ANALYZING THE INFLUENCE OF DESIGN QUALITY ON CUSTOMER SATISFACTION IN THE ELECTRICAL POWER EPC PROJECTS IN THAILAND

Huiqiang Chen[*]
Bhumiphat Gilitwala[**]

ABSTRACT

Purpose- *The contribution of design is regarded as one of the most crucial factors in the construction business. However, there remains ambiguity about how the design quality influences the customer satisfaction of the EPC project. This research study attempts to investigate the influence of design quality on customer satisfaction through the performance of the engineering team in the 5 sections in terms of the following areas: problem definition, solution validation, communication, decision-making, and professional analysis. Improving design quality and customer satisfaction has received considerable attention in recent years. This study examines EPC projects in terms of design quality and customer satisfaction.*

Design/Methodology/Approach – *A sample of 218 employees of Company T with a tenure of more than 1 year in Bangkok, Thailand responded to the offline questionnaire survey. A simple linear regression analysis was used in the data analysis.*

Findings – *All the hypotheses were statistically supported. The result of this study suggests that design quality is a key factor in improving customer satisfaction.*

Practical Implications – *Results of this research indicate that the need for contractors to improve performance relates mostly to design quality. For an EPC contractor, the main benefit of high customer satisfaction is the opportunity to remain a customer's potential partner in the future.*

Keywords: *Physiotherapeutic Rehabilitation, Cubital Tunnel Syndrome, Post Operative Cubital Tunnel Syndrome.*

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Introduction

Construction is a multi-faceted and highly organised operation, consisting of many tasks focused solely and in conjunction with the singular purpose of constructing a building or structure (Martens & Carvalho, 2017).The construction industry represents a significant percentage of many countries' gross domestic product (GDP). According to the World Bank, developing countries are responsible for approximately 6–9% of the GDP (Kenny, 2007) (Lopes, Oliveira, & Abreu, 2017). Construction increased by 3.0% in Thailand in the 1st Quarter of 2019 (NESDC, 2019).The construction market in Thailand is expected to maintain its growth prospects in the next few years, helped primarily by major public sector infrastructure projects. We believe that private-sector construction work will also increase, helped by the expansion of public infrastructure projects and a recovery in residential property activity. (2019, Bangkok Post).Therefore, the success of the construction industry often leads to the promotion and maintenance of long-term economic growth and stability. In recent years, multiple attempts have been made to improve construction project productivity and success rates, which frequently represent the fundamental principles for the successful implementation of project management and optimization. The construction projects' success is the main foundation of management and control

[*] Student, MBA, Assumption University of Thailand.
[**] PhD, Director, S-MBA, GS-BATM, Assumption University of Thailand.

procedures for the current project and detailed planning for future projects (Zavadskas & Vainiunas, 2012).Construction projects generally involve complex and fragmented multi-tasks that are carried out by several professionals and non-professionals within the Project Life Cycle (PLC), which includes engineering, procurement, and construction (EPC) phases. Construction projects comprise building and infrastructure projects and need accurate coordination to achieve project success. Accordingly, the construction industry is often confronted with dilemmas in its processes that cause poor performance. As such, the construction industry is left embattled by the resulting flow-on effects of low efficiency and productivity (Olanrewaju & Abdul-Aziz, 2015).

The successful implementation of construction projects in the competitive construction market plays a significant role in the company's success. Meanwhile, construction companies that are able to manage their resources (material, human, financial, equipment, and time) achieve high performance efficiency. Construction projects are complex with regard to the variety of work, budget, duration, and the number of parties involved (Zavadskas & Vilutiene, 2014).Customer satisfaction is an important factor in the development of the construction phases and customer relationships. As construction companies face increasing competition, greater attention continues to be placed on customer relationships and satisfied customers. Customer satisfaction enables construction companies to differentiate themselves from their competitors and create sustainable advantages. Many authors propose the importance of customer satisfaction and its use for evaluating quality from the perspective of customers (Torbica& Stroh, 2001).

Review of Literature

Design Quality

A general definition of design quality as a match between product characteristics and customer needs can be specified by invoking the concept of a zone of tolerance in customer expectations (Zeithaml and Bitner, 2003). A tolerance zone is the distance between desired and adequate levels of expectations. A desired level of expectations stands for the maximum level of customers' expectations, while an adequate level reflects the minimum level of quality that is acceptable to customers. The design quality is the highest when there is no discrepancy between values in product specifications and corresponding values in a product's tolerance zone. The specification also represents a "zone", or a range between upper and lower specification limits; a target, or nominal value, usually lies in the middle. It is logical to assert that specification limits should be in accordance with an adequate level of expectations, whereas nominal value should be close to the desired level of expectations. A misfit between expectations and specifications can take several forms.

Problem Definition

For defining a problem, this implies that it is not sufficient to describe the existing state. Therefore, we speak consciously of the situation that someone is or is not satisfied with. As a result, a situation description is a state description plus the relevant causal model(s), including the assumed patterns of behaviour of the people and organizations involved. A situation is only a problem if the problem-owner wants to do something about it. This implies that a situation must be conceivable that is more desirable than the present one: the goal situation. The existing situation, however, can also be formulated in such a manner that a problem does arise. (Boeijen, 2010).

Solution Validation

The knowledge area includes content on evaluating whether the value is being delivered by a solution and discusses the business analyst's role in assessing what is hindering an organization from receiving full value from a solution. (IIBA, 2015).

Communication

The word "communication" comes from the Latin word "communis," which means "common" (Broni, Velezas, & Mamalis, 2010).Thus, "to communicate" means "to make common" or "to make known", "to share" and includes verbal, non-verbal, and electronic means of human interaction. Scholars who study communication analyse the development of communication skills in humans and theories about how communication can be made more effective.

Decision Making

Decision-making is the study of identifying and choosing alternatives based on the values and preferences of the decision maker. Making a decision implies that there are alternative choices to be considered, and in such a case, we want not only to identify as many of these alternatives as possible but to choose the one that best fits with our goals, objectives, desires, values, and so on. (Harris, 1998)

Professional Analysis

This form of analysis is normally conducted by large-scale institutional or professional evaluation systems. The analysis of professionals is carried out within a team or among professionals, including appropriate tool selection, tool proficiency, parameter identification, system modeling, sensitivity analysis, estimating, experimenting, optimization.

Customer Satisfaction

Customer satisfaction has long been recognized in marketing thought and practice as a central concept as well as an important goal of all business activities (Anderson, E. C., 1994). In fact, there are at least two different conceptualizations of customer satisfaction: one is transaction-specific and the other is cumulative. Transaction-specific satisfaction provides specific diagnostic information about a particular product or service encounter (Lam, 2004). In contrast, cumulative customer satisfaction is an overall evaluation based on the total purchase and consumption experiences with a product or service over time (Anderson, E. C., 1994). High customer satisfaction has many advantages for the firm, including increased loyalty for current suppliers, reduced price elasticities, insulation of current suppliers from competitive efforts, lower costs of future transactions, lower failure costs, lower costs of attracting new customers, and an improved reputation (Anderson, Fornell, & Lehmann, 1994).Moreover, it is believed that customer satisfaction is a good, if not the best, indicator of a firm's future profits (Chan, 2003).

Predictor

From the conceptual framework, there are a total of five hypotheses that the researcher would like to analyze.
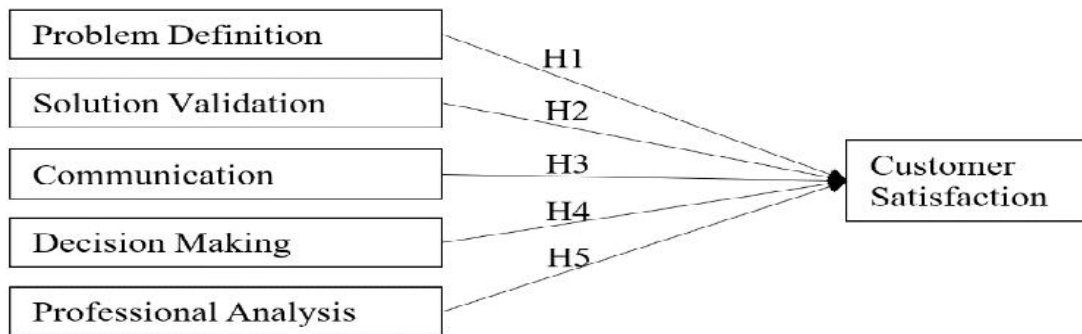

Figure 1: Conceptual Framework of Influence of Design Quality on Customer Satisfaction

H_1:   Design quality in term of Problem Definition does have a statistically significant influence on the Customer Satisfaction.

H_2:   Design quality in term of Solution Validation does have a statistically significant influence on the Customer Satisfaction.

H_3:   Design quality in term of Communication does have a statistically significant influence on the Customer Satisfaction.

H_4:   Design quality in term of Decision Making does have a statistically significant influence on the Customer Satisfaction.

H_5:   Design quality in term of Professional Analysis does have a statistically significant influence on the Customer Satisfaction.

Method

Sample

Using a 100% sampling survey among all employees in the engineering department, questionnaires were distributed from July 21, 2019 to July 29, 2019 to 218 employees of Company T. The researcher received 216 surveys on the deadline date, which is an initial survey response rate of 99%. After screening through the survey, the sample size dropped to 210 employees, for a final response rate of 96%, which satisfied the questionnaire requirement of employees with at least one year of working experience. The number of samples was found to be satisfactory to proceed with the descriptive and inferential analysis due to the actual situation. The summary analysis of the demographic factors using frequency and percentage is shown below.

Table 1: Summary of Demographic Factors Analysis

	Demographic Factors	Variables	Frequency	Percentage
1	Gender	Male	154	73.3
2	Material Status	Single	133	63.3
3	Age	31-40	97	46.2
4	Years of working	3-4 years	89	42.4
5	Monthly income	THB50,001-75,000	110	52.4
6	Education level	Bachelor's Degree and higher	101	48.1
7	Job Related	Electrical	104	49.5
8	Engineer level	Professional Engineer	85	40.5

According to the results of the demographic factor analysis, it was found that the majority of the sample size was male (73.3%), aged 31 to 40 (46.2%), had a monthly income of 50,001 to 75,000 THB (52.4%), had a Bachelor's Degree or higher (48.1%), had an electrical job related (49.5%), and professional engineer (40.5%).

Measure

The questionnaire consisted of 37 questions, which were separated into 8 categories. This part is intended to be used to screen out unqualified respondents who have less than a year of experience working by having respondents answer the question "Have you worked in engineering work for more than one year?" If the respondent answers yes, the respondents will continue to answer the next part. If the answer is no, the respondents will stop answering the survey and return the questionnaire. The 5 Point Likert Scale was used to measure the following 5 categories: problem definition, solution validation, communication, decision-making, professional analysis, and customer satisfaction, all of which were found to be reliable (> 0.6).

Table 2: Independent and Dependent Variable Scale, Reliability and Source Summary

Part	Question Category	Questions	Scale Used	α
1	Screening Question	1	Simple Category	-
2	Problem Definition	5	Likert Scale	0.677
3	Solution Validation	5	Likert Scale	0.637
4	Communication	5	Likert Scale	0.605
5	Decision Making	5	Likert Scale	0.618
6	Professional Analysis	5	Likert Scale	0.648
7	Customer Satisfaction	3	Likert Scale	0.658
8	Demographic Factors	8	Category Scale	0.883
Total # of Questions		**37**		

Result

Five hypotheses were developed based on the research objectives in order to study the conceptual framework and the testing variables and their relationships. The results of the study indicated that all of the null hypotheses were rejected as the significant value of each was found to be less than 0.05 at a confidence level of 95 percent. It was found that all of these variables were considered to have a relationship with each other. The results are concluded as follows:

Table 3: Summary of Hypothesis Testing through Simple Linear Regression

		Null Hypothesis	Significant Level	Result	Beta	Prediction
H1$_o$		Design quality in term of problem definition does not have a statistically significant influence on customer Satisfaction.	0.000	Rejected	0.627	Supported
H2$_o$		Design quality in term of solution validation does not have a statistically significant influence on customer Satisfaction.	0.000	Rejected	0.670	Supported
H3$_o$		Design quality in term of communication does not have a statistically significant influence on customer Satisfaction.	0.000	Rejected	0.580	Supported
H4$_o$		Design quality in term of decision making does not have a statistically significant influence on customer Satisfaction.	0.000	Rejected	0.595	Supported
H5$_o$		Design quality in term of professional analysis does not have a statistically significant influence on customer Satisfaction.	0.000	Rejected	0.658	Supported

Based on the inferential analysis, it was found that five hypotheses had positive betas, showing there is a positive influence on the dependent variable when the independent variable increases, with beta ranging from 0.580 to 0.670.

Discussion

The researcher studied the influence of design quality through problem definition, solution validation, communication, decision making, and professional analysis on customer satisfaction, which affects the organization. Data was collected in July 2021 from Company T, an enterprise of the Thai government located in Bangkok, Thailand.

Hypothesis

Hypothesis 1 (H$_1$)

The inferential analysis results showed that design quality in terms of problem definition does have a statistically significant influence on customer satisfaction. The beta was calculated to be 0.627, signifying a positive influence on customer satisfaction. This is supported by previous studies, which state that customer needs can be defined as the problems that customers intend to solve with the purchase of a good or service. Understanding the customer's situation and needs together with the right offering of products leads to high customer satisfaction and, in turn, a better running business (Ramees & Safeena, 2016).

Hypothesis 2 (H$_2$)

The inferential analysis results showed that design quality in terms of solution validation does have a statistically significant influence on customer satisfaction. The beta was calculated to be 0.670, signifying a positive influence on customer satisfaction. This is supported by previous studies, which state that design solutions are then analyzed, and the best design solution is then selected in the scheme design phase. The solution is then worked out in detail in technical and functional terms to satisfy the client requirements during the detailed design phase (Tatsiana & Saad, 2010).

Hypothesis 3 (H$_3$)

The inferential analysis results showed that design quality in terms of communication does have a statistically significant influence on customer satisfaction. The beta was calculated to be 0.580,

signifying a positive influence on customer satisfaction. This is supported by previous studies, which state that communication can have a major impact not only on the customer's satisfaction, but also on the employees' satisfaction, and that it contributes to the stability and sustainability of the corporation (Mariana & Ramona, 2013). (Pickton and Broderick, 2001) concluded that communication influences the satisfaction levels of the consumer in a significant manner.

Hypothesis 4 (H₄)

The inferential analysis results showed that design quality in terms of decision-making does have a statistically significant influence on customer satisfaction. The beta was calculated to be 0.595, signifying a positive influence on customer satisfaction. This is supported by previous studies, which state that the decision-making process is critical to the success of any construction project. Construction personnel have to make decisions on a daily basis and must be able to justify these decisions. Wrong decisions can be costly in terms of time, quality, cost, and influence (Poon & Price, 1999).

Hypothesis 5 (H₅)

The inferential analysis results showed that design quality in terms of professional analysis does have a statistically significant influence on customer satisfaction. The beta was calculated to be 0.658, signifying a positive influence on customer satisfaction. This is supported by previous studies, which state that the lack of necessary competences through the rushed and early implementation of new technologies leads to the disruption of work processes, additional costs, a reduction in quality and, thereby, customer dissatisfaction (Martin Kröll, 1997).

Managerial Implications

The inferential data analysis supports the conceptual framework showing that design quality has a large positive influence on customer satisfaction. Effective leaders should focus on problem definition and solution validation, which will cascade into an improvement in customer satisfaction. Both on problem definition and solution validation were found to have similar beta (0.627 & 0.670), which shows that both were equally important in improving customer satisfaction, which is supported by Hypothesis # 1 and # 2. That means the designers of SINOHYDRO at the engineer level of apprentice designer could not define the problems well based on the needs of the customer, further affecting the solution validation as a matter of course. A contract seminar should be arranged between Company T and SINOHYDRO for the purpose of clarifying the uncertainties and ambiguities. Based on the situation that the designer cannot define the problems well according to the bidding documents, professional designers and contract managers should be involved in the seminar. Then, effective leaders should concentrate on professional analysis, which was found to have the greatest influence (0.658) on customer satisfaction than design quality factors, as supported by Hypothesis # 5.

The training programmes should be developed by SINOHYDRO in order to prepare designers to gain these skills or learn about these tools in order to upgrade the engineers to a higher level of engineering.

Limitations and Directions for Future Study

This study focused only on those employees of Company T who had at least one year of tenure. Thus, the study can be expanded to other companies within Thailand and other countries while varying the demographics of the sample size. Two elements of quality structure—design quality and conformance quality—are recognized and described in the literature (Sinha & Willborn, 1985). Quality of design is defined as a fit between a product's (or service's) design and customer needs; quality of conformance is defined as a fit between the attributes of an actual product and its specification. In order to satisfy customers, quality should be high in both dimensions. At the same time, these quality dimensions have not been analyzed systematically so far. This study focused on design quality only. Further study should continue on conformance quality.

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