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Rahman, Mohammad Anisur; Qi, Xu; Saif, Abu Naser Mohammad; Ibrahim, Ismail Bin; Sultana, Rabeya

Article

Assessing service quality of online bill payment system using extended SERVQUAL model (SERVQUAL-Butterfly model): A case study of Dhaka electric supply company limited (DESCO), Bangladesh

Cogent Business & Management

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Suggested Citation: Rahman, Mohammad Anisur; Qi, Xu; Saif, Abu Naser Mohammad; Ibrahim, Ismail Bin; Sultana, Rabeya (2017) : Assessing service quality of online bill payment system using extended SERVQUAL model (SERVQUAL-Butterfly model): A case study of Dhaka electric supply company limited (DESCO), Bangladesh, Cogent Business & Management, ISSN 2331-1975, Taylor & Francis, Abingdon, Vol. 4, https://doi.org/10.1080/23311975.2017.1301195

This Version is available at: https://hdl.handle.net/10419/205957

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Received: 30 October 2016 Accepted: 27 February 2017 Published: 30 March 2017

*Corresponding author: Abu Naser Mohammad Saif, Faculty of Business Studies, Department of Management Information Systems, University of Dhaka, Dhaka, Bangladesh E-mail: saif@du.ac.bd

Reviewing editor: Shaofeng Liu, University of Plymouth, UK

Additional information is available at the end of the article

OPERATIONS, INFORMATION & TECHNOLOGY | RESEARCH ARTICLE Assessing service quality of online bill payment system using extended SERVQUAL model (SERVQUAL-Butterfly model): A case study of Dhaka electric supply company limited (DESCO), Bangladesh

Mohammad Anisur Rahman^{1,2}, Xu Qi¹, Abu Naser Mohammad Saif²*, Ismail Bin Ibrahim³ and Rabeya Sultana²

Abstract: The aim of this paper is to assess the service quality of Dhaka Electric Supply Company Limited's (DESCO) online bill payment system using extended SERVQUAL model termed as SERVQUAL-Butterfly Model that integrates customer expectation and perception of actual service quality, customer satisfaction, and loyalty. Using random sampling method, primary data were collected from a total of 300 customers from three operating zones of DESCO. The data were analyzed through PLS-SEM second-order hierarchical modeling approach and Importance-Performance Map Analysis (IPMA). We found that expectation on service quality has no effect on customer satisfaction; however, it influences the formation of perception about the actual quality of service. Customer satisfaction is significantly influenced by the perception of actual service quality and customer satisfaction significantly helps to make the customer loyal. For DESCO, empathy found to be a powerful indicator of both expectation and actual service quality and perception of actual service found to be the single most

ABOUT THE AUTHORS

Mohammad Anisur Rahman is a PhD candidate at Glorious Sun School of Business and Management, Donghua University, China. He is also serving as an assistant professor in the Department of Management Information Systems at University of Dhaka, Bangladesh. He is the ideator of SERVQUAL-Butterfly Model.

Xu Qi is a distinguished professor in the Department of Logistics Management and E-Commerce, Glorious Sun School of Business and Management, Donghua University, China.

Abu Naser Mohammad Saif is serving as an assistant professor in the Department of Management Information Systems at University of Dhaka, Bangladesh.

Ismail Bin Ibrahim is serving as an assistant engineer in the Dhaka Electric Supply Company Limited (DESCO), Bangladesh.

Rabeya Sultana is serving as an associate professor in the Department of Management Information Systems at University of Dhaka, Bangladesh.

PUBLIC INTEREST STATEMENT

This paper represents the assessment of service quality of Dhaka Electric Supply Company (DESCO)'s online bill payment system by using our extended SERVQUAL model termed as SERVQUAL-Butterfly Model. By assessing DESCO data, we found that for both customers' expectation and customers' perception of actual service, genuine care for customers found to be a substantial indicator followed by responsive, safe, and esthetically designed website. Moreover, perception of actual service is found to be the single most important factor for customer satisfaction which helps to make customer loyal. Thus, DESCO must concentrate more on customer care, responsiveness, and well-designed sites to meet the customer expectations. Future researchers can use this SERVQUAL-Butterfly Model, which eliminates inherent limitations of original of SERVQUAL model, and modify it according to their specific industry, context, and culture.





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important factor for customer satisfaction. Future researchers can use this SERVQUAL-Butterfly Model that eliminates inherent limitations of original SERVQUAL model and augment it according to their specific industry, context, and culture.

Subjects: Management of Technology & Innovation; Management of Technology; Innovation Management

Keywords: SERVQUAL; SERVQUAL-Butterfly model; PLS-SEM; higher order hierarchical model; formative-reflective model; DESCO; Bangladesh

1. Introduction

The worldwide dominance of Information and Communication Technology (ICT) is quite visible. As the world continues its journey in an electronic age, convergence continues to be a predominant theme. Convergence was initially a term used to explain the convergence of the various methods of telecommunication, namely telephone or television broadcasting—the separate wires for telephone and broadcast became unified. Recent convergence refers to digital convergence—hand-held devices, electronics, telecommunication, networking, etc. Both products and services are presumably more flexible and of higher value due to the occurrence of digital convergence. The number of payment system incorporating technological edge is increasing in number over the years, as there is a constant decline in the difference between paper transaction and electronic transaction (Boss, 2009).

The worldwide ICT boom has also been ignited in Bangladesh, with the total number of internet users summing to roughly around 62 million till April 2016 (BTRC, 2016). Thus, it is only natural that e-commerce is flourishing as the internet has unveiled a new dimension for trade and commerce. The Government of Bangladesh (GoB) has been encouraging the expansion of ICT through "Digital Bangladesh" initiatives. As a result, a lot of public services agencies have opened up their websites and have been sharing various information.

In line with that Dhaka Eclectic Supply Company (DESCO), an electricity distribution company formed as part of the reform in the power sector of Bangladesh, launched electronic bill payment systems through the organization's website or the website of banks via the internet. This method has several advantages. First, it can improve the quality of service and customer satisfaction by making the bill payment process easier and faster, avoiding the long queues at the banks in the conventional system at their convenient time and from any place. Second, it enhances the bill collection process aiding in the faster collection of revenue and reducing the number of due bills every month.

As part of management's endeavor to provide better customer service, DESCO introduced the online bill payment system in 2010. Since then, the users of this system have grown incrementally. This system, however, has a minuscule contribution in comparison to the total revenue earned by DESCO and still has a long way to go. Understanding the consumer expectation and perception of the service is a key to improving the quality of service methods.

Our study aims at identifying the service quality gap of DESCO online billing systems. By doing so, we will also identify the factors affecting the customer satisfaction and loyalty of the DESCO online billing systems.

2. Literature review

Customer satisfaction has become a prime theme in any marketing strategy in today's dynamic business environment (Al-allak & Bekhet, 2011). Exploring customer satisfaction via various service quality studies has become a key tool in formulating market strategies. This process includes the involvement of different academic discipline and led to many service providers opting for such studies to evaluate their service quality (Azar, 2009). Service Quality is a critical parameter in establishing the service provider's superior business performance in a highly competitive environment (Chowdhary

& Prakash, 2007). Service can be defined as actions or processes, which consists of all economic activities, whose output is intangible and supplies value to its consumers in the form of convenience, entertainment, amusement, comfort, satisfaction, etc.(Quinn, Baruch, & Paquette, 1987).

Despite service quality being a must for being superior and competitive in the market, there is no concrete definition of it (Beecham, 2009). The meaning of service quality, being multidimensional and having multi-characteristics, varies from person to person (Brady, 2001). Due to the generic nature of quality, defining it is also difficult. The standard of quality varies from case to case, culture to culture and from one period to another (Jayasundara, Ngulube, & Minishi-Majanja, 2009). Setting the quality standard is easy when characteristics are quantitative. However, setting quality standards for qualitative characteristics such as excellence, happiness, satisfaction, and luxury which are difficult to measure and control (Snoj, 1995).

Quality service can only be provided to customers by viewing the service from the customer's viewpoint and subsequently meeting their expectation (Quinn, 1997). Focusing on the quality of service usually helps an organization to team up with its customers and achieve competitive edge (Hernon & Nitecki, 2001). Various researchers have indicated that uncovering perception of the service experience of customers is the key to the success of service organizations. To retain and satisfy customers, service organizations need to examine systematically the services they provide from a customer viewpoint and enrich the design of their services and the environment in which their services are delivered (Awad, 2012).

Many governments have focused on delivering quality service to its customers/citizens in all its branches, keeping customer/citizen in focus. Like private organizations, public sector organizations such as health care, police, local government, and various government organizations have also recognized that service quality and customer satisfaction is a major strategic parameter. However, it is also more difficult to assess the service quality in such public organizations (Wisniewski, 2001).

Despite these efforts, public sector service development and delivery is still weakly developed. The various customer service tools and methods employed by the government might result in greater political inequality despite possible improvement in service (Fountain, 2001). In developing countries, access to quality public service is of utmost importance for the poor to rise from their poverty and current standard (Akter, Upal, & Hani, 2008).

To improve the public service quality, electronic media is becoming a central theme in the modernization process of various governments. However, lack of clear vision of government (Lenk, 2002) and age-related obstacles to accessing the internet (Sourbati, 2009) are two major obstacles to public service delivery over the internet. One way to overcome the obstacles is to know clearly where the service delivery problems lie and how to improve it.

To do so, Parasuraman, Zeithaml, and Berry (1985, 1988) proposed SERVQUAL model. This model takes account the customer expectation of service and perception of actual service quality of five dimensions of service quality: (1) Reliability, (2) Assurances, (3) Empathy, (4) Tangibles, and (5) Responsiveness also termed as RATER. The difference in expectation and perceived service is the gap which indicates various levels of satisfaction. A small gap indicates greater customer satisfaction and vice versa. However, some scholars later criticized SERVQUAL on the following grounds:

- Existing methods have the shortcomings in finding out holistic and actual service quality characteristics which cause customer satisfaction (Al-allak & Bekhet, 2011).
- The method of analyzing the gap between perception and satisfaction from service received to determine service quality is inaccurate since most studies have been a performance-based measure of service quality (Cronin & Taylor, 1992). Some scholars also criticized the model as being too focused on the service process and neglecting the technical factors associated (Kang & James, 2004).
- The expectation of customers changes over time (Cronin & Taylor, 1992; Hsieh & Yuan, 2011).
- SERVQUAL cannot be used in all service sectors and needs to be modified to be appropriate for that industry (Kanning & Bergmann, 2009).

As a result, different researchers such as Brady and Cronin (2001), Grönroos (1984) and Oliver, Rust, and Varki (1997) came up with different augmentations and other researchers came up with alternative methods of assessing service quality (see details in the next section).

3. Model specification

The SERVQUAL conceptual model was introduced in 1985 by Parasuraman et al. (Enríquez et al., 2016). The basic SERVQUAL model includes five service quality dimensions termed as Responsiveness, Assurance, Tangibility, Empathy, and Reliability (RATER). Using these dimensions, the model identifies the gap between perceived customer's expectation of services and customer actual experience. After identifying the average gap, the service providers try to minimize the gap to improve the service quality.

As time passed, different researchers onward tried to modify this model and used different statistical techniques to enhance SERVQUAL model. For example, Enríquez et al. (2016), Puni, Okoe, and Damnyag (2014), Albarq (2013), used average score and confidence interval to find out whether the differences are meaningful. Ali, Leifu, Yasirrafiq, and Hassan (2015), Albarq (2013), Gloria (2012) used multiple regression method to identify the SERVIQUAL actual performance dimension effect on satisfaction and loyalty. Ho, Feng, and Yen (2014), Tsai, Hsu, and Lin (2011) used importance–performance matrix analysis (IPA). Wong (2014) has used the forecasting dimension of MAGAL and, fuzzy analytic hierarchy process (FAHP) to identify the most important quality dimension that customer deems important. Bodet (2008) used first-order structural equation modeling (SEM) technique to predict satisfaction and loyalty using actual service usage perception of customers of SERVQUAL dimensions.

We can identify three clear patterns from the previous researchers: (1) different statistical technique, (2) adding or removing variables from the original model, and (3) implied disagreement over the use of expectation as an indicator variable for customer satisfaction.

A major limitation of using gap analysis is the inability of linking customer satisfaction or loyalty. The basic SERVQUAL model stands on the assumption that if actual performance is better than expected one, the customer may perceive it as a better service quality or increase in service quality (Parasuraman et al., 1985, 1988). However, minimizing the expectation and actual usage perception gap may not result in customer satisfaction is a direct determining factor in customer loyalty, a central determinant of customer retention (Gerpott, Rams, & Schindler, 2001).

From the previous research pattern and limitation of SERVQUAL, it is evident that when expectation and current performance dimensions of quality are used, researchers applied average scores, confidence intervals, and when multiple regression and SEM were used they just only used actual performance dimensions to link with satisfaction and loyalty. The implied reason may lie in the methodological limitation. To cope with this limitation, we have formulated and augmented the original SERVQUAL model. The details are discussed in the following research design.

4. Hypotheses

Focused on the literature review and our model specification, we hypothesize the followings:

H1: Perception of actual performance positively influences satisfaction of users of DESCO online bill payment system.

H2: Expectation of the users of DESCO online bill payment system positively influences the perception of actual performance.

H3: Expectation of the users positively influences satisfaction of the users of DESCO online bill payment system.

H4: Satisfaction of the users of online bill payment system positively influences users' loyalty to DESCO online bill payment system.

5. Research design

We will be using second-order reflective-formative construction of SEM to incorporate expectation, current quality performance dimensions as exogenous variables, and satisfaction and loyalty as endogenous variables. In our extended SERVQUAL model, both expectation and perception of actual performance are higher order formative constructs as they are formed by the first-order reflective constructs, the five quality dimensions, as suggested by the original SERVQUAL model. Following Figure 1 illustrate our extended SERVQUAL model.

A reflective indicator is an observed variable that is assumed to be an effect of a latent construct, whereas formative indicator is a variable measuring an assumed cause of or a component of a latent construct (Lowry & Gaskin, 2014). In the case of modeling reflective–formative, higher order construct is automatically to be formative construct to play a double explanation comprises reflective and formative measurement model in structural model (Asyraf & Afthanorhan, 2014).

We followed the methodology of Asyraf and Afthanorhan (2014), Lowry & Gaskin (2014), Wong (2016) and video tutorial of Gaskin (2012). The results of the data analysis of PLS-SEM are classified under measurement model and structural model. For PLS-SEM second-order reflective–formative model calculations Becker, Klein, and Wetzels (2012) found that, out of (1) the repeated indicator approach, (2) the two-stage approach, and (3) the hybrid approach, the repeated indicator approach gives better



Figure 1. Proposed extended SERVQUAL (SERVQUAL-Butterfly) model. results. However, when the researchers are only interested in the higher level estimates (the path coefficient to and from the higher order constructs), the two-stage approach proves more useful than the repeated indicator approach (Becker et al., 2012). The two-stage approach is also preferable to repeated indicator approach to overcome the potential effect of "first-order constructs' perfect prediction of second-order construct" (Lowry & Gaskin, 2014). Thus, we will use two-stage approach for our study.

6. Sample and instruments

Data were collected deploying face-to-face interview method with a structured questionnaire in two parts. First part included demographical questions and second part included questions on five quality dimensions (reliability, assurance, tangibles, empathy, and responsiveness) proposed by original SERVQUAL model (Parasuraman et al., 1985) using a five-point Likert scale ranging from (1) "strong-ly disagree" to (5) "strongly agree." The survey questionnaire included total 16 questions for the five dimensions of SERVQUAL: 3 questions in the reliability dimension, three questions for assurance, three questions for tangibles, four questions for empathy, and three questions for responsiveness (see Table 1).

| Table 1. Constructs and items used in the model | | | | | | | | | |
|---|------------|--|--|--|--|--|--|--|--|
| Constructs (latent variables) | Indicators | Questions | | | | | | | |
| Reliability | Rel1 | How well does the online bill payment system complete your bill payment transaction? | | | | | | | |
| | Rel2 | How is the accessibility of the DESCO's online bill payment system when you want to pay your bill? | | | | | | | |
| | Rel3 | How well is your online payment reflected in your bill account summary? | | | | | | | |
| Assurance | Asu1 | How sophisticated is the security of DESCO's online bill payment system? | | | | | | | |
| | Asu2 | How safe do you feel paying your DESCO bill online? | | | | | | | |
| | Asu3 | Based on the service, how skilled do you feel the operators of this system are? | | | | | | | |
| Tangibility | Tan1 | What is your satisfaction level from the appearance of the bill payment system's user interface? | | | | | | | |
| | Tan2 | How organized is the user interface of DESCO's online bipayment system? | | | | | | | |
| | Tan3 | How futuristic is the outlook of DESCO's online bill payment system? | | | | | | | |
| Empathy | Empt1 | How well does DESCO's online bill payment system provide its promised 24 h service? | | | | | | | |
| | Empt2 | How user-friendly is DESCO's online bill payment system? | | | | | | | |
| | Empt3 | How sufficient is DESCO's online resources to guide the first time user is through the bill payment process? | | | | | | | |
| | Empt4 | What is your satisfaction level regarding the option of different banks offered for bill payment? | | | | | | | |
| Responsiveness | Res1 | How is the speed of operation and processing of DESCO's online bill payment system? | | | | | | | |
| | Res2 | How well does DESCO serve your complain regarding the online bill payment system? | | | | | | | |
| | Res3 | How functioning are the options offered in DESCO's online bill payment system website? | | | | | | | |
| Satisfaction | S1 | How much satisfied are you with the DESCO online bill payment system? | | | | | | | |
| | S2 | How often do you use the DESCO online bill payment system? | | | | | | | |
| Loyalty | L1 | Are you going to use this billing system in the future? | | | | | | | |
| | L2 | Would you suggest others paying a bill with DESCO online bill payment system? | | | | | | | |

The study area includes the three zones under DESCO's jurisdiction—Mirpur zone, Gulshan Zone, and Uttara Zone. These zones include Agargaon, Shahali, Pallabi, Kafrul, Monipur Rupnagar, Gulshan, Banani Baridhara, Badda, Uttara, Khilkhet, Cantonment, Uttarkhan, Dakshinkhan, and Tongi. The users were chosen at random and surveys were conducted at the surveyor's convenience. We have distributed more than 300 surveys questionnaires with 100% returned filled.

7. Software used

Data analysis for this study is done by SmartPLS 3.0 software (Ringle, Wende, & Becker, 2015) and SPSS 21. With SPSS, we screened the data and checked its validity. For data analysis, we have used SmartPLS.

8. Data screening

After screening the data for missing values and other problems such as same values for all questions, and improper value assignment we were left with 300 questionnaires to proceed for further analysis.

9. Data validation/test for common methods bias

Since the endogenous and exogenous variables were collected at the same time using the same instrument, we tested for common methods bias (CMB) to ensure that our data are free of distortion. We have employed two approaches.

Firstly, using SPSS we tried to conduct Harman's single-factor test using exploratory, unrotated factor analysis for all of the first-order constructs. The result of our factor analysis produced 36 distinct factors, the largest of which accounted for only 46.61% of the variance of the model (see Appendix 1). The outcome is less than the threshold of 50% or above (Gaskin, 2011). This suggested that our data not be suffered from CMB. However, researchers have a dispute over using Harman's single-factor test for CMB (Podsakoff, MacKenzie, & Lee, 2003) and thus we adopted the second approach.

Secondly, we have examined a correlation matrix of the constructs (using Pearson's correlations) to test whether the formative indicators have correlation value over 0.90, which gives evidence that data have CMB (Pavlou, Liang, & Xue, 2006). In our case, all the correlation values were below 0.80, which indicate our data is less likely to have common method bias.

10. Data analysis and findings

10.1. Demographic findings

The descriptive statistics of the demographic profile (see Table 2) of the respondents are as follows.

Demographic information shows respondents were equal in number (100) from each zone. However, they are male dominated (90%) and married (77%). Most of the respondents are young around 90% of the respondents belong to age group 20–40 years. Most of the respondents are doing service (73%) and business (17%). Around 45% of the respondents are from income level of Tk. 45,000–Tk. 60,000 and 30% of respondents are from above Tk. 60,000 income level, which means the respondents are mostly from affluent group Bangladesh.

11. Measurement model

In two-stage approach, first, the model is run for the indicators and constructs reliability and validity under the measurement model. Then the path coefficient of the second-order construct is checked under the structural model. Becker et al. (2012) suggested reporting indicator loadings, AVE, composite reliability, discriminant validity, etc. for first-order reflective constructs, and indicator weights, the significance of weights, multicollinearity of indicators, etc. for second-order formative constructs.

11.1. Construct validity of the reflective constructs

To test the construct *convergent validity* for the reflective construct, we first checked the measurement items loading with significant t-statistics and *p* values (Lowry & Gaskin, 2014). Table 3 shows that all of our reflective indicators: expected quality and actual performance are statistically significant (*t*-value > 1.96 and *p*-value < 0.05). These results confirm strong convergent validity in our model for the reflective constructs.

To test the discriminant validity we used the Fornell-Larcker criterion (1981) and cross-loading (Wong, 2016). Fornell and Larcker used the square root of AVE, which should be larger than the latent variable correlations (LVC). For cross-loading examination, each indicator's loading to its latent construct should be higher than that of other constructs. Table 4 shows the square root of AVE, where each latent variable's value is greater than other LVC. Table 5 shows the cross-loading of all indicator items with each construct. It can be observed that items loading of the construct have a higher value than loading on other constructs. Both of these findings confirm the strong discriminant validity of the reflective constructs.

| Table 2. Respondents' demographic profile | | | | | | | | |
|---|---------------------|-----------|---------|--|--|--|--|--|
| Profile | Groups | Frequency | Percent | | | | | |
| Gender | Female | 30 | 10.0 | | | | | |
| | Male | 270 | 90.0 | | | | | |
| Age | 10–19 years | 4 | 1.3 | | | | | |
| | 20–29 years | 99 | 33.0 | | | | | |
| | 30-40 years | 175 | 58.3 | | | | | |
| | 41–60 years | 22 | 7.3 | | | | | |
| Marital Status | Married | 230 | 76.7 | | | | | |
| | Single | 70 | 23.3 | | | | | |
| Profession | Business | 51 | 17.0 | | | | | |
| | Others | 18 | 6.0 | | | | | |
| | Service | 218 | 72.7 | | | | | |
| | Student | 13 | 4.3 | | | | | |
| Income | Below 25,000 TK | 20 | 6.7 | | | | | |
| | 25,000 TK-44,999 TK | 58 | 19.3 | | | | | |
| | 45,000 TK-60,000 TK | 134 | 44.7 | | | | | |
| | Above 60,000 TK | 88 | 29.3 | | | | | |
| Zone | Gulshan zone | 100 | 33.3 | | | | | |
| | Mirpur zone | 100 | 33.3 | | | | | |
| | Uttara zone | 100 | 33.3 | | | | | |

| Table 3. T-statistics and p-values for convergent validity of constructs | | | | | | | | |
|--|-----------|---------------------|----------|--|--|--|--|--|
| Constructs (latent variables) | Indicator | T-statistics | p-values | | | | | |
| E_Reliability | RelE1 | 38.906 | 0.000 | | | | | |
| | RelE2 | 34.973 | 0.000 | | | | | |
| | RelE3 | 61.224 | 0.000 | | | | | |
| E_Assurance | AsuE1 | 60.605 | 0.000 | | | | | |
| | AsuE2 | 40.804 | 0.000 | | | | | |
| | AsuE3 | 43.790 | 0.000 | | | | | |
| E_Tangibility | TanE1 | 32.533 | 0.000 | | | | | |
| | TanE2 | 46.946 | 0.000 | | | | | |
| | TanE3 | 49.793 | 0.000 | | | | | |
| E_Empathy | EmptE1 | 43.386 | 0.000 | | | | | |
| | EmptE2 | 31.865 | 0.000 | | | | | |
| | EmptE3 | 43.163 | 0.000 | | | | | |
| | EmptE4 | 41.865 | 0.000 | | | | | |
| E_Responsiveness | ResE1 | 48.108 | 0.000 | | | | | |
| | ResE2 | 34.995 | 0.000 | | | | | |
| | ResE3 | 47.828 | 0.000 | | | | | |
| P_Reliability | RelP1 | 83.757 | 0.000 | | | | | |
| | RelP2 | 61.293 | 0.000 | | | | | |
| | RelP3 | 54.670 | 0.000 | | | | | |
| P_Assurance | AsuP1 | 54.141 | 0.000 | | | | | |
| | AsuP2 | 67.466 | 0.000 | | | | | |
| | AsuP3 | 50.584 | 0.000 | | | | | |
| P_Tangibility | TanP1 | 45.054 | 0.000 | | | | | |
| | TanP2 | 45.306 | 0.000 | | | | | |
| | TanP3 | 56.285 | 0.000 | | | | | |
| P_Empathy | EmptP1 | 29.032 | 0.000 | | | | | |
| | EmptP2 | 86.253 | 0.000 | | | | | |
| | EmptP3 | 40.959 | 0.000 | | | | | |
| | EmptP4 | 21.706 | 0.000 | | | | | |
| P_Responsiveness | ResP1 | 36.520 | 0.000 | | | | | |
| | ResP2 | 40.418 | 0.000 | | | | | |
| | ResP3 | 67.828 | 0.000 | | | | | |

Notes: E = expected and P = actual performance.

11.2. Reliability of the reflective constructs

The internal reliability can be evaluated considering Cronbach's alpha and composite reliability. Cronbach's alpha is used to test the reliability of the items, and composite reliability is used to test the reliability of the construct, the latent variable (Hoque, 2016). Although Cronbach's alpha has been used extensively in social science, it provides a conservative outcome for PLS-SEM; consequently, researchers suggested composite reliability as an alternative measure (Wong, 2013). A satisfactory reliable value will be between 0.60 and 0.95 (Bagozzi & Yi, 1988; Hair, Ringle, & Sarstedt, 2013). Table 6 shows the results of the internal reliability of our reflective constructs. Here, all the reflective constructs have a value above 0.7 that confirms strong internal reliability.

| Table 4. Fornell–Larcker criteria of discriminant validity | | | | | | | | | | |
|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Constructs (latent variable) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| E_Assurance (1) | 0.894 | | | | | | | | | |
| E_Empathy (2) | 0.878 | 0.893 | | | | | | | | |
| E_Reliability (3) | 0.859 | 0.859 | 0.878 | | | | | | | |
| E_Responsiveness (4) | 0.751 | 0.726 | 0.741 | 0.869 | | | | | | |
| E_Tangibility (5) | 0.835 | 0.849 | 0.814 | 0.723 | 0.893 | | | | | |
| P_Assurance (6) | 0.553 | 0.545 | 0.555 | 0.362 | 0.477 | 0.887 | | | | |
| P_Empathy (7) | 0.501 | 0.561 | 0.537 | 0.357 | 0.477 | 0.821 | 0.823 | | | |
| P_Reliability (8) | 0.605 | 0.636 | 0.684 | 0.490 | 0.591 | 0.727 | 0.780 | 0.910 | | |
| P_Responsiveness (9) | 0.415 | 0.406 | 0.449 | 0.613 | 0.427 | 0.588 | 0.594 | 0.635 | 0.860 | |
| P_Tangibility (10) | 0.460 | 0.430 | 0.453 | 0.421 | 0.513 | 0.660 | 0.629 | 0.570 | 0.554 | 0.894 |

11.3. Construct validity for formative indicators

The construct validity for formative constructs is measured by indicator weights. When the indicator weights for formative constructs are roughly equal and significant, then the formative constructs are said to have construct validity (Lowry & Gaskin, 2014). Table 7 shows that all the indicator weights are roughly equal and significant. Thus, formative constructs are valid.

12. Structural model

After measurement model, the structural model needs to be evaluated to draw the conclusion. For formative constructs, we will evaluate three things: collinearity, coefficient of determination (R^2), and the path coefficient between the constructs.

12.1. Collinearity assessment

Collinearity is assessed by variance inflation factor (VIF), for which a value of 5 or above typically indicates problem (Hair, Ringle, & Sarstedt, 2011). However, a maximum, the VIF for formative factors should be below 10, but for a more rigorous test, they should be below 3.30 (Petter, Straub, & Rai, 2007). Collinearity assessment of our model shows that all the construct values of independent variables are below 3.30 (see Table 8).

12.2. The coefficient of determination (R^2)

 R^2 is a major part of a structural model evaluation. R^2 value of 0.25, 0.50, and 0.70 are referred to as a weak, moderate, and strong coefficient of determination, respectively (Hair, Hult, Ringle, & Sarstedt, 2013). In our case, the perception of expected quality can explain 41.20% of variations of perception of actual quality performance. Actual Performance and Expected are found to jointly explain 49.00% of variances of Satisfaction and in line with that Satisfaction found to explain 68.00% variances in loyalty (see Figure 2) in this PLS-SEM model.

12.3. Path coefficient

Path coefficients in the PLS-SEM are checked for the relationship between constructs and significance level. Table 9 shows that perception about expected quality strongly affects the performance about actual quality performance ($\beta = 0.642$, t = 9.687, p < 0.05); however, perception about expected quality has no significant effect on the satisfaction ($\beta = -0.079$, t = 1.245, p > 0.05). Perception of actual quality performance has strong significant effect on the customer satisfaction ($\beta = 0.748$, t = 12.951, p < 0.05) and in turn customer satisfaction has strong effect on customer loyalty ($\beta = 0.825$, t = 33.681, p < 0.05).

| | P_Tangibility | 0.403 | 0.332 | 0.499 | 0.355 | 0.414 | 0.367 | 0.399 | 0.376 | 0.360 | 0.452 | 0.316 | 0.360 | 0.432 | 0.377 | 0.522 | 0.479 | 0.597 | 0.637 | 0.517 | 0.451 | 0.608 | 0.548 | 0.454 | 0.521 | 0.553 | 0.479 | 0.482 | 0.487 | 0.463 | 0.898 | 0.883 | 0.900 |
|----------------|-----------------|-------|-------|-------|--------|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | PResponsiveness | 0.386 | 0.314 | 0.414 | 0.365 | 0.387 | 0.326 | 0.372 | 0.338 | 0.364 | 0.472 | 0.464 | 0.576 | 0.579 | 0.339 | 0.377 | 0.429 | 0.505 | 0.570 | 0.487 | 0.561 | 0.582 | 0.493 | 0.278 | 0.603 | 0.566 | 0.563 | 0.835 | 0.854 | 0.891 | 0.478 | 0.559 | 0.449 |
| | P_Reliability | 0.573 | 0.536 | 0.512 | 0.561 | 0.591 | 0.537 | 0.582 | 0.604 | 0.568 | 0.628 | 0.555 | 0.301 | 0.377 | 0.580 | 0.487 | 0.512 | 0.626 | 0.646 | 0.662 | 0.753 | 0.705 | 0.593 | 0.492 | 0.928 | 0.904 | 0.897 | 0.577 | 0.491 | 0.571 | 0.529 | 0.511 | 0.489 |
| | P_Empathy | 0.441 | 0.439 | 0.463 | 0.514 | 0.549 | 0.455 | 0.485 | 0.469 | 0.491 | 0.455 | 0.440 | 0.191 | 0.256 | 0.488 | 0.394 | 0.390 | 0.695 | 0.773 | 0.714 | 0.812 | 0.913 | 0.849 | 0.703 | 0.727 | 0.745 | 0.653 | 0.484 | 0.502 | 0.546 | 0.561 | 0.546 | 0.580 |
| | P_Assurance | 0.500 | 0.440 | 0.543 | 0.500 | 0.518 | 0.441 | 0.489 | 0.498 | 0.470 | 0.496 | 0.413 | 0.225 | 0.273 | 0.457 | 0.400 | 0.418 | 0.878 | 0.903 | 0.878 | 0.666 | 0.748 | 0.695 | 0.584 | 0.672 | 0.695 | 0.614 | 0.439 | 0.550 | 0.528 | 0.588 | 0.580 | 0.601 |
| | E_Tangibility | 0.759 | 0.750 | 0.730 | 0.735 | 0.745 | 0.770 | 0.781 | 0.658 | 0.738 | 0.744 | 0.742 | 0.519 | 0.584 | 0.864 | 006.0 | 0.915 | 0.410 | 0.456 | 0.400 | 0.469 | 0.439 | 0.362 | 0.280 | 0.559 | 0.478 | 0.580 | 0.449 | 0.288 | 0.368 | 0.466 | 0.439 | 0.471 |
| | EResponsiveness | 0.678 | 0.634 | 0.700 | 0.651 | 0.660 | 0.638 | 0.643 | 0.560 | 0.618 | 0.762 | 0.854 | 0.859 | 0.892 | 0.630 | 0.648 | 0.659 | 0.314 | 0.360 | 0.286 | 0.424 | 0.323 | 0.305 | 0.083 | 0.482 | 0.362 | 0.498 | 0.634 | 0.468 | 0.486 | 0.339 | 0.440 | 0.350 |
| it items | E_Reliability | 0.807 | 0.746 | 0.747 | 0.744 | 0.792 | 0.764 | 0.769 | 0.872 | 0.855 | 0.907 | 0.765 | 0.517 | 0.605 | 0.776 | 0.691 | 0.709 | 0.466 | 0.523 | 0.485 | 0.544 | 0.483 | 0.400 | 0.319 | 0.655 | 0.553 | 0.663 | 0.453 | 0.337 | 0.371 | 0.409 | 0.400 | 0.405 |
| f measuremen | E_Empathy | 0.785 | 0.816 | 0.754 | 0.900 | 0.883 | 0.889 | 0.901 | 0.732 | 0.747 | 0.782 | 0.799 | 0.485 | 0.550 | 0.817 | 0.736 | 0.715 | 0.455 | 0.520 | 0.472 | 0.559 | 0.491 | 0.435 | 0.342 | 0.603 | 0.512 | 0.624 | 0.410 | 0.288 | 0.352 | 0.379 | 0.390 | 0.384 |
| ross-loading a | E_Assurance | 0.912 | 0.877 | 0.892 | 0.773 | 0.783 | 0.778 | 0.803 | 0.724 | 0.724 | 0.809 | 0.774 | 0.543 | 0.598 | 0.784 | 0.727 | 0.722 | 0.496 | 0.509 | 0.466 | 0.511 | 0.453 | 0.381 | 0.280 | 0.583 | 0.484 | 0.587 | 0.410 | 0.321 | 0.344 | 0.381 | 0.430 | 0.422 |
| Table 5. C | _ | AsuE1 | AsuE2 | AsuE3 | EmptE1 | EmptE2 | EmptE3 | EmptE4 | RelE1 | RelE2 | RelE3 | ResE1 | ResE2 | ResE3 | TanE1 | TanE2 | TanE3 | AsuP1 | AsuP2 | AsuP3 | EmptP1 | EmptP2 | EmptP3 | EmptP4 | RelP1 | RelP2 | RelP3 | ResP1 | ResP2 | ResP3 | TanP1 | TanP2 | TanP3 |

| Table 6. Internal reliability measurements of reflective constructs | | | | | | | | | |
|---|------------------|-----------------------|-------------------------------------|--|--|--|--|--|--|
| Constructs | Cronbach's Alpha | Composite reliability | Average variance extracted (AVE) | | | | | | |
| E_Assurance | 0.874 | 0.922 | 0.799 | | | | | | |
| E_Empathy | 0.915 | 0.940 | 0.798 | | | | | | |
| E_Reliability | 0.851 | 0.910 | 0.771 | | | | | | |
| E_Responsiveness | 0.840 | 0.902 | 0.755 | | | | | | |
| E_Tangibility | 0.873 | 0.922 | 0.797 | | | | | | |
| P_Assurance | 0.864 | 0.917 | 0.786 | | | | | | |
| P_Empathy | 0.838 | 0.893 | 0.677 | | | | | | |
| P_Reliability | 0.896 | 0.935 | 0.828 | | | | | | |
| P_Responsiveness | 0.824 | 0.895 | 0.740 | | | | | | |
| P_Tangibility | 0.874 | 0.922 | 0.799 | | | | | | |

Figure 2. Path model estimation.



13. Importance-performance map analysis

Importance-performance map analysis (IPMA) is also known as importance-performance analysis, importance-performance matrix, impact-performance map, or priority map analysis (Table 10). It is a useful tool in PLS-SEM to identify the predecessor constructs' relative importance in shaping a certain target construct (Ringle & Sarstedt, 2016). More specifically, for a targeting construct, the IPMA contrasts the predecessor constructs' relative importance (total effects) and the average values of the latent variable scores (performance) to highlight significant areas of improvements for managers (Schloderer, Sarstedt, & Ringle, 2014).

For our model, we have done three IPMA; first one for the expectation of quality (second-order construct), second one for the customer perception on the actual performance and the last one for the satisfaction. The rationale for the first one is that the managers might need to know which indicator variables they should address as the expectation on quality influence the perception of actual quality performance (Parasuraman et al., 1988).

| Table 7. Indicator weights for formative constructs | | | | | | | | |
|---|-----------------|---------------------|----------|--|--|--|--|--|
| Formative constructs | Original sample | T-statistics | p-values | | | | | |
| AsuE1 ← Expected_Quality | 0.380 | 38.474 | 0.000 | | | | | |
| AsuE2 ← Expected_Quality | 0.371 | 31.848 | 0.000 | | | | | |
| AsuE3 ← Expected_Quality | 0.368 | 39.838 | 0.000 | | | | | |
| AsuP1 ← Actual_Performance | 0.369 | 47.027 | 0.000 | | | | | |
| AsuP2 ← Actual_Performance | 0.394 | 38.788 | 0.000 | | | | | |
| AsuP3 ← Actual_Performance | 0.365 | 43.336 | 0.000 | | | | | |
| EmptE1 ← Expected_Quality | 0.277 | 27.140 | 0.000 | | | | | |
| EmptE2 ← Expected_Quality | 0.280 | 28.038 | 0.000 | | | | | |
| EmptE3 ← Expected_Quality | 0.279 | 31.576 | 0.000 | | | | | |
| EmptE4 ← Expected_Quality | 0.283 | 28.863 | 0.000 | | | | | |
| EmptP1 ← Actual_Performance | 0.313 | 36.606 | 0.000 | | | | | |
| EmptP2 ← Actual_Performance | 0.343 | 31.513 | 0.000 | | | | | |
| EmptP3 ← Actual_Performance | 0.307 | 38.483 | 0.000 | | | | | |
| EmptP4 ← Actual_Performance | 0.246 | 21.872 | 0.000 | | | | | |
| OS1 ← Satisfaction | 0.361 | 34.126 | 0.000 | | | | | |
| OS2 ← Satisfaction | 0.374 | 29.171 | 0.000 | | | | | |
| OS3 ← Loyalty | 0.404 | 28.400 | 0.000 | | | | | |
| OS4 ← Loyalty | 0.375 | 46.143 | 0.000 | | | | | |
| RelE1 ← Expected_Quality | 0.377 | 41.335 | 0.000 | | | | | |
| RelE2 ← Expected_Quality | 0.348 | 48.431 | 0.000 | | | | | |
| RelE3 ← Expected_Quality | 0.455 | 19.558 | 0.000 | | | | | |
| RelP1 ← Actual_Performance | 0.331 | 31.026 | 0.000 | | | | | |
| RelP2 ← Actual_Performance | 0.366 | 31.566 | 0.000 | | | | | |
| RelP3 ← Actual_Performance | 0.376 | 32.108 | 0.000 | | | | | |
| $ResE1 \leftarrow Expected_Quality$ | 0.385 | 32.338 | 0.000 | | | | | |
| ResE2 ← Expected_Quality | 0.401 | 30.961 | 0.000 | | | | | |
| ResE3 ← Expected_Quality | 0.386 | 27.449 | 0.000 | | | | | |
| $ResP1 \leftarrow Actual_Performance$ | 0.367 | 31.805 | 0.000 | | | | | |
| ResP2 ← Actual_Performance | 0.368 | 33.905 | 0.000 | | | | | |
| ResP3 ← Actual_Performance | 0.374 | 36.913 | 0.000 | | | | | |
| TanE1 <- Expected_Quality | 0.375 | 36.186 | 0.000 | | | | | |
| TanE2 ← Expected_Quality | 0.370 | 37.804 | 0.000 | | | | | |
| TanE3 ← Expected_Quality | 0.380 | 38.474 | 0.000 | | | | | |
| TanP1 ← Actual_Performance | 0.371 | 31.848 | 0.000 | | | | | |
| TanP2 ← Actual_Performance | 0.368 | 39.838 | 0.000 | | | | | |
| TanP3 ← Actual_Performance | 0.369 | 47.027 | 0.000 | | | | | |

| Table 8. Collinearity assessment (VIF) | | | | | | | | | |
|--|--------------------|-------------|---------|--------------|--|--|--|--|--|
| Constructs | Actual performance | Expectation | Loyalty | Satisfaction | | | | | |
| Actual performance | | | | 1.699 | | | | | |
| Expectation | 1.000 | | | 1.699 | | | | | |
| Satisfaction | | | 1.000 | | | | | | |

| Table 9. Significance testing results of the structural model path coefficients | | | | | | | | | |
|---|-----------------------|---------------------|----------|------------|--|--|--|--|--|
| Path | Path Coefficients (β) | T-statistics | p-values | Hypothesis | | | | | |
| Actual Performance \rightarrow Satisfaction | 0.748 | 12.951 | 0.000 | Accepted | | | | | |
| $Expectation \to Actual \; Performance$ | 0.642 | 9.687 | 0.000 | Accepted | | | | | |
| Expectation \rightarrow Satisfaction | -0.079 | 1.245 | 0.214 | Rejected | | | | | |
| Satisfaction \rightarrow Loyalty | 0.825 | 33.681 | 0.000 | Accepted | | | | | |

| Table 10. IPMA for expectation of quality | | | | | | | | |
|---|--------------|--------------|--|--|--|--|--|--|
| Criterion: expectation | Total effect | Performances | | | | | | |
| E_Assurance | 0.204 | 81.72 | | | | | | |
| E_Empathy | 0.271 | 81.32 | | | | | | |
| E_Reliability | 0.201 | 81.14 | | | | | | |
| E_Responsiveness | 0.149 | 77.11 | | | | | | |
| E_Tangibility | 0.174 | 80.41 | | | | | | |

13.1. IPMA for expectation of quality

Table 10 shows that all other indicators perform more or less higher (performance \approx 0.80). However, in terms of importance empathy (total effect = 0.271) followed by assurance (total effect = 0.204) and reliability (total effect = 0.201). The next group of importance are tangibility (total effect = 0.174) and responsiveness (total effect = 0.149). The Figure 3 shows that performance values for the indicators formed almost a straight line. However, importance varies.

13.2. IPMA for perception of actual quality

Table 11 shows that expectation variables have relatively higher performance. However, they have no importance effect (total effect = 0.00) on the perception of actual quality. Expected quality as a higher order construct of the expectation variable also performs higher but has no effect (total effect = -0.002) on perception on actual quality performance. On the contrary, actual empathy has the highest impact on the perception of actual performance, followed by second group assurance and reliability and next group responsiveness and tangibility.



| Table 11. IPMA results of actual performance | | | | | | | | | |
|--|--------------|--------------|--|--|--|--|--|--|--|
| Criterion: actual performance | Total effect | Performances | | | | | | | |
| E_Assurance | 0.000 | 81.722 | | | | | | | |
| E_Empathy | 0.000 | 81.323 | | | | | | | |
| E_Reliability | 0.000 | 81.140 | | | | | | | |
| E_Responsiveness | 0.000 | 77.111 | | | | | | | |
| E_Tangibility | 0.000 | 80.412 | | | | | | | |
| Expected_Quality | -0.002 | 80.589 | | | | | | | |
| P_Assurance | 0.217 | 67.696 | | | | | | | |
| P_Empathy | 0.253 | 71.122 | | | | | | | |
| P_Reliability | 0.213 | 79.360 | | | | | | | |
| P_Responsiveness | 0.157 | 66.913 | | | | | | | |
| P_Tangibility | 0.161 | 60.577 | | | | | | | |

Figure 4. IPMA results of actual performance.



Figure 4 also shows the same output of the IPMA, where reliability has the highest performance followed by empathy, assurance, and responsiveness. However, the lowest performer is the tangibility. So, these low performing, but important indicators have room for improvements.

13.3. IPMA results for satisfaction

IPMA results for satisfaction in Table 12 and Figure 5 shows that indicators for expectation on quality (performance ≈ 0.80) perform better than the indicators of the perception of actual quality (performance ≈ 0.70). However, expectation of quality has no importance effect on satisfaction.

| Table 12. IPMA results of satisfaction | | | | | | | | | |
|--|---------------|--------------|--|--|--|--|--|--|--|
| Criterion: satisfaction | Total Effect* | Performances | | | | | | | |
| Expected_Quality | -0.097 | 80.589 | | | | | | | |
| E_Assurance | -0.020 | 81.722 | | | | | | | |
| E_Empathy | -0.026 | 81.323 | | | | | | | |
| E_Reliability | -0.019 | 81.140 | | | | | | | |
| E_Responsiveness | -0.014 | 77.111 | | | | | | | |
| E_Tangibility | -0.017 | 80.412 | | | | | | | |
| Actual_Quality | 0.975 | 69.690 | | | | | | | |
| P_Assurance | 0.212 | 67.696 | | | | | | | |
| P_Empathy | 0.246 | 71.122 | | | | | | | |
| P_Reliability | 0.208 | 79.360 | | | | | | | |
| P_Responsiveness | 0.153 | 66.913 | | | | | | | |
| P_Tangibility | 0.157 | 60.577 | | | | | | | |

*Negative signs are not significantly different from zero for total effect (Schloderer et al., 2014).



Figure 5. IPMA results of satisfaction.

As a second-order construct, perception of actual quality has the almost perfect total effect (0.975) on customer satisfaction. The effect of the indicator of perception of actual quality can be grouped into three. The highest important indicator is the empathy, followed by assurance and reliability. The last groups of important items are responsiveness and tangibility.

The reliability indicator is already performing well and at the level of customer expectation. However, there is room for improvement for tangibility, responsiveness, assurance, and empathy to meet the expectation of the customers.

14. Discussion on the findings

In this study, we augmented and extended the original SERVQUAL model termed it as SERVQUAL-Butterfly Model. In the SERVQUAL-Butterfly Model, we claimed that customers' expectation of a service quality is formed before receiving the actual service and it influences the perception of actual service quality. These prior expectations and perception of actual service quality affect customer satisfaction, and satisfaction ultimately influences customer loyalty.

Analyzing DESCO data with our SERVQUAL-Butterfly Model, we have identified four noteworthy outcomes. Firstly, the expectation of service quality significantly influences the perception of actual service quality that conforms with the study of the original SERVQUAL model developer Parasuraman et al. (1985, 1988) including Robledo (2001). Secondly, the expectation of service quality did not have any significant direct influence on customer satisfaction. Thirdly, the perception of actual service quality had a significant influence on customer satisfaction that also conforms with previous studies (Albarq, 2013; Cronin & Taylor, 1992; Iacobucci, Grayson, & Ostrom, 1994; Jun, Yang, & Kim, 2004; Wolfinbarger & Gilly, 2003). Lastly, we have also found customer satisfaction has a strong and significant influence on customer loyalty that conforms with the previous studies (Ahmad & Al-Zu'bi, 2011; Albarq, 2013; Bodet, 2008; Gerpott et al., 2001; Govindan, Shankar, & Kannan, 2016).

IPMA analysis of DESCO data shows the management of DESCO was able to generate a higher expectation of service quality among the DESCO customers. All of the indicators of customer expectation showed superior performance, however, for expectation empathy found to have single most importance for expectation formulation. Assurance and reliability of the service have the next level of importance and lastly tangibility and responsiveness. However, indicators of expectation and expectation as a whole did not found to have an important role in generating the perception of actual quality.

The reason may be that expectation of service quality formed a benchmark of service quality (evident in performance), but the perception of actual quality performance only formulates when customers encounter actual service, and hence actual service quality variables found to be important elements in forming perception of actual quality performance. Like expectation of service quality, empathy is also the most important factor that influence actual perception followed by assurance and empathy. However, unlike expectation of service quality, tangibility found to have more importance than responsiveness in the formulation of perception of actual service.

Like perception of actual quality performance, expectation did not found to have important role in satisfaction. Perception of actual quality performance found to be the single most important factor for customer satisfaction of DESCO online bill payment system. Again, empathy found to have more influence on customer satisfaction. Moreover, customer satisfaction found to significantly influence the customer loyalty of DESCO online bill payment system. The more the satisfaction, the more the customer will be loyal to the system.

Customers no more need to travel to the billing counter, wait in the long queue in front of service desk, etc. The convenience and time saving could be a good reason why customers are satisfied with the system and seem loyal to it.

15. Managerial implications

From the managerial point of view, our research suggests some guidelines to the decision-making authorities of the DESCO online bill payment system about how to improve the overall quality of the system regarding reliability, assurance, empathy, tangibility, and responsiveness. These elements reinforce perceived quality of the service and consequently help to increase customers' satisfaction with the service and later make them loyal to the system.

- Customer expectation influences the perception of experience. Customer expectation management is an essential issue for service providers to design proper customer experiences in future.
 Empathy is the key items with which the management could manipulate the expectation level of the customers.
- In the case of actual quality perception, only reliability seemed to achieve the expected performance level compared with the expectation indicators. Empathy, assurance, responsiveness indicators are close to expected level performance but need improvement.
- Regarding importance, management should concentrate first on empathy to give the vibe to the customers that DESCO genuinely cares for their customers. DESCO can increase empathy by the following ways:
- Creating videos tutorials on bill payment procedure and upload to their and other popular websites such as Youtube and Facebook to lessen customer frustration and confusion regarding the procedure.
- Introducing mobile apps to execute the bill payment process easily, making the system more user-friendly.
- Adding other banks and different plastic cards (VISA, Mastercard, Nexus, etc.) under the DESCO's online bill payment systems.
- Creating an exclusive and effective customer care helpline for online bill payment systems.
- DESCO needs to assure that their system is dependable and safe and highly responsive. As time passes by, the systems need to be upgraded with the state-of-art technology. Data security should be maintained by Norton's SSL certificate. The optical fiber connection in each of the bank's server can also provide sufficient physical security, avoid data hack and responsiveness. Furthermore, a password oriented log in system can be implemented in the system instead of the account number login, which is quite a weak point in this regard, to instill trust in the users regarding the security of the system.
- For tangibility, we recommend to change the design and appearance of the website can greatly uplift the satisfaction of the average users regarding the system. Since majority of the users are young, DESCO should employ young and creative people in the development of a new futuristic looking website to fulfill the user's expectation.

16. Theoretical implication

Our study has the following unique theoretical implications.

First, this study extends SERVQUAL model and develops a modified model named as SERVQUAL-Butterfly Model. With the extension and methodological changes, this study demonstrated that using PLS-SEM second-order hierarchical approach; we can still have all the benefits of SERVQUAL model while reducing the previous limitations of this model. Moreover, we were able to incorporate satisfaction and loyalty dimensions, which are the ultimate output of service quality assessment.

The second unique finding is that our study proved that expectation on service quality has no significant effect on the customer satisfaction. It merely forms a basis for the perception of actual service quality.

Third, we also showed that using IPMA with our model could specifically identify the areas of improvement, which was also the primary goal of using SERVQUAL.

17. Future research direction

Future researchers can use this model for further augmentation with other variables and methodologies that suit different context in cross-industry and cross-country environment. Researchers may incorporate moderating effects and mediating effects in this model for further augmentations.

Funding

This work was supported by National Natural Science Foundation of China (NSFC) [grant number 71572033, 71172174]

Author details

Mohammad Anisur Rahman^{1,2} E-mail: anisur@du.ac.bd ORCID ID: http://orcid.org/0000-0002-2503-2397 Xu Qi¹ E-mail: xuqi@dhu.edu.cn Abu Naser Mohammad Saif² E-mail: saif@du.ac.bd Ismail Bin Ibrahim³ E-mail: ismail@desco.org.bd Rabeya Sultana² E-mail: zhalak 19@yahoo.com

- ¹ Department of Logistics Management and e-Commerce, Glorious Sun School of Business and Management, Donghua University, Shanghai, China.
- ² Faculty of Business Studies, Department of Management
- Information Systems, University of Dhaka, Dhaka, Bangladesh. ³ Dhaka Electric Supply Company Limited (DESCO), Dhaka, Bangladesh.
- **Citation information**

Cite this article as: Assessing service quality of online bill payment system using extended SERVQUAL model (SERVQUAL-Butterfly model): A case study of Dhaka electric supply company limited (DESCO), Bangladesh, Mohammad Anisur Rahman, Xu Qi, Abu Naser Mohammad Saif, Ismail Bin Ibrahim & Rabeya Sultana, Cogent Business & Management (2017), 4: 1301195.

References

- Ahmad, A. E. M. K., & Al-Zu'bi, H. A. (2011). E-banking functionality and outcomes of customer satisfaction: An empirical investigation. International Journal of Marketing Studies, 3, 50-65. Retrieved from www.ccsenet.org/ijms
- Akter, M. S., Upal, M., & Hani, U. (2008). Service quality perception and satisfaction: A study over sub-urban public hospitals in Bangladesh. Journal of Services Research, 8, 125-146.
- Al-allak, B. A., & Bekhet, H. A. (2011). Beyond SERVQUAL: A paradigm shift. Australian Journal of Basic and Applied Sciences, 5, 129-134.
- Albarq, A. N. (2013). Applying a SERVQUAL model to measure the impact of service quality on customer loyalty among local Saudi Banks in Riyadh. American Journal of Industrial and Business Management, 3, 700. Retrieved from http://ezproxy. upm.edu.my/login?url=http://search.ebscohost.com/login. aspx?direct=true&db=edsarl&AN=edsarl.21645167.201312. 201405130039.201405130039.700.707&site=eds-live http://dx.doi.org/10.4236/ajibm.2013.38079
- Ali, R., Leifu, G., Yasirrafiq, M., & Hassan, M. (2015). Role of perceived value, customer expectation, corporate image and perceived service quality on the customer satisfaction. The Journal of Applied Business Research, 31, 1425-1437
- Asyraf, W. M., & Afthanorhan, B. W. (2014). Hierarchical component using reflective-formative measurement model in partial least square structural equation modeling (Pls-Sem). International Journal of Mathematics and Statistics Invention, 2, 55-71. Retrieved from http:// www.ijmsi.org/Papers/Volume.2.Issue.2/Version-1/ H0221055071.pdf
- Awad, B. A. A. A. G. (2012). The relationships between service quality, satisfaction, and behavioral intentions of Malaysian spa center customers. International Journal of Business and Social Science, 3, 198-206.

- Azar, O. H. (2009). Incentives and service quality in the restaurant industry: The tipping-service puzzle. Applied Economics, 41, 1917-1927. doi:10.1080/00036840601131813
- Bagozzi, R. P., & Yi, Y. (1988). On the evaluation of structural equation models. Journal of the Academy of Marketing Science, 16, 74-94, doi:10.1007/bf02723327
- Becker, J. M., Klein, K., & Wetzels, M. (2012). Hierarchical latent variable models in PLS-SEM: Guidelines for using reflective-formative type models. Long Range Planning, 45, 359-394. doi:10.1016/j.lrp.2012.10.001
- Beecham, R. (2009). Teaching quality and student satisfaction: Nexus or simulacrum? London Review of Education, 7, 135-146. doi:10.1080/14748460902990336
- Bodet, G. (2008). Customer satisfaction and loyalty in service: Two concepts, four constructs, several relationships. Journal of Retailing and Consumer Services, 15, 156–162. doi:10.1016/j.jretconser.2007.11.004
- Boss, A. H. (2009). Convergence in electronic banking: Technological convergence, systems convergence, legal convergence. Drexel Law Review, 2, 63-103.
- Brady, M. K. (2001). Some new thoughts on conceptualizing perceived service quality: A hierarchical approach. Journal of Marketing, 65, 34-49.
- http://dx.doi.org/10.1509/jmkg.65.3.34.18334 Brady, M. K., & Cronin, Jr, J. J. (2001). Some new thoughts on conceptualizing perceived service quality: A hierarchical

approach. Journal of Marketing, 65, 34-49. http://dx.doi.org/10.1509/jmkg.65.3.34.18334

- BTRC. (2016). Internet subscriber of Bangladesh. Retrieved June 10, 2016, from http://www.btrc.gov.bd/content/ internet-subscribers-bangladesh-april-2016
- Chowdhary, N., & Prakash, M. (2007). Prioritizing service quality dimensions. Managing Service Quality: An International Journal, 17, 493-509. doi:10.1108/09604520710817325
- Cronin, J. J., & Taylor, S. A. (1992). Measuring service quality: A reexamination and extension. Journal of Marketing, 56, 55. doi:10.2307/1252296
- Enríquez, G., Olimpia, S., Darío, G. H., Martínez, M., Adriana, R., Verónica, G. G., & Yolanda, T. F. (2016). Expectations and perspectives of users with the screening program for cervical. Cancer, 565-572.
- Fountain, J. E. (2001). Paradoxes of public sector customer service. Governance, 14, 55-73. doi:10.1111/0952-1895.00151
- Gaskin, J. (2011). Common method bias—YouTube. Retrieved youtube.com from https://www.youtube.com/ watch?v=w7zZCBIRXog
- Gaskin, J. (2012). SmartPLS formative 2nd order constructs-YouTube. Retrieved youtube.com from https://www. youtube.com/watch?v=kPeUTKjMF7o

Gerpott, T. J., Rams, W., & Schindler, A. (2001). Customer retention, loyalty, and satisfaction in the German mobile cellular telecommunications market. Telecommunications Policy, 25, 249-269. doi:10.1016/S0308-5961(00)00097-5

- Gloria, B. (2012). The effect of service quality and customer satisfaction. Interdisciplinary Management Research XI, 3, 3-10.
- Govindan, K., Shankar, M., & Kannan, D. (2016). Supplier selection based on corporate social responsibility practices. Intern. Journal of Production Economics, 1, 1-1. doi:10.1016/j.ijpe.2016.09.003
- Grönroos, C. (1984). A service quality model and its marketing implications. European Journal of Marketing, 18, 36-44. http://dx.doi.org/10.1108/EUM000000004784

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2013). A primer on partial least squares structural equation modeling (PLS-SEM). Qualitative research (vol. 6). Thousand Oaks, CA: SAGE Publications, Inc. doi:10.1177/1468794106058877

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. The Journal of Marketing Theory and Practice, 19, 139–152. doi:10.2753/MTP1069-6679190202

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2013). Partial least squares structural equation modeling: Rigorous applications, better results and higher acceptance. *Long Range Planning*, 46, 1–12. doi:10.1016/j.lrp.2013.01.001.
Hernon, P., & Nitecki, D. A. (2001). Service guality: A concept

not fully explored. *Library Trends*, 49, 687–708. Ho, L., Feng, S., & Yen, T. (2014). *Using modified IPA to improve*

- service quality of standard hotel in Taiwan, 1, 222–234. Hoque, M. R. (2016). Factors affecting e-health adoption in a developing country: An empirical study. Wuhan Shi: The Huazhong University of Science and Technology.
- Hsieh, Y. H., & Yuan, S. T. (2011). Evaluating a mechanism for measuring customer expectation in real-time service contexts. Proceedings - 2011 International Joint Conference on Service Sciences, IJCSS 2011, 97–104. doi:10.1109/IJCSS.2011.27
- Iacobucci, D., Grayson, K. A., & Ostrom, A. L. (1994). The calculus of service quality and customer satisfaction: Theoretical and empirical differentiation and integration. Advances in Services Marketing and Management, 3(1), 1–67. doi:10.1016/S1067-5671(94)03013-8
- Jayasundara, C., Ngulube, P., & Minishi-Majanja, M. K. (2009). Developing a model for predicting customer satisfaction in relation to service quality in university libraries in Sri Lanka. South African Journal of Libraries & Information Science, 75, 179–194.

doi:10.1016/S1474-4422(09)70010-9

- Jun, M., Yang, Z., & Kim, D. (2004). Customers' perceptions of online retailing service quality and their satisfaction. *International Journal of Quality & Reliability Management*, 21, 817–840. doi:10.1108/02656710410551728
- Kang, G. D., & James, J. (2004). Service quality dimensions: An examination of Grönroos's service quality model. Managing Service Quality: An International Journal, 14, 266–277.
- http://dx.doi.org/10.1108/09604520410546806 Kanning, U. P., & Bergmann, N. (2009). Predictors of customer satisfaction: Testing the classical paradigms. *Managing Service Quality: An International Journal*, 19, 377–390. http://dx.doi.org/10.1108/09604520910971511
- Lenk, K. (2002). Electronic service delivery–A driver of public sector modernisation. *Information Polity*, 7, 87–96.
- Lowry, P. B., & Gaskin, J. (2014). Partial least squares (PLS) structural equation modeling (SEM) for building and testing behavioral causal theory: When to choose it and how to use it. *IEEE Transactions on Professional Communication*, 57, 123–146. doi:10.1109/TPC.2014.2312452
- Oliver, R. L., Rust, R. T., & Varki, S. (1997). Customer delight: Foundations, findings, and managerial insight. *Journal of Retailing*, *73*, 311–336.
- http://dx.doi.org/10.1016/S0022-4359(97)90021-X Parasuraman, A., Zeithaml, V., & Berry, L. (1985). Conceptual model of service quality and its implications for future research. *Journal of Marketing*, 49, 41–50. doi:10.1016/S0148-2963(99)00084-3
- Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1988). SERVQUAL: A multi-item scale for measuring consumer perceptions of the service quality. *Journal of Retailing*, 64, 12–40.
- Pavlou, P., Liang, H., & Xue, Y. (2006). Understanding and mitigating uncertainty in online environments: A principalagent perspective. *MIS Quarterly*. Retrieved from http:// papers.ssrn.com/sol3/papers.cfm?abstract_id=2380164

- Petter, S., Straub, D. W., & Rai, A. (2007). Specifying formative constructs in information systems research. MIS Quarterly, 31, 623–656.
- Podsakoff, P., MacKenzie, S., & Lee, J. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88*, 897. Retrieved from http://psycnet.apa. org/journals/apl/88/5/879/
- Puni, A., Okoe, A., & Damnyag, J. B. (2014). A gap analysis of customer perceptions and expectation of service quality amongst mobile telephony companies in Ghana. *Journal* of Management and Strategy, 5, 60–70. doi:10.5430/jms.v5n3p60
- Quinn, B. (1997). Adapting service quality concepts to academic libraries. The Journal of Academic Librarianship, 23, 359–369. doi:10.1016/S0099-1333(97)90033-1
- Quinn, J. B., Baruch, J. J., & Paquette, P. C. (1987). Technology in Services. *Scientific American*, 257, 50–58.
- http://dx.doi.org/10.1038/scientificamerican1287-50 Ringle, C. M., & Sarstedt, M. (2016). Gain more insight from your PLS-SEM results. *Industrial Management & Data Systems*, 116, 1865–1886. doi:10.1108/IMDS-10-2015-0449
- Ringle, C. M., Wende, S., & Becker, J.-M. (2015). SmartPLS 3. Bönningstedt: SmartPLS.
- Robledo, M. Á. (2001). Measuring and managing service quality: Integrating customer expectations. Managing Service Quality: An International Journal, 11, 22–31. doi:10.1108/09604520110379472
- Schloderer, M. P., Sarstedt, M., & Ringle, C. M. (2014). The relevance of reputation in the nonprofit sector: The moderating effect of socio-demographic characteristics. International Journal of Nonprofit and Voluntary Sector Marketing, 19, 110–126. doi:10.1002/nvsm.1491
- Snoj, B. (1995). The profiles of importance of service quality components in health spas. *Der Markt*, 34, 95–104. http://dx.doi.org/10.1007/BF03032046
- Sourbati, M. (2009). "It could be useful, but not for me at the moment": Older people, internet access and e-public service provision. *New Media & Society*, 11, 1083–1100. doi:10.1177/1461444809340786
- Tsai, W.-H., Hsu, W., & Lin, T. W. (2011). New financial service development for banks in Taiwan based on customer needs and expectations. *The Service Industries Journal*, 31, 215–236. doi:10.1080/02642060903295636
- Wisniewski, M. (2001). Using SERVQUAL to assess customer satisfaction with public sector services. Managing Service Quality: An International Journal, 11, 380–388. http://dx.doi.org/10.1108/EUM000000006279
- Wolfinbarger, M., & Gilly, M. C. (2003). eTailQ: Dimensionalizing, measuring and predicting etail quality. *Journal of Retailing*, 79, 183–198. doi:10.1016/ S0022-4359(03)00034-4
- Wong, K. K. (2013). Partial least squares structural equation modeling (PLS-SEM) techniques using smart PLS. Marketing Bulletin, 24(1), 1–32. doi:10.1108/EBR-10-2013-0128
- Wong, K. K.-K. (2016). Mediation analysis, categorical moderation analysis, and higher-order constructs modeling in partial least squares structural equation modeling (PLS-SEM): A B2B example using SmartPLS. The Marketing Bulletin, 26, 1–22. doi:10.13140/RG.2.1.1643.0562
- Wong, M. (2014). Evaluating online shopping service quality— SERVEGAL in Taiwan tourism industry. Open Journal of Social Sciences, 2, 213–216. http://dx.doi.org/10.4236/jss.2014.29036

Appendix 1

Exploratory factor analysis for Harman's single-factor test.

| Total variance explained | | | | | | |
|--------------------------|---------------------|---------------|--------------|-------------------------------------|---------------|--------------|
| Factor | Initial Eigenvalues | | | Extraction sums of squared loadings | | |
| | Total | % of variance | Cumulative % | Total | % of variance | Cumulative % |
| 1 | 17.486 | 48.572 | 48.572 | 16.781 | 46.613 | 46.613 |
| 2 | 4.231 | 11.752 | 60.323 | | | |
| 3 | 2.061 | 5.726 | 66.049 | | | |
| 4 | 1.491 | 4.141 | 70.190 | | | |
| 5 | 1.061 | 2.948 | 73.138 | | | |
| 6 | 0.758 | 2.107 | 75.245 | | | |
| 7 | 0.642 | 1.783 | 77.027 | | | |
| 8 | 0.607 | 1.687 | 78.715 | | | |
| 9 | 0.566 | 1.573 | 80.288 | | | |
| 10 | 0.519 | 1.440 | 81.728 | | | |
| 11 | 0.479 | 1.331 | 83.059 | | | |
| 12 | 0.451 | 1.253 | 84.313 | | | |
| 13 | 0.418 | 1.160 | 85.473 | | | |
| 14 | 0.387 | 1.076 | 86.548 | | | |
| 15 | 0.365 | 1.013 | 87.562 | | | |
| 16 | 0.352 | 0.978 | 88.540 | | | |
| 17 | 0.336 | 0.932 | 89.472 | | | |
| 18 | 0.309 | 0.859 | 90.331 | | | |
| 19 | 0.301 | 0.837 | 91.169 | | | |
| 20 | 0.280 | 0.778 | 91.947 | | | |
| 21 | 0.269 | 0.748 | 92.695 | | | |
| 22 | 0.250 | 0.694 | 93.390 | | | |
| 23 | 0.237 | 0.660 | 94.049 | | | |
| 24 | 0.220 | 0.611 | 94.661 | | | |
| 25 | 0.215 | 0.597 | 95.258 | | | |
| 26 | 0.210 | 0.584 | 95.842 | | | |
| 27 | 0.208 | 0.577 | 96.419 | | | |
| 28 | 0.192 | 0.534 | 96.953 | | | |
| 29 | 0.180 | 0.500 | 97.453 | | | |
| 30 | 0.169 | 0.470 | 97.923 | | | |
| 31 | 0.160 | 0.446 | 98.368 | | | |
| 32 | 0.138 | 0.384 | 98.753 | | | |
| 33 | 0.124 | 0.343 | 99.096 | | | |
| 34 | 0.118 | 0.327 | 99.424 | | | |
| 35 | 0.105 | 0.292 | 99.716 | | | |
| 36 | 0.102 | 0.284 | 100.000 | | | |

Note: Extraction Method: Maximum Likelihood.



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