
Proximity of the retail outlet relative to your place of work or residence	0	1	1	0	0	0	0	0	0	0	0	0
Reputation of the outlet for delivering quality product	0	0	1	1	9	0	1	0	9	3	0	1
Prompt service, minimum queue buildup	3	1	3	0	9	1	9	3	0	0	9	9
Cleanliness and decor	1	3	1	9	0	0	1	1	3	9	3	3
Availability of clean toilet and drinking water	0	3	3	1	0	9	0	0	0	9	0	9
Availability of ATM and convenio stores	3	1	3	0	0	0	0	0	0	0	0	3
Availability of lubricant, free air and vehicle care services	3	1	1	0	0	9	0	0	0	0	0	1
Reliability and assured availability of product	0	1	1	1	9	0	0	0	0	0	9	1
Round the clock availability of services	0	3	3	3	3	0	1	1	0	0	3	1
Legend												
Strong(S)	9											
Medium(M)	3											
Weak(W)	1											

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Results of Analysis

Importance Score of the Measurable Design Parameters are calculated as: $\sum(\text{Importance of an attribute}) * (\text{Correlation of the attribute with this parameter})$

Design Parameter	Importance Score	Rank
Automation	3.70	1
Customer Service Index	3.02	2

Preventive Maintenance Index	2.90	3
Housekeeping Index	2.14	4
Add On (ATM,Convenio, Toilet, Service Station, Air, Parking Lot)	2.03	5
RO Type (KSK, SWAGAT, XTRA-CARE, COCO, None)	1.84	6
Visual Parameters (Visual Identity,Canopy,Signage,DisplayBoard,High Mast)	1.60	7
Class of market(A,B,C, Urban,Rural,Highway,Hilly)	1.50	8
No. of DUs x Nozzles	1.45	9
Q&Q Index	1.41	10
Area (Sq M)	1.09	11
No. of Products Handled	0.59	12

Conclusion

Automation is the most important factor to be considered, followed by **Customer Service Index** and **Preventive Maintenance Index**.

Reference

<https://www.whatissixsigma.net/house-of-quality-qfd/>