

Integration of SERVQUAL Model with Quality Function Deployment to enhance Library's Service Quality

Nantapatr Vorasaiharit¹, and Natcha Thawesaengskulthai²

Abstract—Advance technology and change in student behavior cause dissatisfaction to old style library and service. Hence, there is a need in new library service and infrastructure which the new design require right match to vibrant new student lifestyle. This study is to propose a methodology to capture customer requirements and translate them to technical requirement and propose appropriate solution to the needs using case study at the Engineering Faculty library of Chulalongkorn University. This study integrates SERVQUAL model and Quality Function Deployment (QFD) for this design purpose. Nineteen questions were created in Likert Scale to measure customer expectation and perception. Mean difference between expectation score and perception score were calculated, analyzed and tested their statistically significant at 95% confident interval. From five dimensions of SERVQUAL, there are 3 dimensions that analysis confirms statistically significant. Highest score of mean difference is tangible dimension with mean difference -0.61. The second is Reliability with mean difference -0.22 and the last one is Empathy with -0.14 score. House of Quality is in charge of translating customer requirement to technical requirement as a way to design new library. Attractive qualities obtained from HOQ are (1) online searching and borrowing book or journal program. (2) Increase facilities like plug, Wi-Fi stability and speed. (3) Library has books or journal online reservation program for loan.

Keywords—SERVQUAL, Library service, Quality Function deployment, QFD, House of Quality

I. INTRODUCTION

IN early 1990s, the digital world started to replace the library silently as information provider. Google has developed Google Scholar emphasize menace to existence of building library. However digital world will not take over present libraries but libraries need to change their content, services, restructuring the organizational design and physical layout [1],[2]. The truth is behavior of student has changed. Generation Y students are high achievers, ambitious [3] and multitaskers, doing activities simultaneously plus working time of them may over midnight or later which most libraries have already closed [4]. Changed behavior will leads two major to Thai academic libraries [5]. First is digital environment which become vital part of human life and second is the increasing of competitor which is not only library in other university but learning center or coffee shop also. In order to survive, their service must be improved.

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Above paragraphs point out necessity of adaptation, engineering faculty library of Chulalongkorn University face similar problems as others. Students require many services to support their study and prefer using coffee shop nearby university. Because lacking of library utilities such as seat, plug etc. cause students go to coffer shop more than library and also environment of library unable to attract student to come. Thus question was occurred, How to make library more than a ton of books storage. This research use SERVQUAL model to measure user's satisfaction integrated with Quality Function Deployment to create technical requirement for library improvement.

II. THEORETICAL BACKGROUND

A. Service quality measurement

Service quality framework, "Gap theory model" was developed by Parasuraman et.al. [6] which defined service quality as discrepancy between customer expectation for service and perception of service performance they received [7]. Concept of Gap theory model can be divided into 5 gaps [8] but this research focus on fifth gap, *Expected service-perceived service gap*. More recently, service quality measurement scale with 22 items in 10 dimensions named SERVQUAL has been developed [9]. But finally SERVQUAL was concluded to be 5 dimensions scale [10]; Tangibles, Reliability, Responsiveness, Assurance and Empathy which widely using in present [11]-[17]. Definition of each dimension is explained by table I.

TABLE I
DEFINITION OF SERVQUAL DIMENSION

Dimension	Definition
Tangibles	The appearance of physical facilities, equipment, personnel and communication materials
Reliability	The ability to perform the promised service dependably and accurately
Responsiveness	The willingness to help customers and to provide prompt service
Assurance	The knowledge and courtesy of employees and their ability to convey trust and confidence
Empathy	The provision of caring, individualized attention to customers

B. Quality Function Deployment

Quality Function Deployment (QFD) was developed in

Japan by Yoji Akao in 1966 [18]. After widespread in Japan, USA company took an interest in QFD and apply to USA business. QFD is an overall concept that provides a means of translating customer requirements into the appropriate technical requirements [19]. It is customer oriented approach for product development and support design process [20] by using customer needs, design requirements, target value, and competitive assessment [21] which widely applies to both manufacturing and service industries. In conclusion, we can say QFD is a systematic process for concentrate on customer needs [22].

One of QFD element is House of Quality (HOQ) which using planning matrix to relate customer needs to the method that leads to meet that needs [23]. Traditionally the customer needs, or “Voice of Customers (VOC)”, are translated into quality characteristic correspondingly [24]. Figure 1 shows compositions of HOQ. The left room, “What” express customer needs and needs are translated into conformable “Hows” in the upper room below the “Roof”. “Roof” display positive or negative relation of each “How” to other “How”. After both “Hows” and “Whats” have been completely specified, next is to fill up correlation matrix in the middle room which display how much each “How” affect each “What”. Finally priorities have been made for “Hows” at the bottom and for “Whats” on the right.

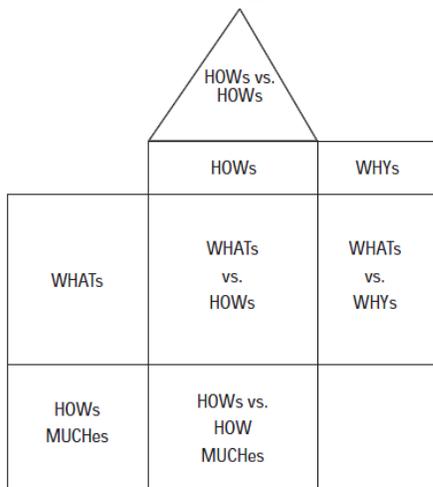


Fig. 1 The house of quality [25]

C. Integration of SERVQUAL, QFD and Flower of Service

House of Quality is commonly used matrix in Quality Function Deployment methodology [26]. Key to conduct HOQ is filling up left room or customer requirements (Whats) and upper room or design requirement (Hows) which many researchers frequently use others tools to define “Whats” and “How” [27],[28]. This research conducted SERVQUAL questionnaire to specify customer requirements and Flower of Service [29] to specify design requirements. Figure 2 showed

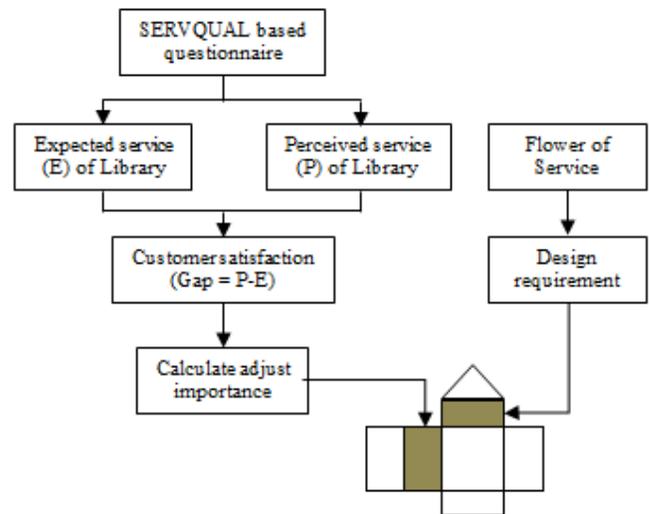


Fig. 2 Integration of SERVQUAL, QFD and Flower of Service framework

III. METHODOLOGY

Methodology of this research is an integration of SERVQUAL model, Quality Function Deployment and Flower of Service concept for finding out customer requirements to improve library service quality. Figure 3 demonstrate process of this research since questionnaire design, collecting information, conduct House of Quality and information analysis till the result come out.

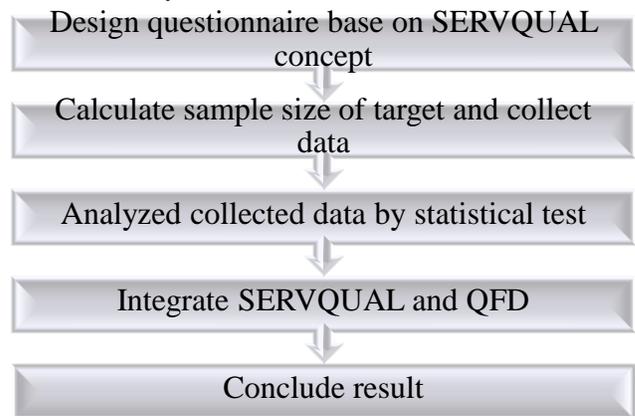


Fig. 3 Process steps for identifying library service quality

Questionnaire design base on SERVQUAL concept

Firstly, we need to conduct questionnaire for collecting data of library customer. SERVQUAL concept was used in conducting questionnaire to analyze customer satisfaction base on customer expectation and perception. 19 questions were created in 5 dimension of SERVQUAL model in 5 points Likert scale [30] together with screening questions to avoid bias data from people who not experienced in library service. After questionnaire was created as exhibit in Table II, it was examined by 3 specialists in library service to validate questionnaire before execution. Result of validation is IOC score of each questions are over 0.5, thus questionnaire is capable to execute.

TABLE II
SERVQUAL BASED QUESTIONNAIRE

SERVQUAL dimension	Code	Question detail
Tangible	T1	Library has sufficient seats and tables
	T2	Library has extensive books and journal for research
	T3	Library has up-to-date information exploring system
	T4	Library has sufficient information exploring equipments
	T5	Library information exploring equipments are in good condition
	T6	Library has tranquil environment
	T7	Library has sufficient facilities ex. Plug, iPad, Internet
	T8	Library has sufficient study room
Reliability	RE9	Books borrow-return is fast and accurate
	RE10	Books and journals arrange for convenient searching
	RE11	Library website provide useful information and well functioning
	RE12	Librarian provide fast and accurate information
Responsiveness	RES13	Librarian provide prompt service to customers
	RES14	Librarian always willing to help customers
Assurance	A15	Customers trust librarians
	A16	Librarians are courteous to customers
	A17	Librarians have knowledge to answer question
Empathy	E18	Librarians understand specific need of customers
	E19	Librarians keep students' interest at heart

Statistical data analysis

After collecting data, service quality was measure by customer perception score and expectation score from 19 questions in 5 dimensions though following formula:

Service quality = Perception score (P) – Expectation score (E)

When result is negative indicates customer has expectation in service more than he/she perceived or library services cannot meet customer expectation means customer is unsatisfied. In opposition, positive result indicates library services meet customer expectation or customer received service better than he/she expected. Mean of expectation score of each question in each customer were calculated. Then 19 questions mean scores were classified by SERVQUAL dimension and calculate mean again into 5 grand means. This 5 grand means represent expectation score of dimensions. Repeat process again for perception score result in 5 grand means that represent perception score of dimensions and conduct comparison by radar chart as Figure 5: Statistical pair t-test was conducted with 95% confident level to make certain of service quality in of each dimension is significantly different. Input data to Minitab program to test each dimension perception versus expectation score.

IV. RESULT AND DISCUSSION

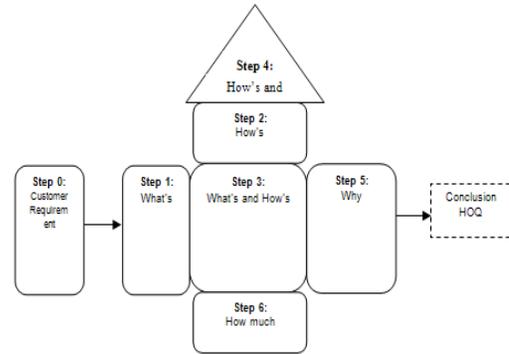


Fig. 3 Steps to Create the House of Quality[31]

Step 0: Customer Requirement

The process of Quality Function Deployment with 6 total Steps is shown in Figure 6. First step of QFD is to identify customer need or voice of customer. SERVQUAL based questionnaire was design to collect customer data Nineteen questions were created in fives dimension of SERVQUAL model in 5 points Likert scale together with screening questions to avoid bias data from people who not experienced in library service Then questionnaire was examined by 3 specialists in library service to validate questionnaire before execution. Result of validation is IOC score of each questions are over 0.5, thus questionnaire is capable to execute.

Target group of this research is people in Chulalongkorn University engineering faculty; total 5,783 people. Simplified formula for proportions method [32],[33] was used to calculate sample size as formula below:

$$n = \frac{N}{1 + Ne^2}$$

N refers to population size, *n* refers to sample size and *e* refers to acceptable sampling error which 95% confident level are assumed. Thus; $n = \frac{5783}{1+5783(0.05^2)} \approx 375$. Then 375 customers random sampling was used to collect data.

Step 1: What's

Customer requirement obtained from SERVQUAL based questionnaire. Nineteen questions became “What’s” of House of Quality.

Then service quality expectations (SQE) were calculated by geometric mean method [34]. In case of Self state importance, all are filled by constant 1.00 to avoid bias on self evaluation. Adjust importance can be calculated as formula below:

Adjust importance = SQE * Self State Importance

Step 2:How's

Flower of Service concept which consists of core service and eight supplementary services (Information, Payment, Billing, Order-Taking, Consultation, Exception, Safekeeping and Hospitality) were used to create design requirements.

Each design requirement was specified improvement direction for developing by using symbols as below

-  = Objective is to maximize
-  = Objective is to hit target
-  = Objective is to minimize

TABLE III
FLOWER OF SERVICE AND DESIGN REQUIREMENTS

Service	Design requirements
Core service	Decrease books storage area, increase seating area
	Provide books and journal cover engineering science
	Separate noisy zone and quiet zone
	Increase facilities like plug, Wi-Fi stability and speed
Information	Install LCD screen TV providing information
	Add online channel for inquiring information
	Online searching and borrowing book or journal program
	Book or journal reviewing service
Order taking	Library has study room online reservation program/application
	Library has books or journal online reservation program for loan
Billing	Pay penalty by money top-up card
Payment	
Consultation	Library has specialist for giving information in doing research
Hospitality	Library has snack bar.
	Library has iPad for loan
	Increase CCTV security
Safekeeping	Library has locker for customer possession deposit
Exception	-

Step 3: What's and How's

Correlations between customer requirements and design requirements were determined. Relationships were represent by number as below:

- "1" = weak relation,
- "3" = moderate relation,
- "9" = strong relation
- Blank = no relationship between them

Step 4: How's and How's

At the roof top of HOQ is correlations between each design requirement which show how one design requirement effect to others. Correlations are presented by symbols as follow:

-  = very positive relationship
-  = positive relationship
-  = negative relationship
-  = very negative relationship
- Blank = no relationship

Step 5: Why

On the right-hand side of the House of Quality is used for strategic planning because it contains information about the

survey of customers' opinions between the product / service of competitors and ours. In case of engineering library of Chulalongkorn University, our competitors are Faculty of Political Science, Chulalongkorn University, Thailand and Thailand Knowledge Park (TK Park). Method of benchmarking is using SERVQUAL questionnaire 50 sets to collect data of two competitors. Average perception score of each question of our library, Political Science library and TK Park. Conduct both competitors average perception score divide by our library perception score become of comparison ratio that present how much different between our perceived service and competitors. Table 6 displays perception of our and competitor, include the ratios.

TABLE V
ADJUST IMPORTANCE

Code	Customer requirement	Serf state important	SQE	Adjust importance
T1	Library has sufficient seats and tables	1.00	1.14	1.14
T2	Library has extensive books and journal for research	1.00	1.13	1.13
T3	Library has up-to-date information exploring system	1.00	1.23	1.23
T4	Library has sufficient information exploring equipments	1.00	1.18	1.18
T5	Library information exploring equipments are in good condition	1.00	1.16	1.16
T6	Library has tranquil environment	1.00	1.35	1.35
T7	Library has sufficient facilities ex. Plug, iPad, Internet	1.00	1.20	1.20
T8	Library has sufficient study room	1.00	1.22	1.22
RE9	Books borrow-return is fast and accurate	1.00	1.04	1.04
RE10	Books and journals arrange for convenient searching	1.00	1.07	1.07
RE11	Library website provide useful information and well functioning	1.00	1.10	1.10
RE12	Librarian provide fast and accurate information	1.00	1.04	1.04
E18	Librarians understand specific need of customers	1.00	1.04	1.04
E19	Librarians keep students' interest at heart	1.00	1.05	1.05

TABLE VI
COMPETITORS PERCEPTION SCORE AND COMPARISON RATIO

Customer requirement		Our library Perception score	Political Science library perception score	TK Park perception score	Political Science library ratio	TK Park perception ratio
Tangible	Library has sufficient seats and tables	3.67	3.53	3.14	0.96	0.86
	Library has extensive books and journal for research	3.48	3.94	3.65	1.13	1.05
	Library has up-to-date information exploring system	3.16	3.68	3.69	1.17	1.17
	Library has sufficient information exploring equipments	3.29	3.66	3.50	1.11	1.06
	Library information exploring equipments are in good condition	3.43	3.80	3.63	1.11	1.06
	Library has tranquil environment	3.09	2.78	3.57	0.90	1.15
	Library has sufficient facilities ex. Plug, iPad, Internet	3.46	3.38	3.54	0.98	1.02
	Library has sufficient study room	3.39	2.70	3.18	0.80	0.94
Reliability	Books borrow-return is fast and accurate	3.82	4.13	3.89	1.08	1.02
	Books and journals arrange for convenient searching	3.70	4.09	3.69	1.11	1.00
	Library website provide useful information and well functioning	3.42	4.03	3.74	1.18	1.09
	Librarian provide fast and accurate information	3.77	4.06	3.61	1.08	0.96
Empathy	Librarians understand specific need of customers	3.88	3.99	3.46	1.03	0.89
	Librarians keep students' interest at heart	3.87	4.00	3.56	1.03	0.92

Step 6: How much

At the bottom of the House of Quality is used in addressing absolute weight and relative weight of each design requirement by calculated from correlation matrix which was created in step 3. Calculating formulas are as below:

$$\text{Absolute weight} = \sum(\text{Interrelationship} * \text{adjust importance})$$

$$\text{Relative weight} = \frac{\text{Absolute Weight}}{\sum \text{Absolute Weight}} * 100$$

V. CONCLUSION

Result of SERVQUAL based surveys method together with statistical test showed most 3 dimensions that have biggest gap were Tangible, Reliability and Empathy. Integration of SERVQUAL, QFD and Flower of service provide design

requirements that response to customer requirements. Attractive design requirement are (1) online searching and borrowing book or journal program. (2) Increase facilities like plug, Wi-Fi stability and speed. (3) Library has books or journal online reservation program for loan.

The integration approach provides value that using each method alone cannot afford appropriate outcome. Customers gain advantage from this research as library understands requirement directly from customer and provide guidance for future research how to obtain and design what customers want. Furthermore, valid conducting in design process by integrating other tools will be road map to other research.

For further research, focusing on external customer like other university student or working people might bring out different customer requirements. Wider target group enhance library into international or global learning center.

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