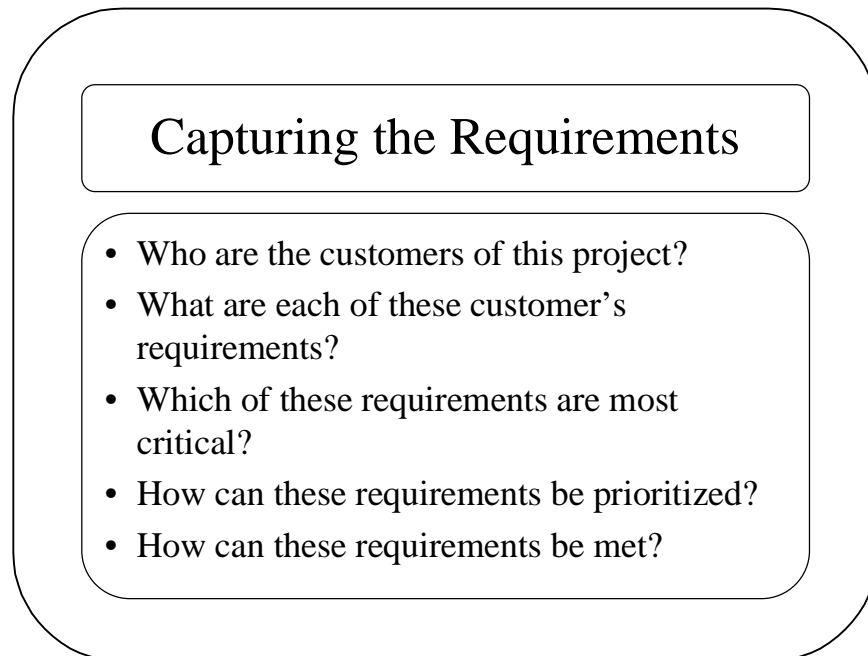


## 1.8 Quality Function Deployment

Quality Function Deployment (QFD) is an important and useful tool that can improve the definition and integration of system/project requirements. QFD improves the design process by initially concentrating on the "whole" product, rather than individual product components. Thus, the design team that uses QFD should reflect the multi-disciplinary focus required for this total view. QFD compels the team to examine the proposed product from initial conception through final disposal, and provides a mechanism for performing a systematic alignment of these customer requirements.

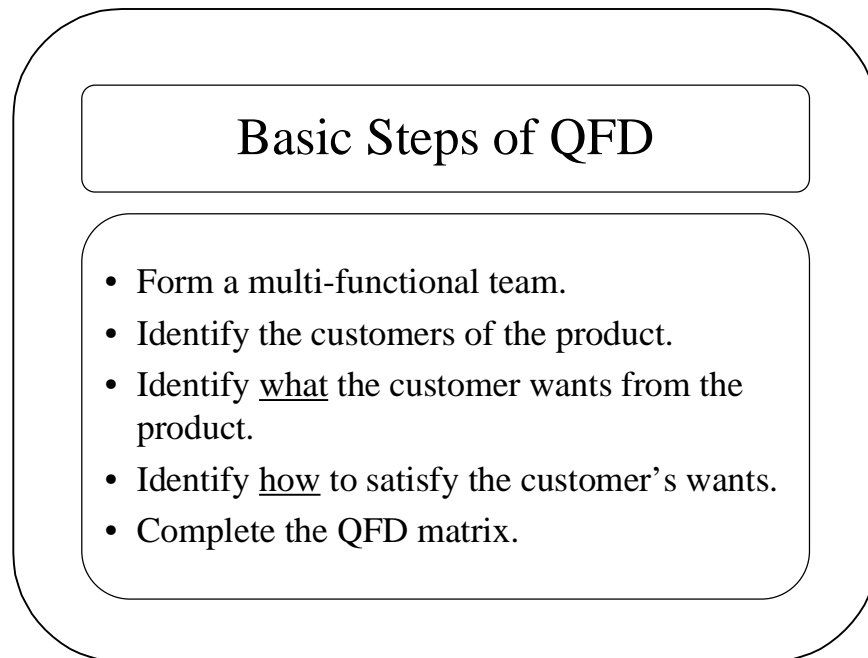


The key to QFD success is that the voice of the customer is heard from a product's earliest inception. To hear this voice, however, the IPT must be able to identify and solicit inputs from the product's future customers. These customers not only represent the end user of the product, but also the many internal customers (i.e., production, logistics, maintenance, etc.) who will receive the outputs from each successive process in its life cycle. QFD enables the IPT to answer three basic questions: "Who are the customers?", "What do these customers want?", and "How can we satisfy these customer wants?". By answering these questions correctly and integrating these responses into the product's design, the probability of success is greatly enhanced. In short, QFD allows the design team to take a true systems approach to product development.

Used originally in the shipbuilding and automobile industries of Japan, QFD is often viewed as a technique by which a physical product is designed for manufacture. However, QFD has also been used successfully as a strategic planning tool for the design of an intangible product, such as in the development of a program or activity. While there is no industry standard guiding the use of

QFD, the following detailed procedures represent a common methodology for its implementation. As a simple example, the design of a wallet is used to illustrate the steps of QFD.

## **QFD STEPS**



1. Form a multi-functional team to include informed representatives from the product's life cycle.
2. Identify the customers of the product. This could be the end user or any intermediate users of the product.
3. For each customer, identify what that customer wants from the product. This is often best achieved by brainstorming and/or the use of affinity diagrams, where each customer demand is written on a post-it note or index card.
4. For each customer demand, the team must decide how the demand can be met. These are the quality characteristics of the product.
5. Fill in the QFD matrix using the customer demands (whats) and quality characteristics (hows).



6. Determine the correlation between each customer demand (*what*) and each quality characteristic (*how*). At the intersection of these whats and hows, record the correlation.

A-1

		Quality Characteristics											A		N		P		B		C		D	
		Smoothness	Texture	Taper	Contour	Width	Weight	Thickness	Length	Compartmentability	Foldability	Depth of compartments	Clearness	rating of importance	company now	competitor x	competitor y	plan	ratio of improvement	sales point	absolute weight	demanded weight		
Demanded Quality	Removes from pocket easily	⊙	○	○	○	○	○	⊙	△	△														
	Removes from purse easily	○	○	△	△	○	⊙	○	△															
	Carries money easily							○		⊙														
	Carries credit cards easily							○		⊙	○													
	Contents can be seen easily									⊙	△	⊙	⊙											
	Contents can be separated quickly	△	△							⊙	△	○	○											
	<b>Total</b>																				<b>Total</b>			
	<b>%</b>																							
	<b>company now</b>																							
	<b>competitor x</b>																							
	<b>competitor y</b>																							
	<b>plan</b>																							

**Relationships**

- ⊙ 9 = strong relationship
- 3 = medium relationship
- △ 1 = weak relationship

D = A x B x C  
B = P/N



8. Determine how the organization is doing currently on each of the customer demands, and record in the matrix under the heading "Company Now". (Scale: 5 is very good; 1 is very poor).

**A-1**

		Quality Characteristics												A		N		P		B		C		D	
		Smoothness	Texture	Taper	Contour	Width	Weight	Thickness	Length	Compartmentability	Foldability	Depth of compartments	Clearness	rating of importance	company now	competitor x	competitor y	plan	ratio of improvement	sales point	absolute weight	demand weight			
Demanded Quality	Removes from pocket easily	⊙	○	○	○	○	⊙	△	△					4	2										
	Removes from purse easily	○	○	△	△	○	⊙	○	△					3	3										
	Carries money easily						○		⊙					3	4										
	Carries credit cards easily						○		⊙	○	○			5	3										
	Contents can be seen easily								⊙	△	⊙	⊙		3	2										
	Contents can be separated quickly	△	△						⊙	△	○	○		2	3										
	<b>Total</b>																								
	<b>%</b>																								
	<b>company now</b>																								
	<b>competitor x</b>																								
	<b>competitor y</b>																								
	<b>plan</b>																								

**Relationships**

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**D = A x B x C**  
**B = P/N**



10. Based on your organization's current position in regard to your competitors, along with other factors (i.e. rate of importance, strategic goals, etc.), determine and record in the matrix where the company plans to be.

**A-1**

		Quality Characteristics											A N				P B C D								
		Smoothness	Texture	Taper	Contour	Width	Weight	Thickness	Length	Compartmentability	Foldability	Depth of compartments	Clearness	rating of importance	company now	competitor x	competitor y	plan	ratio of improvement	sales point	absolute weight	demand weight			
D demanded	Quality	Removes from pocket easily	⊙	○	○	○	○	○	⊙	△	△														
		Removes from purse easily	○	○	△	△	○	⊙	○	△															
		Carries money easily							○		⊙														
		Carries credit cards easily							○		⊙	○	○												
		Contents can be seen easily									⊙	△	⊙	⊙											
		Contents can be separated quickly	△	△							⊙	△	○	○											
		<b>Total</b>																							
		<b>%</b>																							
<b>company now</b>																									
<b>competitor x</b>																									
<b>competitor y</b>																									
<b>plan</b>																									

**Relationships**

⊙ 9 = strong relationship

○ 3 = medium relationship

△ 1 = weak relationship

**D = A x B x C**

**B = P/N**



12. Determine the three main sales points to be stressed among the list of customer demands. Assign weights of 1.5 for the strongest sales points; 1.2 for the lesser sales points; and 1.0 for all others.

**A-1**

		Quality Characteristics											A N				P B C D					
		Smoothness	Texture	Taper	Contour	Width	Weight	Thickness	Length	Compartmentability	Foldability	Depth of compartments	Clearness	rating of importance	company now	competitor x	competitor y	plan	ratio of improvement	sales point	absolute weight	demand weight
D demanded	Removes from pocket easily	⊙	○	○	○	○	⊙	△	△				4	2	3	4	4	2.0	1.5			
	Removes from purse easily	○	○	△	△	○	⊙	○	△				3	3	3	3	3	1.0	1.0			
	Carries money easily						○		⊙				3	4	4	3	4	1.0	1.2			
	Carries credit cards easily						○		⊙	○	○		5	3	4	4	5	1.7	1.5			
	Contents can be seen easily								⊙	△	⊙	⊙	3	2	3	4	3	1.5	1.0			
	Contents can be separated quickly	△	△						⊙	△	○	○	2	3	3	3	3	1.0	1.0			
	<b>Total</b>																					
	<b>%</b>																					
	<b>company now</b>																					
	<b>competitor x</b>																					
	<b>competitor y</b>																					
	<b>plan</b>																					

**Relationships**

- ⊙ 9 = strong relationship
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**D = A x B x C**  
**B = P/N**









17. Convert each quality characteristic total to a percentage.

		Quality Characteristics												A				N				P				B				C				D			
		Smoothness	Texture	Taper	Contour	Width	Weight	Thickness	Length	Compartmentability	Foldability	Depth of compartments	Clearness	rating of importance	company now	competitor x	competitor y	plan	ratio of improvement	sales point	absolute weight	demand weight															
Quality	Removes from pocket easily	⊙ <sub>288</sub>	○ <sub>96</sub>	○ <sub>96</sub>	○ <sub>96</sub>	○ <sub>96</sub>	○ <sub>96</sub>	⊙ <sub>288</sub>	△ <sub>32</sub>	△ <sub>32</sub>				4	2	3	4	4	20	1.5	12.0	32															
	Removes from purse easily	○ <sub>24</sub>	○ <sub>24</sub>	△ <sub>8</sub>	△ <sub>8</sub>	○ <sub>24</sub>	⊙ <sub>72</sub>	○ <sub>24</sub>	△ <sub>8</sub>					3	3	3	3	3	1.0	1.0	3.0	8															
	Carries money easily							○ <sub>27</sub>	⊙ <sub>81</sub>					3	4	4	3	4	1.0	1.2	3.6	9															
	Carries credit cards easily							○ <sub>102</sub>	⊙ <sub>306</sub>	○ <sub>102</sub>	○ <sub>102</sub>			5	3	4	4	5	1.7	1.5	12.8	34															
	Contents can be seen easily								⊙ <sub>108</sub>	△ <sub>12</sub>	⊙ <sub>108</sub>	⊙ <sub>108</sub>		3	2	3	4	3	1.5	1.0	4.5	12															
	Contents can be separated quickly	△ <sub>5</sub>	△ <sub>5</sub>						⊙ <sub>45</sub>	△ <sub>5</sub>	○ <sub>15</sub>	○ <sub>15</sub>		2	3	3	3	3	1.0	1.0	2.0	5															
	<b>Total</b>	317	125	104	104	120	168	441	40	572	119	225	123																								
	<b>%</b>	13	5	4	4	5	7	18	2	23	5	9	5																								
Demanded	company now																																				
	competitor x																																				
	competitor y																																				
	plan																																				
	<b>Total</b>												2458																								
	<b>Total</b>																				37.9	100															

**Relationships**  
 ⊙ 9 = strong relationship  
 ○ 3 = medium relationship  
 △ 1 = weak relationship  
 D = A x B x C  
 B = P/N

18. List the current value for each measurable quality characteristic. For example, weight in pounds, length in inches, etc. Note that not all quality characteristics are quantifiable. Record in the "Company Now" row of the matrix.

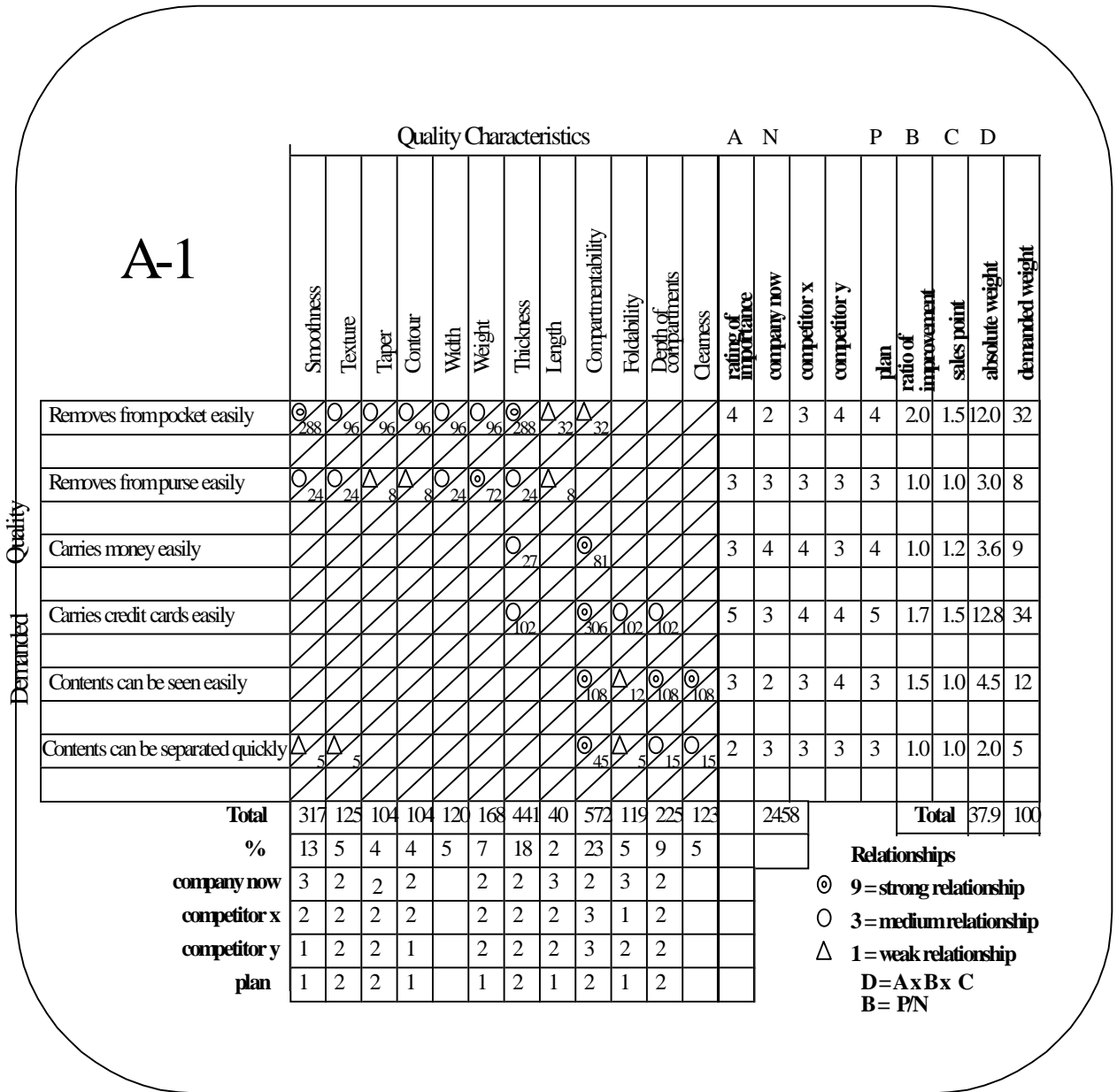
		Quality Characteristics													A N				P B C D				
		Smoothness	Texture	Taper	Contour	Width	Weight	Thickness	Length	Compartmentability	Foldability	Depth of compartments	Clearness	rating of importance	company now	competitor x	competitor y	plan	ratio of improvement	sales point	absolute weight	demand weight	
Quality Demanded	Removes from pocket easily	⊙ <sub>288</sub>	○ <sub>96</sub>	○ <sub>96</sub>	○ <sub>96</sub>	○ <sub>96</sub>	○ <sub>96</sub>	⊙ <sub>288</sub>	△ <sub>32</sub>	△ <sub>32</sub>				4	2	3	4	4	2.0	1.5	12.0	32	
	Removes from purse easily	○ <sub>24</sub>	○ <sub>24</sub>	△ <sub>8</sub>	△ <sub>8</sub>	○ <sub>24</sub>	⊙ <sub>72</sub>	○ <sub>24</sub>	△ <sub>8</sub>					3	3	3	3	3	1.0	1.0	3.0	8	
	Carries money easily							○ <sub>27</sub>		⊙ <sub>81</sub>				3	4	4	3	4	1.0	1.2	3.6	9	
	Carries credit cards easily							○ <sub>102</sub>		⊙ <sub>306</sub>	○ <sub>102</sub>	○ <sub>102</sub>		5	3	4	4	5	1.7	1.5	12.8	34	
	Contents can be seen easily									⊙ <sub>108</sub>	△ <sub>12</sub>	⊙ <sub>108</sub>	⊙ <sub>108</sub>	3	2	3	4	3	1.5	1.0	4.5	12	
	Contents can be separated quickly	△ <sub>5</sub>	△ <sub>5</sub>							⊙ <sub>45</sub>	△ <sub>5</sub>	○ <sub>15</sub>	○ <sub>15</sub>	2	3	3	3	3	1.0	1.0	2.0	5	
	<b>Total</b>	317	125	104	104	120	168	441	40	572	119	225	123		2458								
	<b>%</b>	13	5	4	4	5	7	18	2	23	5	9	5										
<b>company now</b>	3	2	2	2		2	2	3	2	3	2												
<b>competitor x</b>																							
<b>competitor y</b>																							
<b>plan</b>																							
																		<b>Relationships</b>					
																		⊙ 9=strong relationship					
																		○ 3=medium relationship					
																		△ 1=weak relationship					
																		D=AxBxC					
																		B= P/N					

19. For each competitor, record their respective values for each quality characteristic.

		Quality Characteristics													A N				P B C D				
		Smoothness	Texture	Taper	Contour	Width	Weight	Thickness	Length	Compartmentability	Foldability	Depth of compartments	Clearness	rating of importance	company now	competitor x	competitor y	plan	ratio of improvement	sales point	absolute weight	demand weight	
Quality Demanded	Removes from pocket easily	⊙ 288	○ 96	○ 96	○ 96	○ 96	○ 96	⊙ 288	△ 32	△ 32				4	2	3	4	4	2.0	1.5	12.0	32	
	Removes from purse easily	○ 24	○ 24	△ 8	△ 8	○ 24	⊙ 72	○ 24	△ 8					3	3	3	3	3	1.0	1.0	3.0	8	
	Carries money easily							○ 27		⊙ 81				3	4	4	3	4	1.0	1.2	3.6	9	
	Carries credit cards easily							○ 102		⊙ 306	○ 102	○ 102		5	3	4	4	5	1.7	1.5	12.8	34	
	Contents can be seen easily									⊙ 108	△ 12	⊙ 108	⊙ 108	3	2	3	4	3	1.5	1.0	4.5	12	
	Contents can be separated quickly	△ 5	△ 5							⊙ 45	△ 5	○ 15	○ 15	2	3	3	3	3	1.0	1.0	2.0	5	
	<b>Total</b>	317	125	104	104	120	168	441	40	572	119	225	123	2458					<b>Total</b>	37.9	100		
	<b>%</b>	13	5	4	4	5	7	18	2	23	5	9	5										
<b>company now</b>	3	2	2	2		2	2	3	2	3	2												
<b>competitor x</b>	2	2	2	2		2	2	2	3	1	2												
<b>competitor y</b>	1	2	2	1		2	2	2	3	2	2												
<b>plan</b>																							

**Relationships**  
 ⊙ 9=strong relationship  
 ○ 3=medium relationship  
 △ 1=weak relationship  
 D=AxBxC  
 B= P/N

20. List the target value for each measurable quality characteristic.



21. Analyze the top 3-5 customer demands and quality characteristics. This analysis should result in a knowledge of what's important to the customer, and how customer satisfaction can be achieved.

The value of QFD is not only in the results of the exercise, but also in the “thinking” process that is required to complete the matrix. QFD forces the user to answer questions that they may assume they know the answers to, but in many cases do not. QFD may also show correlations that are not necessarily obvious. By requiring that each “what” and “how” be analyzed, the user

can determine which quality characteristics will deliver the “biggest bang for the buck” by maximizing those activities that produce the most satisfaction to the customer.

The QFD matrix shown in this text is called an A-1 Quality Matrix. This is only one of many types of matrices. For example, the “hows” listed in the A-1 matrix can be dropped down in a subsequent matrix to form the “whats”, and a new group of “hows” formulated for each of those. For a more complete training guide on QFD, the reader is referred to “*Better Designs in Half the Time*” by Bob King, or “*Facilitating and Training in QFD*”, by Marsh, Moran, Nakui, and Hoffherr, from which the above examples were adapted.