Quality Function Deployment

Quality Function Deployment, or QFD, is a tool that can help improve your existing processes by focusing your energy and your attention on efforts that will ensure the greatest result. QFD works by first identifying and prioritizing customer requirements and expectations. You then can use this information to focus with greater confidence on the important customer requirements as a starting place to define such things as product requirements, design features, manufacturing processes or support requirements.

What can it do for you?

The payoff of a Quality Function Deployment is the creation of more robust designs and processes that work together to assure customer satisfaction. An added benefit is that QFD is able to document key decisions in a form that can become a template for future improvement efforts.

A full-blown application of the Quality Function Deployment discipline produces a complex-looking series of matrices. In almost all instances, this level of detail is not necessary. Normally, an abbreviated version of QFD with only one or two matrices is enough to do the job of resolving a problem, defining Critical-To-Quality (CTQs) characteristics or implementing actions to reduce costs.

The effort and discipline of Quality Function Deployment produces the greatest results in situations in which customer requirements have not or cannot be sharply defined, those requirements cannot be met through conventional processes or practices, or the elements of the business that must work together to deliver the requirements have divergent or conflicting goals.

Although Quality Function Deployment is a disciplined tool, it is also a flexible and adaptable one. Through QFD, customer expectations can be logically and practically linked to almost any business process. Virtually any cause-and-effect relationship can be adapted to the Quality Function Deployment discipline.

The application of QFD can range from one person constructing a simple matrix to classic Quality Function Deployment in which a formal team generates a systematic flow down of customer expectations to technical requirements, critical part requirements, critical process requirements, and process controls. The most practical application of Quality Function Deployment is usually somewhere between these two strategies.

Quality Function Deployment is especially useful in *Define, Measure* and *Improve* phases of Lean Six Sigma methodology.

How do you do it?

1. Define the project.

The first step is to define the project and describe the intended results. This will enable you to decide if Quality Function Deployment is the right tool.

- If the approach is clear, but the requirements are not, or you want to clarify the link between customer requirements and process requirements, a simplified Quality Function Deployment might be appropriate.
- If the objective is a significant challenge or there are many conflicting requirements, a more complex Quality Function Deployment is probably a good idea.

2. Create the team.

The next step is to bring together a team.

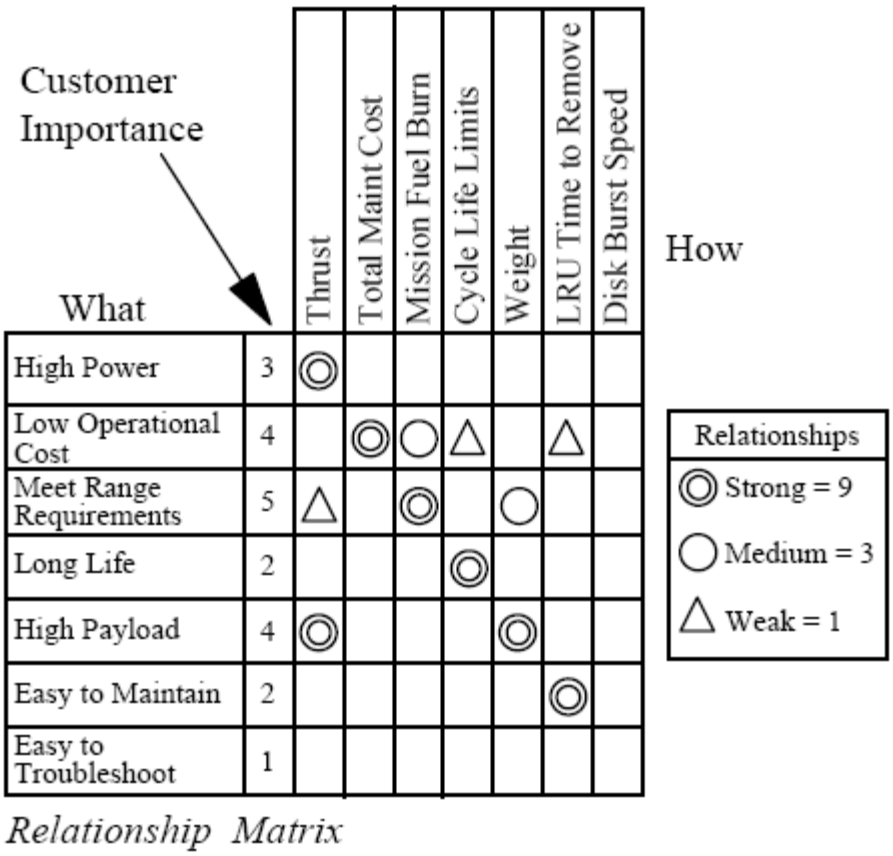
- List the organizations that have an interest in or an influence on the result.
- Consolidate representation as necessary to get the list down to two or three for a simple Quality Function Deployment or five to eight for a complex one.
- Identify team members who represent the defined areas and who would also have ownership for implementing the results.

3. Get buy-in.
Make sure you have commitment from the proposed team members.

- If anyone is not interested, find a suitable replacement.
- Ensure you have the commitment of management in each of the interested areas, as well.
- Once the team is defined, agree on a team leader, team ground rules and a regular meeting schedule.

4. Define customer expectations.
Think of this as answering the question, "***What*** does the customer want or need?"

- Generate your own ideas through brainstorming if direct customer involvement or surveys are impractical.
- Clearly state each expectation as a customer would perceive it.
- Group the expectations into meaningful clusters that share a common theme. Consider creating an affinity diagram with everyone's input.
- Although each customer expectation is important, it is necessary to prioritize them to help resolve any conflicts over what to do first. Rate each customer expectation from 1 to 5, with 1 being the least important and 5 being the most.
- Validate your collection of customer expectations and their relative importance by talking with your customer or sources close to your customer. (Always remember, a fundamental part of the QFD discipline is to listen to the *voice of the customer*.)
- When you are satisfied with your list, transfer your rated customer requirements to the left side of your first matrix.



Relationship Matrix

5. Define the requirements that will satisfy your customers' expectations.
Think of this as answering the question, "***How*** can we meet each customer expectation?"

- Work on each expectation, one at a time. Remember that you are looking for requirements that will *cause* the customer's expectations to be satisfied. (Alternately, you might use the discipline to show a customer why an expectation cannot be met or to consider what may be possible beyond the customer's expectation.)
- You could try brainstorming or create a cause-and-effect diagram to generate requirements.
- After you have a list of requirements, screen them until you have identified the critical few. Good requirements for QFD are not only relevant; they are also controllable and measurable.

6. Develop the first relationship matrix.
This matrix will compare each customer expectation (the ***whats***) against your list of identified product or service requirements (the ***hows***).

- To help decide if the customer would feel that the product or service expectation would be met if the requirement were met, ask, "If we meet this product or service requirement, would the customer perceive this as an improvement in satisfying this need or expectation?"
- If there would be a perceived improvement in satisfaction, decide if the relationship between meeting the requirement and improving the customer's satisfaction is a strong one, a moderate one or a weak one.

- In your matrix, use a double circle to symbolize a strong relationship, a single circle for a moderate one, and a triangle for a weak one.
- Complete the matrix for all the possible relationships. You should normally have at least one strong relationship under each requirement. Determining the strength of a relationship is a team judgment.

Here are some tips to help calibrate that judgment to make the most useful matrix.

- Try to avoid making a matrix that contains mostly weak or moderate relationships.
- On the other hand, avoid making a matrix that shows every requirement related in some way to each customer expectation.
- A good general rule is that *only one-third to one-half of the intersections in the matrix should have symbols in them.*

7. Check your work.

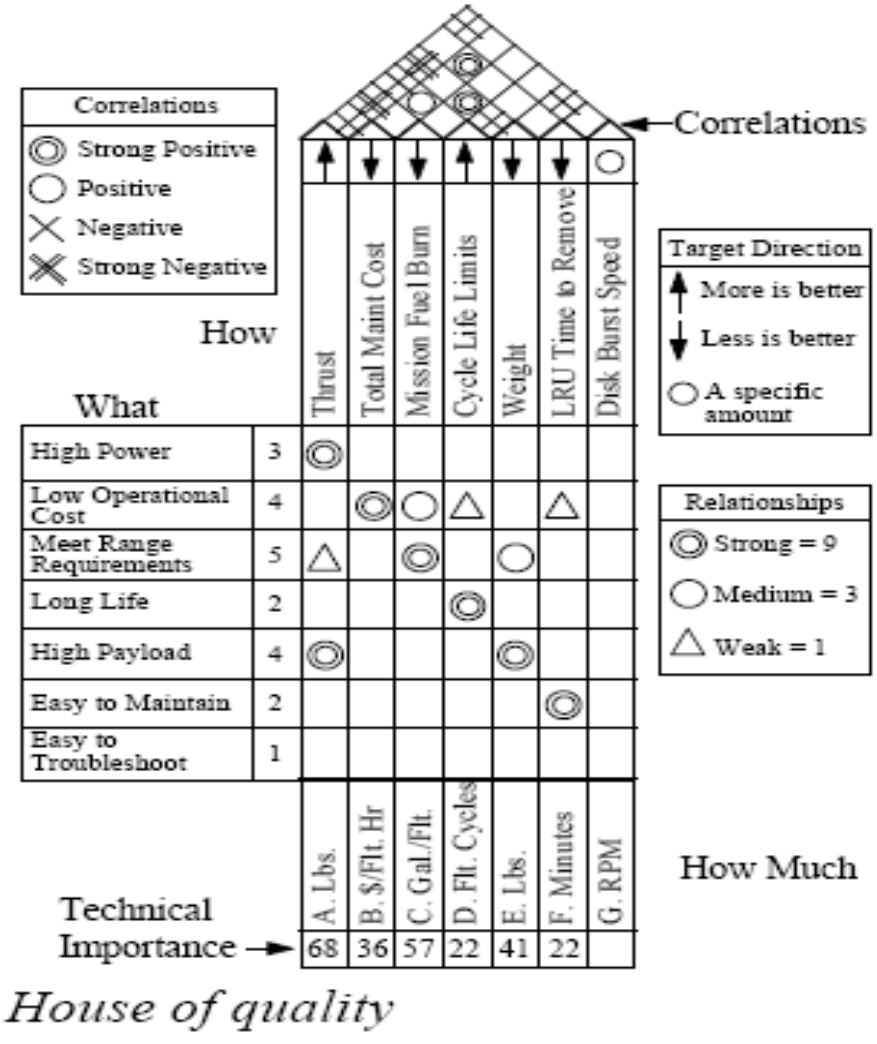
A reality check is usually a good idea at this point. Ask if the customer would really be satisfied if you delivered a product or service that met your list of requirements. Be sure that there are no obvious holes or underrated relationships.

8. Prioritize your requirements.

When you are satisfied that your matrix is complete and accurate, prioritize the requirements

- Multiply the strength of each relationship (1 for weak, 3 for moderate and 9 for strong) times the priority number (1 to 5) for each corresponding customer expectation.
- Add the results and enter the sum for each requirement at the bottom of the matrix.

The numeric quantities have no real meaning, but they do help you to prioritize the relative importance that meeting each of the identified requirements would have in satisfying the package of identified customer expectations.



House of quality

9. Establish targets.

Through team discussion, develop target values for the requirements. Take into account whether the goal is to maximize or minimize a value or condition or to hit a specific target value.

Pay attention in this step to the effect that optimizing one requirement has on the ability of the process to meet the other requirements.

- Completing the *roof* matrix that gives the first matrix the name *house of quality* is the way that this is done in a formal QFD study. The *roof* records correlations between the requirements.
- Symbols in the correlation matrix respond to the question, "Would meeting this requirement help or hurt meeting each of the other requirements?"
- The roof matrix is constructed and read diagonally. In our house-of-quality example, *reducing weight* has a strong positive correlation with *reducing fuel burn* and a strong negative correlation with *increasing thrust.*

- For simpler QFD projects, formal correlation analysis may not be necessary. If the team wants to look at correlations, it may be enough to compare the requirements against one another informally and note whether optimizing one would compromise another.

10. Construct the next QFD matrix.

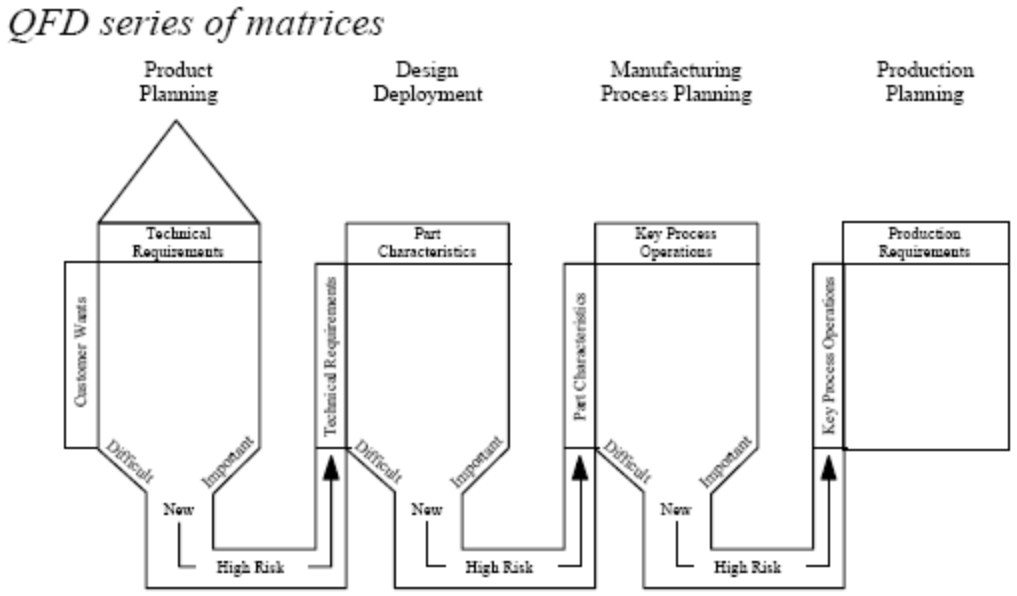
- The *requirements* output of the first matrix is usually used as the input to the second matrix. The relative importance of each requirement from the previous matrix would be rescaled to fit in a 1 to 5 range to keep calculations easy.
- Using the highest priority and most challenging requirements as a starting place, the team would generate a list of design features to satisfy them.

The other requirements are not forgotten. They are often able to be handled by practices other than QFD, however. The team must decide which are the most important for entry into the second matrix to keep the focus sharp.

- By completing and evaluating this second matrix in the same way as the team did the first one, they arrive at a prioritized list of design features and Critical To Quality characteristics (CTQs). The matrix scoring helps keep the focus tied to what is most important in ultimately satisfying the customer.
- In selecting those most important CTQs, it is helpful to ask, "Is this measurable, controllable and relevant?"
- A characteristic should be all three to be considered as a CTQ.

11. Construct the QFD series of matrices.

- Using the CTQs as the starting point for the next matrix, the team should apply their understanding of the process to create a list of the process characteristics that must be controlled to reduce variation in the CTQs.
- Fill in the matrix using the same kind of weighting process as you used before. Ask, "If we reduce the variation in this key control characteristic (KCC), will the customer perceive this as an improvement?" As with CTQs, the selected KCCs must be measurable, controllable and relevant.
- Completion of this matrix generates a list of the important process characteristics (KCCs) that must receive special attention to ensure that design features (CTQs) are met.



- The classic form of Quality Function Deployment then converts the KCCs into a prioritized quality plan (process controls) using a variation of the relationship matrix.

Now what?

Classic Quality Function Deployment can be time-consuming and may involve several teams or teams with shifting membership as the Quality Function Deployment looks at different processes. In actual application, the QFD tool is usually modified, simplified and individually targeted to improve a wide range of process challenges. Quality Function Deployment is not limited to new products or services. It can be applied to the improvement of existing products, services or processes as well as for resolving problems that affect both external and internal customers.

Here are some points to ponder about Quality Function Deployment:

- The process may look simple, but it requires a lot of effort.
- Many of the results look obvious, after they are written down.
- If you don't experience some tough spots, you probably aren't doing it right.

- The charts are not the objective; they are only the tool for achieving the objective. Pleasing the end-user is the real objective.
- It is important to use the Quality Function Deployment process to find ways to succeed in the eyes of the customer, not to justify failing to live up to the customer's expectations or needs.

Consider using Quality Function Deployment when risks are very high, such as situations involving safety or large investment, and it is extremely important to do things right the first time.

You should also consider Quality Function Deployment if:

- Customers are not satisfied with your product or service.
- Your product demands an extensive development time.
- Your customers' wants and needs tend to get lost in the complexity of your process.
- Communication has been difficult between the functions responsible for delivering the product or service to the end user.
- The structure or logic for allocating resources is not clear.
- The challenges in satisfying customer requirements appear to be greater than the normal processes can handle.

It is a good idea to get help from your area's Black Belt or Master Black Belt before starting a QFD process. If you would like to read about QFD, a good book is "The Customer Driven Company: Managerial Perspectives on QFD" by William E. Eureka and Nancy E. Ryan (ASI Press, Dearborn, MI, 1988.)

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