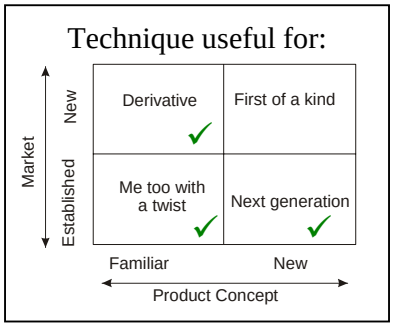
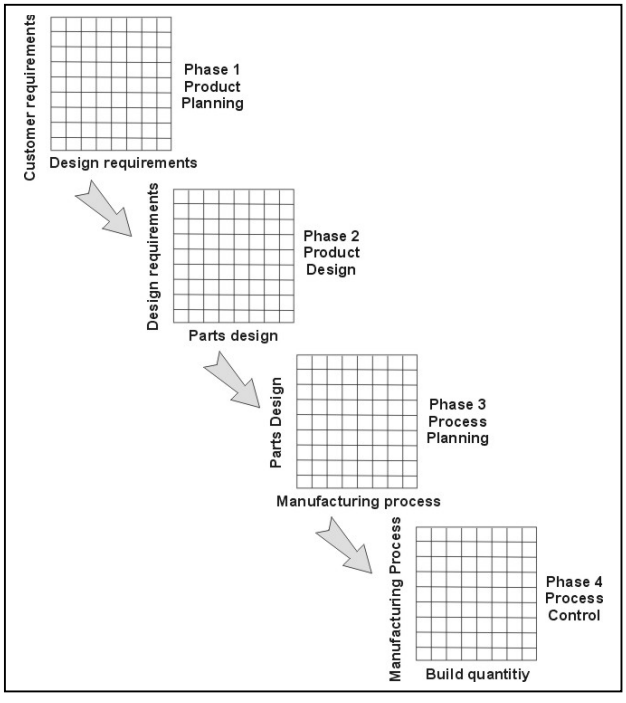
Quality Function Deployment

In a few words: ***The voice of the customer translated into the voice of the engineer.***



To design a product well, a design teams needs to know what it is they are designing, and what the end-users will expect from it. Quality Function Deployment is a systematic approach to design based on a close awareness of customer desires, coupled with the integration of corporate functional groups. It consists in translating customer desires (for example, the ease of writing for a pen) into design characteristics (pen ink viscosity, pressure on ball-point) for each stage of the product development (Rosenthal, 1992).

Ultimately the goal of QFD is to translate often subjective quality criteria into objective ones that can be quantified and measured and which can then be used to design and manufacture the product. It is a complimentary method for determining how and where priorities are to be assigned in product development. The intent is to employ objective procedures in increasing detail throughout the development of the product. (Reilly, 1999)



Quality Function Deployment was developed by Yoji Akao in Japan in 1966. By 1972 the power of the approach had been well demonstrated at the Mitsubishi Heavy Industries Kobe Shipyard (Sullivan, 1986) and in 1978 the first book on the subject was published in Japanese and then later translated into English in 1994 (Mizuno and Akao, 1994).

In Akao's words, QFD "is a method for developing a design quality aimed at satisfying the consumer and then translating the consumer's demand into design targets and major quality assurance points to be used throughout the production phase. ... [QFD] is a way to assure the design quality while the product is still in the design stage." As a very important side benefit he points out that, when appropriately applied, QFD has demonstrated the reduction of development time by one-half to one-third. (Akao, 1990)

The 3 main goals in implementing QFD are:

1. Prioritize spoken and unspoken customer wants and needs.
2. Translate these needs into technical characteristics and specifications.
3. Build and deliver a quality product or service by focusing everybody toward customer satisfaction.

Since its introduction, Quality Function Deployment has helped to transform the way many companies:

- Plan new products
- Design product requirements
- Determine process characteristics
- Control the manufacturing process
- Document already existing product specifications

QFD uses some principles from Concurrent Engineering in that cross-functional teams are involved in all phases of product development. Each of the four phases in a QFD process uses a matrix to translate customer requirements from initial planning stages through production control (Becker Associates Inc, 2000).

Each phase, or matrix, represents a more specific aspect of the product's requirements. Relationships between elements are evaluated for each phase. Only the most important aspects from each phase are deployed into the next matrix.

Phase 1, Product Planning: Building the House of Quality. Led by the marketing department, Phase 1, or product planning, is also called The House of Quality. Many organizations only get through this phase of a QFD process. Phase 1 documents customer requirements, warranty data, competitive opportunities, product measurements, competing product measures, and the technical ability of the organization to meet each customer requirement. Getting good data from the customer in Phase 1 is critical to the success of the entire QFD process.

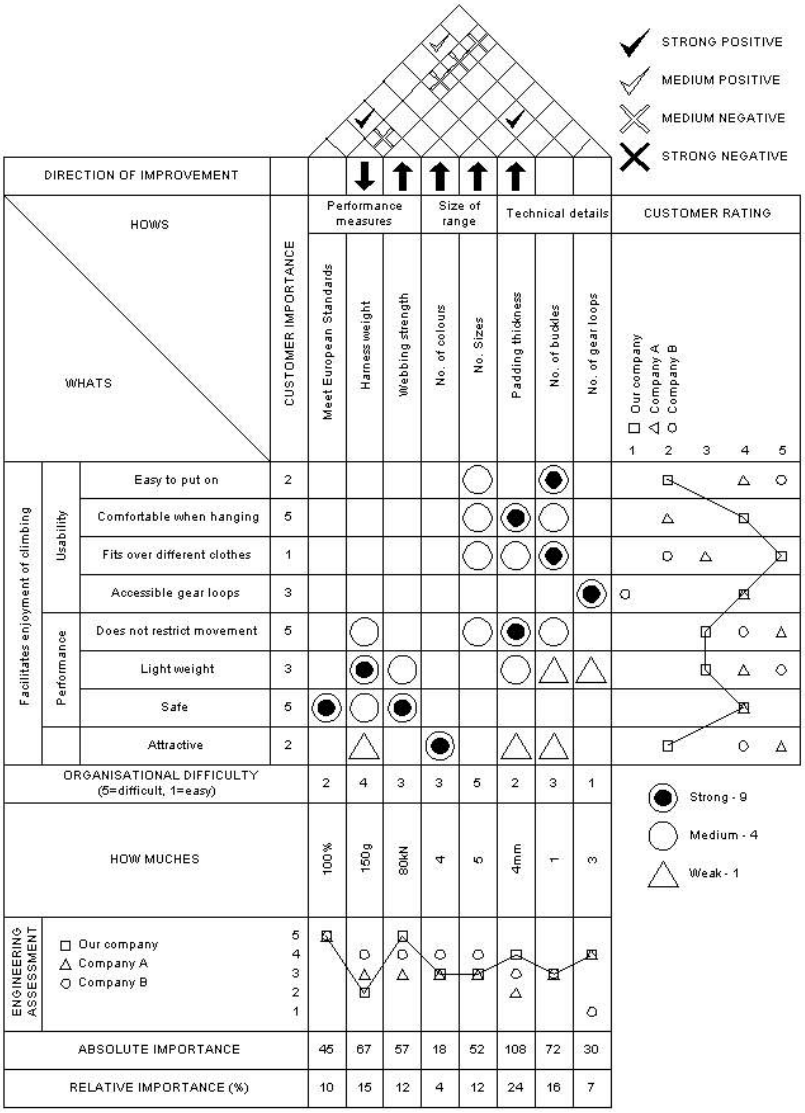
Phase 2, Product Design: This phase 2 is led by the engineering department. Product design requires creativity and innovative team ideas. Product concepts are created during this phase and part specifications are documented. Parts that are determined to be most important to meeting customer needs are then deployed into process planning, or Phase 3.

Phase 3, Process Planning: Process planning comes next and is led by manufacturing engineering. During process planning, manufacturing processes are flowcharted and process parameters (or target values) are documented.

Phase 4, Process Control: And finally, in production planning, performance indicators are created to monitor the production process, maintenance schedules, and skills training for operators. Also, in this phase decisions are made as to which process poses the most risk and controls are put in place to prevent failures. The quality assurance department in concert with manufacturing leads Phase 4.

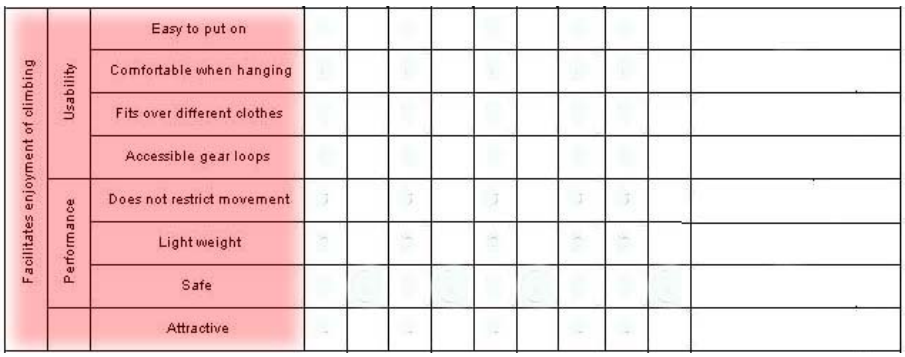
The House of Quality

The first phase in the implementation of the Quality Function Deployment process involves putting together a "House of Quality" (Hauser and Clausing, 1988) such as the one shown below, which is for the development of a climbing harness (fig. from Lowe & Ridgway, 2001).



Steps to the House of Quality (Becker and Associates, 2000)

Step 1: Customer Requirements - "Voice of the Customer"
The first step in a QFD project is to determine what market segments will be analyzed during the process and to identify who the customers are. The team then gathers information from customers on the requirements they have for the product or service. In order to organize and evaluate this data, the team uses simple quality tools like Affinity Diagrams or Tree Diagrams.

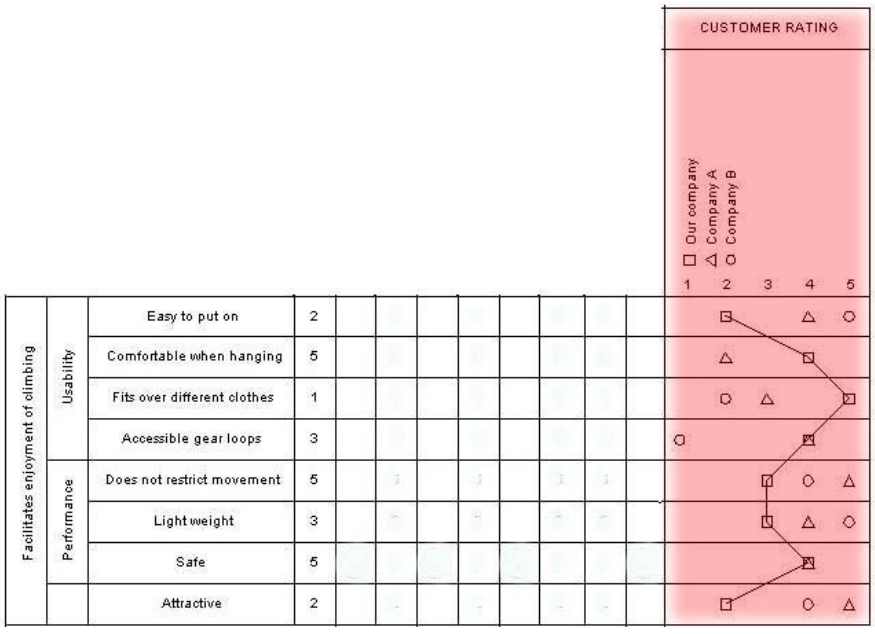


Step 2: Regulatory Requirements
Not all product or service requirements are known to the customer, so the team must document requirements that are dictated by management or regulatory standards that the product must adhere to.

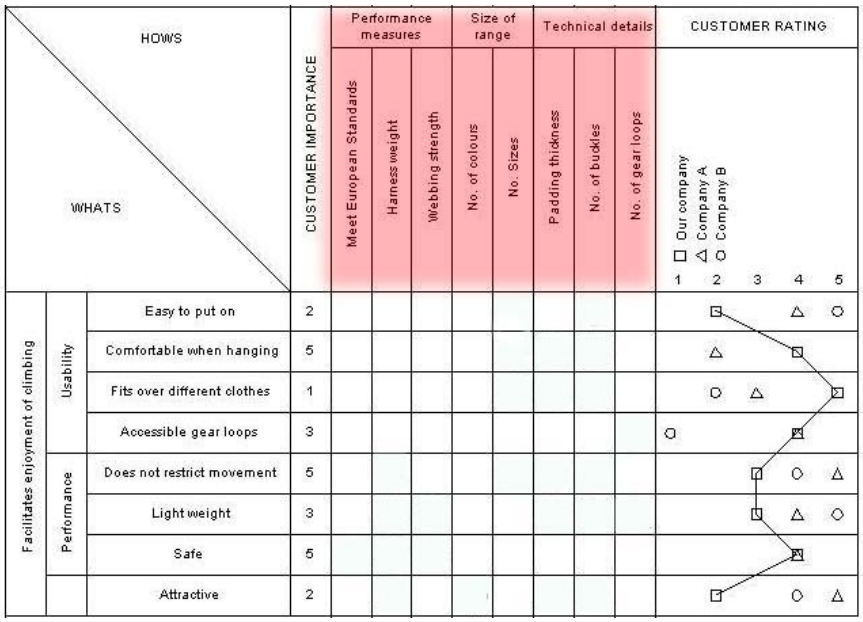
Step 3: Customer Importance Ratings
On a scale from 1 - 5, customers then rate the importance of each requirement. This number will be used later in the relationship matrix.

Facilitates enjoyment of climbing	Usability	Easy to put on	2
		Comfortable when hanging	5
		Fits over different clothes	1
		Accessible gear loops	3
	Performance	Does not restrict movement	5
		Light weight	3
		Safe	5
		Attractive	2

Step 4: Customer Rating of the Competition
Understanding how customers rate the competition can be a tremendous competitive advantage. In this step of the QFD process, it is also a good idea to ask customers how your product or service rates in relation to the competition. There is remodeling that can take place in this part of the House of Quality. Additional rooms that identify sales opportunities, goals for continuous improvement, customer complaints, etc., can be added.

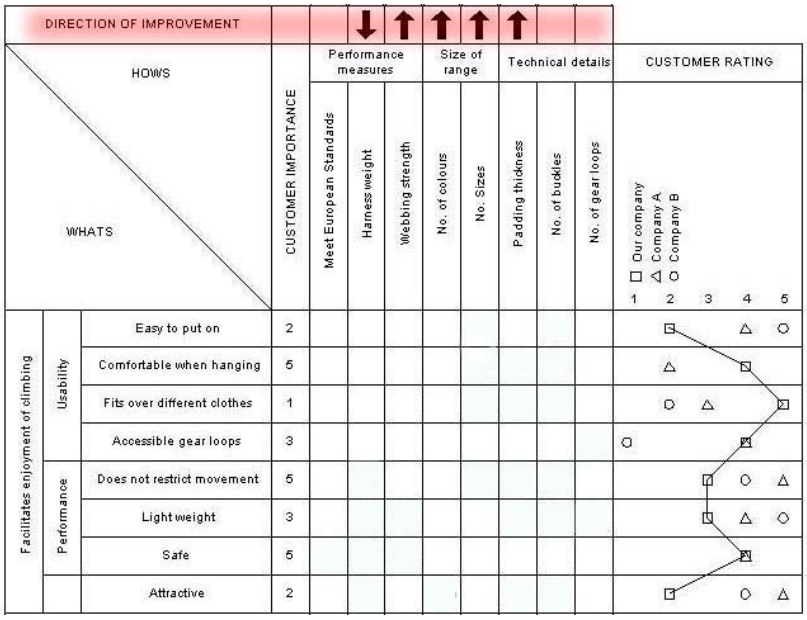


Step 5: Technical Descriptors - "Voice of the Engineer"
The technical descriptors are attributes about the product or service that can be measured and benchmarked against the competition. Technical descriptors may exist that your organization is already using to determine product specification, however new measurements can be created to ensure that your product is meeting customer needs.



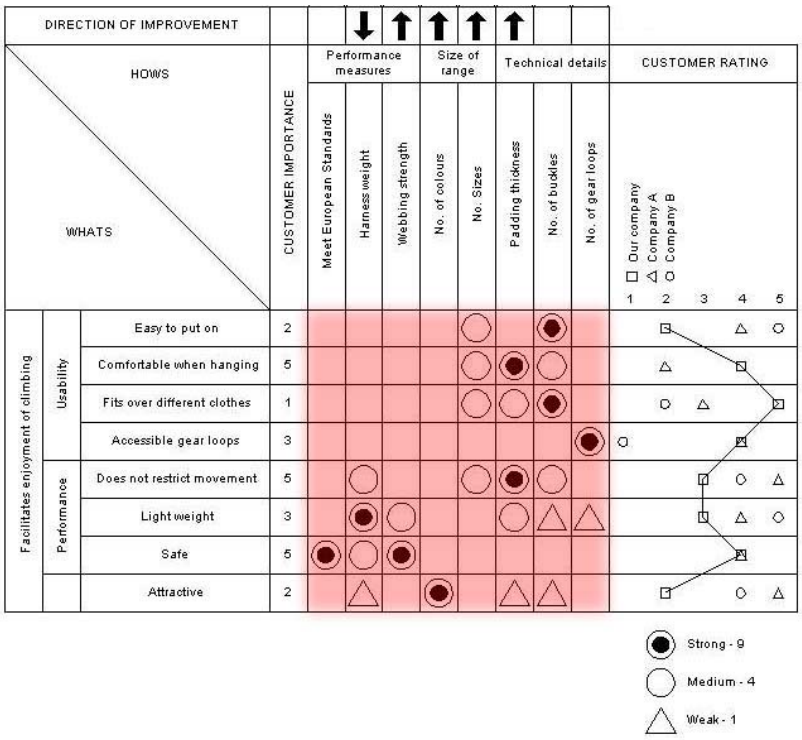
Step 6: Direction of Improvement

As the team defines the technical descriptors, a determination must be made as to the direction of movement for each descriptor.



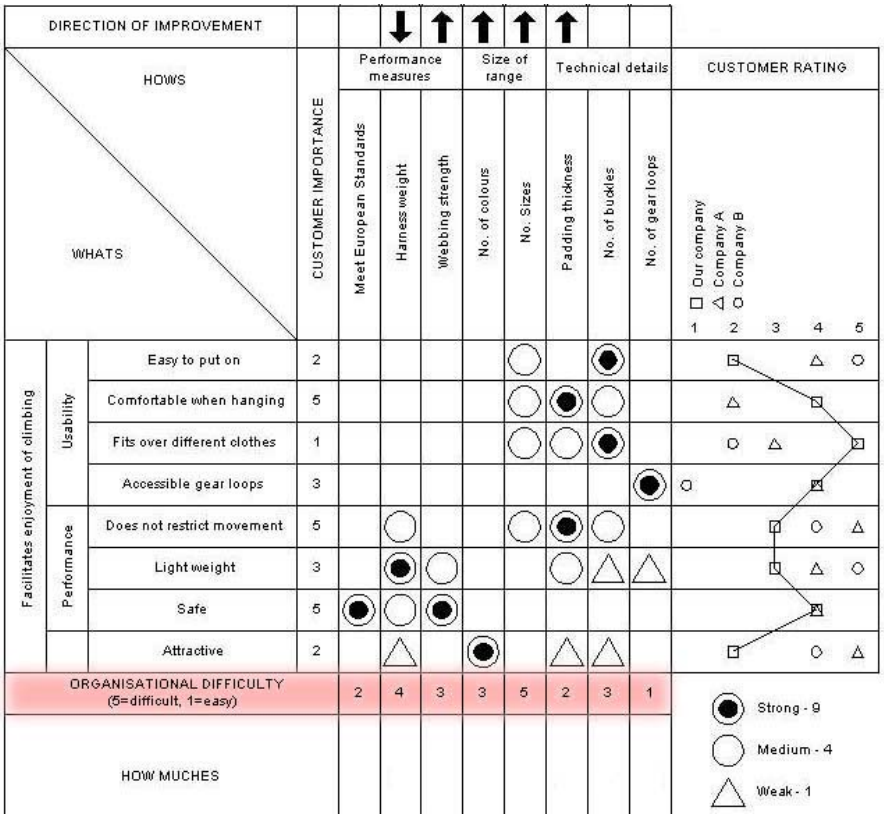
Step 7: Relationship Matrix

The relationship matrix is where the team determines the relationship between customer needs and the company's ability to meet those needs. The team asks the question, "what is the strength of the relationship between the technical descriptors and the customers needs?" Relationships can either be weak, moderate, or strong and carry a numeric value of 1, 3 or 9.



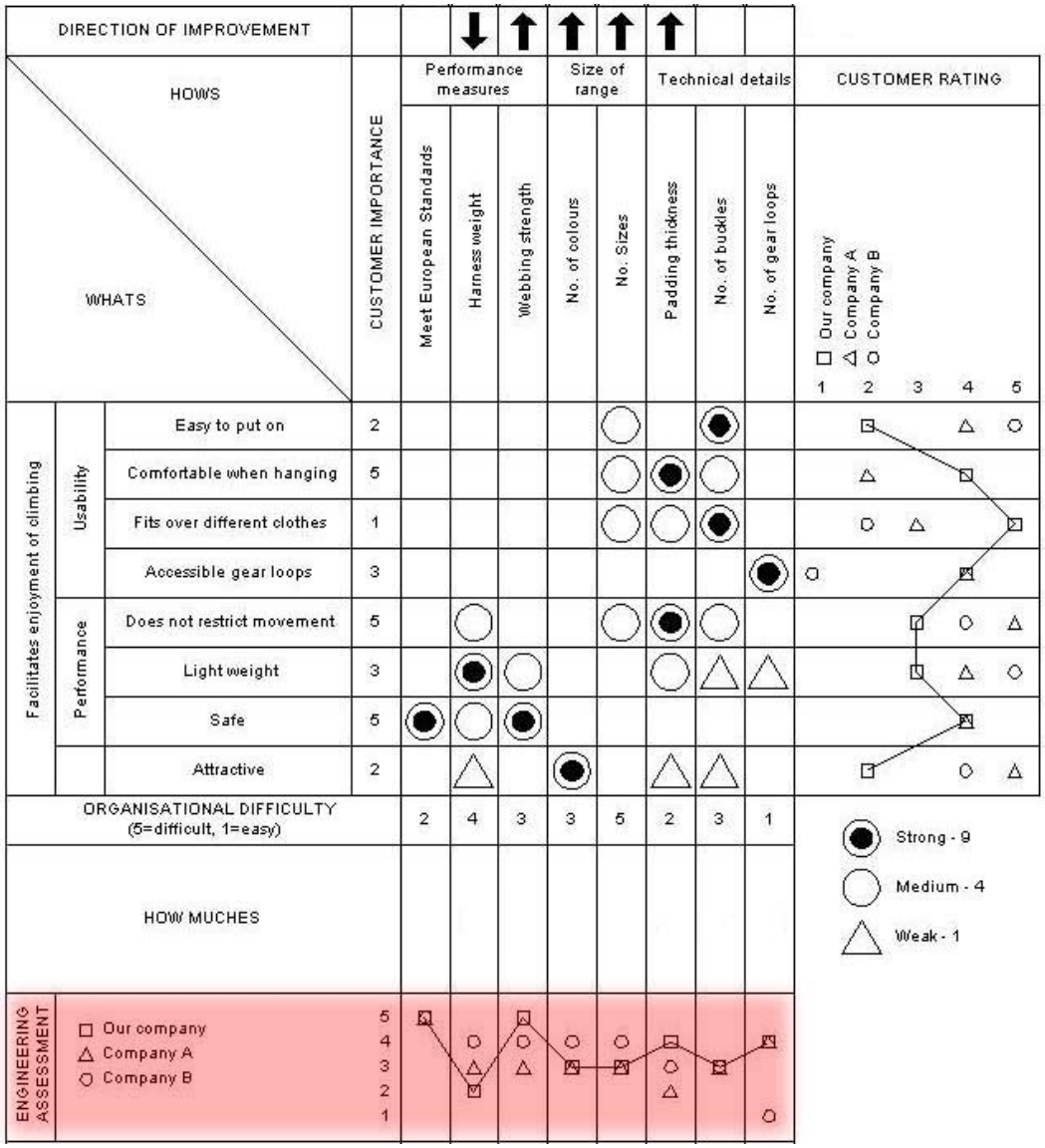
Step 8: Organizational Difficulty

Rate the design attributes in terms of organizational difficulty. It is very possible that some attributes are in direct conflict. Increasing the number of sizes may be in conflict with the companies stock holding policies, for example.



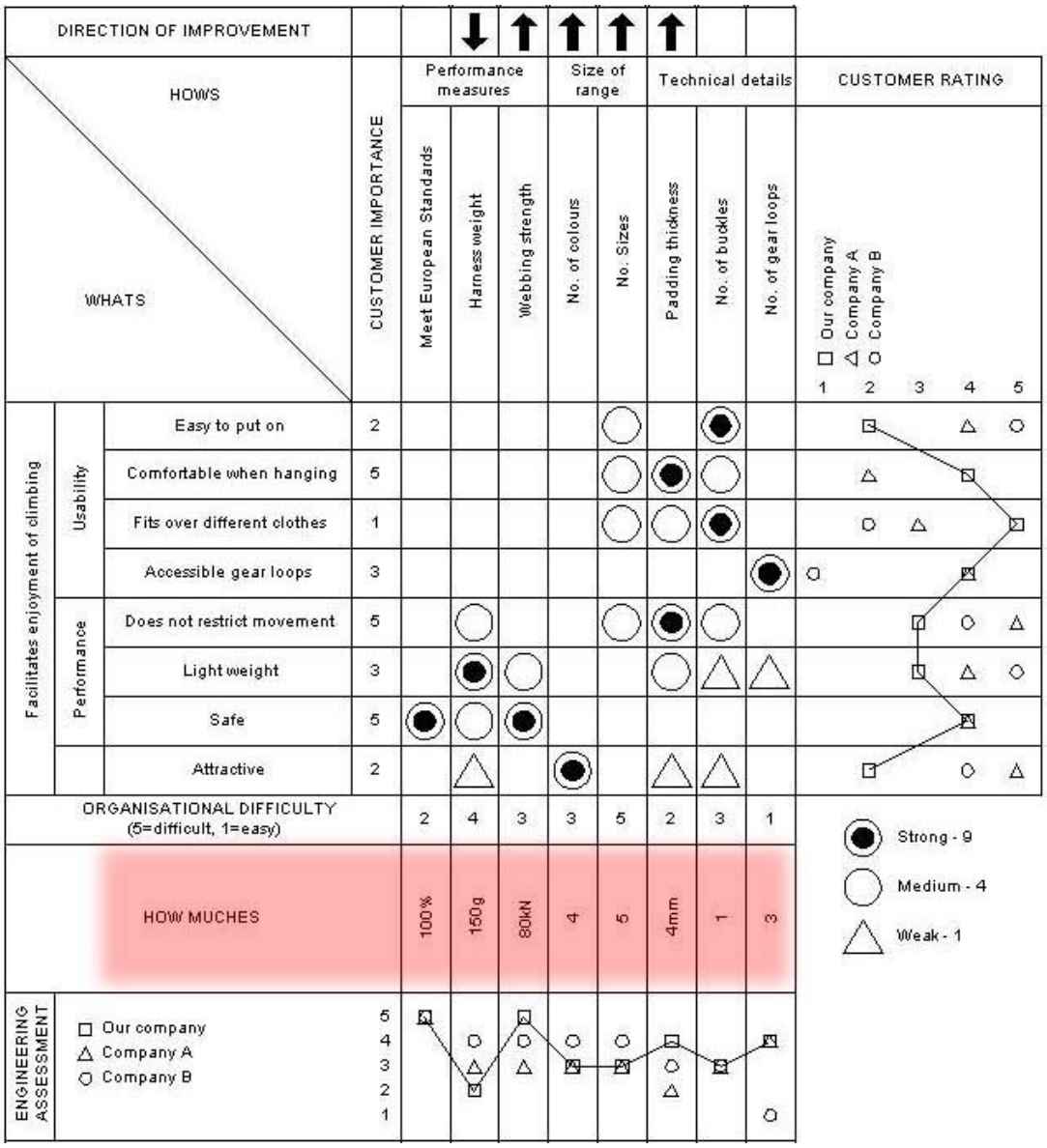
Step 9: Technical Analysis of Competitor Products

To better understand the competition, engineering then conducts a comparison of competitor technical descriptors. This process involves reverse engineering competitor products to determine specific values for competitor technical descriptors.



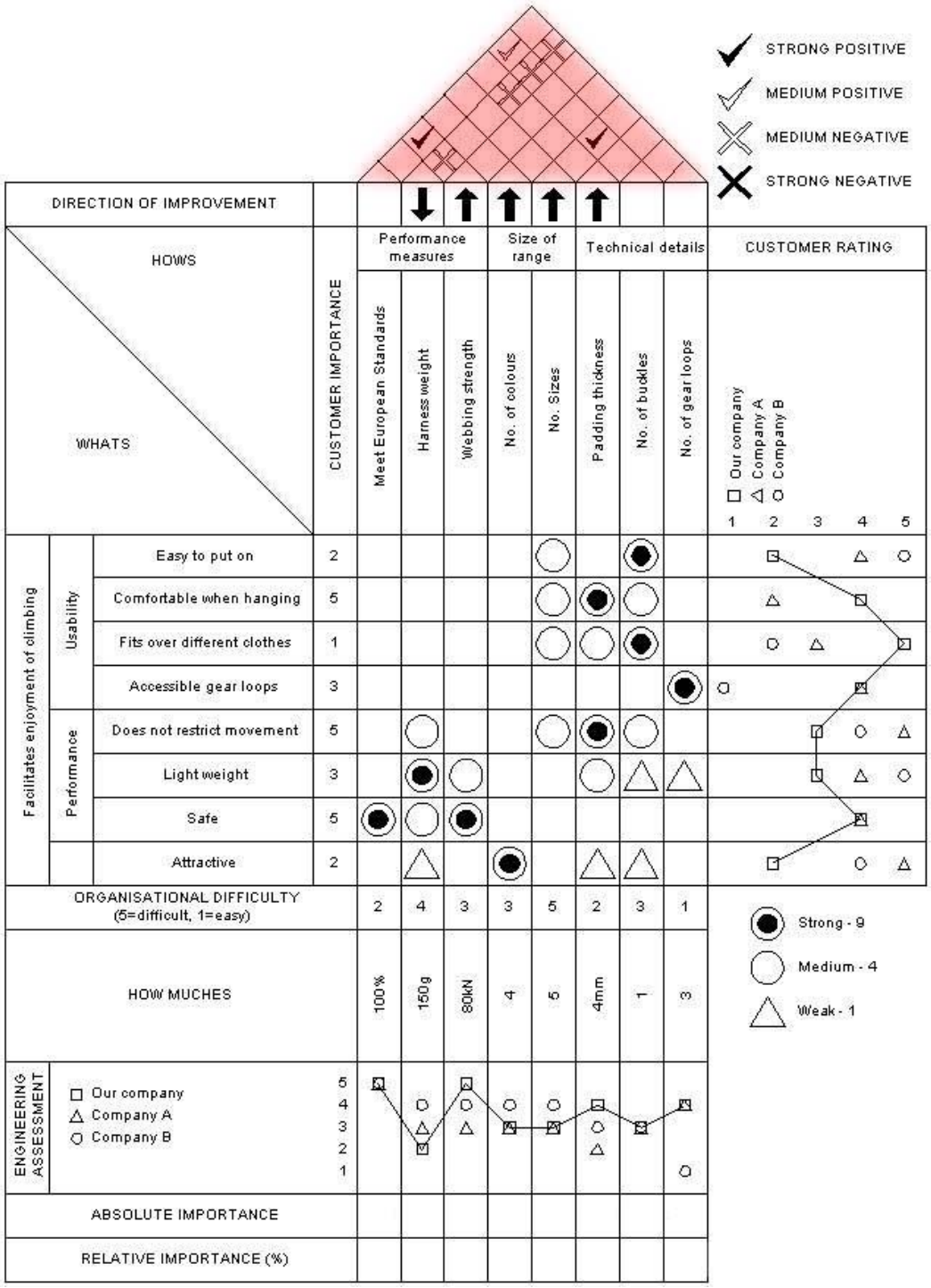
Step 10: Target Values for Technical Descriptors

At this stage in the process, the QFD team begins to establish target values for each technical descriptor. Target values represent "how much" for the technical descriptors, and can then act as a base-line to compare against.



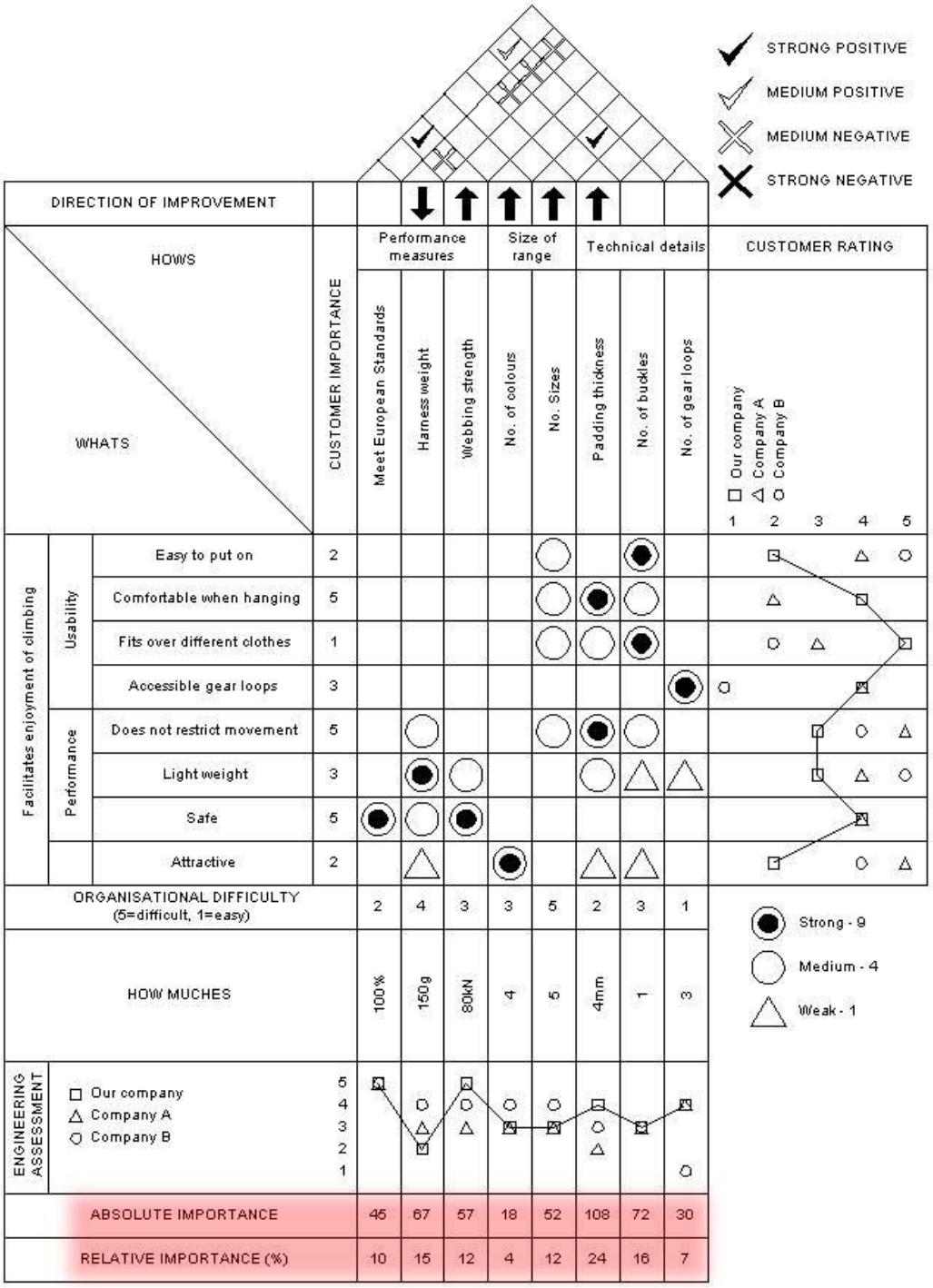
Step 11: Correlation Matrix

This room in the matrix is where the term House of Quality comes from because it makes the matrix look like a house with a roof. The correlation matrix is probably the least used room in the House of Quality; however, this room is a big help to the design engineers in the next phase of a comprehensive QFD project. Team members must examine how each of the technical descriptors impact each other. The team should document strong negative relationships between technical descriptors and work to eliminate physical contradictions.



Step 12: Absolute Importance

Finally, the team calculates the absolute importance for each technical descriptor. This numerical calculation is the product of the cell value and the customer importance rating. Numbers are then added up in their respective columns to determine the importance for each technical descriptor. Now you know which technical aspects of your product matters the most to your customer!



The Next stage

The above process is then repeated in a slightly simplified way for the next three project phases. A simplified matrix involving steps 1, 2, 3, 5, 6, 7, 9 & 11 above is developed.

The main difference with the subsequent phases however, is that in Phase 2 the process becomes a translation of the voice of the engineer in to the voice of the part design specifications. Then, in phase 3, the part design specifications get translated into the voice of manufacturing planning. And finally, in phase 4, the voice of manufacturing is translated into the voice of production planning.

QFD is a systematic means of ensuring that customer requirements are accurately translated into relevant technical descriptors throughout each stage of product development. Therefore, meeting or exceeding customer demands means more than just maintaining or improving product performance. It means designing and manufacturing products that delight customers and fulfill their unarticulated desires. Companies growing into the 21st century will be enterprises that foster the needed innovation to create new markets.

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Recommended further reading

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