CPQP

TOOLSET GUIDELINE 1

Quality Function Deployment Guideline

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CONSTRUCTION INNOVATION HUB

UK Research and Innovation

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Use of this Guide

The Quality Function Deployment (QFD) guideline is part of the Construction Product Quality Planning (CPQP) process and should be used in conjunction with the CPQP Guide and its toolset, published by the Construction Innovation Hub.

Intended as a guideline for conducting QFD analyses, this document covers the basic principles of the approach as well as a methodology. The layout of the templates used in this guideline can be changed and modified to suit individual companies.

This guideline is aimed at companies that manufacture offsite construction products and use the CPQP process with their customers and suppliers. By following this guideline, CPQP teams will be able to conduct a QFD analysis. The guideline will also provide a base reference for those unfamiliar with QFD and further support the work of quality teams.

For a list of the acronyms and abbreviations used in this document, refer to Appendix B – List of Abbreviations.

For the various terms used in this document, refer to Appendix C – Glossary of Terms.

For further information about the CPQP Guide and its toolset please contact:
cpqp@constructioninnovationhub.org.uk

Introduction

Introduction

Quality Function Deployment (QFD) is a structured process that helps translate customer requirements into detailed technical specifications.

The basic design tool used within QFD is known as the 'House of Quality', which helps to identify and classify customer desires by creating a plan for products that fulfil customer requirements. An example of the 'House of Quality' is shown in Figure 1.

Customers today have a range of options when choosing a product or service. The purpose of QFD is to capture and prioritise the key requirements (such as reliability, performance, aesthetics, etc.) for the product being developed, based on their importance to the customer. This allows for incorporating design quality and customer perceived value in the product itself. In order to do so, the Voice of the Organisation (VoO) must harness and integrate the Voice of the Customer (VoC) into the design and manufacturing of their product and systems. Companies utilise the structured process and team-based nature of this QFD to help define, rank and prioritise customer's wants and needs.

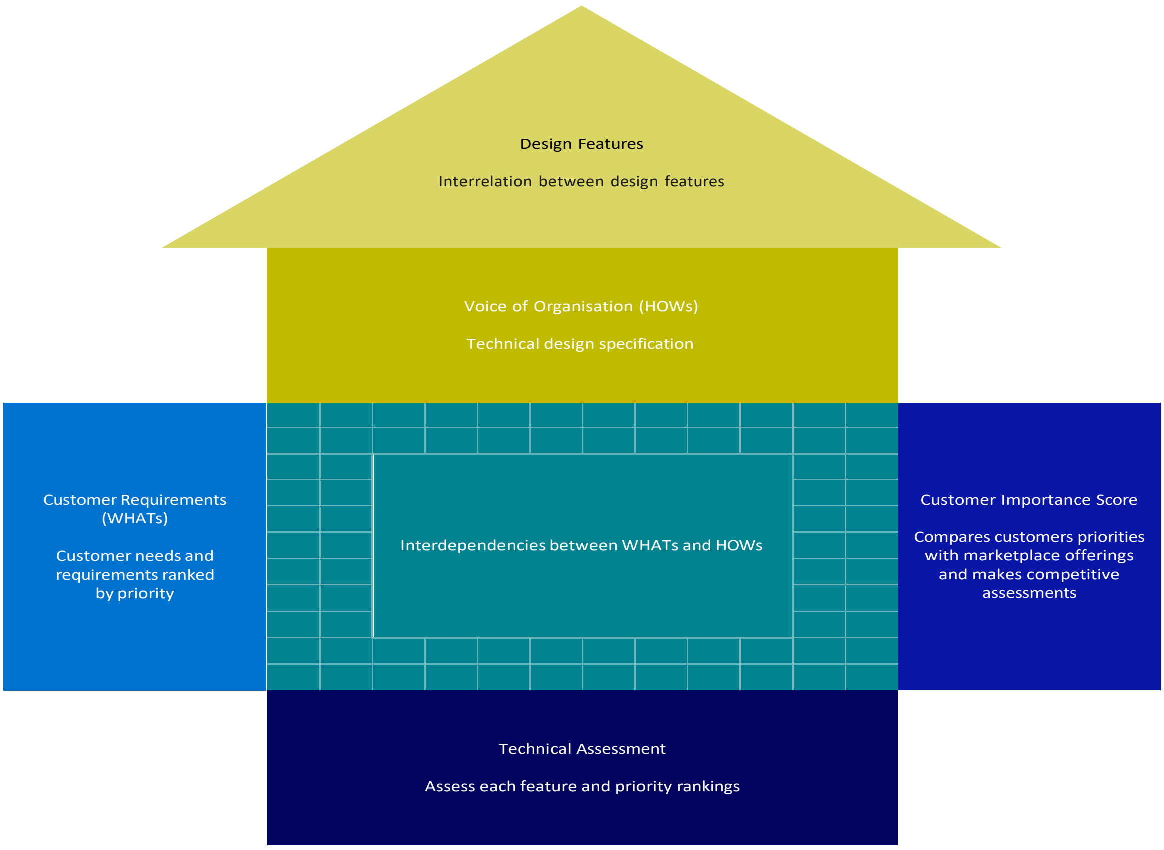


Figure 1. Visual display of the 'House of Quality' design tool

Background

QFD was initially developed in Japan by Yoji Akao in the late 1960s while working for Mitsubishi's shipyard. It was later adopted by Toyota and its supply chain, with Japanese manufacturers going on to successfully use the 'House of Quality' for consumer electronics, clothing, and construction equipment. It was also adopted for the design of retail outlets and even when planning apartment layouts [1].

In the early 1980s, QFD was introduced in the United States by three main automotive companies and several electronic manufacturers [2]. Initially, the acceptance and adoption of QFD was slow in the United States. Over time, popularity levels increased and it is now in widespread use across the manufacturing, healthcare, and service industries.

Purpose

The key purpose of QFD is to effectively define customer requirements and translate them into specific product or service characteristics and specifications in a structured manner. Implementing QFD helps to build strong cross-functional teams, allowing the entire organisation to work together to produce products and services with high levels of customer perceived value. The use of QFD also ensures effective communication of the Voice of the Customer (VoC) throughout organisational departments, such as design, quality, manufacturing, sales and marketing.

Benefits

The House of Quality enables effective communication of the customer's wants and needs throughout the organisation, from design and quality to manufacturing and production.

The main benefits of adopting QFD are:

- Voice of the Customer (VoC) is at the core of all decisions
  QFD places direct importance on the wants and needs of the customer as opposed to the organisation making assumptions of what the customer wants;

- Clear technical design specifications
  QFD ensures that the customer's requirements are translated into clear technical specifications throughout all production and assembly phases;

- Powerful prioritisation tool
  QFD enables organisations to combine different views and expectations into a single house-like structure known as the 'House of Quality';

- Helps to make trade-off decisions
  QFD takes into consideration requirements of the customer and ranks them alongside the capabilities of competitors in the market;

- Clear documentation
  QFD makes information available for decision-makers in a structured manner. The methodology enables the recording of lessons learnt during the product development stage, serving as a historical record for future projects; and

- Shorter development time and lower cost
  QFD focuses on key product features that meet customer's requirements and therefore reduces the likelihood of late design changes. This prevents the loss of valuable project time and resources.

How does QFD fit in with Construction Product Quality Planning?

The Construction Product Quality Planning (CPQP) process supports the development of new products for manufacturing led-construction approaches. The process covers the entire product development cycle, from concept design through to product launch. The CPQP process has been broken down into five phases as shown in Figure 2. The first phase (Planning) refers to building the Voice of Customer (VoC) into easy-to-interpret requirements and planning the product development process from concept to product launch. The QFD approach fits suitably with the CPQP process, particularly when capturing the VoC.

Team Approach

The advanced planning process in the CPQP is built upon a team-based approach. Similarly, the effective use of the QFD methodology requires the engagement and participation of the cross-functional team. The team composition depends on the type of organisation and the product needs.

In any case, the team should be made up of members from a variety of disciplines with relevant knowledge and experience (i.e. design engineering, process engineering, manufacturing engineering, and quality control). The team should also include either an external customer representative or an internal party who represents the customer. Finally, representatives from a non-technical background, such as marketing or sales, should also be included.

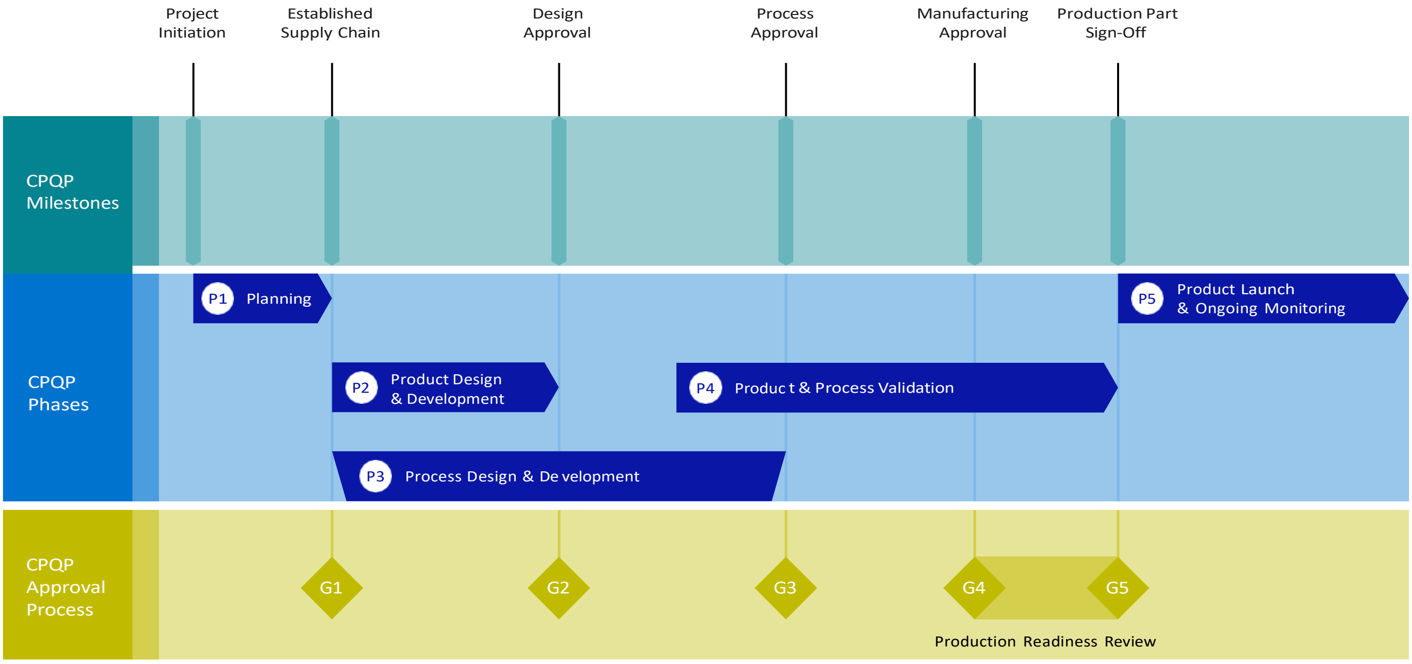


Figure 2. Construction Product Quality Planning (CPQP) process

Methodology

Methodology

QFD analysis is carried out across four main stages, which cover key activities in the product development cycle.

Figure 3 illustrates the flow of information in the QFD analysis. The process starts by capturing the VoC at the start of House 1 and after completing the analysis the output of a house becomes the input for the following house.

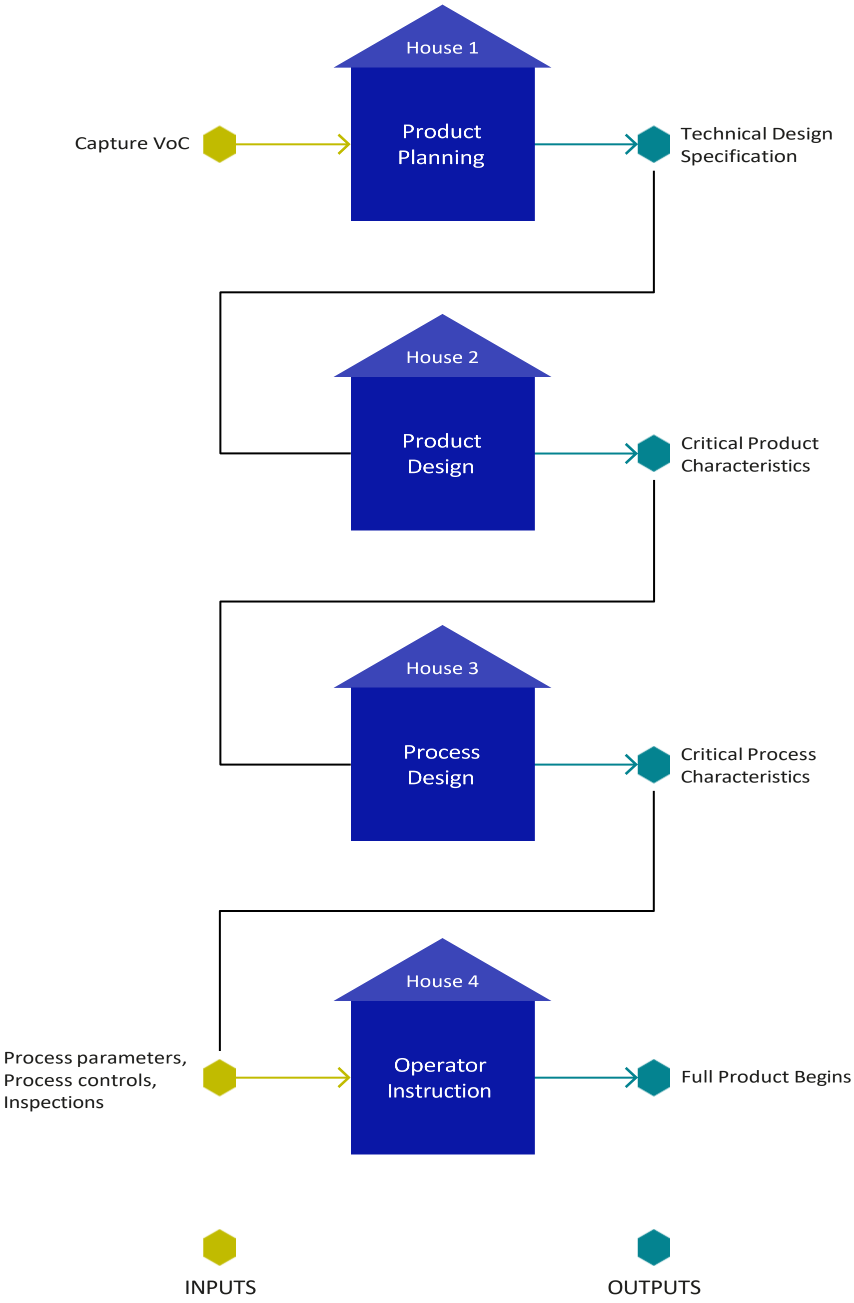


Figure 3. Process flow diagram for QFD with key inputs and outputs

The key tasks to be completed in each of the four QFD stages are detailed in Table 1. The completion of the task requires a collaborative effort and should involve teams from different disciplines and with relevant experience at each of the stages of the process. Some examples of responsible bodies that could deliver these tasks in the scope of the CPQP process are also listed in the table.

	Stage	Definition	Recommended Responsible Body
1	Product Planning	Capturing VoC	Consultants Architects Senior Management Teams
		Customer requirements → Technical design specifications	
		Competitive analysis of similar products	
		Cost / Budget	
		Comparison of alternative routes	
2	Product Design	Design requirements → Critical part characteristics	Designers Architects
		Identification of critical parts and assemblies	
		Product concepts creation	
		Progression into Phase 3 of concepts meeting the design requirements flow	
3	Process Design	Critical part characteristics → Process parameter for production	Process Engineers
		Critical manufacturing processes designed, and equipment identified	
		Process flow developed	
		Critical process parameters documented for Phase 4	
4	Operators Instruction	Key instructions for processes	Operations Manager
		Inspections and test specifications developed	
		Error-proofing mechanisms in place	

Table 1. Key tasks fulfilled in each of the four QFD stages

The QFD methodology utilises the 'House of Quality' design tool. Figure 4 below shows a step-by-step process for using the 'House of Quality', from House 1 (Product Planning) through to House 4 (Operator Instructions). It can be seen again how the information from one house becomes the initial input for the next house.

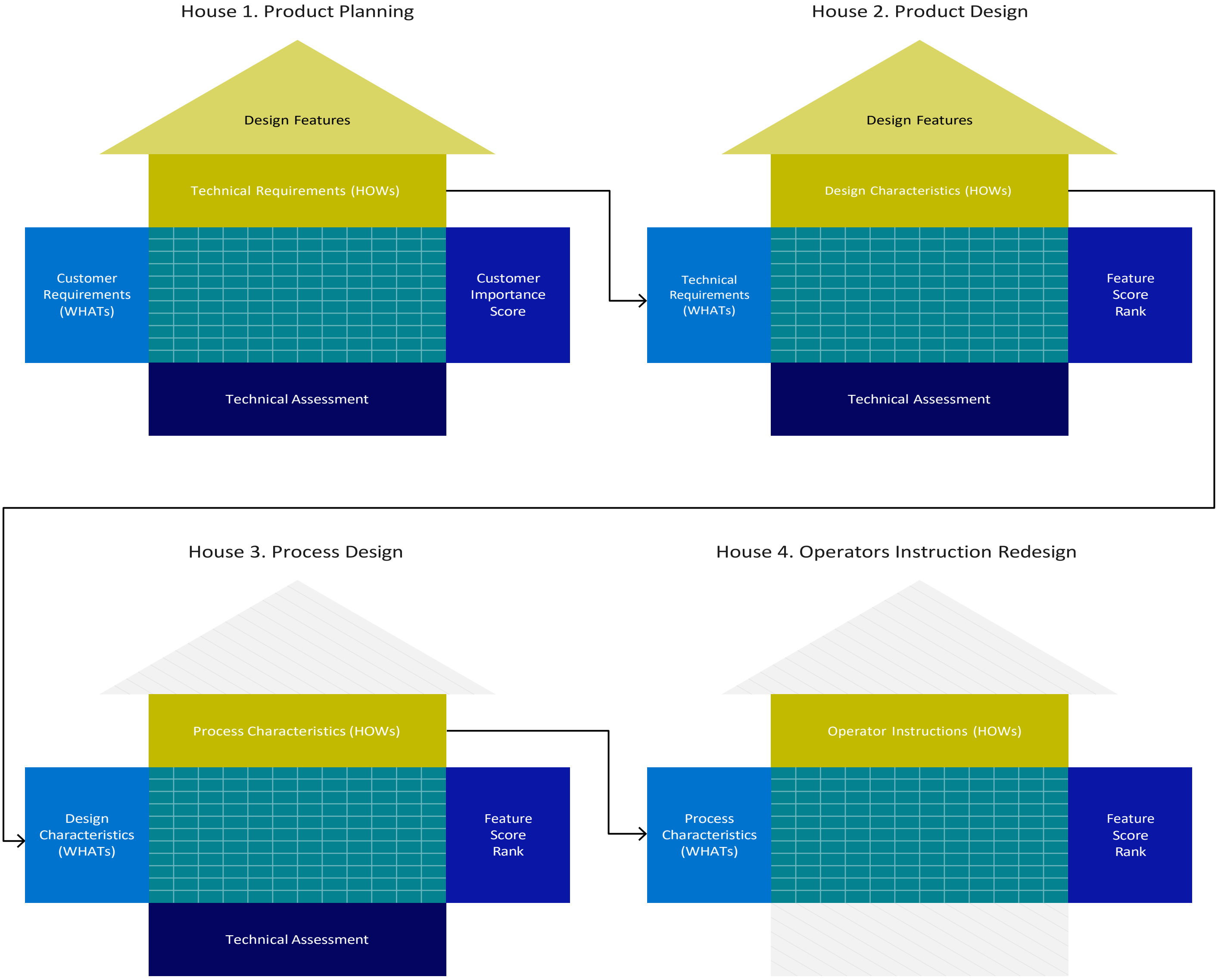


Figure 4. Key stages of the QFD 'House of Quality' methodology

Guideline

Guideline

The 'House of Quality' (Figure 4) is a highly efficient design tool which is used to carry out the four stages of the QFD process. This section covers the details to complete each of the houses and the information flow between them. A worked example is also included in the next section to illustrate the process.

Stage 1: Product Planning

The QFD process commences with the product planning stage. This is where the wants and needs of the customer (WHATs) are translated into technical design requirements (HOWs). In House 1, the customer's requirements are listed and ranked for defining the technical design goals. To complete House 1, or the Product Planning House, perform the following steps:

1. Collect customer needs and requirements. Here, it is important to consider inputs from technical and non-technical contributors, so that the requirements reflect the view of the product and the market opportunity from different angles. There are several methodologies available to gather and prioritise requirements. For instance, the Analytic Hierarchy Process (AHP) surveys are widely used in other industries to analyse and prioritise a list of previously gathered requirements [3];

2. Input the most important customer needs and requirements based on the previous research into the WHATs section on the left side of House 1 (Figure 4);

3. Assign a customer importance score (usually on a scale of 1 to 5) for each WHAT or requirement. These scores are usually derived through pairwise comparisons of the hard and soft requirements. Customers may rate several items of high importance, so it is possible to have multiple 5s or multiple 4s, for instance. Input the scores on the right side of House 1;

4. Evaluate similar products introduced in the past and conduct competitive analyses. Observe followed methodologies and consider any lessons learnt as well as areas for improvement. This evaluation will allow the team to define a product strategy and effectively focus the efforts towards areas of high priority;

5. List the technical design requirements in the box above the central block of the house. This defines the HOWs section of House 1 (Figure 4). Technical design requirements are specified by architects, design engineers, and senior management team members within the organisation. This builds the Voice of the Organisation (VoO) into the technical concept/design;

6. Weight the relationship between the customer requirements in the WHATs section and the technical design requirements in the HOWs section. That is, how strongly each of the technical design requirements relates to or affects a customer requirement. The relationship between the WHATs and the HOWs is usually scored using a three-tier scale, from strong to weak (e.g. ⬢ Strong (+9), ⬡ Medium (+3), + Weak (+1));

7. Once all the relationships are scored in the central block of the house, the technical assessment in the lower block can be completed. The team can now calculate the feature raw scores or use readily available templates to automatically determine this. The feature raw score accounts for the importance rating for each technical design requirement listed in the HOWs section, as well as the feature rank, that defines the priorities. The feature raw score for an item in the HOWs section is calculated by adding the product of each customer importance score and the corresponding relationship score in the item column. The feature rank is calculated based on the feature raw scores and they are ranked from highest to lowest;

8. Identify the correlations between the different technical design requirements listed in the HOWs section. This will highlight how the design requirements help or hinder each other. The correlation is usually scored between strong positive correlation and strong negative correlation (e.g. +3 to -3 respectively) and a separate scoring scale is used as shown in Figure 5. Add the score in the corresponding field in the roof of House 1;

9. Add the competitor research information into the feature score rank block on the right side of the house, just beside the customer importance score (Figure 5). The competitive analysis helps to assess how companies currently rank for each of the customer requirements. This enables the team to determine what has been overlooked or any competitive advantage the product could have; and

10. The technical requirements are now finalised by the team and ranked appropriately, ready to be used in House 2.

Stage 2: Product Design

House 2 focuses mainly on the product design. This is a design-led process where the product concepts are created, and critical parts/assemblies are identified. To complete House 2, perform the following steps:

1. Add the technical design requirement from House 1 into the WHATs section. The finalised technical requirements in the HOWs from House 1 now become the WHATs of House 2 (Figure 4);

2. Calculate the importance score (usually on a scale of 1 to 5) for each WHAT. The score is based on the feature rank score for each item in House 1. To do so, the feature rank score in House 1 is normalised according to the applicable scale (usually 1 to 5). As stated earlier, this can be automatically calculated using readily available templates;

3. Translate the technical design requirements (WHATs) into critical part characteristics (HOWs). This is where the creativity of designers and architects comes into play and the development progresses from 'what the product should do' to 'what the product should look like';

4. Assess the market and carry out competitive analysis by looking into and exploiting new technological advancements, methodologies, and processes currently used in the sector;

5. Identify and document critical characteristics. Use a proof of concept to capture the views from the extended team participating in the process and ensure that the design requirements are feasible;

6. Once all the relationships are scored in the central block of the house, the technical assessment in the lower block can be completed. The feature raw scores and the feature rank are calculated as described for House 1;

7. In the roof of the house, identify and score the correlations between the different critical part characteristics listed in the HOWs section. Similar to House 1, the correlation in the roof is scored between strong positive correlation and strong negative correlation; and

8. The design characteristics are now ranked and ready to be used in House 3 for the process design phase.

Stage 3: Process Design

House 3 of the QFD approach focuses on the process design phase. To complete House 3, perform the following steps:

1. Input the part design characteristics from the HOWs section in House 2 into the WHATs section of House 3;
2. Input the importance score (usually on a scale of 1 to 5) for each WHAT. The score is based on the feature rank score for each item in House 2. To do so, the feature rank score is normalised according to the applicable scale (usually 1 to 5);
3. Translate the critical design characteristics into critical process parameters. The process engineers are now designing the production process together with the production team. The team identifies key manufacturing processes and equipment. At this stage, a process flow chart is developed. As part of the CPQP toolset, a separate Process Flow guideline is provided to support this exercise;
4. Complete the central block of the house by scoring how well the WHATs and the HOWs relate to one another. The relationship between the WHATs and the HOWs is scored from strong to weak, in a similar manner as in the previous two houses;
5. Once all the interactions are scored in the central block of the house, the technical assessment in the lower block can be completed. The feature raw scores and the feature rank are calculated for the process characteristics, similar to the previous two houses;
6. The correlations between the different process characteristics listed in the HOWs section are identified and scored in the roof of the house. Similar to the other houses, the correlation is scored between strong positive correlation and strong negative correlation; and
7. The resulting critical process parameters are documented and ready for use in House 4 – Operator Instruction.

The output of House 3 is a prioritised ranking of the process parameters, which has converted what the product will look like into how the product will be made.

Stage 4: Operator Instruction

House 4 will cover the Operator Instructions, as shown in Figure 4. This involves the internal procedures, processes, and operator instructions that could be developed for the new product and processes. To complete House 4, perform the following steps:

1. Translate the critical process characteristics in the HOWs section of House 3 into the WHATs section of House 4 – Operator Instructions;

2. Input the importance score (usually on a scale of 1 to 5) for each WHAT. The score is based on the feature rank score for each item in House 3. To do so, the feature rank score is normalised to the selected scale (usually 1 to 5);

3. Identify ways to error-proof (poka-yoke methodology) the newly designed process and list them in the HOWs section of House 4. Likewise, define control action plans (for preventing mistakes before they occur) and warning action plans (for when mistakes are made);

4. Complete the central block of the house, similar to the previous houses. Score the relationships between the critical process characteristics in the WHATs section and the operator instructions in the HOWs section. The relationship between the WHATs and the HOWs is scored from strong to weak;

5. Once all the relationships are scored in the central block of the house, the technical assessment in the lower block can be completed. The feature raw scores and the feature ranks are calculated for each of the HOWs, similar to the previous three houses; and

6. Clear guidance/steps for processes, inspections, and test specifications with weighted rankings are determined. This will enable the design of Standard Operating Procedures (SOPs).

Worked Example: Manufacturing of a volumetric module

Worked example

The following worked example illustrates the adoption of the QFD methodology for the manufacture of a volumetric module.

The customer has requested the volumetric module to be designed as part of a modern student accommodation, with each module covering a minimum of $40m^2$. The example should not be regarded as a complete and comprehensive case study; it aims only to illustrate the process of completing the different houses in a simple manner.

Stage 1: Product Planning

The customer's requirements for this modern student accommodation are captured and ranked with importance through the AHP survey methodology [3]. After completing the pair-wise comparison of the requirements, it is clear that the customer views sustainability as a relevant factor. The team identifies low carbon design and energy efficiency solutions as priorities. The combined target should achieve 40% less embodied carbon emissions and improved energy efficiency when compared to traditional buildings. The project requires 10 volumetric modules to be completed within a maximum budget of £500,000 and 12 weeks delivery time.

The team captures the requirements within the WHATs section on the left side of the template as shown in Figure 5. Each of the requirements in the WHATs section is scored taking the customer importance levels into account. These are shown in the column on the right side of the house.

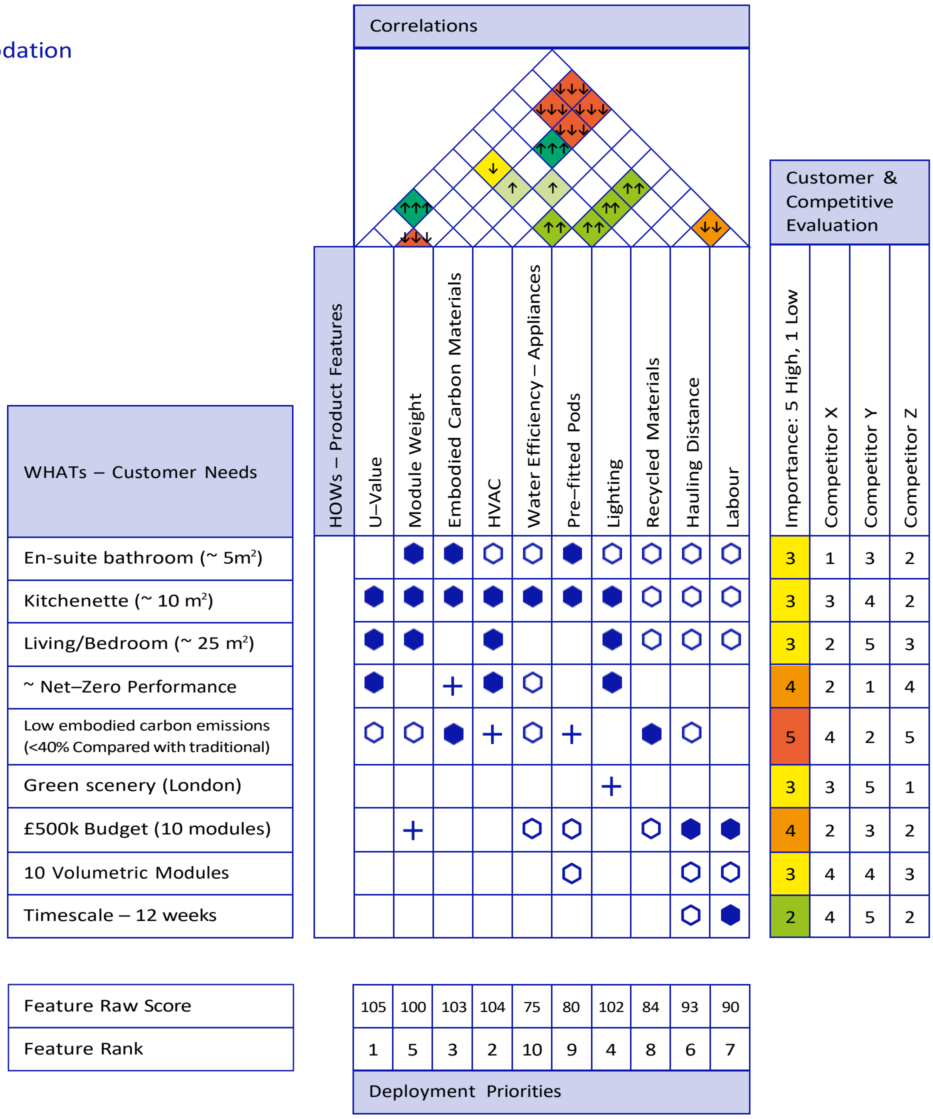
The team then translates the customer requirements into technical requirements (HOWs) such as the consideration of U-Values (thermal transmittance), efficient Heating, Ventilation and Air Conditioning (HVAC) systems, and embodied carbon in the products/systems to be integrated.

The team evaluates the interactions between the WHATs and the HOWs in the central block of the first house (Figure 5). Once the team has completed all the inputs, the features are ranked and scored at the bottom of the house. Finally, the correlations between the HOWs are assessed in the roof of the house.

This process allows the team to determine the main technical requirements to consider for the next stage of the QFD process – Product Design. The team has identified the importance of the thermal performance of the modules and the carbon footprint of the main parts and components as key factors to consider.

House 1 – Product Planning

Volumetric Module for Student Accommodation



Key – Correlations

Strong Positive Correlation	↑↑↑	+9
Medium Positive Correlation	↑↑	+3
Weak Positive Correlation	↑	+1
No Correlation		0
Weak Negative Correlation	↓	-1
Medium Negative Correlation	↓↓	-3
Strong Negative Correlation	↓↓↓	-9

Key – Relationship (Central matrix)

Strong Interaction	⬢	+9
Medium Interaction	⬡	+3
Weak Positive Correlation	+	+1
No Correlation		

Figure 5. 'House of Quality' tool adopted for the Product Planning phase, example

Stage 2: Product Design

Stage 2 is where the creativity takes place, with the HOWs from the earlier product planning stage becoming the WHATs of the product design stage. The feature rank from House 1 becomes the priority level in the column on the right side of House 2. The importance for each of the technical features (WHATs) is then calculated as shown on the right side in Figure 6.

The designers and architects (responsible bodies) evaluate the technical features and define critical part characteristics that are specified in the HOWs section. In this example, the cross-functional team places importance on the insulation components the heating system, the integration of renewable technologies, and the low embodied carbon materials/solutions.

Similar to House 1, the interactions between the technical features (WHATs) and the critical part characteristics (HOWs) are evaluated in the central block of the house (Figure 6). The correlations between the critical part characteristics are evaluated in the roof of the house. Finally, the team enters the feature scores and ranks each of the product or part characteristics (HOWs) in terms of weighted importance.

Figure 6 shows that the important areas to consider are the double-glazed windows and the insulation material, the evaluation of the carbon footprint of the structural modules, and the use of photovoltaic panels and (hybrid) heating systems. These key areas are entered into House 3 – Process Design.

House 2 – Product Design
Volumetric Module for Student Accommodation

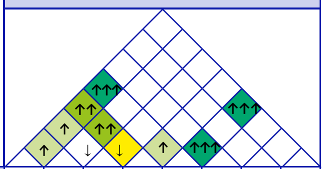
Key – Correlations

Strong Positive Correlation	↑↑↑	+9
Medium Positive Correlation	↑↑	+3
Weak Positive Correlation	↑	+1
No Correlation		0
Weak Negative Correlation	↓	-1
Medium Negative Correlation	↓↓	-3
Strong Negative Correlation	↓↓↓	-9

Key – Relationship (Central matrix)

Strong Interaction	⬢	+9
Medium Interaction	⬡	+3
Weak Positive Correlation	+	+1
No Correlation		

Correlations



WHATs – Technical Features	28mm Double Glazed Window	180mm Fibreglass Insulation	40dB Acoustic Insulation	Light steel/Timber structure	BIPV panels	Hybrid heating systems	Low flush-WC	Low energy lighting	Priority from First House	Importance: 5 High, 1 Low	Competitor X	Competitor Y	Competitor Z
U-Value	⬢	⬢	+	⬡					1	5	3	4	2
Module Weight				⬢					5	3	5	3	2
Embodied carbon – Materials	⬡	⬡	⬡	⬢	+	+		+	3	4	4	4	1
HVAC	⬡	⬡			⬢	⬢		+	2	4	2	5	3
Water efficiency – Appliances							⬢		10	1	4	3	5
Pre-fitted pods					⬡				9	1	5	4	4
Lighting	⬢				⬡			⬢	4	3	4	2	1
Recycled Materials				⬡					8	1	1	2	4
Hauling distance	+	+	+	⬡	⬡	+	+	+	7	2	3	4	2
Labour	+			⬡	⬡	+			6	2	2	1	5
Feature Raw Score	100	71	19	93	64	44	11	37					
Feature Rank	1	3	7	2	4	5	8	6					

HOWs – Part Specifications; Customer & Competitive Evaluation; Deployment Priorities

Figure 6. 'House of Quality' tool adopted for the Product Design phase, example

Stage 3: Process Design

Once the product design phase is complete, the HOWs of House 2 becomes the WHATs in House 3 (Figure 7). The critical part characteristics are now listed on the left side of the house.

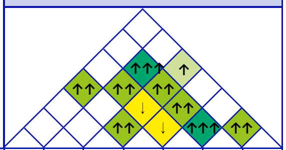
The process parameters are defined; new manufacturing processes, assembly advancements, and key equipment requirements are taken into account. In this example, the team evaluates the processes for the supply and installation of the key elements identified in the previous house.

These critical process parameters are determined similarly to Houses 1 and 2 by calculating a feature score. The team identifies that priority should be given to installing the modules on-site, enabling the service connections through plug-and-play solutions, and integrating PV panels and hybrid heating systems.

House 3 – Process Design

Volumetric Module for Student Accommodation

Correlations



Key – Correlations

Strong Positive Correlation	↑↑↑	+9
Medium Positive Correlation	↑↑	+3
Weak Positive Correlation	↑	+1
No Correlation		0
Weak Negative Correlation	↓	-1
Medium Negative Correlation	↓↓	-3
Strong Negative Correlation	↓↓↓	-9

Key – Relationship (Central matrix)

Strong Interaction	⬢	+9
Medium Interaction	⬡	+3
Weak Positive Correlation	+	+1
No Correlation		

WHATs – Technical Features	HOWs – Process Specifications	Supply/Installation of Window XYZ	Fitting Prefab pods	Heat pump installation	Installation of XY BIPV system	Stack up Modules/onsite	Services connections/plug-and-play	Installation Net-Bulb System	Priority from First House	Importance: 5 High, 1 Low	Competitor X	Competitor Y	Competitor Z
28mm Double Glazed Window		⬢			⬡	⬡			1	5	4	5	3
180mm Fibreglass Insulation				⬡	+	+	⬡		3	3	2	4	4
40dB Acoustic Insulation						+	⬡		7	1	4	3	5
Light steel/Timber structure		+	⬢		+	⬢	⬡		2	4	5	3	2
BIPV panels				⬡	⬢	⬡	⬡	⬡	4	3	2	4	5
Hybrid heating systems				⬢		+	⬢		5	2	4	3	5
Low flush-WC			⬡				⬡		8	1	4	2	5
Low energy lighting							⬡	⬢	6	1	3	2	4
Feature Raw Score		49	39	36	49	66	57	18					
Feature Rank		3	5	6	3	1	2	7					

Customer & Competitive Evaluation: Priority from First House; Importance: 5 High, 1 Low; Competitor X; Competitor Y; Competitor Z

Deployment Priorities: Feature Raw Score; Feature Rank

Figure 7. 'House of Quality' tool adopted for the Process Design phase, example

Stage 4: Operator Instructions

The final stage of the QFD management approach is the Operator Instructions. The process parameters from Stage 3 are entered into the WHATs section in House 4.

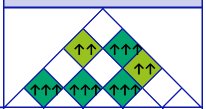
The HOWs section in stage 4 includes operator requirements, such as on-site assembly instructions, use of control and reaction plans, BIM asset information, and guidance for testing.

The feature score is determined after the team scores the relationships between the process parameters (WHATs) and the operator instructions (HOWs) as shown in Figure 8. The team identifies the assembly instructions as well as the control and reaction plans as priorities for this house. Importance is also given to end-user manuals and BIM asset information. This ensures that the operations team can effectively plan, prioritise, and assign sufficient resources for generating control plans, reaction plans, Standard Operating Procedures (SOPs) and test instructions, respectively.

House 4 – Operator Instructions

Volumetric Module for Student Accommodation

Correlations



WHATs – Processes	SOP testing guidelines	BIM asset information	Assembly/operator instructions on-site	Control/Reaction Plan	End-user Manual	Priority from First House	Importance: 5 High, 1 Low	Competitor X	Competitor Y	Competitor Z
Supply/Installation of Window XYZ	⬡	⬢	+	⬡	⬢	5	1	4	2	4
Fitting Prefab pods	+	⬢	+	⬢	+	6	1	2	1	4
Heat pump installation	⬢	⬢	⬢	⬢	⬢	4	2	5	3	4
Installation of XY BIPV system	⬢	⬢	⬡	⬢	⬢	3	3	3	4	2
Stack up Modules/onsite			⬢	⬢	+	1	5	4	3	3
Services connections/plug-and-play			⬢	⬢	+	2	4	5	3	4
Installation Net-Bulb System	⬢	⬢	+	⬡	⬢	7	1	2	3	1

(HOWs – Work Instructions; Customer & Competitive Evaluation)

Feature Raw Score	58	72	111	141	73
Feature Rank	5	4	2	1	3

Deployment Priorities

Key – Correlations

Strong Positive Correlation	↑↑↑	+9
Medium Positive Correlation	↑↑	+3
Weak Positive Correlation	↑	+1
No Correlation		0
Weak Negative Correlation	↓	-1
Medium Negative Correlation	↓↓	-3
Strong Negative Correlation	↓↓↓	-9

Key – Relationship (Central matrix)

Strong Interaction	⬢	+9
Medium Interaction	⬡	+3
Weak Positive Correlation	+	+1
No Correlation		

Figure 8. 'House of Quality' tool adopted for the Operator Instructions phase, example

References and Appendices

References

[1] Quality-One. Retrieved 2020, from www.quality-one.com/qfd

[2] Lean Toolbox: Quality Function Deployment. (2020). (Master of Project Academy) Retrieved Feb 8, 2020, from www.blog.masterofproject.com/qfd

[3] De Felice & F. & Petrillo, A. (2011). A multiple choice decision analysis: an integrated QFD – AHP model for the assessment of customer needs. International Journal of Engineering, Science and Technology, 9, 2.

[4] Automotive Industry Action Group. (2008). Advanced product quality planning (APQP) and control plan reference manual (2nd ed.). Southfield, MI: AIAG.

Appendices

Appendix A – Tool Templates

Templates to be used within the context of this guideline are available, please contact:
cpqp@constructioninnovationhub.org.uk

Appendix B – List of Abbreviations

The following is a list of initialisations and acronyms used in this guideline.

A	AHP	Analytic Hierarchy Process
	APQP	Advanced Product Quality Planning
C	CPQP	Construction Product Quality Planning
H	HVAC	Heating, Ventilation and Air Conditioning
Q	QFD	Quality Function Deployment
S	SOP	Standard Operating Procedure
V	VoC	Voice of the Customer
	VoO	Voice of the Organisation

Appendix C – Glossary of Terms

The following is a list of commonly utilised quality, manufacturing and construction specific terms and their definitions within this context used within this guideline.

A

Analytic Hierarchy Process (AHP)

A mathematical methodology used for organising and analysing complex decisions in a structured manner. It provides a comprehensive framework for structuring a decision problem and is often deployed in survey formats by using pairwise comparisons.

C

Construction Product Quality Planning (CPQP)

An adaptation of Advanced Product Quality Planning (APQP) [4] that is aimed at those enterprises that will feed construction with new componentry for offsite builds.

H

Heating, Ventilation and Air Conditioning (HVAC)

HVAC refers to Heating Ventilation and Air Conditioning technologies, which can be used in buildings to maintain internal air quality, regulate internal temperatures and regulate internal humidity.

P

Poka-yoke

Based on the Japanese term for 'mistake-proofing', it more broadly refers to any mechanism within a product or process designed to prevent errors.

Q

Quality Function Deployment (QFD)

A structured approach to defining customer needs and translating them into specific product development plans.

S

Standard Operating Procedures (SOP)

A set of step-by-step instructions compiled by an organisation to detail how routine operations are carried out.

U

U-Value

The U-Value (thermal transmittance) expresses the rate of heat transfer through any element of a building, such as a wall, roof, or window.

V

Voice of the Customer (VoC)

The stated and unstated customer needs or requirements. This includes customer feedback (both positive and negative) [4].

Voice of the Organisation (VoO)

This refers to the style and point of view of a particular organisation and includes the positive benefits that voice can bring to an organisation, for example, improved innovation.

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