



Research article

Factors influencing cloud service quality and their relationship with customer satisfaction and loyalty

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ARTICLE INFO

Keywords:

Cloud service quality
Customer satisfaction
Customer loyalty
PLS SEM
India

ABSTRACT

The quality of cloud service is an important aspect to the success of any global business in today's world. The objective of this paper is to find the factors of the cloud service quality and assess the impact of service quality on customer satisfaction and loyalty. A survey of 419 cloud experts/users was conducted in India by means of an organized survey instrument/questionnaire based on Likert scale. The respondents were the cloud experts/users using the services of top 5 cloud service providers of India. Research hypotheses were tested using partial least squares structural equation modeling. The study found that agility, assurance of service, reliability, scalability, security, service responsiveness, and usability all have a positive and significant effect on overall cloud service quality. The research revealed the partial mediation effect of customer satisfaction amid service quality and customer loyalty. It is noticed that service quality has positive and significant link with customer loyalty and customer satisfaction. This establishes the partial mediation effect of customer satisfaction on the link between service quality and customer loyalty. Finally, the paper recommends cloud experts/users/service providers to give specific attention to these factors when migrating to cloud services.

1. Introduction

Indian cloud computing industry is still in embryonic phase. The cloud services have significant benefits to business establishments such as digital innovation and improved economy of scale however, at the same time it brings numerous issues, and challenges e.g., security, data lock-in, cloud service quality etc. [1]. The growth of cloud service in India is not that inspiring, as it was envisioned a decade before. The poor cloud computing growth is obvious from the numerous global cloud indices. There is no reservation on that the cloud is a bright technology. In addition, abundance of literature has been printed on how cloud will transform the information technology business. The cloud service growth factors could be different for each nation. There are numerous whys and wherefores ascribed to the poor cloud service growth in India. Despite the poor growth of cloud service in India, the service providers are providing good quality of service. This paper deliberates the factors of cloud service quality in India. The cloud standing in India is shown in Table 1.

The worldwide race in the cloud computing segment has prompted cloud service providers to create pioneering ways to beat the competition. The cloud service providers have incorporated novel technologies that have reimagined the cloud computing landscape. Cloud computing has steered into a new age and hence cloud service providers across the globe including India, have engrossed cloud

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service quality as existence policy in recent years. They today deliver superlative cloud service quality to their clientele.

This study has become inevitable as the Indian cloud industry is research scarce with very limited literature available in context of India. This novel study is one of the forerunner studies for cloud service quality factors in India, and no relevant literature found on cloud service quality factors in Indian context even after thorough search, however there is abundance of research papers available on cloud adoption, cloud vendor selection and cloud service quality in other countries and no or minimum focus in India. This study has four goals namely-find significant factors of the cloud service quality in Indian context, examine the influence of the factors on cloud service quality, assess the impact of service quality of customer satisfaction and loyalty, and investigate the impact of mediating factor (customer satisfaction) on the link amid service quality and customer loyalty. This study is founded on the survey instrument prepared to collect the data for the significant factors influencing quality of cloud service. The research encompasses of below segments-i) literature review and factors conclusion, ii) research model, questionnaire, and hypotheses establishment, iii) execution of survey to capture primary data, iv) quantitative data analysis using PLS-SEM, discussions, and outcomes.

2. Literature review and hypothesis

The comprehensive literature review was performed by swotting more than 140 research papers and articles available in diverse national and international journals, reports, conference proceedings, various internet sites, and books. Cloud service quality factors, customer satisfaction, customer loyalty, PLS-SEM and structural equation model were the significant keywords to obtain the appropriate research materials. The principal goal of the literature review was to find factors influencing cloud service quality quoted by numerous researchers in their research work, investigate the link of service quality with customer satisfaction and customer loyalty and scrutinize the role of mediation factor (customer satisfaction) on the link amid service quality and customer loyalty. Cloud service is different from traditional service and hence service quality factors for cloud services are not identical as traditional services. Researchers have revealed multiple factors for cloud service quality however some of these factors such as assurance of service, reliability, and service responsiveness, are same as traditional services. The most common cloud service quality factors mentioned by the researchers are stated in Table 2.

The link amongst service quality, customer satisfaction and customer loyalty has been deliberated by research authors numerous times. The factors of service quality could be different for different kind of services however the link amidst service quality, customer satisfaction and customer loyalty remain same across all kinds of service. It is the service quality that drives customer satisfaction and customer satisfaction in turn drives customer loyalty. It has been found by several researchers that customer satisfaction plays a role of mediating variable too on the link amid service quality and customer loyalty. Hence it shows that there is a direct link amid service quality and customer loyalty. The below Table 3 presents the link amidst service quality, customer satisfaction and customer loyalty as deliberated by various authors.

Post identification of factors through exhaustive literature review, an exploratory discussion was steered with cloud experts/users using Delphi technique to conclude the final cloud service quality factors. A total of 72 cloud experts/users from diverse technical and functional domains and engaged in cloud services such as architects, design consultants, program managers, project managers, cloud engineers, and cloud users participated in Delphi technique. Kushagra and Dhingra (2019) [50] referred to Delphi technique to identify the factors of cloud adoption in the context of Indian government sector. Cloud experts/users engaged in discussion had experience on Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS). Post three iterations, the eleven factors were revealed namely-agility, assurance of service, availability, interoperability, latency, reliability, scalability, security, service level agreement, service responsiveness, and usability. On further discussion (fourth iteration) with cloud experts/users the number of core cloud service quality factors reduced to seven namely-agility, assurance of service, reliability, scalability, security, service responsiveness, and usability.

i) Agility

According to Buyya et al. (2019) [6], Fonstad and Ross (2015) [7], Garg et al. (2013) [9], Baliyan and Kumar (2013) [8], Siegel and Perdue (2012) [10], agility is one of the key factors to influencing the service quality of the cloud service providers. It is the capability provided by the cloud services to move swiftly and effortlessly, to quickly develop, assess and deploy software applications to boost the commercial benefits, and to acclimate fast and cost effectiveness in reply to the new customer requirements. Hence below hypothesis (H1) is proposed for Agility factor-

Table 1
Cloud status in India.

Indicators	Cloud Status/Rank in India	References
Cloud readiness index	Rank 10; Total countries 14	Asia Cloud Computing Association (2020) [2]
Cloud spending	6% of IT spending; Global average 7.9%	National Association of Software and Service Companies (2019) [3]
Global cloud computing scorecard	Rank 20; Total countries 24	Business Software Alliance (BSA) cloud computing scorecard (2018) [4]
Information and communication technology (ICT) development index	Rank 134; Total countries 176	International Telecommunication Union (2017) [5]

Table 2
Literature review for service quality factors.

Service Quality Factors	Authors and Year
Agility	Buyya et al. (2019) [6] Fonstad and Ross (2015) [7] Baliyan and Kumar (2013) [8] Garg et al. (2013) [9] Siegel and Perdue (2012) [10]
Assurance of service	Kochovski et al. (2019) [11] Garg et al. (2013) [9] Siegel and Perdue (2012) [10] Rosen and Karwan (1994) [12] Parasuraman et al. (1985) [13]
Reliability	Buyya et al. (2019) [6] Shatnawi et al. (2018) [14] Zheng et al. (2014) [15] Gupta et al. (2013) [16] Prade et al. (2012) [17] Lee et al. (2009) [18] Zeithaml et al. (2001) [19] Rosen and Karwan (1994) [12] Parasuraman et al. (1985) [13]
Scalability	Buyya et al. (2019) [6] Jatoth et al. (2019) [20] Becker et al. (2017) [21] David and Anbuselvi (2015) [22] Phaphoom et al. (2015) [23] Zheng et al. (2014) [15] Pilevari et al. (2013) [24] Garg et al. (2013) [9] Baliyan and Kumar (2013) [8] Prade et al. (2012) [17] Lee et al. (2009) [18]
Security	Buyya et al. (2019) [6] Fernando et al. (2019) [25] Jouini and Rabai (2019) [26] Manuel (2015) [27] Zheng et al. (2014) [15] Ding et al. (2014) [28] AL-Aswadi and Batarfi (2014) [29] Panth et al. (2014) [30] Lian et al. (2014) [31] Koduah et al. (2014) [32] Garg et al. (2013) [9] Pilevari et al. (2013) [24] Arora and Parashar (2013) [33] Cao et al. (2013) [34] Shin (2013) [35] Prade et al. (2012) [17] Siegel and Perdue (2012) [10]
Service Responsiveness	Jatoth et al. (2019) [20] Shatnawi et al. (2018) [14] Zheng et al. (2014) [15] Pilevari et al. (2013) [24] Meehan and Dawson (2002) [36]
Usability	Yadav and Goraya (2018) [37] Olokunde et al. (2017) [38] Phaphoom et al. (2015) [23] Zheng et al. (2014) [15] Garg et al. (2013) [9] Gupta et al. (2013) [16] Baliyan and Kumar (2013) [8] Pilevari et al. (2013) [24] Siegel and Perdue (2012) [10] Lee et al. (2009) [18]

Hypothesis 1. (H1). Agility factor has a significant and positive effect on service quality.

ii) Assurance of Service

As per Kochovski et al. (2019) [11] business organizations require assurance of service from cloud service providers that they will

Table 3

Literature review for relationship among service quality, customer satisfaction and customer loyalty.

Authors and Year	Hypothesized Path Established	Findings
De Oña, J. (2021) [39], Gorondutse and Hilman (2014) [40], Chen et al. (2010) [41]	Service Quality - > Customer Satisfaction Service Quality - > Customer Loyalty With mediating variable (full): Customer satisfaction: Service Quality - > Customer Satisfaction - > Customer Loyalty	The authors analyzed the impact of mediating variable (customer satisfaction) on the link amid service quality and loyalty and confirmed the dominance of the full mediation over the partial mediation. They exposed the mediation role of customer satisfaction on the links amid service quality and customer loyalty.
Slack and Singh (2020) [42], Iqbal et al. (2018) [43], Ashraf et al. (2018) [44], Rahim (2016) [45], Liat et al. (2014) [46], Caruana (2002) [47]	Service Quality - > Customer Satisfaction Service Quality - > Customer Loyalty With mediating variable: Customer satisfaction: Service Quality - > Customer Satisfaction - > Customer Loyalty	The authors found the positive and substantial link amid service quality and customer satisfaction as well as loyalty; and customer satisfaction partially mediates the link amid service quality and customer loyalty. Service quality has a direct as well as indirect impact on customer loyalty via customer satisfaction.
Meesala and Paul (2018) [48]	Reliability - > Customer Satisfaction Reliability - > Customer Loyalty With mediating variable: Customer satisfaction: Reliability - > Customer Satisfaction - > Customer Loyalty	The authors revealed that reliability and responsiveness (dimensions of the service quality) impact satisfaction and satisfaction is directly linked with the loyalty. Also, observed that satisfaction has a mediating role in improving the loyalty.
Al-deewari et al. (2017) [49]	Customer Service - > e-satisfaction e-satisfaction - > Behavioral Loyalty e-satisfaction - > Attitudinal Loyalty With mediating variable: e-satisfaction: Customer Service - > e-satisfaction - > Behavioral Loyalty Customer Service - > e-satisfaction - > Attitudinal Loyalty	The authors indicated that customer service (factor of e-SQ) has a significant impact on satisfaction; found positive link amid e-satisfaction and loyalty; established that satisfaction mediates the link amid e-SQ and behavioral and attitudinal loyalty.

provide acceptable quality of service before taking a decision to migrate to cloud services. In the context of cloud services, it is the policies and processes of the cloud service provider to warrant a minimum acceptable level of service quality to the customers. Garg et al. (2013) [9], Siegel and Perdue (2012) [10] described assurance of service as a vital factor of cloud service quality. Hence below hypothesis (H2) is proposed for Assurance of service factor-

Hypothesis 2. (H2). Assurance of service factor has a significant and positive effect on service quality.

iii) Reliability

According to Buyya et al. (2019) [6], Shatnawi et al. (2018) [14], Zheng et al. (2014) [15], Gupta et al. (2013) [16], Prade et al. (2012) [17] and Lee et al. (2009) [18] reliability is a vital and essential factor for cloud service quality. Gupta et al. (2013) [16] stated that reliability denotes service operation without failure at a given time and condition. They examined reliability and noticed that cloud computing promises the reliability to the organizations by facilitating exceptional backup data, improved reliable storage solutions, outstanding disaster recovery with incessant access, capability to backup data securely from spam and malware. Thus, the below hypothesis (H3) is proposed for Reliability factor-

Hypothesis 3. (H3). Reliability factor has a significant and positive effect on service quality.

iv) Scalability

As per Jatoth et al. (2019) [20], Buyya et al. (2019) [6], Becker et al. (2017) [21], Phaphoom et al. (2015) [23], David and Anbuselvi (2015) [22], Zheng et al. (2014) [15], Baliyan and Kumar (2013) [8], Garg et al. (2013) [9], Pilevari et al. (2013) [24], Prade et al. (2012) [17] and Lee et al. (2009) [18] scalability is a significant factor for cloud service quality. David and Anbuselvi (2015) [22] explained scalability as the addition of hardware resources (e.g., CPU, memory etc.) dynamically to the cloud based on the application processing requirement. Garg et al. (2013) [9] stated that the scalability is a significant quality factor for those who need to migrate their business to the cloud. Business scalability is one of the supreme motives for organizations to migrate to cloud services [23]. Hence below hypothesis (H4) is proposed for Scalability factor-

Hypothesis 4. (H4). Scalability factor has a significant and positive effect on service quality.

v) Security

The researchers have widely deliberated the cloud security [1]. They accepted the data loss, phishing, cyber-attack, and issues arising

from multi tenancy as significant cloud security apprehensions. Cloud security has improved a lot and become very strong and impervious because of technology progressions, high level encryption, and continuous monitoring that warrants strong safekeeping of data/application kept on the cloud [51]. Hence below hypothesis (H5) is proposed for Security factor-

Hypothesis 5. (H5). Security of service factor has a significant and positive effect on service quality.

vi) Service Responsiveness

Jatoth et al. (2019) [20], Shatnawi et al. (2018) [14], Zheng et al. (2014) [15], Pilevari et al. (2013) [24] acknowledged service responsiveness as an important construct for cloud services. Ensuring service responsiveness is crucial to the business. Disregarding customer queries can decrease customer satisfaction and trigger them towards competitors' services. Good service responsiveness takes customer service to next level. Meehan and Dawson (2002) [36] elucidated that customer service responsiveness is precisely helping customers what they need, or don't until now know they need and undertaking it more swiftly than anybody else. Hence below hypothesis (H6) is proposed for Service responsiveness factor-

Hypothesis 6. (H6). Service responsiveness factor has a significant and positive effect on service quality.

vii) Usability

Usability refers to the ease in using the cloud computing services. According to Yadav and Goraya (2018) [37], Phaphoom et al. (2015) [23], Zheng et al. (2014) [15], Gupta et al. (2013) [16], Garg et al. (2013) [9], Baliyan and Kumar (2013) [8], Pilevari et al. (2013) [24], Siegel and Perdue (2012) [10] and Lee et al. (2009) [18] usability/ease of utilization is one of the imperative factors in cloud computing. Gupta et al. (2013) [16] acknowledged the ease of convenience as the foremost aspect of the cloud service quality as it in turn results in reduced learning period for the workforce, facility to access cloud services, and hence data from anyplace. Hence below hypothesis (H7) is proposed for Usability factor-

Hypothesis 7. (H7). Usability factor has a significant and positive effect on service quality.

viii) Service Quality and Customer Satisfaction

The link amid service quality and customer satisfaction has been highlighted by various authors in their research work. Smith and Swinehart (2001) [52] noticed a robust association amid service quality and customer satisfaction. They established that customer's perception of service quality is a significant variable defining level of customer satisfaction. Kim et al. (2004) [53] stated that customer satisfaction will be high if service quality is also high. Kuo et al. (2009) [54] mentioned that service quality influences customer satisfaction. Chen et al. (2010) [41] recognized the link amid service quality and customer satisfaction. Li et al. (2021) [55] explained the positive effect of service quality on customer satisfaction. Hu et al. (2011) [56] and Liat et al. (2014) [46] also established strong link amid service quality and customer satisfaction. Gorondutse and Hilman (2014) [40] stated that there is an affirmative and strong link amidst service quality and customer satisfaction. Rahim (2016) [45] revealed that service quality is positively linked to customer satisfaction. Van Lierop and El-Geneidy (2016) [57] also confirmed the positive effect of service quality on customer satisfaction. Hence below hypothesis (H8) is proposed for Service Quality-

Hypothesis 8. (H8). Service Quality has a significant and positive effect on customer satisfaction.

ix) Customer Satisfaction and Customer Loyalty

Customer satisfaction and loyalty are broadly accepted as key pointers for lasting business accomplishment. The researchers have testified a robust influence of customer satisfaction on customer loyalty and hence the inclusive business success. Several establishments ponder customer loyalty a vital foundation for commercial gain [58]. Kim et al. (2004) [53] stated that customer loyalty will be high if customer satisfaction is also high. According to Chen et al. (2010) [41] business organizations influence customers' loyalty through their total satisfaction. Customer satisfaction is an important precursor to customer loyalty [59]. Kandampully and Suhartanto (2000) [60] stated that there is no academic framework to identify the factors that could lead to customer loyalty [61]. However, there is a consent that service quality and customer satisfaction are precondition to customer loyalty [61,62]. Kandampully and Suhartanto (2000) [60] stated that there is positive relation amid customer satisfaction and customer loyalty. Al-deewari et al. (2017) [49] mentioned that the link amid customer satisfaction and customer loyalty is very intuitive. Customer satisfaction affects customer's behavior and this in turn affects customer loyalty. Kassim and Abdullah (2010) [63] and Liat et al. (2014) [46] established a strong link amid customer satisfaction and loyalty. Helgesen (2006) [64] detected through empirical observation that a more satisfied customer is inclined to be more loyal. Iqbal et al. (2018) [43] revealed a positive and noteworthy direct association among loyalty and service quality and indirectly through customer satisfaction. Gorondutse and Hilman (2014) [40] stated that customer satisfaction is positively and significantly linked to customer loyalty. Rahim (2016) [45] found positive link amid customer satisfaction and customer loyalty. Van Lierop and El-Geneidy (2016) [57] also confirmed the positive effect of customer satisfaction on customer loyalty. Hence below hypothesis (H9) is proposed for Customer Satisfaction-

Hypothesis 9. (H9). Customer satisfaction has a significant and positive effect on customer loyalty.

x) Service Quality and Customer Loyalty

The authors across the world, have established that customer satisfaction plays a mediating role amid service quality and customer loyalty in all kinds of services. Caruana (2002) [47] stated that customer satisfaction acts as a mediating variable in service quality driving customer loyalty. Chen et al. (2010) [41] recognized the link amidst service quality, customer satisfaction and customer loyalty however they found the value of path weight amid service quality and customer loyalty is 0.219 ($p > 0.05$) that shows a very feeble link. Al-deewari et al. (2017) [49] established that customer satisfaction mediates the link amid service quality and customer loyalty. Meesala and Paul (2018) [48] also observed that customer satisfaction has a mediating role in improving the customer loyalty. Gorondutse and Hilman (2014) [40] exposed the mediation effect of customer satisfaction on the link amid service quality and customer loyalty. Liat et al. (2014) [46] discovered that service quality has an indirect impact on customer loyalty via customer satisfaction. Rahim (2016) [45] found the positive mediating effect of customer satisfaction amid service quality and customer loyalty and concluded that service quality does impact customer satisfaction and in turn customer loyalty. Iqbal et al. (2018) [43] also elucidated the influence of service quality on customer loyalty via the mediating character of customer satisfaction. Hence below hypothesis (H10 and H11) are proposed for Service Quality-

Hypothesis 10. (H10). Service Quality has a significant and positive effect on customer loyalty.

Hypothesis 11. (H11). Customer satisfaction has a mediating effect on the link amid service quality and customer loyalty.

The proposed research model representing the link among the cloud service quality factors, cloud service quality, customer satisfaction and customer loyalty is shown below in Fig. 1.

3. Research methodology

3.1. Pilot study, questionnaire design, sampling and data collection

The key objective of this study is to peruse the vital cloud service quality factors in India and evaluate the impact of cloud service quality on customer satisfaction and loyalty. Apart from this, the study evaluates the impact of the mediating variable (customer satisfaction) on cloud service quality. The process of data gathering encompassed three stages. In the first stage, the initial set of factors influencing cloud service quality in Indian context, were attained. In second stage, a pilot study was conducted to get in-depth understanding and amend the questionnaire in Table 10 (Annexure A) based on the feedback. In the third and final stage, a survey was conducted to attain the perception of the cloud experts/users on the factors influencing cloud service quality, customer satisfaction and loyalty. The ethical approval for carrying out this research work was taken from School Research Committee, University School of Management, Guru Gobind Singh Indraprastha University. Informed consent was obtained from all participants prior to the data collection.

Top 5 cloud service providers i.e., Amazon, Microsoft, Google, IBM and Cloud4C (Enterprise IT World, 2018) [65] in India were selected for the research. The sample frame consisted of Indian Organizations using the services of the top 5 cloud service providers. The list of customers of the top cloud service providers was taken from their website. The respondents were Cloud Solution Architect, Cloud Project Managers, Cloud Consultants, Cloud Engineers, and Cloud Users using the cloud services in India. Total 910 cloud industry experts/users were randomly selected to respond to the questionnaire survey. An add-on cover note detailing the objective and confidentiality of the survey was also shared with the respondents. The data were gathered via electronic and direct consultations. The questionnaire survey was shared with randomly selected 910 cloud experts/users and total 445 cloud experts/users responded to questionnaires survey. There were 26 responses that were either partial or wrong. Finally, 419 properly filled responses were received for the analysis, that is 46.04% of the total cloud experts/users selected. The selected cloud experts/users had good knowledge and experience on the subject, and they were made aware of the significance of this research. Partial Least Square Structural equation modeling (PLS-SEM) using SmartPLS version 3.3.3 statistical tool was applied for quantitative analysis.

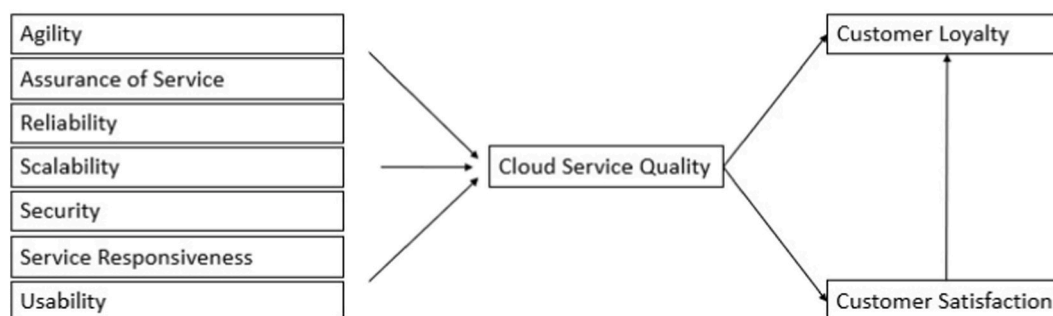


Fig. 1. Proposed research model. Agility, Assurance of Service, Reliability, Scalability, Security, Service Responsiveness, and Usability are the factors of overall Cloud Service Quality. Cloud Service Quality is linked with Customer Loyalty and Customer Satisfaction.

4. Result and analysis

The exogenous and endogenous variables and the link (hypothesized relationship) amid them are presented in Fig. 2. The research model amid the indicators and the latent exogenous constructs is a reflective model.

4.1. Outer model (measurement model)

The below section describes the outer model that includes computation of reliability, internal consistency, and validity of the constructs.

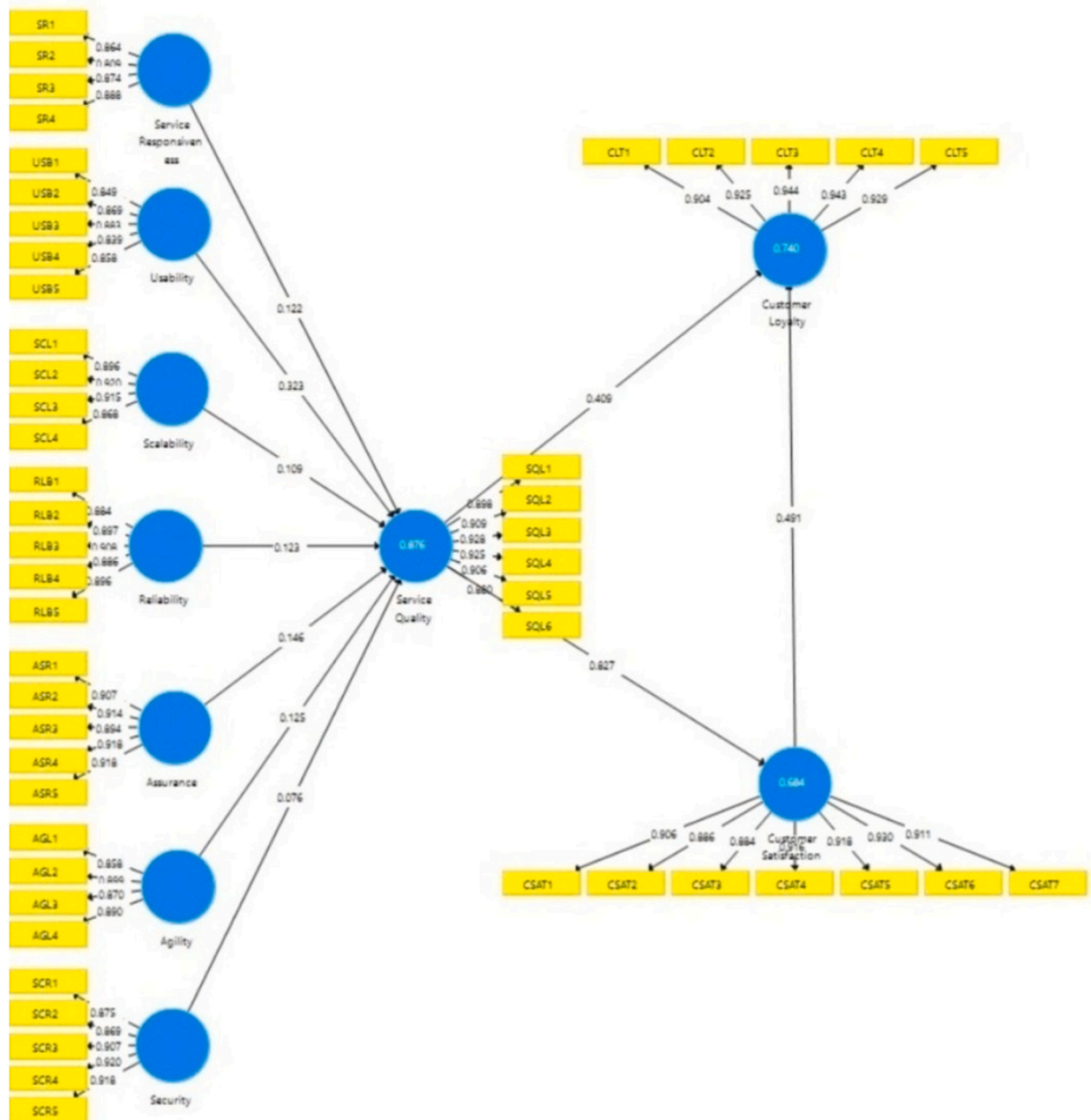


Fig. 2. Assessment of structural equation model. Blue circles represent independent (Agility, Assurance of Service, Reliability, Scalability, Security, Service Responsiveness, and Usability) and dependent variables (Cloud Service Quality, Customer Loyalty and Customer Satisfaction). Yellow boxes represent items of the respective independent and dependent variables. The figure shows the analysis of independent and dependent variables in SmartPLS. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

4.1.1. Reliability

The construct reliability was evaluated by applying Cronbach alpha and Composite reliability. The observed variables having an outer loading value equal to greater than 0.7 are considered good [66]. The observed items with the outer loading less than 0.7 are not acceptable [67]. In this study, the outer loadings, Cronbach alpha and Composite Reliability values were found to be greater than 0.7 and hence the construct reliability is confirmed.

4.1.2. Validity

Construct validity confirms if the questionnaire used in the survey, is tapping the real idea conjectured in the research. Two types of assessments must be done to accomplish validity scrutiny viz.: convergent validity and discriminant validity.

i) Convergent Validity

In PLS, the convergent validity of a construct is probed by evaluating the Average variance extracted (AVE) and item loadings [68]. AVE of a construct is the grand mean value of the squared loadings of its indicators [68]. The AVE value greater than or equal to 0.50 is considered good [68]. The outcome of the internal consistency (Cronbach alpha, Composite reliability, and AVE) is given below in Table 4.

ii) Discriminant Validity

The distinctiveness of a measured factor is probed by evaluating discriminant validity. It is assessed by cross loadings amid measured factors. The two commonly used correlation techniques used to evaluate discriminant validity, are Fornell-Larcker criterion and Heterotrait- Monotrait Ratio (HTMT). The discriminant validity is confirmed if the square root of each measured factors' AVE is more than its correlation with any other measured factor [68]. In this research Fornell and Larcker (1981) [69] criterion was applied to probe discriminant validity and the outcome is presented below in Table 5.

The diagonal values in Table 5 are the square root of the AVE, and these are greater than the off-diagonal values. This supports the fact that there is no correlation amid any two measured factors. Hence, it confirms the discriminant validity in the research model.

The Cronbach alpha, Composite reliability, outer loadings of the indicators, Average value extracted, convergent validity, and discriminant validity- Fornell and Larcker test confirm that the measurement model (outer model) is reliable and valid.

4.2. Inner model

The inner model denotes the exogenous and endogenous variables. The coefficient of determination (R^2), path coefficients (β value) and model fit parameters are used to confirm the link amid constructs in the model.

4.2.1. Measurement of R^2

R^2 is also called as coefficients of determination, it signifies the quality of the constructs in a research model. In this study, R^2 was 0.8764 for service quality, it indicates that the seven exogenous constructs substantially elucidate 87.64% of the variance in service quality. Customer satisfaction and customer loyalty have R^2 value of 0.6837 and 0.7404 respectively. According to Chin (1998) [67] R^2 values more than 0.67 point to high predictive precision. Hair et al. (2011) [66] stated " R^2 values of 0.75, 0.50, or 0.25 for dependent variables in the structural model can be described as substantial, moderate, or weak, respectively." Hence, as shown in Table 6 the R^2 values of 0.7404, 0.6837 and 0.8764 indicate high predictive precision and substantial for service quality in this research.

4.2.2. Path coefficients and T statistics

The standardized beta (β) is used to test the hypothesis significance. It is evaluated for all existing paths in the research model; a large value specifies significant impact on cloud service quality. Nonetheless, the significance level of the β is established via T-test. The values of path coefficients and the T statistics are presented below in Table 7 post executing the bootstrap.

Table 4
Cronbach Alpha, Composite reliability, and AVE values.

Construct	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Agility	0.9022	0.9317	0.7733
Assurance	0.9484	0.9603	0.8289
Customer Loyalty	0.9604	0.9693	0.8633
Customer Satisfaction	0.9642	0.9703	0.8234
Reliability	0.9373	0.9522	0.7995
Scalability	0.9217	0.9446	0.8101
Security	0.9398	0.9541	0.8063
Service Quality	0.9572	0.9656	0.8241
Service Responsiveness	0.8815	0.9186	0.7386
Usability	0.9118	0.9341	0.7393

Table 5
Fornell-Larcker criterion test.

	AG	AS	CL	CS	RL	SB	SC	SQ	SR	US
AG	0.8794									
AS	0.8591	0.9104								
CL	0.7942	0.8268	0.9291							
CS	0.7991	0.7904	0.8291	0.9074						
RL	0.8243	0.8653	0.8199	0.7966	0.8942					
SB	0.8040	0.8305	0.7710	0.7541	0.8757	0.9001				
SC	0.7062	0.7588	0.7378	0.7203	0.7617	0.7271	0.8979			
SQ	0.8417	0.8756	0.8150	0.8269	0.8733	0.8534	0.7558	0.9078		
SR	0.7845	0.8229	0.7987	0.7730	0.8378	0.8158	0.6817	0.8361	0.8594	
US	0.7848	0.8291	0.7532	0.7289	0.8235	0.8072	0.6971	0.8793	0.7824	0.8598

AG- Agility, AS- Assurance of service, CL- Customer loyalty, CS- Customer satisfaction, RL- Reliability, SB- Scalability, SC-Security, SQ- Service quality, SR- Service Responsiveness, US - Usability.

Table 6
R square.

Variables	R Square
Customer Loyalty	0.7404
Customer Satisfaction	0.6837
Service Quality	0.8764

4.3. Hypotheses testing

The hypothesis testing was accomplished by witnessing the size, sign, and statistical importance of the path coefficients (β) as presented in Table 7. The t values associated with respective p-value were evaluated. The p-values of all seven factors i.e, agility, assurance of service, reliability, scalability security, service responsiveness, and usability were less than 0.05, confirming these are significant factors and hence significantly impacting cloud service quality. Among all independent factors, usability has the largest β value of 0.3232, which signifies a robust impact on cloud service quality. The next largest β value is established by assurance of service, which is 0.1458, followed by agility at 0.1247, reliability at 0.1230, service responsiveness at 0.1219, scalability at 0.1087, and security at 0.0759.

4.3.1. Model fit

SmartPLS Ver 3.3.3. was used for Partial Least Square Structural equation modeling (PLS-SEM). The Standardized Root Mean Square Residual (SRMR), Normed Fit Index (NFI), and RMS theta are standard model fit parameters available in SmartPLS Ver 3.3.3. The Standardized Root Mean Square Residual (SRMR value is 0.0508 which is less than 0.08 and hence acceptable. Normed Fit Index (NFI) value is 0.8590 which is less than 1 and hence acceptable. RMS theta value is also 0.1131 which is less than 0.12 and thus acceptable. These three model fit parameters indicate that the proposed research model is acceptable. These parameters are presented below in Table 8.

4.3.2. Mediation analysis

Customer Satisfaction works as a mediating variable amid service quality and customer loyalty. It links the service quality (independent) with the customer loyalty (dependent) variable and elucidates the link amid these two variables. Mediation of customer satisfaction is established using Baron and Kenny (1986) [70] method. According to Baron and Kenny (1986) [70], there are three steps to test the mediation i) independent and mediating variables must be significant with each other, ii) independent and dependent variables must have significant relationship, iii) impact of independent variable on dependent variable must be significantly reduced

Table 7
Path coefficients and T statistics.

Hypothesized Path	Standardised Beta (β)	T Statistics	P Values
Agility - > Service Quality	0.1247	3.0496	0.0023
Assurance of Service- > Service Quality	0.1458	2.3310	0.0198
Customer Satisfaction - > Customer Loyalty	0.4907	6.2096	0.0000
Reliability - > Service Quality	0.1230	2.0046	0.0451
Scalability - > Service Quality	0.1087	1.9937	0.0462
Security - > Service Quality	0.0759	2.2309	0.0257
Service Quality - > Customer Loyalty	0.4092	5.2403	0.0000
Service Quality - > Customer Satisfaction	0.8269	30.7403	0.0000
Service Responsiveness - > Service Quality	0.1219	2.0029	0.0452
Usability - > Service Quality	0.3232	4.3662	0.0000

Table 8
Model fit parameters.

Model fit parameters	Values observed	Target values	Interpretation
Standardized Root Mean Square Residual (SRMR)	0.0508	Should be < 0.08	Acceptable
Normed Fit Index (NFI)	0.8590	Should be between 0 and 1	Acceptable
RMS theta	0.1131	Should be < 0.12	Acceptable

on introduction of mediation variable. If independent and dependent variables have significant relationship, then mediation would be partial else it would be full mediation. In full mediation, mediation variable diminishes the direct link amid the independent variable and dependent variable to nil. Table 9 shows that service quality (independent variable) has positive and significant link with customer loyalty (dependent variable). Also, service quality has positive and significant link with customer satisfaction (mediation variable). When customer satisfaction (mediating variable) is introduced, the impact of service quality on customer loyalty is reduced but still significant. It shows the partial mediation of customer satisfaction. The value of Variance Accounted For (VAF) is 49.79% which indicates partial mediation ($20\% < \text{VAF} < 80\%$) as shown in below table.

5. Discussion

The key objective of this research was to find the vital factors of the cloud service quality in India, impact of service quality on customer satisfaction and loyalty, and effect of the mediating variable (customer satisfaction) on the link amid cloud service quality and customer loyalty. A thorough literature review was accomplished to obtain the factors of the cloud service quality and relationship among service quality, customer satisfaction and loyalty. Delphi technique was used with the 72 cloud experts/users to conclude the seven key factors impacting cloud service quality. A questionnaire was prepared, and the pilot test was done to resolve the shortcomings in the questionnaire. The questionnaire was completed by cloud experts/users having knowledge and experience in the arena. PLS-SEM was applied for statistical examination, and it was noticed that the constructs agility, assurance of service, reliability, scalability, security, service responsiveness, and usability have a substantial and positive impact on cloud service quality. It is established by the coefficient of determination ($R^2 = 0.8764$) for service quality. Customer satisfaction customer loyalty have R^2 value of 0.6837 and 0.7404 respectively. This indicates high predictive accuracy of the model. The outcome exposed that usability ($\beta = 0.3232$, $T = 4.3662$, $p \text{ value} = 0.0000$) is the most vital construct significantly impacting the cloud service quality followed by the assurance of service ($\beta = 0.1458$, $T = 2.3310$, $p \text{ value} = 0.0198$), the third position captured by agility ($\beta = 0.1247$, $T = 3.0496$, $p \text{ value} = 0.0023$), fourth position by reliability ($\beta = 0.1230$, $T = 2.0046$, $p \text{ value} = 0.0451$), fifth position by service responsiveness ($\beta = 0.1219$, $T = 2.0029$, $p \text{ value} = 0.0452$) and sixth and seventh position by scalability ($\beta = 0.1087$, $T = 1.9937$, $p \text{ value} = 0.0462$) and Security ($\beta = 0.0759$, $T = 2.2309$, $p \text{ value} = 0.0257$) respectively. Thus, the cloud service providers must focus on top seven factors—agility, assurance of service, reliability, scalability, security, service responsiveness and usability to ensure desired cloud service quality. The outcome indicates that the hypotheses for seven measured factors were reinforced and confirms that the cloud service quality was positively influenced by these seven factors. These seven key cloud service quality factors are also supported by several studies. Yadav and Goraya (2018) [37], and Phaphoom et al. (2015) [23] described that usability is one of the key factors in cloud computing. Kochoviski et al. (2019) [11], and Garg et al. (2013) [9] mentioned assurance of service as a vital factor of cloud service quality. Buyya et al. (2019) [6], and Fonstad and Ross (2015) [7] explained agility as one of the key construct impacting cloud service quality. Jatoth et al. (2019) [20], and Shatnawi et al. (2018) [14] acknowledged service responsiveness as a key factor for cloud service quality. Buyya et al. (2019) [6], and Shatnawi et al. (2018) [14] indicated reliability as an essential factor for cloud service quality. Buyya et al. (2019) [6], and Jatoth et al. (2019) [20] acknowledged scalability as a vital factor for cloud service quality. Buyya et al. (2019) [6] and Jouini and Rabai (2019) [26] considered security as a one of the important factors for cloud service quality. This study indicates the positive relationship between customer satisfaction and loyalty. Iqbal et al. (2018) [43], Al-deewari et al. (2017) [49], and Rahim (2016) [45] also confirmed the positive effect of customer satisfaction on customer loyalty.

Table 9
Mediation analysis.

Mediation Analysis	Hypothesized Path	Standardized Beta (β)	T Statistics	P Values
Independent and dependent variable without mediating variable	Service Quality - > Customer Loyalty	0.8150	29.9654	0.0000
Direct effect in the presence of mediator: Independent on dependent variable on introduction of mediation variable	Service Quality - > Customer Loyalty	0.4092	5.2403	0.0000
Indirect effect	Service Quality - > Customer Satisfaction Customer Satisfaction - > Customer Loyalty	0.8269 0.4907	30.7403 6.2096	0.0000 0.0000
VAF (Variance Accounted For): Indirect effect/Total effect = $(0.8269 \times 0.4907) / ((0.8269 \times 0.4907) + 0.4092)$ = 0.497889362 = 49.79%				

Table 10

Questionnaire Please select the appropriate option for the questions using the below scale- 1 = Strongly Disagree; 2 = Disagree; 3 = Neither Agree nor Disagree; 4 = Agree; 5 = Strongly Agree.

Cloud Service Quality Questions	1	2	3	4	5
Agility					
• Cloud systems are flexible enough to quickly adapt and adjust the changes requested by the users					
• The employees of the cloud service provider easily and quickly adds new features/service whenever needed					
• Cloud services of the provider can be easily and quickly migrated to another provider with minimal disruption					
• Cloud systems used by your organisation have ability to quickly recover from errors					
Assurance of Service					
• The employees of the cloud service provider are always polite with the customers					
• The employees of the cloud service provider are always willing to help/assist customers					
• The employees of the cloud service provider possess knowledge and information to answer customer queries.					
• Customer feels safe in availing the services of the cloud service provider					
• Customers can repose trust in the cloud service provider while dealing with them					
Reliability					
• Cloud service provider has Disaster Recovery facility for the customer organizations					
• Cloud services used in organization are reliable i.e. always provides same result for same query unless there is change in base data					
• Cloud systems you use are resilient/fault tolerant i.e. if one system is down, other is available.					
• The cloud systems provide accurate and error-free services, transactions and records.					
• The cloud service provider is delivering the services what it promised with the organisation					
Scalability					
• Cloud services used by your organisation quickly scales up/down the resource consumption to meet the users demand					
• Cloud service provider uses auto scaling techniques to meet the users demand					
• Cloud service provides horizontal scaling (adding more machines into the pool of resources) i.e. quickly scales up/down the number of machines to meet the users demand					
• Cloud service provides vertical scaling (adding more resources/power to an existing machine) i.e. quickly scales up/down the CPU/RAM to the existing machine to meet the users demand					
Security					
• Only authorised users can access the services provided by Cloud service provider.					
• Your organization data is protected from virus/malware/attacks while it is hosted on cloud					
• Your organization data is safe from natural disaster while it is hosted on cloud					
• The employees of the cloud service provider do not use and share organisation's data without written permission.					
• Data encryption is used in cloud transactions.					
Service Responsiveness					
• The employees of the cloud service provider show a sincere interest in solving the user problems					
• The employees of the cloud service provider solve user problems in first attempt					
• The employees of the cloud service provider keep users informed about progress of the problem resolution					
• The employees of the cloud service provider are prompt in providing services to users					
Usability					
• Cloud computing interface is user friendly and easy to use					
• Cloud interface allows users to quickly access the cloud systems and complete their tasks					
• Cloud computing interface is enjoyable to work for the users					
• Cloud systems provide reports as required by users					
• You can very easily control, manage and execute services hosted on cloud for your organization					
Service quality					
• The quality of cloud services meets your expectations					
• There are no complaints on quality of the services delivered by cloud service provider					
• There are no complaints on timely delivery of the services provided by cloud service provider					
• There are no complaints on correctness of the information delivered by cloud service provider					
• There are no complaints on speed of the information delivered by cloud service provider					
• Cloud service provides good overall quality service to the users					
Customer Satisfaction					
• You are satisfied with the cloud services used in your organisation					
• The performance of the cloud services used exceeded the expectations of your organisation					
• Users are more satisfied with cloud services as compared to in-house IT systems					
• You are satisfied with the speed of the cloud services used in the organisation					
• You are satisfied with the cloud service provider's data protection mechanisms					
• You are satisfied with the cloud service provider's availability needs of cloud applications					
• You are satisfied with the service responsiveness of the cloud service provider					
Customer Loyalty					
• You would like to continue the services of the current cloud service provider					
• You would like to procure the additional cloud services from same cloud service provider for any new requirement					
• You will recommend the current cloud service provider to other organizations who seek your advice					

(continued on next page)

Table 10 (continued)

Cloud Service Quality Questions	1	2	3	4	5
<ul style="list-style-type: none"> You would say positive things about the current cloud service provider to other people You are proud of using the services of this cloud service provider 					

Standardized Root Mean Square Residual (SRMR) value 0.0508 is less than the 0.08 and hence it confirms a perfect model fit. Normed fit index (NFI) value 0.8590 is close to 1 and hence it is an acceptable model fit too. RMS theta value 0.1131 is close to 0.00 and hence it also signifies a decent model fit. It is observed that customer satisfaction has partial mediation effect on the link amid cloud service quality and customer loyalty. Meesala and Paul (2018) [48], Iqbal et al. (2018) [43], and Rahim (2016) [45] also explained the mediating role of customer satisfaction on the link between service quality and customer loyalty.

6. Research implications

6.1. Theoretical implications

As per the best knowledge of researchers, this is pioneering empirical research to study the factors of the cloud service quality, impact of service quality of the cloud service providers on customer satisfaction and customer loyalty, and mediation effect of customer satisfaction on the link amid cloud service quality and customer loyalty in Indian context. This research adds to the present literature on the cloud service quality factors, link among service quality, customer satisfaction and customer loyalty. And would be very useful to scholars. The cloud services are in an early phase in India. This research will offer a comprehensive model for the cloud service quality considering the key cloud service quality constructs along with customer satisfaction as a mediating variable amid service quality and customer loyalty. It is noticed that the agility, assurance of service, reliability, scalability, security, service responsiveness and usability should be improved to improve the cloud service quality. The foremost implication of this research is revealing pragmatic analysis of customer satisfaction playing role of mediation variable amid cloud service quality and customer loyalty. This explains the impact of cloud service quality on customer loyalty.

6.2. Practical implications

This research emphasizes on the service quality of the cloud service providers in India and offers a direction to cloud service providers to frame a robust policy for quality cloud services in India. This work aids to find the pits in cloud service quality and provides inputs to study the customer behavior on the cloud service quality, customer satisfaction and customer loyalty. The cloud service providers must pay attention to cloud service quality factors to keep their customers satisfied and loyal, and at the same time attract more and more customers to use their cloud services in India else customers will not be satisfied and loyal, and hence may migrate their business to other cloud service providers causing dent in the profit and business growth of the incumbent cloud service providers. Cloud service providers must follow the highest standards of the agility, assurance of service, reliability, scalability, security, service responsiveness and usability to get the customers confidence as these are the most important factor of cloud service quality. These factors must be given attention by cloud service providers to improve customer satisfaction and customer loyalty.

7. Conclusion

The research is steered to evaluate the vital constructs influencing the cloud service quality and the effect of the mediating variable (customer satisfaction) on the link amid cloud service quality and customer loyalty. Post exhaustive literature review and cloud experts/users' inputs (using delphi technique), seven critical cloud service quality factors were acknowledged. A research model was established, and the structural and measurement models were tried for the relationship amid constructs using PLS-SEM. It is observed that these seven constructs viz. Agility, assurance of service, reliability, scalability, security, service responsiveness and usability are significant constructs influencing cloud service quality. Also, partial mediating effect of customer satisfaction on the service quality and customer loyalty link is detected, that proposes that cloud service quality has direct and indirect influence on the customer loyalty. Hence, it is concluded that both cloud service quality and customer satisfactions have influence on customer loyalty.

8. Limitations and future scope

This research work is founded on experiential investigation. A qualitative method can also be encompassed for more effective and accurate examination of the vital factors. The scope of this work is limited to examine vital cloud service quality factors, link amidst cloud service quality, customer satisfaction and customer loyalty, and investigate the mediation effect of customer satisfaction on the link amid cloud service quality and customer loyalty in Indian context and it can be further improved by including the larger world. This research work can be further expanded by examining individual factors in detail and how they transmute the overall cloud service quality. For a truthful interpretation, the findings of this work can be confirmed and substantiated in any other research for the precision of the outcome. Also, this study is limited to the private organizations in India as the respondents to questionnaire survey were from these organizations. There is a scope to include respondents from government organizations in future studies.

The theoretical and experiential research articles on cloud service quality using PLS-SEM technique, are very limited in Indian framework. This research article will throw some light on novel methodological approach and hence, significantly help budding scholars interested to use the innovative statistical method, PLS- SEM.

Author contribution statement

Rajesh Agarwal, B.Tech., M.E., M.B.A.; Sanjay Dhingra, Ph.D.: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Funding statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Data availability statement

Data will be made available on request.

Declaration of interest's statement

The authors declare no competing interests.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.heliyon.2023.e15177>.

References

- [1] R. Agarwal, S. Dhingra, *Cloud computing in India: issues and challenges*, *Consul, Ahead* 12 (1) (2018) 23–35.
- [2] Asia Cloud Computing Association, *Asia cloud computing index*. <http://www.asiacloudcomputing.org/research/2020-research/cric2020>, 2020. (Accessed 20 December 2021). Accessed.
- [3] National Association of Software and Service Companies, *NASSCOM Cloud: Next Wave of Growth in India*, 2019, 2019, <https://www.nasscom.in/knowledge-center/publications/nasscom-cloud-next-wave-growth-india-2019>. (Accessed 26 December 2021). Accessed.
- [4] Business Software Alliance, *BSA global cloud computing scorecard*. <https://cloudscorecard.bsa.org/2018>, 2018. (Accessed 26 December 2021). Accessed.
- [5] International Telecommunication Union, *ICT Development Index*, 2017, 2017, <https://www.itu.int/net4/ITU-D/idi/2017/index.html>. (Accessed 26 December 2021). Accessed.
- [6] R. Buyya, S.N. Srirama, G. Casale, R. Calheiros, Y. Simmhan, B. Varghese, E. Gelenbe, B. Javadi, L.M. Vaquero, M.A. Netto, A.N. Toosi, *A manifesto for future generation cloud computing: research directions for the next decade*, *ACM Comput. Surv.* 51 (5) (2019) 1–51, <https://doi.org/10.1145/3241737>.
- [7] N.O. Fonstad, J.W. Ross, *Building business agility: cloud-based services digitized platform maturity*, *MIT CISR Res. Brief.* 15 (2) (2015) 1–4.
- [8] N. Balian, S. Kumar, *Quality Assessment of Software as a Service on Cloud Using Fuzzy Logic*, *Proceedings of the IEEE International Conference on Cloud Computing in Emerging Markets, CCEM '2013*, 2013, pp. 1–6, <https://doi.org/10.1109/CCEM.2013.6684439>.
- [9] S.K. Garg, S. Versteeg, R. Buyya, *A framework for ranking of cloud computing services*, *Future Generat. Comput. Syst.* 29 (4) (2013) 1012–1023, <https://doi.org/10.1016/j.future.2012.06.006>.
- [10] J. Siegel, J. Perdue, *Cloud Services Measures for Global Use: the Service Measurement Index (SMI)*, *Proceedings of the IEEE Annual Service Research and Innovation Institute Global Conference (SRII '2012)*, 2012, pp. 411–415, <https://doi.org/10.1109/SRII.2012.51>.
- [11] P. Kochovski, P.D. Drobintsev, V. Stankovski, *Formal Quality of Service assurances, ranking and verification of cloud deployment options with a probabilistic model checking method*, *Inf. Software Technol.* 109 (2019) 14–25, <https://doi.org/10.1016/j.infsof.2019.01.003>.
- [12] L.D. Rosen, K.R. Karwan, *Prioritizing the dimensions of service quality: an empirical investigation and strategic assessment*, *Int. J. Serv. Ind. Manag.* 5 (4) (1994) 39–52, <https://doi.org/10.1108/09564239410068698>.
- [13] A. Parasuraman, V.A. Zeithaml, L.L. Berry, *A conceptual model of service quality and its implications for future research*, *J. Market.* 49 (4) (1985) 41–50, <https://doi.org/10.1177/002224298504900403>.
- [14] A. Shatnawi, M. Orru, M. Mobilio, O. Riganelli, L. Mariani, *CloudHealth: a Model-Driven Approach to Watch the Health of Cloud Services*, *Proceedings of the IEEE/ACM 1st International Workshop on Software Health*, 2018, pp. 40–47, <https://doi.org/10.1145/3194124.3194130>. SoHeal '2018).
- [15] X. Zheng, P. Martin, K. Brohman, L.D. Xu, *CLOUDQUAL: a quality model for cloud services*, *IEEE Trans. Ind. Inf.* 10 (2) (2014) 1527–1536, <https://doi.org/10.1109/TII.2014.2306329>.
- [16] P. Gupta, A. Seetharaman, J.R. Raj, *The usage and adoption of cloud computing by small and medium businesses*, *Int. J. Inf. Manag.* 33 (5) (2013) 254–264, <https://doi.org/10.1016/j.ijinfomgt.2013.07.001>.
- [17] J. Prade, M. Murphy, J. Limjap, R. Tanagras, W. Paukert, S. Delord, N. Teckguan, R. McQuillan, S. Wong, P. Dahlberg, M. Ross, *Cloud assessment tool white paper, the asia cloud computing association (ACCA), Ver. 3.0* 5 (2012) 1–23.
- [18] J.Y. Lee, J.W. Lee, S.D. Kim, *A Quality Model for Evaluating Software-As-A-Service in Cloud Computing*, *ACIS 2009: Proceedings of the 7th International Conference on Software Engineering Research, Management and Applications*, IEEE Computer Society, 2009, pp. 261–266, <https://doi.org/10.1109/SERA.2009.43>.
- [19] V.A. Zeithaml, A. Parasuraman, A. Malhotra, *A Conceptual Framework for Understanding E-Service Quality: Implication for Future Research and Managerial Practice*, *Mark. Sci. Inst.*, Cambridge, MA, 2001. Working Paper Series No. 00-115.
- [20] C. Jatoth, G.R. Gangadharan, U. Fiore, R. Buyya, *SEL-CLOUD: a hybrid multi-criteria decision-making model for selection of cloud services*, *Soft Comput.* 23 (13) (2019) 4701–4715, <https://doi.org/10.1007/s00500-018-3120-2>.
- [21] S. Becker, G. Brataas, S. Lebrig, *Engineering Scalable, Elastic, and Cost-Efficient Cloud Computing Applications: the CloudScale Method*, Springer, 2017. <https://books.google.co.kr/books?hl=en&lr=&id=cYmDwAAQBAJ&oi=fnd&pg=PR5&dq=Scalable,+Elastic,+and+Cost-Efficient+Cloud+Computing+Applications:+The+CloudScale+Method+Springer,+2017.&ots=9ra7rakXU5&sig=3aTdgnJDoXIQAbno3nDvgjGV5Q>. (Accessed 20 December 2021). Accessed.

- [22] G.S.S. David, R. Anbuselvi, An Architecture for Cloud Computing in Higher Education, Proceedings of the IEEE International Conference on Soft-Computing and Networks Security, ICSNS '2015, 2015, pp. 1–6, <https://doi.org/10.1109/ICSNS.2015.7292432>.
- [23] N. Phaphoom, X. Wang, S. Samuel, S. Helmera, P. Abrahamsson, A survey study on major technical barriers affecting the decision to adopt cloud services, J. Syst. Software 103 (1) (2015) 167–181, <https://doi.org/10.1016/j.jss.2015.02.002>.
- [24] N. Pilevari, A. Toloei, M. Sanaei, A model for evaluating cloud-computing users' satisfaction, Afr. J. Bus. Manag. 7 (16) (2013) 1405–1413.
- [25] Y. Fernando, S. Achmad, A. Gui, Leveraging business competitiveness by adopting cloud computing in Indonesian creative industries, Int. J. Bus. Inf. Syst. 32 (3) (2019) 364–392, <https://doi.org/10.1504/IJBIS.2019.103082>.
- [26] M. Jouini, L.B.A. Rabai, A Security Framework for Secure Cloud Computing Environments, Cloud Security: Concepts, Methodologies, Tools, and Applications, IGI Global, 2019, pp. 249–263, <https://doi.org/10.4018/978-1-5225-8176-5.ch011>.
- [27] P. Manuel, A trust model of cloud computing based on quality of service, Ann. Oper. Res. 233 (1) (2015) 281–292, <https://doi.org/10.1007/s10479-013-1380-x>.
- [28] S. Ding, S. Yang, Y. Zang, C. Liang, C. Xia, Combining QoS prediction and customer satisfaction estimation to solve cloud service trustworthiness evaluation problems, Knowl. Base Syst. 56 (2014) 216–225, <https://doi.org/10.1016/j.knosys.2013.11.014>.
- [29] F.N. Al-Aswadi, O. Batarfi, A framework for enhancing privacy provision in cloud computing, Int. J. Comput. Sci. Inf. Technol. 5 (3) (2014) 3542–3547.
- [30] D. Panth, D. Mehta, R. Shelgaonkar, A survey on security mechanisms of leading cloud service providers, Int. J. Comput. Appl. 98 (1) (2014) 34–37.
- [31] J.W. Lian, D.C. Yen, Y.T. Wang, An exploratory study to understand the critical factors affecting the decision to adopt cloud computing in Taiwan hospital, Int. J. Inf. Manag. 34 (1) (2014) 28–36, <https://doi.org/10.1016/j.ijinfomgt.2013.09.004>.
- [32] S. Koduah, B. Popovsky, A. Tsetse, Barriers to the government cloud adoption, Int. J. Manag. Inf. Technol. 6 (3) (2014) 1–16, <https://doi.org/10.5121/ijmit.2014.6301>.
- [33] R. Arora, A. Parashar, Secure user data in cloud computing using encryption algorithms, Int. J. Eng. Res. Afr. 3 (4) (2013) 1922–1926.
- [34] Y. Cao, X. Bi, L. Wang, A Study on User Adoption of Cloud Storage Service in China: A Revised Unified Theory of Acceptance and Use of Technology Model, International Conference on Information Science and Cloud Computing Companion, IEEE, Guangzhou, China, 2013, <https://doi.org/10.1109/ISCC-C.2013.32>.
- [35] D.H. Shin, User centric cloud service model in public sectors: policy implications of cloud services, Govern. Inf. Q. 30 (2) (2013) 194–203, <https://doi.org/10.1016/j.giq.2012.06.012>.
- [36] S. Meehan, C. Dawson, Customer responsiveness: getting it fast and right through impatience and intolerance, Bus. Strat. Rev. 13 (4) (2002) 26–37, <https://doi.org/10.1111/1467-8616.00231>.
- [37] N. Yadav, M.S. Goraya, Two-way ranking based service mapping in cloud environment, Future Generat. Comput. Syst. 81 (2018) 53–66, <https://doi.org/10.1016/j.future.2017.11.027>.
- [38] T. Olokunde, S. Misra, A. Adewumi, Quality Model for Evaluating Platform as a Service in Cloud Computing, International Conference on Information and Software Technologies, Springer, Cham, 2017, October, pp. 280–291, https://doi.org/10.1007/978-3-319-67642-5_23.
- [39] J. De Oña, Understanding the mediator role of satisfaction in public transport: a cross-country analysis, Transport Pol. 100 (2021) 129–149, <https://doi.org/10.1016/j.tranpol.2020.09.011>.
- [40] A.H. Gorondutse, H. Hilman, Mediation effect of customer satisfaction on the relationships between service quality and customer loyalty in the Nigerian foods and beverages industry: sobel test approach, Int. J. Manag. Sci. Eng. Manag. 9 (1) (2014) 1–8, <https://doi.org/10.1080/17509653.2013.812337>.
- [41] Y.H. Chen, X. Wang, Y.Y. Wang, S.C. Tsai, The Moderating Effect of Retailer Image on Customers' Satisfaction-Loyalty Link, 2010 7th International Conference on Service Systems and Service Management, IEEE, 2010, June, pp. 1–6, <https://doi.org/10.1109/ICSSSM.2010.5530163>.
- [42] N.J. Slack, G. Singh, The effect of service quality on customer satisfaction and loyalty and the mediating role of customer satisfaction: supermarkets in Fiji, The TQM J 32 (3) (2020) 543–558, <https://doi.org/10.1108/TQM-07-2019-0187>.
- [43] M.S. Iqbal, M.U. Hassan, U. Habibah, Impact of self-service technology (SST) service quality on customer loyalty and behavioral intention: the mediating role of customer satisfaction, Cogent Bus. Manag. 5 (1) (2018) 1, <https://doi.org/10.1080/23311975.2018.1423770>.
- [44] S. Ashraf, R. Ilyas, M. Imtiaz, S. Ahmad, Impact of service quality, corporate image and perceived value on brand loyalty with presence and absence of customer satisfaction: a study of four service sectors of Pakistan, Int. J. Acad. Res. Bus. Soc. Sci. 8 (2) (2018) 452–474, <https://doi.org/10.6007/IJARBS/v8-i2/3885>.
- [45] A.G. Rahim, Perceived service quality and customer loyalty: the mediating effect of passenger satisfaction in the Nigerian airline industry, Int. J. Manag. Econ. 52 (2016) 94–117, <https://doi.org/10.1515/ijme-2016-0029>.
- [46] C.B. Liat, S. Mansori, C.T. Huei, The associations between service quality, corporate image, customer satisfaction, and loyalty: evidence from the Malaysian hotel industry, J. Hospit. Market. Manag. 23 (3) (2014) 314–326, <https://doi.org/10.1080/19368623.2013.796867>.
- [47] A. Caruana, Service loyalty: the effects of service quality and the mediating role of customer satisfaction, Eur. J. Market. 36 (7/8) (2002) 811–828, <https://doi.org/10.1108/03090560210430818>.
- [48] A. Meesala, J. Paul, Service quality, consumer satisfaction and loyalty in hospitals: thinking for the future, J. Retailing Consum. Serv. 40 (2018) 261–269, <https://doi.org/10.1016/j.jretconser.2016.10.011>.
- [49] R.M. Al-deewari, Z.M. Obeidat, M.A. Al-dwiry, M.T. Alshurideh, A.M. Alhorani, The impact of e-service quality and e-loyalty on online shopping: moderating effect of e-satisfaction and e-trust, Int. J. Market. Stud. 9 (2) (2017) 92–103, <https://doi.org/10.5539/ijms.v9n2p92>.
- [50] K. Kushagra, S. Dhingra, Determinants for adoption of cloud in government sector in India: a review, Int. J. Bus. Inf. Syst. 32 (2) (2019) 170–198, <https://doi.org/10.1504/IJBIS.2019.103073>.
- [51] T. Oliveira, M. Thomas, M. Espadanal, Assessing the determinants of cloud computing adoption: an analysis of the manufacturing and services sectors, Inf. Manag. 51 (5) (2014) 497–510, <https://doi.org/10.1016/j.im.2014.03.006>.
- [52] A.E. Smith, K.D. Swinehart, Integrated systems design for customer focused health care performance measurement: a strategic service unit approach, Int. J. Health Care Qual. Assur. 14 (1) (2001) 21–29, <https://doi.org/10.1108/09526860110366232>.
- [53] M.K. Kim, M.C. Park, D.H. Jeong, The effects of customer satisfaction and switching barrier on customer loyalty in Korean mobile telecommunication services, Telecommun. Pol. 28 (2) (2004) 145–159, <https://doi.org/10.1016/j.telpol.2003.12.003>.
- [54] Y.F. Kuo, C.M. Wu, W.J. Deng, The relationships among service quality, perceived value, customer satisfaction, and post-purchase intention in mobile value-added services, Comput. Hum. Behav. 25 (4) (2009) 887–896, <https://doi.org/10.1016/j.chb.2009.03.003>.
- [55] F. Li, H. Lu, M. Hou, K. Cui, M. Darbandi, Customer satisfaction with bank services: the role of cloud services, security, e-learning and service quality, Technol. Soc. 64 (2021), 101487, <https://doi.org/10.1016/j.techsoc.2020.101487>.
- [56] H.Y. Hu, C.C. Cheng, S.I. Chiu, F.Y. Hong, A study of customer satisfaction, customer loyalty and quality attributes in Taiwans medical service industry, Afr. J. Bus. Manag. 5 (1) (2011) 187–195.
- [57] D. Van Lierop, A. El-Geneidy, Enjoying loyalty: the relationship between service quality, customer satisfaction, and behavioral intentions in public transit, Res. Transport. Econ. 59 (2016) 50–59, <https://doi.org/10.1016/j.retrec.2016.04.001>.
- [58] T. Guimaraes, K. Paranjape, Testing cloud computing for customer satisfaction and loyalty, Int. J. Electron. Cust. Relatsh. Manag. 8 (1–3) (2014) 72–86, <https://doi.org/10.1504/IJECRM.2014.066885>.
- [59] H. Morshedlou, M.R. Meybodi, Decreasing impact of sla violations: a proactive resource allocation approach for cloud computing environments, IEEE Trans. Cloud Comput. 2 (2) (2014) 156–167, <https://doi.org/10.1109/TCC.2014.2305151>.
- [60] J. Kandampully, D. Suhartanto, Customer loyalty in the hotel industry: the role of customer satisfaction and image, Int. J. Contemp. Hospit. Manag. 12 (6) (2000) 346–351, <https://doi.org/10.1108/09596110010342559>.
- [61] D.D. Gremler, S.W. Brown, Towards a conceptual model of service loyalty, in: Marketing Theory and Applications AMA Winter Educators' Conference, 1997, pp. 218–219.
- [62] J.J. Cronin Jr., S.A. Taylor, Measuring service quality: a reexamination and extension, J. Market. 56 (3) (1992) 55–68, <https://doi.org/10.1177/002224299205600304>.

- [63] N. Kassim, N.A. Abdullah, The effect of perceived service quality dimensions on customer satisfaction, trust, and loyalty in e-commerce settings: a cross cultural analysis, *Asia Pac. J. Mark. Logist.* 22 (3) (2010) 351–371, <https://doi.org/10.1108/13555851011062269>.
- [64] Ø. Helgesen, Are loyal customers profitable? Customer satisfaction, customer (action) loyalty and customer profitability at the individual level, *J. Market. Manag.* 22 (3–4) (2006) 245–266, <https://doi.org/10.1362/026725706776861226>.
- [65] Enterprise IT World, CIO Perception Study, India's Leading Public Cloud Providers, 2018. <https://www.enterpriseitworld.com/cio-perception-study-indias-leading-public-cloud-providers/>. (Accessed 20 December 2021). Accessed.
- [66] J.F. Hair, C.M. Ringle, M. Sarstedt, PLS-SEM: indeed a silver bullet, *J. Market. Theor. Pract.* 19 (2) (2011) 139–152, <https://doi.org/10.2753/MTP1069-6679190202>.
- [67] W.W. Chin, The partial least squares approach to structural equation modelling, *Mod. Methods Bus. Res.* 295 (2) (1998) 295–336.
- [68] J.F. Hair, C.M. Ringle, M. Sarstedt, Partial least squares structural equation modeling: rigorous applications, better results and higher acceptance, *Long. Range Plan.* 46 (1–2) (2013) 1–12.
- [69] C. Fornell, D.F. Larcker, Evaluating structural equation models with unobservable variables and measurement error, *J. Mar. Res.* 18 (1) (1981) 39–50, <https://doi.org/10.1177/002224378101800104>.
- [70] R.M. Baron, D.A. Kenny, The moderator–mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations, *J. Pers. Soc. Psychol.* 51 (6) (1986) 1173–1182, <https://doi.org/10.1037/0022-3514.51.6.1173>.