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An Integrated Fuzzy Weighted SERVQUAL - QFD Approach for Service Quality Improvement

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Abstract— Service quality is an essential aspect of any service provider. The role of service quality becomes critical in the success of any organization. Nowadays, with the increased competition, service quality has become a popular area of academic research. In order to measure and improve service quality, it is important to use a reliable instrument. In this paper, an integrated approach (Fuzzy Weighted SERVQUAL - QFD) is proposed to help the organization to measure service quality and guide to development of innovative service through identification of weak attribute which are critical to customers. The proposed methodology is documented with practical case and obtained outcomes are reported

Keywords—Service quality, fuzzy, SERVQUAL, quality function deployment.

I. Introduction

Service quality is a concept that has aroused considerable interest and debate in the research literature due to the difficulties in defining and measuring it, with no consensus emerging on either [vi]. It is also evident that high service quality contributes significantly to profitability. Service quality is about ensuring customers, both internal and external, to get what they want. Hence satisfaction and service quality are often treated together as functions of customer's perceptions and expectations. Always there exists an important question: why should service quality be measured? Measurement allows for comparison before and after changes, for the location of quality related problems and for the establishment of clear standards for service delivery. In search of competitive advantage, both practitioners and academics are keen on accurately measuring service quality in order to better understanding its essential antecedent and consequences, and ultimately establish methods for improving and measuring service quality [xviii].

Measurement of service quality is difficult due to intangible nature of service. SERVQUAL and SERVPERF are widely used to measure the service quality of the service sector. SERVQUAL model, proposed by Parasuraman et al [xiii] measures the gap between customer perception and customer expectation. When perceived or experienced service is less than the expected, less satisfactory service level is achieved. Measuring the performance gap between perceived and expected service, the model is known as gap model in service quality. SERVPERF methodology was proposed by Taylor et al [ii], who discarded the expectation (E) component of SERVQUAL and instead performance (P) component alone be used. Hence SERVPERF method is used to measure the current performance of the service sector. But in case of service quality improvement the service provider must know about the expectations of customers, and hence SERVQUAL method is most suited in such service quality improvement process.

Individual usage of service quality methodologies has its own drawbacks and that difficulties can be minimized by using integrated approaches [xxv]. Several integrated approaches in service quality are available in the literature [vii, xvi]. The integrated model on service quality provides the information to management regarding the customer expectations and the quality of service.

This paper aims to integrate fuzzy weighted SERVQUAL method with QFD model. It also tries to apply this method to an automobile service centre, since service quality in the motor vehicle industry is a largely unknown factor [xiv].

II. Methodology

The proposed integrated approach in service quality improvement is shown in Figure 1. In this approach, fuzzy weighted SERVQUAL method is used to evaluate the basic service quality attributes and QFD is used to transform customer requirements into technical requirements.

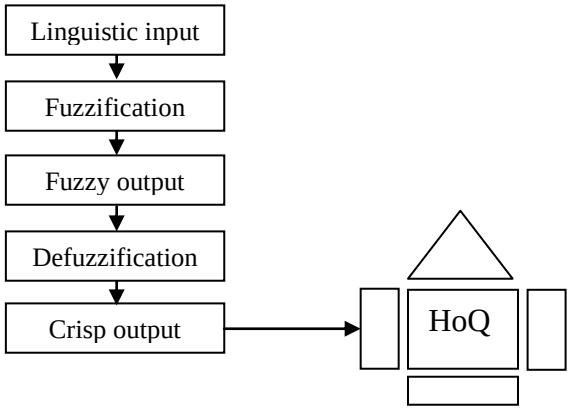

Figure 1 Fuzzy Weighted SERVQUAL – QFD Approach

Human judgments and preferences are often vague and cannot estimate with an exact numerical value. Since subjective evaluation data can be more adequately expressed in linguistic variables [i] making the fuzzy set theory a useful tool for measuring customer's perception and expectation. In this proposed model triangular fuzzy numbers are used to convert the linguistic inputs to fuzzy outputs and graded mean integration representation [i, vii xi, xxiii] is used as a defuzzifier to transform the fuzzy outputs to crisp outputs.

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Quality function deployment (QFD) is used for mapping the identified customer needs in to technical requirements. It uses a matrix format to capture a number of issues that are vital to the planning process. The house of quality matrix is the most recognized and widely used form of this method. There are many different forms of the house of quality, but its ability to be adapted to the requirements of a particular problem makes it a very strong and reliable system to use [iv]. In this study, the house of quality matrix incorporates customer requirements, technical requirements, interrelationship matrix and technical priorities, benchmarks & targets section.

III. Data Collection

The firm selected for the documentation purpose is an automobile service centre. The data are collected with the help of a structured questionnaire. Questionnaire design is based on the pervious literature. The questionnaire is designed using five dimensions (tangibles, reliability, responsiveness, assurance, empathy) of service quality. Questionnaire contains 12 questions aiming at reducing the size and then improving the response rate [xviii]. The fuzzy weighted SERVQUAL questionnaire addressing expectations and perceptions are rated using the linguistic variables scale. For example, the linguistic variables for customer's expectations and perceptions include "very poor", "poor", "fair", "good" and "very good". The linguistic variables for importance weight of evaluation criteria include "least important", "less important", "fairly important", "important" and "critical" [i]. Prior to the major survey, a pilot survey of 20 numbers was carried out. The aim of the pilot study is to test the wording of questionnaire, identify the ambiguous questions, and test the intended technique for data collection and the effectiveness of the potential response. The reliability analysis on these data was conducted and the Cranach's alpha value is 0.797 which is an acceptable level [xvi, xxi, xxiv]. The sample size determined for this study is calculated as 92 and is justifiable [ix].

VI. Results and Discussion

Service quality has been measured by using fuzzy weighted SERVQUAL scale having twelve items of service quality. The data collected as linguistic variables are converted in to fuzzy numbers by fuzzification. The average service perception, expectation and gap between perception and expectation of all items of service quality are calculated by fuzzy arithmetic operation on triangular fuzzy numbers. Fuzzy weighted service quality gap between perception and expectation of all service quality items is calculated by fuzzy multiplication operation of fuzzy gap and fuzzy weight. The obtained result are shown in Table 1.

Negative value on service quality item gap indicates the dissatisfaction level, higher the negative value higher the dissatisfaction level. The customer requirements are prioritized according to their weighted gap percentage and seven service quality items were selected as the specific customer needs by Pareto analysis.

The technical requirements for these seven service quality items were found out by the QFD team. The defined technical requirements are then evaluated to identify the prioritized technical requirements. The obtained results are reported in Table II.

Table I : Fuzzy Weighted Gap

	Fuzzy gap	Weighted gap
Tangiables	**(-3.46, -1.58, 0.30)**	-6.31
Modern physical Facilities	(-3.66, -1.77, 0.103)	-7.58
Neat and clean customer waiting area	(-3.40, -1.50, 0.396)	-5.83
Enough number of staff	(-3.33, -1.46, 0.40)	-5.59
Reliability	**(-3.15, -1.29, 0.5)**	-5.57
Making vehicle delivery at promised	(-3.36, -1.47, 0.42)	-6.23
Error free vehicle servicing	(-3.15, -1.28, 0.58)	-5.48
Error free billing	(-2.95, -1.12, 0.69)	-4.96
Responsiveness	**(-3.15, -1.25, 0.65)**	-4.98
Providing fast services	(-3.46, -1.15, 0.32)	-6.03
Willing to help you throughout	(-2.83, -0.929, 0.98)	-3.84
Assurance	**(-2.43, -0.54, 1.35)**	-2.15
Polite behavior of staff	(-2.45, -0.56, 1.32)	-2.14
Staff knowledge to answer your	(-2.48, -0.51, 1.39)	-2.14
Empathy	**(-2.24, -0.36, 1.51)**	-1.48
Convenient operating time	(-2.47, -0.56, 1.34	-2.31
Giving maintenance tips	(-2.009, -0.16, 1.68)	-0.65

Table II : Technical Importance Level

Technical requirements	Technical importance level	Technical importance
Vehicle status display board	183.8	5.57
Workshop status monitoring	211	6.38
Cost and time estimation for service	154	4.64
Availability of spares	**347**	**10.5**
In house training programs	200.7	6.069
Basic, advanced and special diagnostic courses conducted	168.4	5.093
Basic, advanced soft skill training program	160	4.83
Monthly in house test	50.05	1.513
Customer on time feed back	79.86	2.41

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Implementation of modern tools and equipments	**601.27**	**18.18**
Skilled labor recruitments	**317.65**	**9.605**
Monthly seminar on modern automotive technologies	170.44	5.15
Supervisory development programs	121.3	3.66
Internet facilities on customer waiting area	290.4	8.78
Road test to customers with staff after servicing	161.58	4.8
Periodic performance of workers and appraisals	89.96	2.72

The implementation of modern tools and equipments, availability of spares and skilled labor recruitments are identified as the most important technical requirements in the automobile service centre. Once the technical requirements are clearly understood the service providers will anticipate with those customer requirements.

V. Conclusion

Quality becomes the crucial factor to the success of any organization. Attention to service quality can lead an organization different from other organizations and gain a lasting competitive advantage. Therefore it is important to use an effective approach to improve the service quality. The present work makes an attempt to integrate service quality evaluation tool (fuzzy weighted SERVQUAL model) and service quality improvement tool (QFD). As the first step of integration, the service quality of automobile service centre was evaluated by fuzzy weighted SERVQUAL method. Fuzzy weighted gap (difference between fuzzy perception and expectation) is calculated to identify customer satisfaction level.

Integrating the fuzzy weighted SERVQUAL with QFD, specific customer needs can be translated in to prioritized technical requirements. The QFD process become more specific and focused with the usage of this integrated approach. From the methodological perspective, it can be concluded that the ability of designing services upon customer satisfaction makes this integrated approach as a powerful tool for service sectors.

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