

## Structure equation modeling (SEM) approach for evaluating and analyzing the effect of IT-based services in banking sector on customer service quality (SERQUAL)



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### ABSTRACT

This study is intended to explore the measures of IT-based service, perceived service quality, and customer satisfaction. The study further delves to analyze the relationship between IT-based services and their influence on service quality and customer satisfaction. The study is one of its kind as it explores SERVQUAL with customer satisfaction in the area of banking services. The sample was drawn from banking customers using digital applications for performing banking transactions. The data was collected from 294 respondents and analyzed through the maximum likelihood method using structural equation modeling (SEM) by using the capabilities of LISREL 8.80. The measurement model and structural model were assessed, and in the initial analysis unidimensionality, reliability, and validity of a research instrument were ascertained. The structural model advocates the presence of hypothesized relationships and it was concluded that customer experiences regarding IT-based services influence service quality and customer satisfaction. The results are interpreted on the basis of estimates generated by the statistical software. The finding of this research is in line with many other research works listed in the discussion section of this paper.

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### 1. Introduction

To survive in a cutthroat competition, the organizations providing services transform their mode of operation towards information technology (IT)-based mediums. Apart from this reason, it also helps them in reducing costs and creating value-added services for their customers. Some examples in the area of the banking sector include web-based banking systems. These systems are provided by the banks and work on the principle of automation. Including these service systems, it was expected that these systems should help service providers to improve service quality, financial performance, and customer satisfaction. Furey (1991) advocated that IT-based services can help improve service quality by increasing convenience, and providing various new services and should be helpful in collecting information regarding the performance of the

service finally this information can be used by the management to improve its services.

Fitzsimmons and Fitzsimmons (2004) also believed that the inclusion of IT in the area of service provision can improve competitiveness among organizations and it also suggested several competitive uses of IT in the area of service provision. In various service industries, IT-based service systems are an integral part of the business and play an important role in putting an organization on a competitive path (Pakurár et al., 2019).

As it is a common notion now, that IT in the service industry is indivisible therefore there is a need to understand customers' perceptions regarding IT-based services and assessment of service quality in the context of customer satisfaction. As customers play an important role and they are the end users of IT-based services, therefore their perception of service quality is the most important aspect organizations want to understand.

There are numerous studies found in the area of Technology adoption, however, researchers are scared when it comes to the perception of customers in the context of customer satisfaction with IT-based services. It is also understood from the literature that the service providers must understand factors customers take into consideration when using their services and factors that affect customer intentions

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when they used IT-based services and how these perceptions affect customer intention regarding service quality. A thorough and comprehensive understanding of these concepts would help managers to design more customer-based services in the future.

Therefore, this paper is derived after developing the research curiosity to investigate these factors, and the relationship between IT-based services and customer intention of service quality was assessed. Therefore the research problem was divided into several research questions which were addressed in this research. They are:

1. What are the factors customers take into consideration when using IT-based service systems?
2. How do IT-based services influence customer satisfaction?
3. How do customers evaluate IT-based services based on service quality?

In the search for solutions to these questions, a causal model with some relationships with key variables and in the context of service quality was assessed. In this regard, an IT-based service construct was developed and the relationship of this construct with the service quality was measured through SERVQUAL (Parasuraman et al., 1988; 2002).

Important research constructs were identified from the latest literature available in the area, the variables and their items influence customers' perception of IT-based services, service quality, and customer satisfaction, and based on these research constructs a conceptual model has been developed. The hypothesized model was assessed after data collection was drawn from a sample of different Bank customers. The analysis was performed on the collected data using structural equation modeling (SEM) through LISREL 8.80.

The structure of this paper is given as under: Initially, recent and relevant literature was reviewed and research gaps were identified based on these research gaps some important research constructs were identified and a conceptual model of research was also developed with all the research variables. Research methodology and the results of structural equation modelling with reference to measurement and structural model were then presented and discussed. The paper concludes with a brief discussion and managerial implications of the findings obtained.

## 2. Literature review

The literature was reviewed in the following areas.

### 2.1. Measuring service quality

A plethora of research in defining, assessing, and measuring service quality has been greatly

influenced by the scale developed by Parasuraman et al. (1985, 1988, and 2002). They considered service quality as the gap between customers' expectations and the real experiences they get when using a service (Parasuraman et al., 1985) and for measuring the service quality multi-item scale called SERVQUAL (Parasuraman et al., 1985) which is the 22 item scale and includes 5 service dimensions listed as tangible, reliability, Responsiveness, Assurance and empathy were considered. The scale developed by Parasuraman et al. (1988, 2002) was initially based on the data collected from 5 different service industries such as repair and maintenance, retail banking, telecom services credit card companies, and some securities Limited.

This scale has been widely used to measure service quality in various countries such as professional services, public services, hospitals, hospitality, auto repair catering, and in the banking industry (Avkiran, 1994; Carman, 1990; Orwig et al., 1997; Bojanic, 1991; Babakus and Mangold, 1992; Reidenbach and Sandifer-Smallwood, 1990; Barsky, 1992; Oberoi and Hales, 1990; Saleh and Ryan, 1991; Buttle, 1996; Johns and Tyas, 1996). SERVQUAL is a very popular scale and has been used extensively. Although some of the researchers and authors criticize it on the ground of dimensionality and some other experts question its measurement of assumptions and expectations and detailed discussion on the description of the pros and cons of this scale can be found in the literature, especially by Llosa et al. (1998).

The scale was initially developed on the dimensions of traditional Service delivery mediums. Today the involvement of IT in the service domain has transferred the service delivery context and content greatly. Therefore it is understood that it is appropriate to include some of the key attributes associated with IT-based service delivery systems to assess the service quality in the banking sector. For instance, in today's scenario, almost all customers can perform all their banking activities with a smartphone except for some functions i.e. withdrawal/Deposition in cash or Cheques (Machkour and Abriane, 2020). These services cannot be measured using the traditional service quality scale as they are recently constructed.

### 2.2. IT and service quality

A comprehensive literature review was conducted and it was suggested that the use of IT in various customer services is common and is responsible for enhancing customer satisfaction (Pakurár et al., 2019; Dabholkar, 1996; Mehdiabadi et al., 2020). However, many research works focusing on the inclusion of IT in service delivery are conducted from the perspective of service providers. Therefore there is a need for a study from the customers' perspective and more comprehensive research is needed to examine the effect of IT-based services on customer perception of service quality.

Convenience was regarded as the most important feature of IT-based service cited by many researchers (Coomes et al., 2019; Bailey et al., 1998; Machkour and Abriane, 2020; Reed, 1998). From a research perspective, convenience refers to accessibility to the service delivery available for the customer when customers actually need them. Some of the researchers concluded that IT-based service options improve customer service as it also provides with getting customer data which is helpful in designing services according to the needs and wants of the customers this feedback can be used in managerial decision-making to improve operational efficiency which finally impacts service quality (Machkour and Abriane, 2020; Furey, 1991).

It may also be noted that providing IT-based service does not guarantee customer satisfaction (Xu et al., 2020; Drake et al., 2020; Thakor, 2020). However, the provision of IT-based services can shape customers' perceptions regarding service quality both ways (Thakor, 2020). For instance, when a consumer uses an ATM machine for the withdrawal of cash the machine can jam his or her banking ATM card and refuse to return it, at that moment if he or she could not receive proper and timely assistance it will frustrate the customer leading to dissatisfaction.

Using IT-based services in a value-added manner at that point can successfully improve customer satisfaction. In this manner inclusion of IT in providing services can change the customers' perception of banking services.

Dabholkar (1996) developed two models assessing how customers evaluate the quality of Technology, the sample was based on University students and it was found that student's perception of a technology-based service option defines their intention to use or leave the service. In that study however it was not discussed that what will be the impact of such options on customers' perception and service quality was also measured through traditional dimensions of service quality.

Berkley and Gupta (1994) also designed a model to describe how IT can be useful for the facilitation of service performance. The approach was a little bit different as they use a case study approach and discussed in detail the use of IT and stated that IT could be used to improve specific service quality dimensions such as reliability, responsiveness, competence, communication, security, knowledge, and understanding the customer and even in quality control. The overall scenario after the comprehensive and integrated literature review it was suggested that there is a gap in the literature regarding the impact of IT-based services on customer-perceived service quality and attention in this area is needed. This notion gives the way to the research opportunity through which some dimensions in this area can be explored and the current state of knowledge should be assessed. Therefore this research develops a conceptual framework that tries to link the main constructs of

IT-based services and their influences on customers' perception of dimensions of service quality.

In this section hypothesized model for the assumed antecedents of service quality was presented. Under this model linkages among various service dimensions measured by the SERVQUAL scale were depicted. The Constructs were designed to measure IT-based service dimensions and their impact on perceived service quality and customer satisfaction measures.

In the process of literature review, statements regarding dimensionality and measurement of service quality were identified. Therefore SERVQUAL was utilized to measure service quality in this study. The reasons for utilizing this scale are several. Firstly, SERVQUAL is a popular and well-documented research scale used in many studies. Secondly, due to its wide use in research, its pros and cons for well-documented in many reputed types of research. Thirdly, the SERVQUAL scale was used for the assessment of service quality in various industries.

On the basis of these arguments, SERVQUAL was adopted and regarded as a desirable global service quality measure for this study. Unlike the other studies, this study investigates the impact of IT-based services on overall service quality and customer satisfaction rather than focusing on individual dimensions of service quality which were a focus of many previous research works.

The research construct measuring IT-based services is utilized to measure how customers evaluate the service quality of IT-based services and are also linked to SERVQUAL i.e measure to test service quality to test the influence of IT-based services on the dimensions of service quality. In this manner, IT-based services measure are linked to both performance measures that is service quality and customer satisfaction. On the basis of the above discussion, the following Hypothesis was proposed:

- H1: IT-based services experience positively influences service quality (SQ) in banking services.  
H2: IT-based services experience positively influences Customer satisfaction (CS) in banking services.

### 3. Measures

#### 3.1. IT-based services (ITBS)

The key items utilized to measure IT-based services were ease of use, time conservation, convenience, privacy, accuracy, multidimensional capabilities, and use of advanced IT systems. The types of IT Services measures included ATMs, online banking systems internet banking systems, etc.

##### 3.1.1. Ease of use

It refers to the effort in using Information Technology based services or in other words the

nature of the service delivery process which affects customers' enjoyment to use such process is also regarded as Ease of use (Dabholkar, 1996). If the customer feels that IT-based service is difficult to use they may not adopt that service (Dabholkar 1996)

### 3.1.2. Time conservation

It is a very important aspect as far as IT-based services are concerned, pointed out by many researchers, it refers to saving time by using IT-based service. Customers do not like to wait once they reach the service delivery point, and waiting in queues affects customers' perception regarding service quality negatively (Appiah and Osei, 2019). Some customers even prefer IT Services if the delivery time can be reduced (Lovelock and Young, 1979). IT-based service may help in the conservation of time and improve customer service quality by providing prompt and efficient service.

### 3.1.3. Convenience

This construct is also regarded as one of the most important constructs for measuring IT-based services as it is regarded as a benefit perceived by the customers (Reed, 1998). McDougall and Levesque (1994) also advocated that the whole network of ATMS attracts customers as they provide convenience to the customers. Alzoubi et al. (2022) suggested that customer satisfaction would also improve when customers enjoy convenience while accessing their accounts through different online modes offered by the banks.

### 3.1.4. Privacy

Privacy is an important construct and especially in the context of banking it becomes more and more important as people are very concerned about their information disclosure. While using IT-based services the customer wants privacy, for example, some customers can have a perception that the internet itself does not offer a very safe environment for doing financial transactions and they may fear that some hacker will get their personal and financial information (Baker et al., 2019). This notion can hamper the development of IT-based services as the concern about potential privacy invasion avert many customers from using IT-based services provided by the bank.

### 3.1.5. Accuracy

As people keep money in banks they want to get ensured that the accuracy of their accounts should be maintained at all times. Therefore services should be performed accurately and accurate information should be provided to the customers as it helps improve service reliability (Parasuraman et al., 1988; 2002) and service outcomes (McDougall and Levesque, 1994). It is also suggested in research that

IT can help service quality by keeping a check on errors as it also collected data and information that can be used for designing better systems that can be more accurate (Licata, et al., 1998).

### 3.1.6. Multidimensional capabilities

This research construct measures the comprehensiveness and scope of IT-based service systems as customers want a variety of supplementary services with the core functionality of the main service (Lerch and Gotsch, 2015). McDougall and Levesque (1994) concluded that a package of services is always attractive to most customers. Moreover, the multidimensional nature of the IT-based system can be regarded as an important factor while satisfying customer needs.

### 3.1.7. Use of advanced IT

This item takes into account the quality of Technology used while providing services to the customers. It also takes into account the tangible part of service quality. Banks' latest technology plays an important role as an indicator of convenience and customer satisfaction (Parasuraman, 1988; 2002). Li et al. (2021) also concluded that up-to-date infrastructure and proper systems and the latest IT may help deliver services to the customers efficiently improving customer satisfaction. All the research constructs which were discussed above are regarded as the measures of perceived IT-based services. The hypothesized model takes IT-based services as an independent variable and assumes that they influence service quality dimensions and customer satisfaction. Service quality dimensions are measured through a scale developed by Parasuraman (1988) as SERVQUAL Scale.

## 3.2. Measures of service quality (SQ)

This study utilized the SERVQUAL scale to measure service quality as described in previous sections. Each item of this scale was enacted in the context of banking and the measurements were based on customers' perceptions. Cronin and Taylor (1992) advocated that performance Scores can solely rely on the estimation of service quality. Service performance was measured through customer satisfaction and a rating of service quality. Five-point Likert's scale was used to collect data from the respondents where a rating of 1 indicates a strong disagreement with the statement and a rating of 5 indicates strong agreement with the statement.

## 3.3. Customer satisfaction (CS)

Customer Satisfaction was measured through customer rating of service quality. Both these measures were ascertained as multiple-item scales due to their definition and interpretability. Five-point Likert's scale was used to collect data from the

respondents where a rating of 1 indicates a strong disagreement with the statement and a rating of 5 indicates strong agreement with the statement.

#### 4. Data collection and analysis

##### 4.1. Sampling

The sample chosen to conduct this study was based on customers who were actively involved in using IT-based Service Delivery such as ATMs, phone banking and internet banking, or any other IT-based App at least 5 times a month. All the efforts for made while doing sampling to ensure that the sample should be free from any kind of bias. The questions were divided into three sections including statements measuring IT-based services, items pertaining to SERVQUAL for the assessment of service quality, and items measuring perceived customer satisfaction.

A brief cover letter was also attached to the questionnaire. The research instrument starts with a brief description stating the aims and objectives of the research conducted. 190 usable responses were collected, and the response rate was found to be an acceptable range as 10% of the response rate was achieved which is quite high in the mail or internet-based surveys (Sheehan, 2005). The research instrument consists of 40 items. All the respondents chosen were more than 18 years of age the average age of the respondents was 35 years.

#### 5. Measurement model assessment

Before the assessment of the structural model, A measurement model with all the research variables was assessed and in this model, some preliminary analysis and testing were performed (Malhotra et al., 2006). In this research measurement model was assessed by testing unidimensionality, assessment of Reliability, and validity. When the measurement model was assessed and the values obtained were found to be in acceptable ranges, the data was utilized for the assessment of the structural model. Analysis for the measurement model is given stepwise in the following sections.

##### 5.1. Unidimensionality assessment

Unidimensionality assessment is an important step as it is the first step while performing any kind of analysis in structural equation modelling (SEM). It refers to making efforts to ensure that the items which are related theoretically and assume to assess any particular construct should have a proper relationship with that construct and it must be accessed through path values provided by the software processing data and indicated while assessing for measurement model the process is also known as factor analysis. To perform factor analysis there are two methods i.e. exploratory factor analysis (EFA) and confirmatory factor analysis

(CFA) this research employs confirmatory factor analysis (CFA) as it is well documented that it is a superior and latest method for scale refinement. Under this method, all the constructs and their items were assessed for measurement model, and on the basis of path values items are retained and deleted from the scale. The items having path values less than 0.40 (Lindquist et al., 2001) were dropped from the scales and in this manner, all the constructs were trimmed until all the path values come in acceptable ranges. In this manner, a refined scale with regard to Unidimensionality comes into existence. The process is described in detail in the next section.

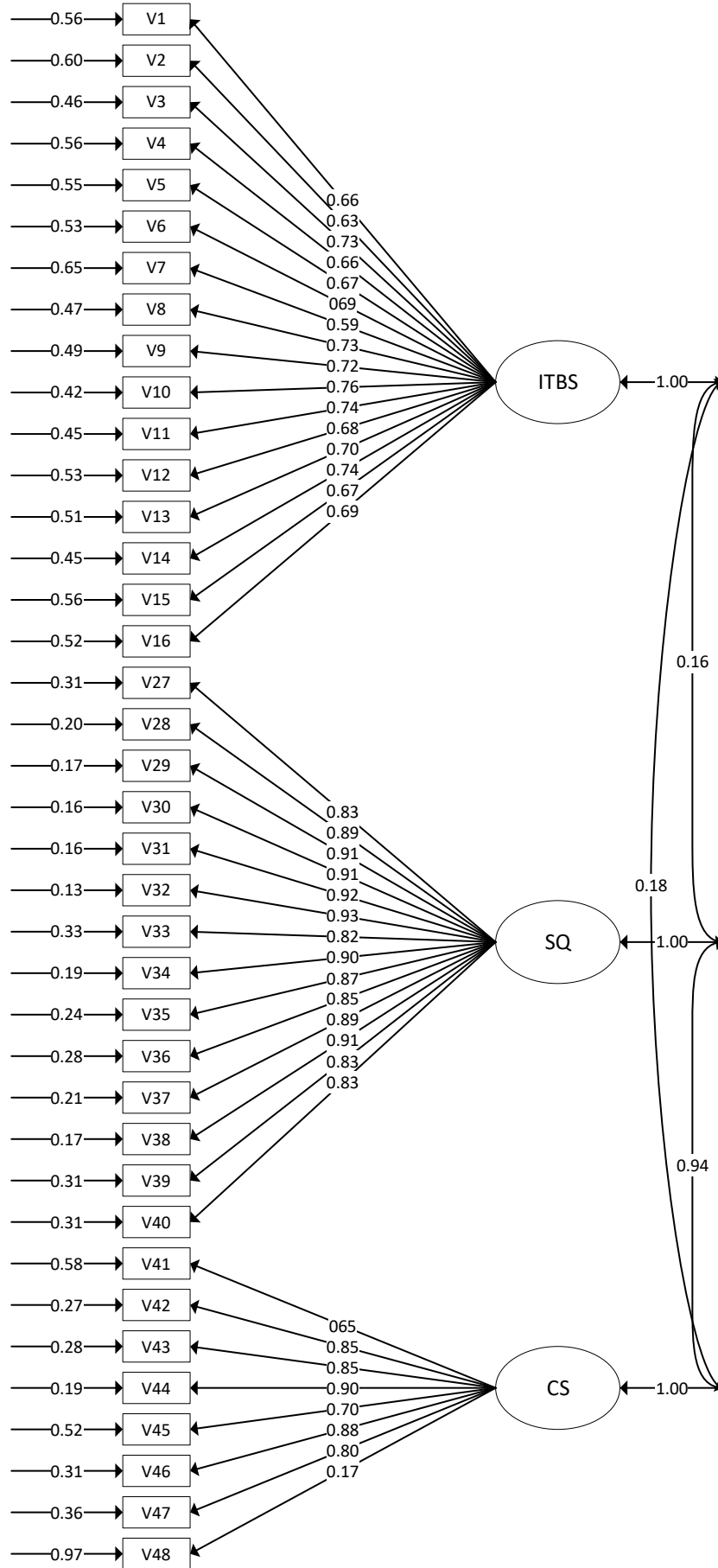
##### 5.2. Confirmatory factor analysis (CFA)

Confirmatory factor analysis was performed on the items of independent variables i.e. measures of IT-based services and also takes into account dependent variables i.e. SERVQUAL dimensions measuring service quality (SQ) and customer satisfaction (CS). The 16-item scale for the measurement of IT-based services was developed on the basis of the literature review and five items scale was developed for the measurement of service quality. Three items scale was developed for the assessment of customer satisfaction which is also regarded as the dependent variable in this research. The observations from the confirmatory factor analysis are given in Fig. 1.

After the confirmatory factor analysis, a 43-item scale was developed as 5 items were trimmed and deleted from the scale. This refined scale considered for the assessment of reliability and validity includes 38 items. There are many studies that adopted the scales used in this study and mould them according to their context of research and objectives. Licata (1998) conducted an empirical study on Bank customers utilizing 20 items of SERVQUAL for the measurement of service quality. In this study, a 14-item scale was utilized. Sample size limitation was not an issue in this research as it utilizes the recommended sample size for using these methods which were calculated through a formula given by Jöreskog and Sörbom (2005). The issue of sample size was recognized by many researchers (Agarwal and Prasad, 1999). The reliability was assessed through Cronbach's alpha. The alpha value should be greater than 0.70 for the assessment of reliability. It was found to be in acceptable ranges.

##### 5.3. Assessment of validity

Convergent and Discriminant validities were assessed. Convergent validity was ensured through path values obtained during CFA. In this manner, convergent validity for the research scale was also established and discriminant validity was ensured by comparing the square root of average variance extracted (AVE) which should be greater than the correlation with other constructs. The validities were assessed and the scale was found to be valid scale (Tables 1 and 2).



Chi-Square=3100.53, df= 662, P-value= 0.00000, RMSEA= 0.112

**Fig. 1:** CFA of all the research variables

**Table 1:** Correlation values indicating discriminant validity

Scale	IT-based services (ITBS)	Service quality (SQ)	Customer satisfaction (CS)
ITBS	1.000		
SQ	0.137	1.000	
CS	0.042	0.074	1.000

**Table 2:** Cronbach alpha, CR, and VE indicating reliability and validity

Scale	Cronbach's alpha	Constructs reliability (CR)	Variance extracted (VE)
ITBS	.664	0.7	0.4
SQ	.631	0.7	0.4
CS	.648	0.7	0.5

## 6. Structural model evaluation

### 6.1. Model fit measures

The conceptually hypothesized model was tested using a structural equation modelling (SEM) approach. The parameters assisted in the model were estimated by the linear structure relation program (LISREL) 8.80. The coefficients of the variables were obtained using the maximum likelihood method (MLE) (Jöreskog and Sörbom, 2005). The results regarding model fit are given in Table 3. The goodness of fit index was 0.91 ensuring a good model fit and the root mean square residual was .70. The Chi-square value was insignificant and the ratio of Chi-square with degrees of freedom was below 3. Therefore it was ascertained that the values regarding model fit were within acceptable ranges.

### 6.2. The structural equation model

The structural equation model provides the relationship between the unobserved Independent and dependent variables. The structural model proposed three variables and linked IT-based services to SERVQUAL/service quality and customer satisfaction. The estimates for these variables and standard errors of the research constructs are given below. All the estimates were found to be significant (Fig. 2).

ITBS had a direct and positive relationship with SQ as indicated by the structural path ( $\beta=0.17$ ) from ITBS to SQ. Thus hypothesis H1 was Accepted. ITBS had a direct and positive relationship with CS as indicated by the structural path ( $\beta=0.19$ ) from ITBS to CS. Thus hypothesis H2 was Accepted.

## 7. Results and discussion

It can be safely concluded by the results of factor analysis that the attributes associated with IT-based services loaded positively to a single construct, IT-based services (ITBS). After the analysis through structural equation modeling (SEM), it is further reinforced that IT-based services have a direct relationship with overall service quality which includes all dimensions such as reliability, responsiveness tangibility, and assurance as included in SERVQUAL Scale. This finding can be attributed to the fact that customers were more

likely to put value to these quality dimensions if they experience IT-based services for the satisfaction of their needs, provided that they don't have any risk of invasion of their privacy. Secondly, it can also be concluded that IT-based services relatively have a greater role in customer satisfaction, which can be attributed to the fact that the more satisfied customers with IT-based services, the higher they rate service dimension which has a positive effect on customer satisfaction. This finding is in line with Fitzsimmons and Fitzsimmons (2004) and Furey (1991). As compared with previous research works, this research provides a unique way of researching through developing composite variables for both service quality and customer satisfaction and further, it pinpoints the interrelationships among these variables using a multivariate methodology. It is very helpful for service providers to understand better how IT-based services will affect service quality and customer satisfaction.

## 8. Conclusion

Initially, this research paper identified many factors associated with IT-based services and also proposed a model for service quality and customer satisfaction for the investigation of relationships between customers' perceptions of IT-based services and overall service quality and customer satisfaction. The model was tested on the sample of bank customers using the structural equation modelling (SEM) approach.

The results of the empirical analysis of the model provide that IT-based services (ITBS) affect the service quality (SQ) dimension with all its attributes and further it also influences customer satisfaction (CS). It can also be noted that this study utilizes single composite scales to measure both service quality and customer satisfaction respectively (Jörling et al., 2019; Dabholkar, 1996; Hui and Bateson, 1991).

**Table 3:** Fit indices for all study scales

Measure	Value
Chi-square value	3.79
Degrees of freedom	54
p-value	0.10
Chi-square/df	1.23
Goodness of fit index (GFI)	0.91
Adjusted goodness of fit index (AGFI)	0.90
Root mean square residual (RMSR)	0.68

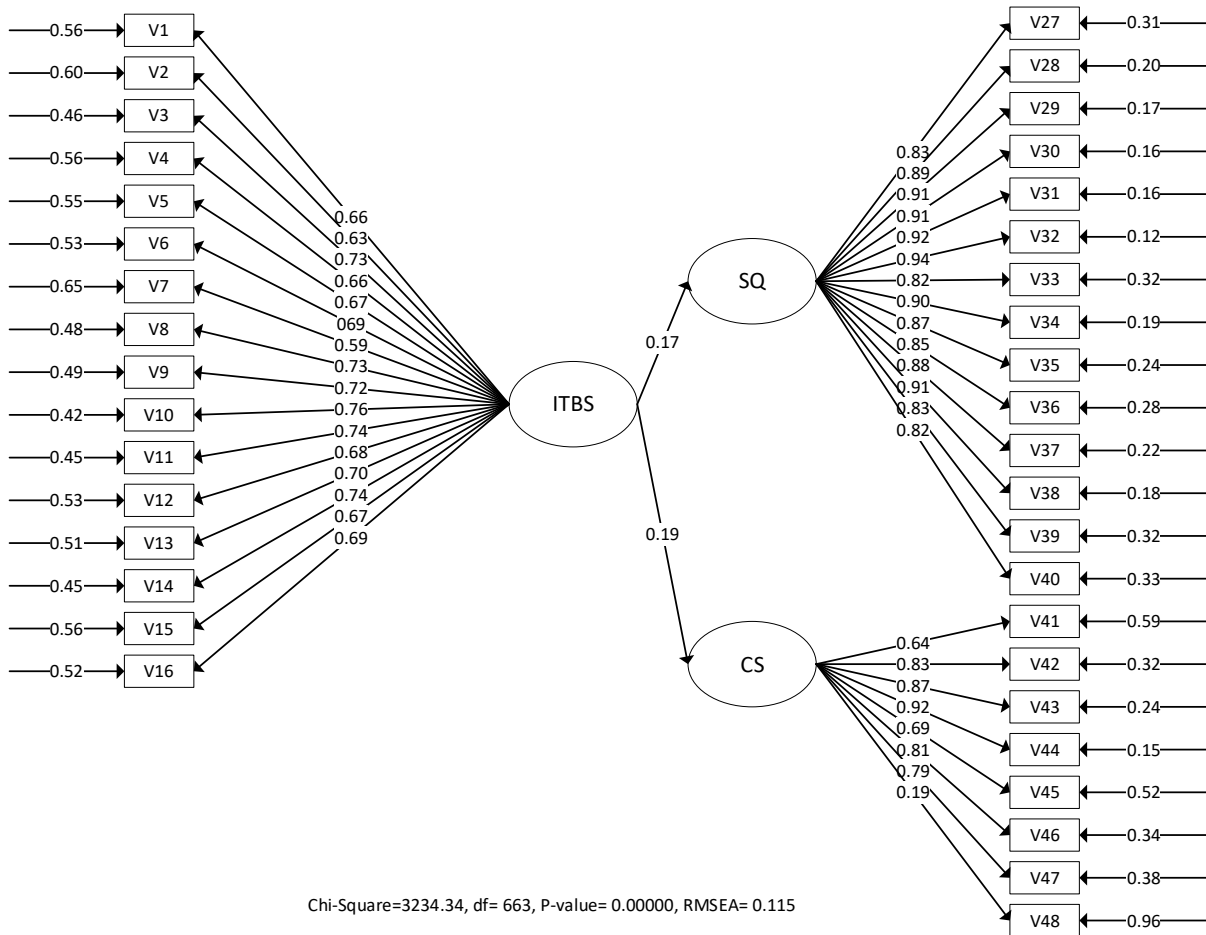


Fig. 2: Structural model for all research variables

The findings presented in this study provide insightful knowledge for IT decision-making, it will help service providers to achieve a higher level of customer service and customer satisfaction, it does not guarantee that technology alone can enhance service quality and customer satisfaction however service providers while providing IT-based services have to understand better that where technology will or will not enhance customer service. After taking into account the perceptions of customers, service providers will be in a better position to develop and promote IT-based services so that a higher level of service quality and customer satisfaction can be achieved.

**Compliance with ethical standards**

**Conflict of interest**

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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