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Housing Improvement using Quality Function Development in Melaka Resident Area: A Case Study

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Abstract – *This paper presents the housing improvement proposition in the Melaka resident area. Quality Function Deployment is used as a method to analyze customer behavior regarding customer requirement, satisfaction and comparison among the developers. By using this method, the main requirement by the buyer for their bungalow is their need of sufficient space to place their appliances in the house. At the end of the study, the details of buyer requirements are plotted into House of Quality, where it is believed to improve the quality of future bungalow house development in Melaka.*

Keywords: Housing, Quality function development, QFD, Customer satisfaction

1.0 INTRODUCTION

In Quality Management System (QMS), Quality Function Deployment (QFD) is a method to represent the analysis of house buyer satisfaction. This method has a powerful development methodology with a wide range of applications in customer-oriented design of customer satisfaction [1-4]. Eshan stated this method can be described as a quality tool that helps to translate the voice of customer into a new product that truly satisfies their needs [5].

Theoretically, Shigeru identified the first invention of the new product development in 1966. According to this invention, the concept of new product development was under one umbrella and called a total quality control (TQC). Yoji detailed up further this invention in 1972. Lastly, QFD was developed in 1978 by a quality control (QC) research group of the Japan Society of Quality Control [5]. This research group believed that it is a powerful tool that can be incorporated with the voice of the customers in the design process and their suggestion is heard until the final product development. Hang et al., described QFD as a tool for improving the development cycle and manufacturing products, and finally it is matched with customer

requirement [6-7]. House of Quality (HOQ) is used in a design tool embedded with the QFD itself. According to HOQ, it records the functional characteristics of customer satisfaction and cross over a matrix of positive and negative relationships between technical characteristics of the final product [8-9].

The objective of this study is to investigate customer satisfaction among the house buyers in Melaka. The study is only focused on the relationship between customer satisfaction and technical issues of the house after the handover to the buyers. In this study, QFD and HOQ were used to analyse customer satisfaction in terms of buying the bungalow house in Melaka, Malaysia. Three different locations were chosen to compare customer satisfaction regarding 4 primary and 14 secondary issues that are located at the Melaka Tengah District.

2.0 RESEARCH METHODOLOGY

This paper uses the HOQ analysis in assessing the QFD system for existing housing development areas in Melaka. The analysis was conducted to focus on the quality improvement of the housing area regarding to the house buyer requirements and how far the developer meets those requirements.

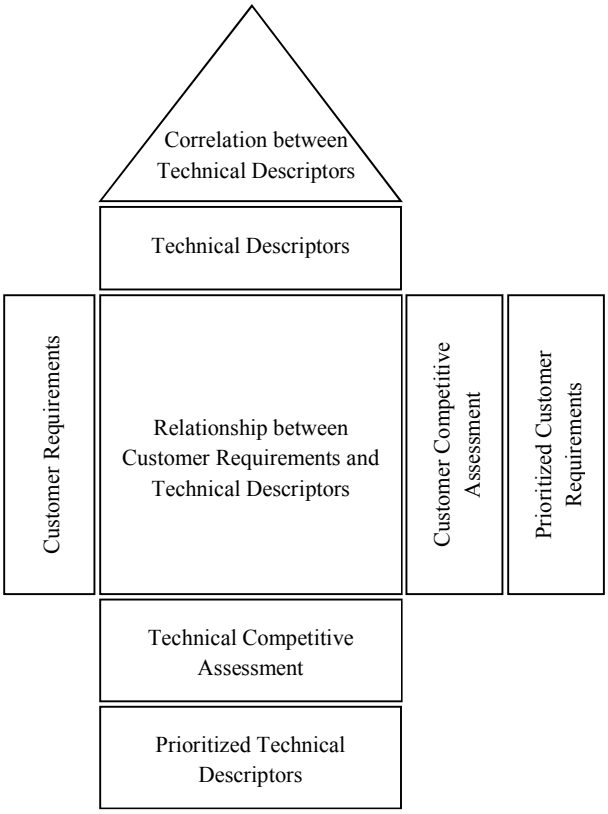

Figure 1: House of Quality (HOQ)

Typically, the HOQ (shown in Figure 1) contains customer requirements, technical descriptors, the relationship between them, and the interrelationship between technical

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descriptions, customer and technical competitive assessment and prioritized both of the requirements and descriptors as reported by Brossert in 1991 [8]. The terms customer requirements specifically refer to the house buyers needs while technical descriptors refer to the house developers [10]. The procedure for building HOQ for the completion of the QFD can be explained by the following steps:

2.1 Step 1: Customer requirements

Customer requirements represent the house buyer (or customer) needs or expectation after buying a bungalow house. The list of buyer needs can be obtained through surveys or interviews among the house buyers. It can be divided into primary (general in nature), secondary (more detail) and tertiary requirements (more specific). The weightage of requirements is measured by the degree of importance using five-value rating scale from 1 to 5, where the greater values of the scale mean that the item is of higher importance.

2.2 Step 2: Technical descriptors

The technical descriptors represent the quality characteristics to assure that those customer requirements are met. The ranks of importance for technical descriptors are similar to the scale for customer requirements (1 for the least and 5 for the most important).

2.3 Step 3: Relationship between Customer Requirements and Technical Descriptors

The relationship matrix shows the contribution level and the relation of each technical descriptor to each customer requirement. Typically, symbols such as strong relation (□), medium relation (Δ) and weak relation (□) are used to represent the strength of the relationship between customer requirements and the technical descriptors. They are given 5, 3 and 1, respectively.

2.4 Step 4: Correlation between Technical Descriptors

Correlation among technical descriptors refers to the ‘roof of HOQ’. This roof helps to identify the interactions among the quality characteristics and to provide recognition of positively and negatively correlated items with technical descriptions [1-3]. Also, it can be used to determine how much they influence each other. The symbols that are used to define the correlation are translated into four-value rating scale, such as strong positive (++), weak positive (+), weak negative (-), and strong negative (--), where the values are defined as +9, +3, -3 and -9, respectively.

2.5 Step 5: Customer Competitive Assessment

Customer competitive assessment is used to show the comparison or benchmarking of the satisfaction level of house buyers with other buyers at two different housing areas. It can be labelled as A for house buyers within this area, whereas B and C represent house buyers with respect to B’s and C’s housing areas respectively. The degree of importance is used as similar to those described in Step 1.

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2.6 Step 6: Technical Competitive Assessment

A similar approach is used for the technical competitive assessment as described in Step 5, where A is referred to house developer within this area, whereas B and C are referred to house developer's competitors for B's and C's housing areas.

2.7 Step 7: Prioritized Customer Requirements

Prioritized customer requirements contain the items of customer importance, target value, scale-up factor, sales point and absolute weight. House developer through their QFD team makes the customer importance. The teams are assigned to rank each customer requirements using a Likert scale of 1 to 5. Number 1 indicates the least important factor and 5 for the most important factor. For target value, the QFD team needs to decide whether they want to maintain the quality of their housing area or better than the competitors. The target value also uses the scale factor from 1 to 5 (1 for the least important factor and 5 for the most important factor). Scale-up factor is the ratio of the target value of the housing area rating given in the customer competitive assessment. In this case, the housing area rating refers to 'A' for house buyers. Sales point is also known as the market value of the housing area. Here, only three values are used to represent the sales point, which is consistent. They are given 1.5, 1.2 and 1.0 for the highest, moderate and lowest sales point, respectively. Then, the absolute weight of each customer requirement is calculated by multiplying customer importance, scale-up factor and sales point. Then, the rank or priority of each customer requirement can be measured after summing all the absolute weights, where the highest value of the absolute weight means that the customer requirement is the most important priority.

2.8 Step 8: Prioritized Technical Descriptors

Prioritized technical descriptors consist of the degree of technical difficulty, target value, and absolute and relative weight. The degree of technical difficulty and target value for technical descriptors uses a similar approach (with definition and rating scale) as stated in Step 7. The absolute and relative weight for the j^{th} technical descriptors is calculated using Eq. (1) and Eq. (2),

$$a_j = \sum_{i=1}^{n} R_{ij} c_i \tag{1}$$

and

$$b_j = \sum_{i=1}^{n} R_{ij} d_i \tag{2}$$

where a_j is the absolute weights for the technical descriptors (j = 1,…, m), R_{ij} is the weights assigned to the relationship matrix (i = 1,…, n, j = 1,…, m), c_i is the customer importance for the customer requirements (i = 1,…, n), b_j is the relative weights for the technical descriptors (j = 1,…, m) and d_i is the absolute weights for the customer requirements (i = 1,…, n).

Then, the rank or priority of each technical descriptor can be measured after summing all the absolute weights or relative weights, where the highest value of these weights means that the technical descriptors are the most important priority.

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3.0 RESULTS AND DISCUSSION

The design of a bungalow house is the responsibility of the developer and it must be parallel with customer satisfaction. The design must be shown in a standard of quality through drawings and technical specifications [1-3]. However, many complaints are lodged at the Housing Tribunal Court regarding customer dissatisfaction after the 2-year warranty period ends. The major problem from the customer is related to the external and internal structure, housekeeping, safety matters and facilities provided by the developer. In this study, QFD method was used to help a customer and the developer to solve the dissatisfaction before the construction begins.

Table 1 shows the customer requirements for their new house. For external view, they concerned on the painting quality, wall cracks, roof structure, durable main door and properly designed and operational drainage system. Customers also mentioned that their house must be able to be fully utilized in terms of its interior space. In this utilization topic, they agree if their house has sufficient interior space for cabinet, electrical appliances, entertainment system placement and also comes with an alarm system. Safety issue is an important factor for the customer. They also requested guarded system to be implemented in their area for better protection from unknown outsider and finally can minimize any robbery activity. Customer also demanded that their area should have a playground for kids, a place for religious activity, proper main road and a recreation area for family. Regarding these requirements by the customer, it has a different degree of importance. The scale is divided into 1 to 5, in which 1 is the lowest importance, and 5 is the highest importance. Sufficient space for cabinets and entertainment system are scaled by 1, which means this is not the main requirement of the customer to developers.

The developers have their own technical description in order to construct their project. Seven major items have been listed and shown in Table 2. The items are high-tech material that is chosen to construct the project, high-tech access including guarded and gated area, hiring skilful workers to minimize defect, extra space for sufficient requirement for customers, minimize repairing cost after the handover process, reduce cost to increase their profit and last but not least is to shorten the building process to avoid late penalty payment to the customer. According to all these items, time has the highest degree of importance to the developer.

The relationship matrix between customer requirements and technical descriptors is shown in Table 3. Three scales are chosen where five is strong, three is medium and one is weak. The highest rank according to this relationship is for extra interior space and followed by high-tech access, high-tech material, skillful worker, time to develop, cost to build and the lowest is costly to repair. Regarding the previous discussion, the voice of customer shows that sufficient interior space in their house is a priority. It is validated that the developers should build the house with an extra space in the future.

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Table 1: Customer requirements

	Primary	Secondary	Degree of Importance (1 to 5)
Customer Requirements (WHATs)	House building (external view)	Painting	5
		Wall crack	5
		Roofing	3
		Anti-theft door	5
		Drainage system	3
	House building (internal view)	Sufficient space for cabinet	1
		Sufficient space for electrical appliances	3
		Sufficient space for entertainment system	1
		Alarm system	5
	Safety	Guarded system	5
	Facilities	Playground	3
		Place for worship	5
		Main road	5
		Recreation area	3

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Table 2: Technical descriptors

	Primary	Degree of Importance (1 to 5)
Technical Descriptors (HOWs)	High-tech material	2
	High-tech access	2
	Skillful worker	3
	Extra space	1
	Cost to repair	4
	Cost to produce	4
	Time to develop	5

The full HOQ is shown in Table 4. From the table, there are two important data that need to be analysed, which are customer competitive and technical competitive assessments. In customer competitive assessment, the highest target value is the main road issue and the lowest target values are anti-theft door, sufficient space for entertainment system and guarded system. Main road is a priority because it is an access road for house residence. Anti-theft door is a non-priority issue because buyers usually will install a grill. It is shown that sufficient place for entertainment system is the least important because entertainment system is becoming smaller. In the issue of guarded system, the security officer stationed will incur a cost to the house buyer and the developer and because of that, most of the voice of customer agreed it is not a priority issue to them. Guarded system is the lowest scale-up factor in customer competitive assessment because it does not need any improvement in the future. Sales point analysis showed that there are three issues that received the highest ranking, which are painting, wall crack and main road. Low paint quality and wall crack on the external facade are the primary issues. Customers believed that these are the highest priority of their house because the issues will actually affect the shielding capability and its aesthetic function. In the technical competitive assessment, the lowest scaled factors are cost to repair, cost to build and time to build. This is because all of these factors will reduce the profit margin for developers. For target value, the lower scale is for extra space and the highest scale is time to build.

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Table 3: Relationship matrix between customer requirements and technical descriptors

		Technical Descriptors							
	Primary / Primary/Secondary	High-tech material	High-tech access	Skillful worker	Extra space	Cost to repair	Cost to produce	Time to develop	Degree of Importance (1 to 5)
Customer Requirements	House building (external view)								
	• Painting	○		○					5
	• Wall crack	○		○					5
	• Roofing	Δ		○		○			3
	• Anti-theft door	○	○						5
	House building (internal view)								
	• Sufficient space for cabinet				□				1
	• Sufficient space for electrical appliances				Δ				3
	• Sufficient space for entertainment system				Δ				1
	• Alarm system	Δ			○		Δ		5
	Safety								
	• Guarded system		○	○	Δ			○	5
	Facilities								

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	• Playground		Δ		□	□	□	□	3
	• Place for worship		○		Δ		Δ	Δ	5
	• Main road		○		Δ		○	○	5
	• Recreation area		□		Δ			□	3
Score		21	24	20	25	6	12	15	
Rank		3	2	4	1	7	6	5	

Legend

5	○	Strong
3	Δ	Medium
1	□	Weak

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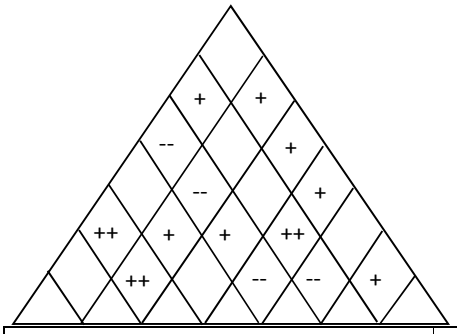
Table 4: The full House of Quality (HOQ)



	Primary / Primary/Secondary	Technical Descriptors: High-tech material	High-tech access	Skillful worker	Extra space	Cost to repair	Cost to produce	Time to develop	Degree of Importance	Customer Competitive Assessment: A	B	C	Importance Customer	Target Value	Scale-up Factor	Sales Point	Absolute Weight
Customer Requirements										A	B	C					
	House building (external view)																
	• Painting	○		○					5	3	3	2	5	3	1.0	1.5	7.5
	• Wall crack	○		○					5	4	4	2	5	4	1.0	1.5	7.5
	• Roofing	Δ		○		○			3	3	3	2	3	3	1.0	1.0	3.0
	• Anti-theft door	○	○						5	1	1	1	5	1	1.0	1.0	5.0
	House building (internal view)																
	• Sufficient space for cabinet				□				1	2	4	2	1	2	1.0	1.0	1.0
	• Sufficient space for electrical appliances				Δ				3	3	3	2	3	3	1.0	1.2	3.6

	• Sufficient space for entertainment system				Δ				1	1	3	1	1	1	1.0	1.0	1.0
	• Alarm system	Δ			○		Δ		5	2	1	1	5	2	1.0	1.0	5.0
	Safety																
	• Guarded system		○	○	Δ			○	5	3	2	1	5	1	0.3	1.2	1.8
	Facilities																
	• Playground		Δ		□	□	□	□	3	3	2	2	3	3	1.0	1.2	3.6
	• Place for worship		○		Δ		Δ	Δ	5	3	2	1	5	3	1.0	1.2	6.0
	• Main road		○		Δ		○	○	5	5	4	3	5	5	1.0	1.5	7.5
	• Recreation area		□		Δ			□	3	2	3	1	3	2	1.0	1.2	3.6

Technical Competitive Assessment	**A**	2	2	3	1	4	4	5
	B	3	3	3	2	4	5	5
	C	1	1	2	1	3	3	5
Degree of Technical Difficulty		5	5	4	5	2	1	1
Target value		2	2	3	1	4	4	5
Absolute Weight and Percent		99	112	90	95	18	58	71
Relative Weight and Percent		124	116	99	101	19	75	72

Legend for interrelation of technical descriptors

Strong Positive	++	+9
Weak Positive	+	+3
Weak Negative	-	-3
Strong negative	--	-9

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Legend for customer needs vs. technical descriptors

5	○	Strong
3	Δ	Medium
1	□	Weak

Legend for current study vs. competitors

5	Highest
4	High
3	Moderate
2	Low
1	Lowest

Legend for sales point

1.5	Highest
1.2	Moderate
1.0	Lowest

Legend for customer and technical competitive assessments

A	Our
B	Competitor 1
C	Competitor 2

4.0 CONCLUSION

QFD is a valuable and important tool that can be used to design the voice of customer. There are four tables produced in this study, and each of them represents each of the cases. Customer competitive assessment and technical competitive assessment are two important analyses to relate the relationship between customer requirements and technical specification. This correlation is a tool that can be improved for future works.

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