

International SEPT Program



QUALITY FUNCTION DEPLOYMENT (QFD) FOR SERVICES

HANDBOOK

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DEFINITION

There is no single or unique definition for Quality Function Deployment (QFD), but a general basic concept of this method is as follows:

“QFD is a system with the aim of translating and planning the “voice of the customer” into the quality characteristics of products, processes and services in order to reach customer satisfaction”.

QFD is not only a quality tool, but also an important planning tool. It allows the consideration of the "voice of the customer" along the service development path to market entry.

The following paragraphs highlight some of the factors that firms need to address by using QFD.

Competitiveness

Three aspects are especially important for the development of firms' competitiveness: quality, costs and opportunities.

Low process costs make it possible to reach price competitiveness. This can actually lead to an increase in market share in the short term, but is normally not profitable in the long run.

Secondly, clients attribute more importance to the quality and differentiation of the offered services. When the firm loses a client because of insufficient service quality, this client may not return. In a worst case scenario, a client could even relay his poor service experience to their friends, creating a potential customer loss previously unimagined.

Thirdly, opportunities are directly related to “time to market”. Mature processes for new service development can lead to shorter development times. Shorter times could mean a more agile response to the market and may increase the competitive ability of the company.

In conclusion, it is desirable to have services with short “time to market”, of high quality and at a low cost; this leads to a more competitive firm.

The quality lever

The quality lever is a concept that helps to visualize the effects of the development stage and how they affect the quality of the produced service. The idea is that improvements carried out in the production phase can lead to a lower cost-benefit ratio when compared to the increase of the service's quality. Alternatively, the improvements achieved within the early stages such as service design and process design have a larger influence due to the mechanics of a lever.

Service design improvements can influence 100 times more than improvements in the production process. This is due to the improvements becoming part of the service.

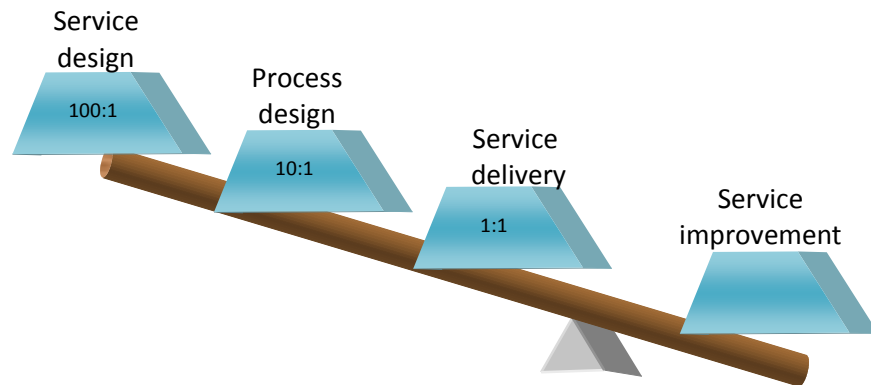


Figure 1. Quality Lever

QFD is a tool that makes it possible to transform reactive service development processes into proactive processes.

QFD-TECHNIQUE

The QFD technique is based on the analysis of the clients' requirements, which normally are expressed in qualitative terms, such as: "easy to use", "safe", "comfortable" or "luxurious".



Figure 2. QFD Technique

In order to develop a service it is necessary to "translate" these fuzzy requirements into quantitative service design requirements; QFD makes this translation possible.

Services are not developed as a whole; instead, these are developed through the integration of different components. The component features are what provide the functionality, that in turn satisfy client requirements.

Firm organization is another factor that effects service development. Unfortunately, the importance of the service development process is not known by all the employees. For this reason, the establishment of an appropriate communication system is particularly important. This system must keep the meaning of the clients' requirements during the development process.

QFD ADVANTAGES

Applying QFD is quite simple, but provides detailed results. Benefits derived from QFD application in firms are listed below:

- **PREVENTIVE DESIGN**

The biggest advantage of QFD is that it promotes the development of services in a proactive way. When applying QFD, more than 90% of changes on service design are performed before the market entry takes place. These changes are less expensive since they are performed “in the worksheet”. This makes it possible to prevent the problems instead of reacting to them.

- **REDUCTION OF DEVELOPMENT TIME**

QFD application allows reducing costs and the time needed to introduce the new service into the market.

- **CLIENT SATISFACTION**

QFD's is oriented to the “voice of the customer” and not to the “thoughts of the developer”. With the focus on the consumer, all decisions made during the service design are targeted at the customer.

QFD-METHODOLOGY

The QFD methodology is based on the development of a series of matrices called “House of Quality”. The structure of these matrices will be described in the following section.

„House of Quality” (HOQ)

This matrix is called House of Quality due to a roof-like structure in its top. This house can be divided in “rooms”. A tour through the different “rooms” is given below.

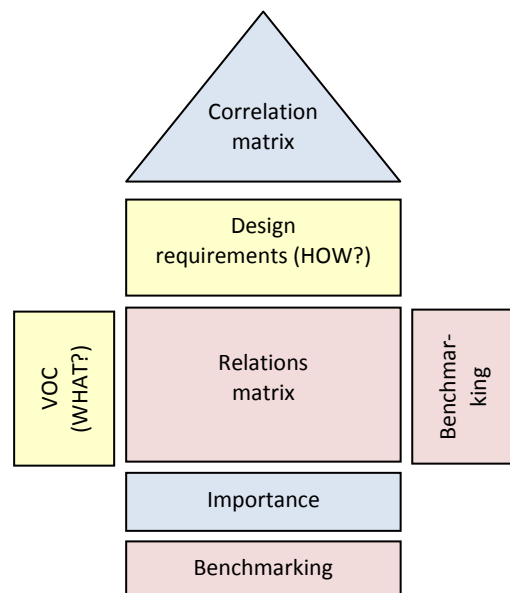


Figure 3. House of Quality

“Voice of the Customer” (VOC)

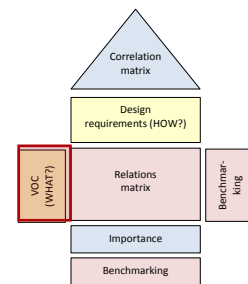
QFD starts with the establishment of objectives, which represent the answer to “What?”; what is desired in order to reach the new service’s development? These objectives derive from clients’ requirements and are called the “Voice of the Customer”.

Table 1. "What?" List

Client's requirements (What?)

Sometimes the client requirements are general, vague and difficult to implement directly; a more detailed description is needed.

There are three kinds of service characteristics that must be differentiated. The requirements mentioned directly by the clients will be called “performance requirements”; other wants are difficult for clients to verbalize. These “wants” are essential parts of the service and perform basic functions that the user expects and considers as given. These basic functions are known as “basic requirements”. The third kind of service feature is an “emotional requirement”, it reflects a need that the client has not appreciated before. Performance, basic and emotional are the three kinds of quality and are shown in the “Kano Model”.



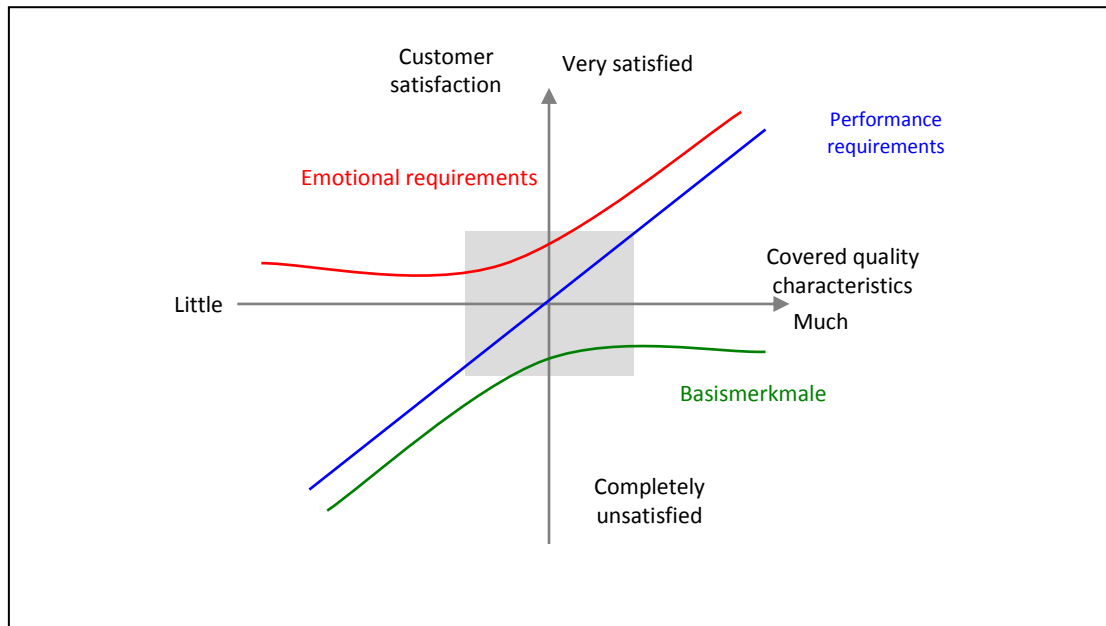


Figure 4. Kano Model

Study Case: The Doctor's Office

The "Voice of the customer"¹

The following example looks at a doctor's office. The attributes and consequences of the service in the reception area are focused on. The background technical staff develops the requirements for meeting the needs of the patients. Together with the doctors, they consider the processes that support customer needs and develop the requirements for the process as well as the key success factors.

The interview process has enabled the doctors to come up with a list of patient concerns:

- Length of time until appointment.
- Number of rings until the call is answered.
- Time on hold.
- I was passed from person to person.
- I was asked few needless questions.
- Use of automated phone system.

¹ Source: Schutta, J.T. (2005); Business Performance through Lean Six Sigma: Linking the Knowledge Worker, the Twelve Pillars, and Baldrige, American Society for Quality

- Waiting time in office too long.
- Responsiveness of personal too slow.
- Insurance coverage processing properly.
- Insurance company recognized by office.

From the above list of attributes, the following consequences are developed:

- I got an appointment within a week of my call.
- I had my choice of days.
- I had my choice of times.
- I spent little time on the phone.
- I was asked if this was an emergency.
- I was not put on hold.
- I was in the doctor's office on schedule.
- My questions were answered accurately and timely.
- My insurance claim was processed property.
- My insurance carrier provides coverage for the doctor.

The customer consequences are developed from the voice of the customer. Next, the consequences will be weighted in order to prioritize them. Figure 5 shows the quality house with the desired consequences and the customer designated weighting.

<div style="text-align: center;"> <div>CTQs</div> <div>VOC</div> </div>																		VOC Customer Importance	VOC Relative Importance
1 Time to appointment																		8,00	9,88%
2 Choice of days																		9,00	11,11%
3 Choice of times																		5,00	6,17%
4 Short time to schedule																		9,00	11,11%
5 Criticalness of visit determined																		10,00	12,35%
6 Appointment made without interruption																		5,00	6,17%
7 Appointment time kept																		8,00	9,88%
8 All questions answered																		9,00	11,11%
9 Insurance claims processed																		8,00	9,88%
10 Insurance coverage recognized																		10,00	12,35%

Figure 5. House of Quality matrix with customer input and importance weightings

Design requirements

After completing the client's requirements list (What?), comes the definition of "How". The "how" are the design requirements of the service.; it is necessary to define *how* each client's requirement will be satisfied by the service. These are measurable features that can be evaluated at the end of the development process.

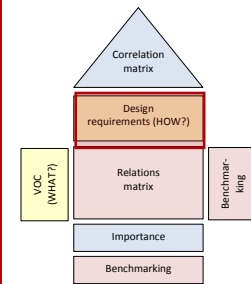


Table 2. "How?" List

Design requiremets (HOW?)							

Study Case: The Doctor's Office

Design (technical) requirements

A receptionist handles the customer appointment request for a routine check-up or a diagnosis with a doctor. The receptionist has a variety of options; they must determine which one or which combination of doctors should be assigned to this particular patient. The development team must identify all alternatives that exist for questioning the patient, and must select the method that the receptionist should use to address the customer's needs. The translation of the customers' needs into design or technical requirements was made by the office personnel using the brainstorming process (see Figure 6).

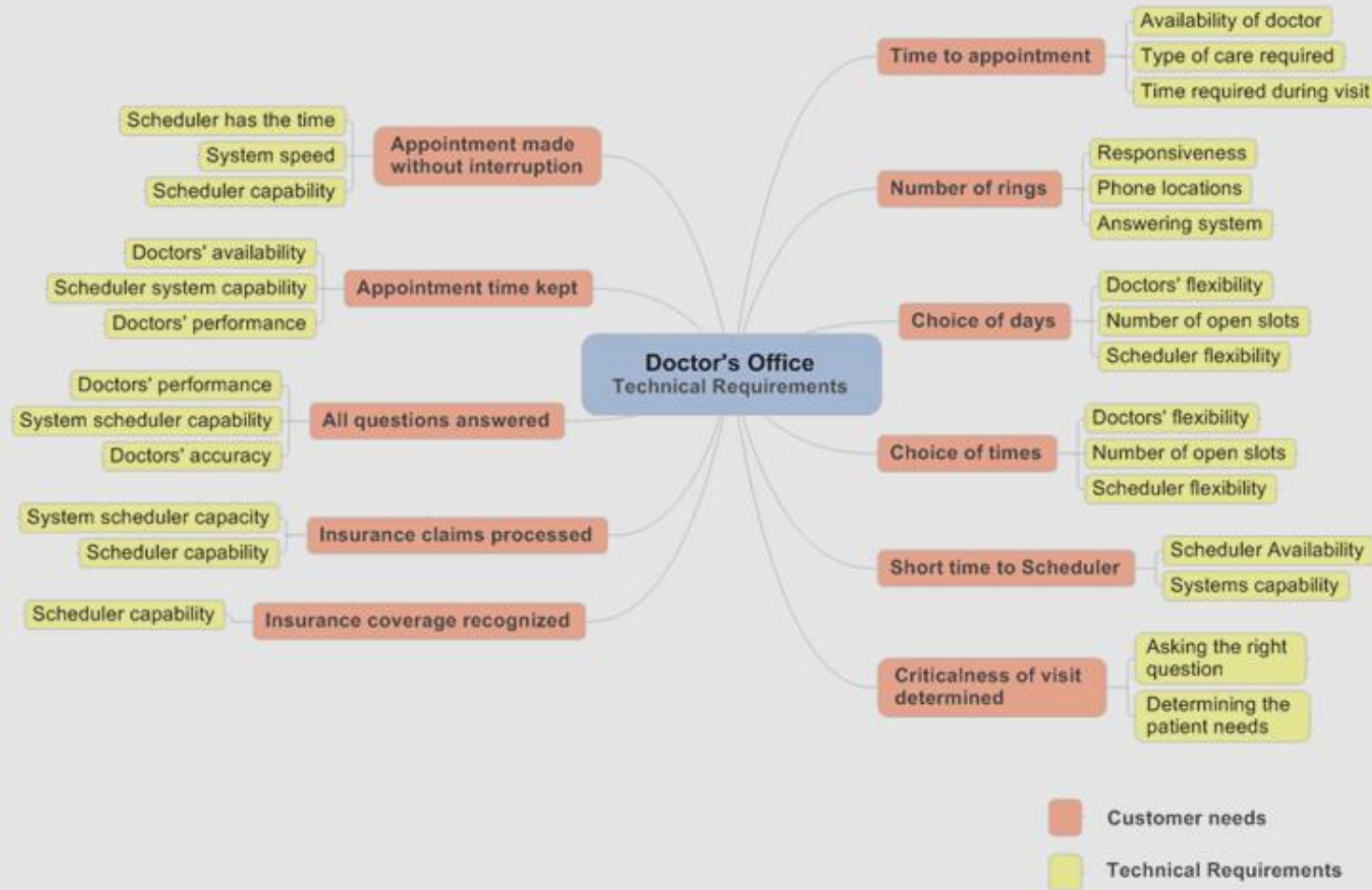


Figure 5: Results of the Brainstorming for getting the design requirements

The next step is to organize the design requirements using a tree diagram. Figure 7 shows a section of what was developed. The tree diagram is useful to describe which methods or techniques are required to satisfy the specific design requirements chosen to fill the need.

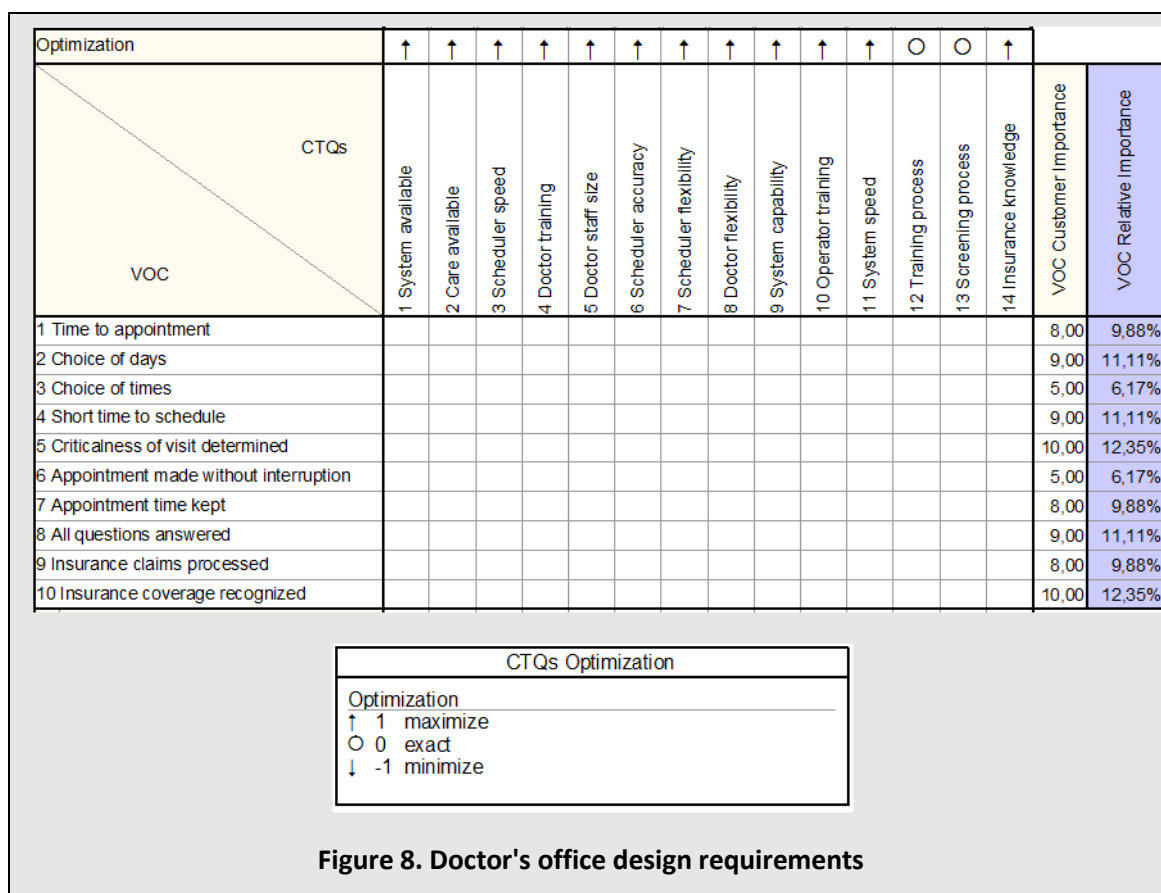


Figure 7. The tree diagram example.

Next, the team must select the process that will meet the selected requirements and determine whether a measurement can be applied to each process. Two processes have been determined to meet the patients' needs: the appointment process and the insurance recognition process.

For the purpose of process functionality verification, analysis of different receptionist experience levels, knowledge or personalities may be necessary to determine whether the process time in making an appointment could vary greatly.

The results of this study were taken into account in order to complete the design requirements of the house of quality. Figure 8 shows the house of quality with the final selected design requirements.



Relation matrix

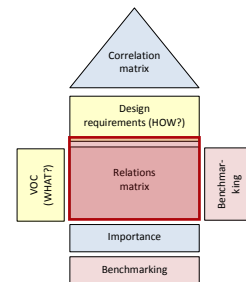
Relations between the client and design requirements are not always 1:1, there are complex relationships and varying levels of strength. A single design requirement may have an influence on several of the client's requirements. Illustrated in table 3 is a matrix that shows the relationships between "What" and "How"; defined by three strength levels: weak relation, medium relation and strong relation.

Table 3. Relation matrix

	Design requirements (HOW?)			
Client's requirements (WHAT?)				
	○	◎	△	
	◎	○		
	△	○	△	◎
		○		
			◎	
				△

QFD	
△	Weak
○	Medium
◎	Strong

An empty column indicates no relationship between the client and design requirements. This may reveal that the translation from "What" into "How" was not properly conducted.



Study Case: The Doctor's Office

Relations

Next, the strength of the design requirement and customer consequence relationships will be developed.

Optimization	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	○	○	↑
CTQs	1 System available	2 Care available	3 Scheduler speed	4 Doctor training	5 Doctor staff size	6 Scheduler accuracy	7 Scheduler flexibility	8 Doctor flexibility	9 System capability	10 Operator training	11 System speed	12 Training process	13 Screening process	14 Insurance knowledge
VOC														
1 Time to appointment	⊙	⊙	⊙		⊙	⊙	⊙	⊙	⊙					
2 Choice of days	⊙	⊙		⊙	⊙	⊙	⊙	⊙	⊙					
3 Choice of times		⊙		⊙	⊙	⊙	⊙	⊙	⊙					
4 Short time to schedule	⊙	⊙		⊙	⊙	⊙	⊙	⊙	⊙		⊙			
5 Criticalness of visit determined										⊙		⊙	⊙	
6 Appointment made without interruption	⊙	⊙	○			⊙	⊙	⊙	⊙	⊙	⊙		⊙	
7 Appointment time kept	△			○	⊙	⊙	△	⊙	⊙	⊙			⊙	
8 All questions answered										⊙		⊙		
9 Insurance claims processed	○									⊙		⊙		⊙
10 Insurance coverage recognized										△		⊙	⊙	⊙

QFD1	
⊙	9 strong correlation
○	3 some correlation
△	1 possible correlation
-	0 (possible negative correlation)

Figure 9. Relationships between design requirements and customer needs

After the matrix is completed, it must be evaluated whether there are technical “hows” with no relationship to the customer needs. These may need to be eliminated.

Benchmarking

The QFD technique allows for a competitor assessment with Benchmarking. The competitor's services are compared to the company's services. Benchmarking is carried out for "What" and "How".

The two companies' services are compared along the lines of client requirements ("What"). A characteristic measure is determined for each service feature. Next, the clients' perception of the satisfaction requirements will be assessed and compared to the competitors'.

In the technical competitor comparison ("How"s), the design requirement fulfillment will be compared. It is recommended that the personnel in charge of the service design make this evaluation.

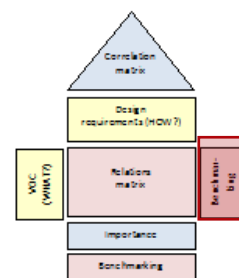


Table 4. Benchmarking

		Design requirements (HOW?)					
						Bad	Good
Client's requirements (WHAT?)		○	⊙			▲	●
		⊙	○			●	▲
		△	○	△	⊙	▲	●
			○			▲	●
				⊙		●	▲
					△	▲	●
Good		▲	■	▲	●		
		■	▲	●	▲		
Bad		●	●	■	■		

Study Case: The Doctor's Office

Benchmarking

The benchmarking compares the delivery of desired consequences to that of the competition. The staff at the doctor's office developed a questionnaire to measure the importance of the patient-desired consequences and to measure the patient perceptions of how well the office delivered. For comparison purposes, the questionnaire asked the patients to rate the office of another doctor or dentist on its delivery performance.

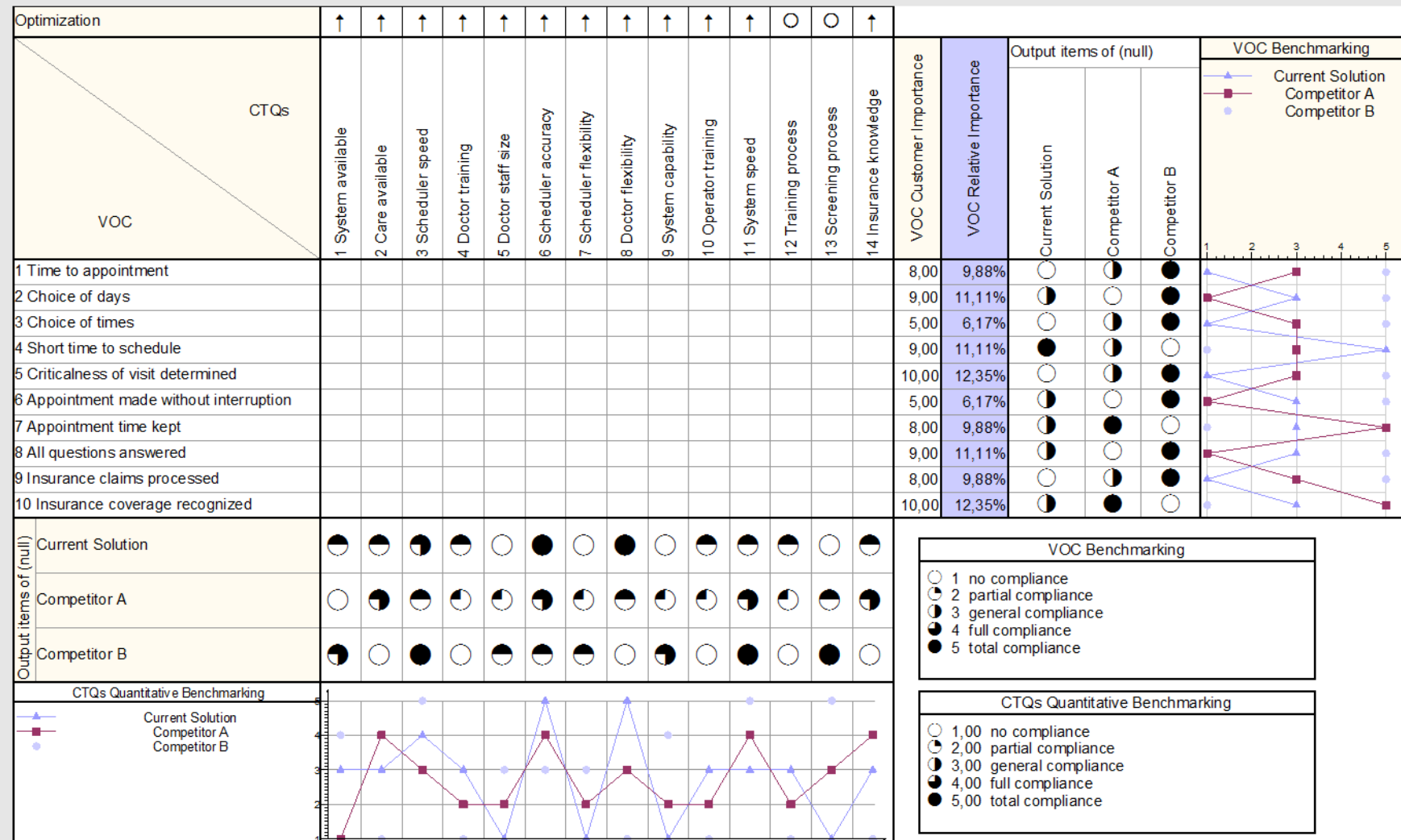


Figure 6: QFD Benchmarking

Importance level

The importance level states the relative significance of each client ("What") and design requirement ("How") to achieve the desired goal. "What"-s relative significance is established through an evaluation by the customer. The relative scale used (1-5 or 1-10) should be set up so that customer importance is seen as more significant the larger the number is.

For each column ("How"), the ("What") importance level is multiplied by the corresponding weighting. This creates a value for each relationship between client and design requirement. The importance of the design requirements ("How") is computed by adding the values together.

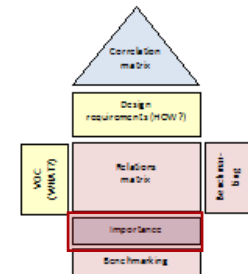


Table 5. Weighting of the Relationship symbols

△	Low	1
○	Medium	3
◎	Strong	9

Table 6. Importance level

		Design requirement (HOW?)			
Client's requirement (WHAT?)	Importance				
	5	○	◎		
	3	◎	○		
	2	△	○	△	◎
	1		○		
	4			◎	
	2				△
Importance		63	81	42	24

The importance level of "How" approximates the most important design requirements for client satisfaction.

Study Case: The Doctor's Office

Prioritization of the design requirements

All design requirements require a weight to be computed. The weight is made up of the weighted sum of the elements in the column corresponding to a design requirement multiplied by the VOC Importance in that row. In the first design requirement, for example, the specification weight was = $(9 \times 8) + (9 \times 9) + (9 \times 9) + (9 \times 5) + (3 \times 8) + (1 \times 8)$. Weights for all specifications were computed likewise. With this step, the Doctor's Office House of Quality was completed.

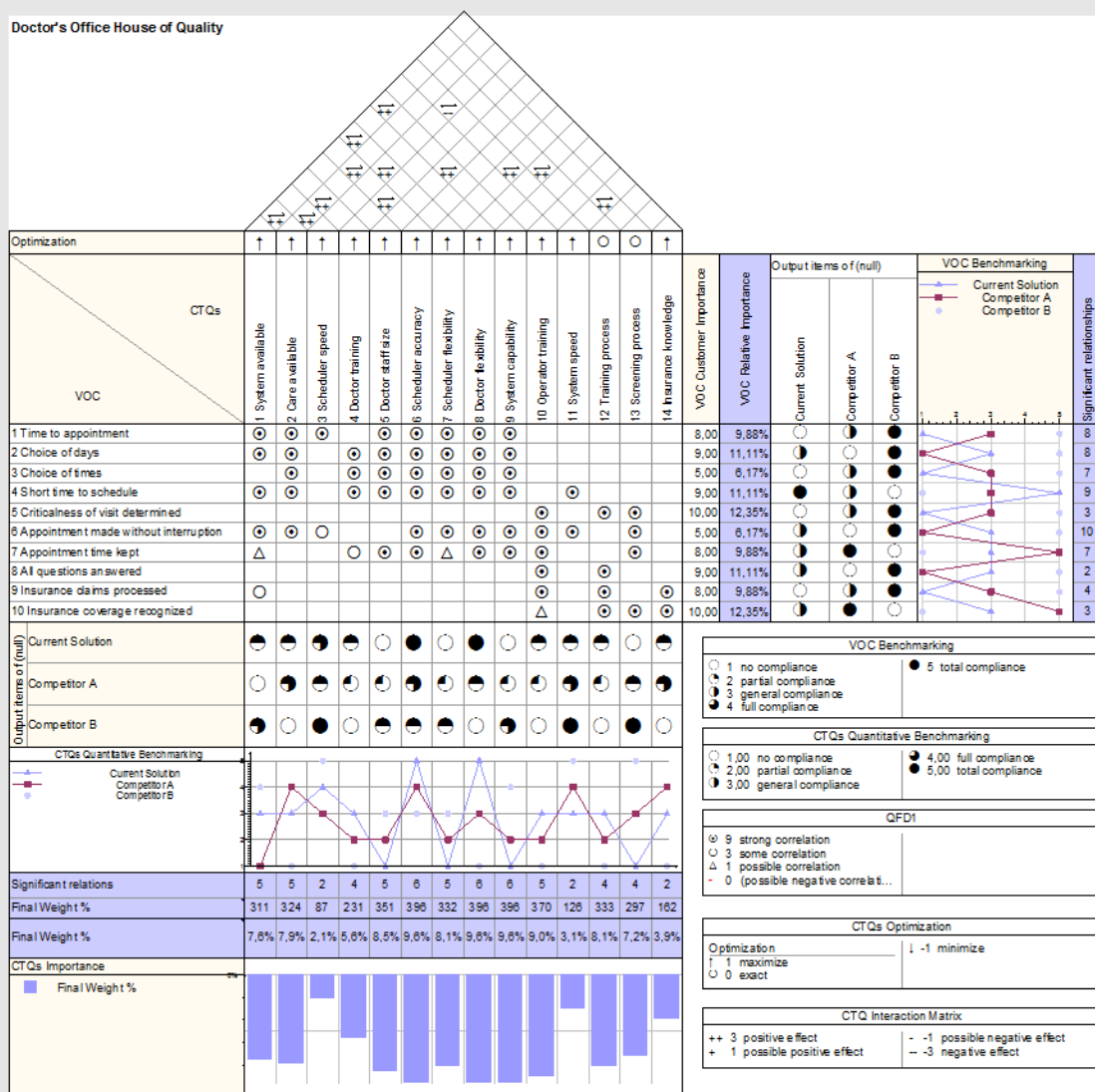


Figure 7. "House of Quality" Doctor's Office

Correlation matrix

The correlation matrix is a triangular table. "How" is integrated by establishing the correlation between all of the elements. The matrix describes the strength of the relationships between the design requirements. The aim is to identify which requirements support each other and which ones do not.

Positive correlations mean that the service development efficiency can be increased without competing or duplicate effort. Deciding which features are absolutely necessary to the service is aided by negative correlations; by increasing one feature, there is a decrease in another and vice versa. If there are no negative correlations, there could be a mistake in a previous step.

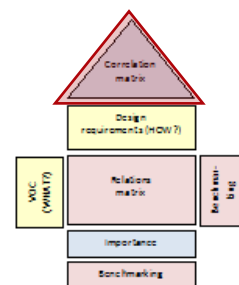


Table 7. Correlations matrix

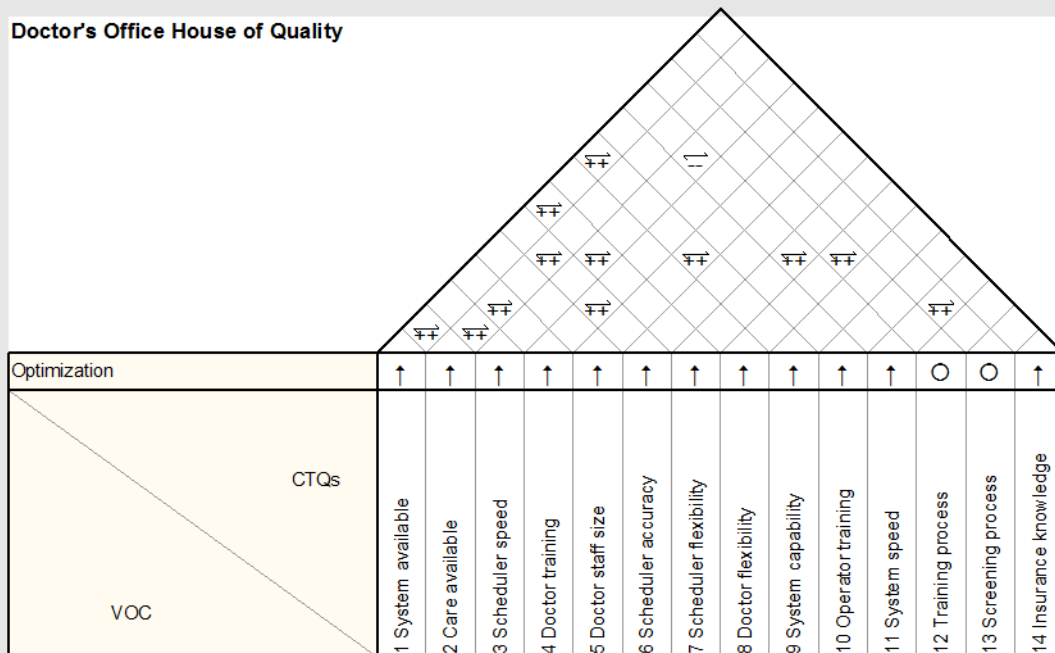
		<div> <div>++ Strong positive</div> <div>+ Positive</div> <div>- Negative</div> <div>-- Strong negative</div> </div>			
		<div> <div>-</div> <div>+</div> <div>-</div> <div>+</div> </div>			
		Design requirements (HOW?)			
Client's requirements (WHAT?)					
	○	⊙	△		
	⊙	○			
	△	○	△	⊙	
		○			
			⊙		
				△	

Study Case: The Doctor's Office

Design (Technical) Correlations

The technical design trade-offs necessary for meeting customer needs are shown on the roof of the house. The relationship between each pair of requirements must be considered. Here it is important to display positive, negative, or no correlation.

Doctor's Office House of Quality



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