SERVICE QUALITY IN TECHNOLOGY BASED SELF SERVICE BANKING

THESIS

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by

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SEPTEMBER, 2016

DECLARATION

I hereby declare that this thesis entitled "**SERVICE QUALITY IN TECHNOLOGY BASED SELF SERVICE BANKING"** by **RAJIV SINDWANI,** being submitted in fulfillment of the requirements for the Degree of Doctor of Philosophy in Department of Management Studies under Faculty of Management Studies of YMCA University of Science & Technology, Faridabad, during the academic year 2016-2017, is a bona fide record of my original work carried out under the guidance and supervision of **Dr. MANISHA GOEL, ASSOCIATE PROFESSOR, DEPARTMENT OF MANAGEMENT STUDIES, YMCA UNIVERSITY OF SCIENCE & TECHNOLOGY, FARIDABAD** and has not been presented elsewhere.

I further declare that the thesis does not contain any part of any work which has been submitted for the award of any degree either in this university or in any other university.

(RAJIV SINDWANI)

Registration No: YMCAUST/Ph50/2011

CERTIFICATE

This is to certify that this thesis entitled **"SERVICE QUALITY IN TECHNOLOGY BASED SELF SERVICE BANKING"** by **RAJIV SINDWANI** submitted in fulfillment of the requirements for the award of Degree of Doctor of Philosophy in Department of Management Studies, under Faculty of Management Studies of YMCA University of Science and Technology, Faridabad, during the academic year 2016-17, is a bona fide record of work carried out under my guidance and supervision.

I further declare that to the best of our knowledge, the thesis does not contain any part of any work which has been submitted for the award of any degree either in this university or in any other university.

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(Rajiv Sindwani)

ABSTRACT

The development of information and communication technology has brought a revolution in the banking industry. The banks across the globe are focussing towards the increasing use of technology to provide banking services. Today almost each and every commercial bank in India is offering self service electronic banking services to its customers using a range of electronic banking channels. These automated banking services that customer avail in self service mode using various electronic banking channels, without any interaction with bank employees may be called as technology based self service banking (TBSSB) services. Increased customer awareness, competition, wider choice and technological innovations have made consumers more demanding of quality banking services. Researchers have found that service quality has an impact on customer satisfaction, customer loyalty, profitability and business performance.

The relationship between automated banking service quality, customer satisfaction, and loyalty has been widely discussed in the literature. But, most of the automated banking studies conducted in India and abroad consider quality attributes corresponding to the single automated banking channel like internet banking or ATM banking or Mobile banking or telebanking for measuring service quality and investigates its relationship with satisfaction and loyalty. As customers tend to use different banking channels in a complimentary manner, therefore, research focussed on a single channel is insufficient to capture the overall image of technology based banking. To get the all-inclusive picture, it is required to include service quality attributes of all the major channels offering automated banking services. The thrust of this thesis is to find the various dimensions of service quality in case of technology based self service banking services and to determine the relationship between TBSSB service quality, customer satisfaction, and customer loyalty. The study also examines the effects of various demographic variables on TBSSB service quality, customer satisfaction, and customer loyalty dimensions. Banks invest a hefty sum of money for offering TBSSB services. So there must be a method that can help banks to quantify TBSSB service quality, which banks may use for self assessment and for comparison

with other banks. Accordingly, this study also quantifies the overall effect of TBSSB service quality attributes in terms of a single numerical index.

A total of 414 completed questionnaires were used for the purpose the analysis. The dimensions of technology based self service banking were identified and confirmed by conducting exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) by using SPSS 16.0 and AMOS 20.0 respectively. Dimensions of TBSSB service quality were identified as Convenience, Reliability & Security, Responsiveness, and Personalization. AMOS 20.0 was also used to investigate the relationship between dimensions using SEM. It was found that Convenience and personalization have a significant effect on customer satisfaction, and personalization and customer satisfaction have a significant effect on loyalty. Customer satisfaction was also confirmed as a mediating factor in the relationship. The results presented the effect of gender, age, qualification, occupation and annual income on TBSSB service quality, customer satisfaction, and loyalty dimensions. To quantify the overall effect of TBSSB service quality, Graph Theoretic Approach (GTA) was used to compute the single numerical index for the TBSSB service quality system using a five step sequential process.

This study may help bank managers to investigate the customers' quality perceptions about TBSSB services using the TBSSBsqual scale developed in this study and enlighten banks about the aspects of services to be focussed. This will help them to formulate strategies for improving the quality of service, resulting in increased customer satisfaction which in turn will lead to enhanced customer loyalty. This study may assist bankers to take various decisions related to TBSSB services using TBSSB index. It will support academicians in better comprehension of TBSSB services and contribute in the field of automated service quality research.

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LIST OF ABBREVIATIONS

Abbreviation	Description
AMOS	**Analysis of Moments Structures**
ANOVA	**Analysis of variance**
ATM	**Automated Teller Machine**
AVE	**Average Variance Extracted**
CBS	**Core Banking Solutions**
CFA	**Confirmatory Factor Analysis**
CFI	**Comparative Fit Index**
CR	**Composite Reliability**
EFA	**Exploratory Factor Analysis**
EFT	**Electronic Funds Transfer**
GDP	**Gross Domestic Product**
GOF	**Goodness of Fit**
GTA	**Graph Theoretic Approach**
ICT	**Information and Communication Technology**
ISO	**International Organization for Standardization**
IT	**Information Technology**
IVRS	**Interactive Voice Response System**
KMO	**Kaiser-Meyer-Olkin**
MICR	**Magnetic Ink Character Recognition**
MIS	**Management Information System**
PSU	**Public Sector Undertaking**
RBI	**Reserve Bank of India**
RMSEA	**Root Mean Square Error of Approximation**
SEM	**Structural Equation Modeling**
SMS	**Short Messaging Service**
SPSS	**Statistical Package for Social Sciences**
SSTs	**Self-Service Technologies**
SWIFT	**Society for Worldwide Interbank Financial Telecommunication**
TBSSB	**Technology Based Self Service Banking**
TLI	**Tucker-Lewis Index**

CHAPTER I
INTRODUCTION

1.1 BACKGROUND OF THE RESEARCH

The three-sector hypothesis is an economic theory which divides economies into three sectors of activity namely extraction of raw materials (primary), manufacturing (Secondary) and services (tertiary). According to the theory, the main focus of the economy's activity shifts from the primary, through the secondary and finally to the tertiary sector. With time the contribution of services in the GDP has increased significantly. Presently service sector forms the main support of the Indian economy with around 60 percent contribution to the GDP. Like other countries across the globe, the role and importance of services have also increased in India in the last couple of decades. Today people are availing a wide range of services including education, transportation, electricity, gas, finance, banking, insurance, entertainment, real estate, healthcare, legal, accounting, hotel, restaurant, travel agency, airline, health club, hair styling, retailing and so on. Some of the reasons for the growth of services are increasing wealth, more leisure, higher life expectancy, cultural changes, the rise in a number of working women and economic liberalization. Along with these reasons, one more important reason for the growth of services is IT revolution. Advancement in technology has made India compete at international level in various services like software development, Business Process Outsourcing, and Knowledge Process Outsourcing. Service managers are under pressure to provide services better or at least at par with the competition. As India is progressing towards a service economy, marketers need to develop new techniques to market their services. Services pose special challenges for marketers of services because of the distinctive characteristics of services. Increased customer awareness, wider choice, technological innovations and increased competition has made consumers more demanding of quality services and service providers cannot afford to neglect customers and their requirements. All this has resulted in a focus on technology for providing effective and efficient services for customers.

Like other services, the banking sector is also increasingly using technology for providing services. Over the years, the banking sector has become so dependent on technology that now the sector cannot think of sustaining without the help of information and communication technology. The banks across the world are focussing towards the use of technology to provide services in the self service mode using a range of electronic banking channels. Today almost each and every commercial bank in India is offering self service electronic banking to its customers. The introduction of technology based self service banking services in India started off with HSBC bank establishing ATM for the first time in India. Although these electronic delivery channels were introduced by foreign banks and new private banks in order to overcome their limitation of fewer branches, presently the public sector banks are also aggressively investing in these services (Joshua, 2009). Using technology Indian banks are providing services through different channels such as ATM, internet banking, mobile banking, telephone banking etc. The use of technology is greatly advantageous to the banks as it can standardize service delivery, expand the options for provisioning of services and reduce costs.

To achieve competitive advantage it has become important for the firm to understand the market from the customer perspective, design and deliver services as per their needs and enhance the service performance level accordingly (Brown and Swartz, 1989; Yavas et al., 2004; Chumpitaz and Paparoidamis, 2004). An organization works under various resource constraints. Even under these constraints, providing quality service to the customer is essential for the survival of the service firm. Today service quality has become a vital component in running a business successfully (Blose, Tankersley & Flynn 2005; Schneider, Holcombe & White 1997). Good quality of service is an essential attribute to have a competitive advantage (Ganesan, 1994; Parasuraman and Grewal, 2000). Organizations in all sectors are trying to exploit technology for their respective businesses, as it results in numerous benefits. Service quality has become a key area of interest to practitioners, managers and researchers as it influences business performances, profitability, customer satisfaction and loyalty (Storbacka et al., 1994, Hallowell, 1996; Al-Hawari et al., 2005; Seth et al., 2006 etc.). Investigations of banks' automated service quality are necessary because of their strong impact on attractiveness, customer retention, positive word-of-mouth, and maximising competitive advantages (Santos, 2003; Al-Hawari et al., 2005).

The focus of this research is on the service quality of self service banking technologies that customers independently use for banking without interaction with bank employees.

1.2 OVERVIEW OF TECHNOLOGY BASED SELF SERVICE BANKING

1.2.1 Role of Technology in Service Delivery

Today almost each and every firm is leveraging technology in service creation and delivery. With technology, it has become relatively easy to manage services. Many shortcomings in services because of the presence of a human element in the traditional service delivery can be taken care of because of technology. Using technology, services can be provided at any time and at any place. There is a greater perceived control on the part of a customer when the customer is in direct contact with the technology, as in internet banking (Dabholkar, 1996). Heterogeneity of the service delivery could be managed and uniform services can be provided. With the inclusion of technology in the service delivery 'mass customization' is possible, by creating customizable services like ATMs or interactive computer services. Using technology, services can be rendered with fewer employees, that may result in cost saving. In short, technology has acted as a boon for organizations worldwide.

1.2.2 Technology and Indian Banking Sector

The functional environment of the banking system in India has undergone a swift change with the financial and banking sector reforms. The reforms in the Indian banking system led to the formation of a competitive and efficient banking system. Liberalization has resulted in the entry of new players in the banking sector and led to more competition among banks. The information and communication technology (ICT) extensively contributed to the survival and growth of banks in India. ICT has transformed the working of banks across the world. Technology advancement in the banking sector is moving people towards the cashless transactions in which physical cash is getting replaced by digital cash. RBI has played a vital role in the execution of information technology in the banking sector. RBI has constituted various committees

to implement ICT in Indian banking. The contribution of some of the committees is briefly discussed below.

In 1984, a committee on mechanisation in the banking industry was constituted under the chairmanship of Dr. C. Rangarajan, Deputy Governor, RBI. Rangarajan committee presented the outline for computerization and mechanisation in the banking industry and looked into modalities of drawing up a phased plan for mechanisation for the banking industry covering period 1985-89. The Committee in its report recommended the introduction of computerization and mechanisation at Branch, Regional Office/ Zonal Office and Head Office levels of banks.

In 1988, second Rangarajan committee was constituted for drawing plans for the computerisation of the banks for the next five years from 1990-94. It identified the purpose of computerisation as improvement in customer service, decision making, housekeeping, and profitability. The committee suggested setting up a network of Automated Teller Machines (ATMs) in Mumbai. The committee advised that the ATMs to be strategically located at airports, railway stations, hospitals, important commercial centres, as well as bank branches, to be used by the customers to perform a variety of functions such as deposits, withdrawals, balance enquiries, statement of accounts etc., at any point of time during the day. The committee favoured the introduction of a single 'All Bank' credit card and advocated the need for its widespread acceptance by merchant establishments and usage by customers to reduce the load on cash and cheque transactions. The second committee laid the foundation for the technological advancement in the banking sector by integrating the usage of computers and telecommunications. These two Rangarajan committees' reports set the pitch for computerization in Indian banking sector.

In 1994, a committee was constituted on technology issues related to cheque clearing, payments system and securities settlement in banking sector under the chairmanship of Mr. W. S. Saraf, Executive Director, RBI. The committee recommended the establishment of an Electronic Funds Transfer (EFT) system, with the BANKNET communications network as its carrier. The committee proposed to introduce MICR clearing at all centres with more than 100 bank branches. The committee suggested

amplifying the use of technology in the banking sector and optimum utilization of SWIFT by the Indian banks.

In 1995, RBI formed a Shere committee under the chairmanship of Smt K. S. Shere, Principal Legal Advisor, RBI for proposing Legislation on Electronic Funds Transfer and other Electronic Payments. The Shere committee recommended introducing Electronic Fund Transfer system immediately by framing regulations under Section 58 of the RBI Act. The committee suggested a Model Customer Contract agreement to govern the banker-customer relationship with regard to EFT to be adopted by all banks participating in the system. As a long term measure, it suggested that a new legislation is needed for defining, regulating and determining the rights and obligations of the system providers and users.

The Reserve Bank has also guided the banking system (mostly PSU banks) in the adoption of technology. In the first phase, banks computerised their labour intensive back office operations to reduce costs and improve housekeeping. In the second phase, banks focussed on enhancing customer convenience to gain competitive advantage. In the third phase, banks have implemented Core Banking Solutions (CBS) combining both front office and back office. This phase marked a paradigm shift in more senses than one and branch customers became bank customers as they can access their accounts from any branch for defined purposes. CBS offered new opportunities for information management, for better customer service and improved risk management.

RBI has always emphasized the importance of IT for the banking and financial sector. In 2011, RBI released 'IT Vision Document- 2011-17' aimed at providing a roadmap towards a transformation which is knowledge based and which has information as its focal point. This vision document set the priorities for commercial banks for moving forward from the core banking solutions to enhanced use of IT in areas like MIS, regulatory reporting, overall risk management, financial inclusion and customer relationship management. It also dwelled on the possible operational risks arising out of technology acceptance in the banking sector which could affect financial stability and emphasized the need for internal controls, risk mitigation systems, and business continuity plans.

1.2.3 Technology Based Self Services

As per Meuter et al. (2000), self service technologies are technological interfaces that permit customers to produce services by themselves independent of direct customer service employee involvement. In the case of technology based self services, customer avails the services by himself/herself using technology without the direct involvement of service employees in the process of service delivery. The major motivators for using technology based self services include time saving, convenience, increased options, and better-perceived control.

1.2.4 Technology Based Self Service Banking (TBSSB)

Before the infusion of technology in the banking sector, banks in India relied on their branch network to provide services to customers. This way of providing services only through branches was not cost effective because of huge investment in establishing branches and high operating expenses. The technology provided a low-cost strategy to banks in the form of alternative service delivery channels like ATM, internet banking, and mobile banking. With the passage of time, these alternate banking service delivery channels are replacing branch banking for banking services. Banks across India are promoting their technology based self service banking channels in a big way as in future these automated channels will act growth drivers for banks.

Many researchers have defined electronic banking as the services provided by internet banking. Only a few researchers have defined automated banking by covering all electronic banking modes. Daniel (1999) has defined it as the services and information offered by a bank to its customers via different delivery platforms such as PC banking, Internet banking, Managed network and TV based. Uppal (2007) defined it as all services provided by banks through all types of electronic delivery channels such as telephone, ATM, the internet, cell phone, and so on. Some important modes of technology based self service banking channels are explained below.

Automated Teller Machine (ATM)

As per www.investopedia.com, an automated teller machine (ATM) is an electronic banking outlet, which allows customers to complete banking transactions without the aid of a branch representative or teller. There are two primary types of automated teller machines or ATMs. The basic units allow the customer to only withdraw cash and receive a report of the account's balance. The more complex machines will accept deposits, facilitate credit card payments and report account information. To access the advanced features of the complex units, you will usually need to be a member of the bank that operates the machine. Basically, ATM is a computerized telecommunication device that allows customers of a financial institution to access their accounts with a magnetically encoded plastic card and a PIN number. It enables the customers to perform several banking operations in self service mode. The ATMs which are installed within bank premises are known as on-site ATMs and the one that are located at some other places like food worlds, railway station, bus stops, shopping malls, petrol pumps etc. are known as off-site ATMs.

Acceptance level of ATM banking in India is very high as compared to other automated banking modes. ATM is no longer only a cash dispensing machine. These days ATM performs a lot of many functions. These functions include withdrawal of cash, deposit of cash, balance enquiry, mini statement of the account, transaction details, transfer of money from one account to another account, cheque book request, request for detailed account statement, request for loans and insurance, payment of telephone, electricity, mobile and credit card bills, payment of insurance premiums, recharge pre-paid mobile phone connections, place orders for demand drafts and fixed deposits, donations to specific temples, causes or charitable trusts etc. These facilities provided by ATMs vary from bank to bank.

HSBC was the first bank to launch the ATM services in India in the year 1987. Now, almost every commercial bank in India is providing ATM facility to its customers. New private sector banks were the front runners in installing ATMs in large numbers to complement their weak branch network and to compete with large public sector banks having many more branches. But with time the picture has changed with the public sector banks aggressively installing the ATMs across India (Joshua, 2009).

Internet banking

As per Wikipedia, Internet banking also known as online banking or web banking is an electronic payment platform that enables customers of a bank to conduct a range of financial transactions through the bank's website. Internet banking has revolutionized the banking services and the way business is conducted. By making the most of the information technology, banks are providing a gamut of financial services to their customers. Various operations can be performed with the help of internet banking including accessing account information, online payment for shopping done on the Internet, applying for various loans, view account balance and statement, fund transfers, stop payments on cheques, standing instructions, payment of utility bills, ordering demand drafts, registering complaints, feedback services etc . These facilities may vary from internet banking services provided by the bank to bank.

RBI has classified the levels of banking services offered through the internet into three types in their Report on Internet banking (2001).

1. Basic level service websites -- This is the fundamental level of internet banking services. The bank shares information about its products and services with customers and public on their website.
2. Simple transactional websites -- This kind of internet banking permits interaction between the customer and the bank system. It may be limited to account inquiry, email, loan applications and its status etc. In communication websites, bank responds corresponding to the customer requests by email or by updating the status. It does not permit any fund-based transactions on accounts.
3. Fully Transactional websites -- In this Internet banking system, customers are allowed to conduct a wide range of financial as well as non-financial transactions. Most of the banks today have fully transactional internet banking websites. As compared to the basic level and simple transactional websites, transaction websites bear more risk and therefore should have the strong security features.

ICICI bank was the pioneer to offer internet banking in 1997 by the name 'infinity'. This was followed by other private banks such as Citibank, HDFC bank, Federal Bank

and Centurion Bank. Today most of the commercial banks are providing internet banking services. Considering the recommendations of the committee on banking sector technology up gradation headed by Mr. Srinivasan, the RBI issued guidelines in year 2001on three major areas of internet banking, viz. (i) technology and security issues, (ii) legal issues and (iii) regulatory and supervisory issues. The aim was to minimize the problems faced by banks and their customers. The group recommended guidelines for the smooth and proper working of internet banking.

Internet banking offers many advantages to the customers as compared to branch banking. Advantages such as access to internet banking 24 hours a day and seven days a week, cheaper alternative as compared to physically going to the bank branch for availing services, a wide range of services provided at the button click, no more waiting in a queue to receive services, no geographical constraints, and customization of banking services as per customer requirements.

Telebanking

Telebanking refers to using a telephone to access the bank account and avail banking services by customers. Telebanking is based on an Interactive Voice Response System (IVRS). In telebanking, a registered bank customer dials the bank's toll-free telephone number and is guided by a voice response system for availing different banking services. The registered customer is provided with telebanking PIN that acts as a password for conducting various transactions. A customer can carry out transactions by accessing his/her account through telephone 24 hours, 7 days from the comfort of their home, office or on the move throughout the country with the single telebanking PIN. With the exception of cash deposits and withdrawals, telebanking offers almost all the features of an automated teller machine. Many banks in India offer telebanking services to customers in their preferred language. Telebanking offers various services like balance enquiry, transactions history, general product information, cheque status, stop cheque, transaction statement request, funds transfer, ATM locator, cheque book request etc. A variant of telebanking is popularly called as phone banking in which a customer talks to a phone banking officer (service employee) for banking transactions. Phone banking is beyond the scope of the present study as only technology based self services are considered in this study.

Mobile banking

As per Wikipedia, Mobile banking is a service provided by a bank or other financial institution that allows its customers to conduct a range of financial transactions remotely using a device such as a mobile phone or tablet. Mobile banking can be provided as a value-added service for the existing customers and at the same time, it has the potential to be used as a means to bring into the banking system the unbanked and underbanked segment of the population. ICICI bank was also the pioneer in Mobile banking services with the launch of SMS banking in 2002 and iMobile ICICI in 2008. Broadly three types of mobile banking services are offered by Banks namely SMS (Short Messaging Service), WAP (Wireless Application Protocol) and App (downloadable Smartphone Application). As the mobile phone penetration in India is quite high and is increasing day by day, mobile banking has immense potential to be a cost-effective method of conducting banking transactions by the Indian customers including the rural population.

Earlier in India, only SMS based mobile banking was provided by the banks. For customers who wish to take advantage of mobile banking but do not have a smartphone, SMS banking (text banking) is a good option. Customer may request his/her bank to send alerts via text messages. These alerts are available for account balances, payments, direct deposits, and other account related activities. Financial institutions charge a nominal fee for these alerts. SMS banking may also be used to communicate with banks using the array of codes for different requests provided by the banks. The customer can request information by sending an SMS containing a service command to a pre-specified number and the bank reply with an SMS containing the specific information. The disadvantage is that the SMS based mobile banking will not be able to support the full breadth of transaction based services.

The mobile web browser also known as WAP allows financial institution customers who have smartphones or tablets to access a modified version of the bank's online site. Full account access is given from the site, allowing customers to monitor account activity, request account transfers and make payments. WAP is similar to internet banking in its operation and it offers secure online access to the web using mobile

phones. Banks maintain WAP sites which customers' access using a WAP compatible browser on their mobile phones. WAP site offers a similar form-based interface and allows the customers to access all enquiry and transaction-based services and in addition, they can also access more complex transactions.

The newest and rapidly growing form of mobile banking technology is the development of smartphone and tablet banking applications. These applications give customer one-touch access to many account features. Similar to the web browser technology, the customer has access to his/her account through a mobile phone application. Banks provide different types of apps for different types of phones like Android App, iPhone App, App for Windows phone, App for Blackberry phone etc.

Mobile banking can be used for various purposes like account balance enquiry, account statement enquiry, cheque status enquiry, cheque book request, fund transfer between accounts, credit/debit alerts, minimum balance alerts, bill payments, recent transactions history, information requests on interest rates/ exchange rates, m-commerce, utilities bill payments and so on.

1.3 NEED OF THE STUDY

With the passage of time almost each and every commercial bank in India has started offering automated banking services to its customers. The commercial banks are leveraging technology for the customers' as well as their own benefits. For the banks, the advantages are a reduction in the cost of the transaction and lesser load on branches. For the customers, technology based banking provides value by anytime, anywhere and anyway banking. The use of technology has resulted in achieving efficiency, speed, customer service, cost reduction and competitive advantage for banks. Now the technology strategy is no longer considered as a subordinate to the business strategy, rather it has become equally important as a business strategy.

As the products offered to the customers of a bank are more or less standardized in nature, banks are feeling an increasing need to differentiate themselves from the competitors on other criteria that can influence customer satisfaction and loyalty. This is so because customer satisfaction and loyalty have been shown to be of utmost

importance for a firm's performance in the long run (Hallowell, 1996). This has resulted in increasing number of banks using technology to deliver their services to customers. Although security concerns, lack of operating knowledge and lack of confidence are some of the reasons for non-usage of automated banking services by the customers, but gradually automated banking acceptance is growing among customers of Indian banks. This is also evident from the reduction in the branch transactions and the rise in the usage of automated banking channels in many of the banks. Growing customer expectations have made all major commercial banks, irrespective of the sectors (Public, Private or Foreign National), to adopt the automated self service banking (Joshua, 2009).

Assessment of published studies exposed that numerous studies have been conducted mainly in developed countries and a few in developing countries about the service quality of automated banking. A few of such studies include Joseph et al. (1999) in Australia, Jun & Cai (2001) in USA, Broderick & Vachirapornpuk (2002) in UK, Al-Hawari et al. (2005) in Australia, Khan et al. (2009) in India, Ganguli and Roy (2011) in USA, Lin (2013) in Taiwan, Narteh (2013) in Ghana, Ismail Hussien and Abd El Aziz (2013) in Egypt, Dhurup et al. (2014) in South Africa.

On reviewing different studies, it has been found that various scales have been proposed by researchers to measure automated banking service quality but there is no generally accepted scale to measure automated banking service quality. Most of the automated banking studies conducted in India and abroad covers attributes corresponding to the single mode of automated banking like internet banking (Khan et al., 2009), ATM banking (Narteh, 2013) or Mobile banking (Lin, 2013) for measuring service quality. In today's scenario, customers tend to use different banking channels in a complimentary manner. So, research focussed on a single channel is insufficient to capture the overall image of technology based banking. To get the all-inclusive picture, it was required to include service quality attributes of all the major channels offering automated banking services.

So, there was a need to design a scale in Indian context for measuring automated banking service quality by considering the attributes related to all the channels of automated banking. These automated banking services may be called as technology

based self service banking (TBSSB) services. There was also a requirement to understand the relationship of TBSSB service quality with customer satisfaction and loyalty, and to analyze the effect of various demographics factors on TBSSB service quality, satisfaction, and loyalty. Moreover, to provide these automated banking services, banks invest a hefty amount of money in infrastructure and other facilities. So a method to quantify TBSSB service quality in terms of a single numeric index could be of great help to banks for self-analysis and comparison with other banks.

In view of the above needs, various objectives to carry out research were set. These objectives are summarized in the next section.

1.4 RESEARCH OBJECTIVES

The following research objectives were the focus of investigation in this research

1. To find the various dimensions of service quality in case of technology based self service banking services.

2. To determine the relationship between TBSSB service quality, customer satisfaction, and customer loyalty.

3. To examine the effect of various demographic variables on TBSSB service quality, customer satisfaction, and customer loyalty.

4. To quantify the overall effect of TBSSB service quality attributes in terms of a single numerical index.

1.5 SIGNIFICANCE OF THE STUDY

The study makes contributions to the banking sector as well as the world of academics in many ways. The study provides an insight of customer perceptions of technology based banking service quality to bankers and academicians. This study identifies key factors of technology based self service banking and presents a conceptual model for understanding the relationship between service quality of the TBSSB services,

customer satisfaction, and customer loyalty. This study is particularly important because most of past studies focussed on a single banking channel to measure electronic banking service quality and investigated the relationships involving two constructs. The simultaneous investigation of the relationships among all three constructs (TBSSB service quality, customer satisfaction, and customer loyalty) would provide a complete picture of the nature of the relationships. The TBSSB quality dimensions found in this study will provide guidelines for bank managers to improve customer experience with automated services. The study will also help them to understand which service delivery attributes of TBSSB impact customer satisfaction and loyalty and how a bank may take advantage of them to create value for customers. Finally, this study presents an evaluation method that can be used to quantify TBSSB service quality in single numeric value. This may be used by the bank to evaluate their technology and also for technology comparison with other banks.

In short, this study will lead to the development of a structure for understanding the service quality of the technology based self service banking, thereby extending the knowledge base in the area of self service technologies. Findings of the study will assist bank managers to take various decisions related to TBSSB, resulting in better quality, higher customer satisfaction, enhanced loyalty and increased profitability.

1.6 ORGANIZATION OF THE THESIS

The thesis is principally divided into seven chapters. The summary of each chapter is discussed underneath

Chapter I:

This chapter presents the background of the research work. The chapter covers the overview of the technology based self service banking services. The chapter also illustrates the need for the study and the research objectives. The significance of the study is also presented, which describes the various ways in which this study can make contributions to academic literature and to the banking sector.

Chapter II:

The chapter discusses the various concepts including service quality, automated service quality, customer satisfaction and customer loyalty. The various models and scales developed by researchers for measuring service quality, electronic service quality/automated Service quality, service quality in the banking sector and electronic banking service quality are reviewed in this chapter. The relation between service quality and customer satisfaction, service quality and loyalty, and customer satisfaction with loyalty has also been explored using past studies. Important studies showing the mediating role of customer satisfaction between service quality and loyalty are also reviewed. To study the effect of Technology based self service banking quality on customer satisfaction and loyalty, and also to test the mediating role of customer satisfaction in the relationship various hypotheses are proposed in the chapter.

Chapter III:

This chapter explains the research methodology used for exploring the TBSSB service quality dimensions and also to test the linkage between TBSSB service quality, customer satisfaction, and customer loyalty. This chapter covers research design used in the study. The chapter also explains the step by step process of questionnaire design following the best practices. Sampling design, data sources and data analysis procedures used in this research are also discussed in the chapter.

Chapter IV:

Data analysis is divided into three parts. This chapter presents the first part of the data analysis which fulfils the first objective of the research. The chapter summarises the profile of the respondents. The chapter presents the results of exploratory and confirmatory factor analysis conducted to identify and confirm the dimensions of TBSSB service quality. The outcome of the procedures which are used to test the unidimensionality, reliability and validity of the model are also described.

Chapter V:

This chapter covers the second and third objective of the research. In this chapter, a conceptual model consisting of TBSSB service quality, customer satisfaction, and loyalty dimensions has been developed and tested using confirmatory factor analysis. The model has also been empirically tested for unidimensionality, reliability, and validity. Various hypotheses have also been tested in this chapter using structural equation modeling. The chapter also compares partially and fully mediated proposed structural models. Finally, to find out whether there is any significant difference in TBSSB service quality, customer satisfaction, and loyalty dimensions on the basis of demographic variables, the results of t-test and Analysis of Variance (ANOVA) are presented.

Chapter VI:

This chapter covers the third objective of the research. The chapter explains the step by step method to quantify TBSSB service quality attributes in terms of a numerical index using the graph theoretic approach. The value of TBSSB index is computed in the chapter. The minimum and maximum values of TBSSB index are also calculated in this chapter.

Chapter VII:

This chapter presents the findings and conclusion of the research. The findings are presented for each research objective of the study. The chapter covers the implications of this research for bankers. The contributions of the study in academic literature and banking sector are also illustrated. Thereafter limitations of the study, scope for future work and the conclusion of the study are presented.

1.7 CONCLUSION

This chapter started with the background of the research. It discussed the increasing role and importance of services in India and other countries in the last couple of

decades. The importance of service quality in running a business successfully and achieving competitive advantage was highlighted. It talked about the increasing focus of banks in utilizing technology for providing services through self-administration mode using different automated channels (ATM banking, Mobile banking, Internet banking, Telebanking etc). The benefits of these self service automated channels for both the banks and their clients were also discussed. The chapter included the description of the role played by Information and Communication Technology in the Indian banking sector. There was also an explanation on various automated banking delivery channels. The need of the study was also discussed. After that research objectives were presented. This was followed by a discussion on the significance of the study. The chapter concluded with the structure of the thesis.

CHAPTER II

LITERATURE REVIEW

2.1 INTRODUCTION

The aim of this chapter is to extend the understanding of service quality and to comprehend that how service quality is related to customer satisfaction and loyalty in the past studies. This chapter reviews the literature on service quality in general and automated banking services in particular. Various models and scales for measuring service quality and its relation to customer satisfaction and loyalty are presented. The chapter also includes studies examining the effect of demographic variables on service quality, customer satisfaction, and loyalty. Based on the literature review, the gaps in literature have been identified. The hypotheses addressing the research objectives are developed and presented.

2.2 SERVICE QUALITY THEORY

2.2.1 Services

Zeithmal and Bitner (2000) defined services as deeds, processes, and performances. Lovelock (2001) defined service as an act or the performance offered by one party to another party. Though the process may be tied to a physical product, the performance is essentially intangible and does not normally result in ownership of any of the factors of production. Service encounter is defined as the moment of interaction between a customer and the organization. These are considered as critical moments of truth as during these encounters customer make an impression about the service firm (Bitner, 1990; Bitner et al., 2000). These encounters can be either face-to-face, over the phone, via the internet or any other mode. But these encounters play a vital role in shaping customers' perception regarding quality and its effect on customer satisfaction (Parasuraman et al., 1985).

The services possess distinct characteristics including intangibility, perishability, heterogeneity, and inseparability of production - consumption (Parasuraman et al.,

1985; Zeithaml et al., 1985). All these create challenges for managers in service organizations, of which banking sector is not an exception. For a marketer and researcher, it is better to understand these characteristics of services in order to devise strategies for services marketing.

The fundamental characteristic of services is intangibility. As services are deeds, processes and performances and not physical objects, unlike goods they cannot be felt, tasted, seen or touched. The implication of this characteristic is that services cannot be easily patented, cannot be readily displayed or communicated, pricing is difficult and services cannot be inventoried (Parasuraman et al., 1985; Zeithaml et al. 1985).

Another important characteristic of services is perishability. This resulting implication of perishability is that the services cannot be returned or resold and the service managers find it very difficult to harmonize supply and demand (Parasuraman et al., 1985; Zeithaml et al., 1985).

Heterogeneity refers to variability in service delivery (Zeithaml et al. 1985). The quality of service may vary from one service provider to another, from one customer to another, from day to day and even from one service encounter to another. It may even difficult for the service provider to repeat exactly the same service. The implication of this characteristic is that in the case of services, service quality and customer satisfaction depends on upon employee and customer actions and also there is no certainty that the actually delivered service is in accordance with the planning and promotion. Thus, the standardization and quality control are difficult to achieve (Parasuraman et al., 1985; Zeithaml et al., 1985).

Usually, goods are first manufactured, then sold and after that consumed, but services are first sold, then produced and consumed simultaneously (Regan, 1963). Pure services cannot be mass produced. Inseparability aspect means that in the case of services there is simultaneous production and consumption. The resulting implication is that in services, employees affect the service outcome, customers participate in and affect the transaction, customers affect each other and centralized mass production of services is difficult (Parasuraman et al., 1985; Zeithaml et al. 1985).

As banking is an important part of the service industry, bank managers need to play an important role in managing services because of these characteristics. Branch banking is one of the main channels of banking services in which banking services are delivered by the frontline employees of a bank branch. The performance of these service employees may vary day to day or even hour to hour leading to heterogeneity in the services provided. Due to the presence of bank employees in service delivery, the services cannot be mass produced and services are offered only during the working hours, resulting in crowd and queues in the bank branches (Parasuraman et al., 1985). As customer also play a role in service creation and delivery, they are considered as 'partial employees' of a service firm and they may also contribute to service quality and satisfaction (Mills and Morris, 1986; Zeithmal and Bitner, 2000). The presence of the customers in service delivery may also result in heterogeneity of services.

2.2.2 Quality

Quality has been conceptualized and defined by researchers in different ways. The word quality means different things to different people as per the context. Experts defined quality using their own unique perspective. Crosby (1979) defined quality as conformance to requirements. American Society of Quality Control defined Quality as the totality of characteristics and features and of a product or service that bear on its ability to satisfy stated or implied needs. ISO defines quality as the extent to which a set of inherent characteristics fulfils requirements.

The quality may be defined with respect to product, manufacturer, user and value perspective.

Product-based definitions consider quality as a function of a specific and measurable variable. It defines quality objectively.

The manufacturing-based approach centres on conformance to specifications that often are driven by productivity and cost goals.

User-based approach defines quality from the customer perspectives and focuses on fulfilling customer's expectations. These definitions connect quality with customer satisfaction.

Value-based definitions define quality in terms of value and price. Value based definitions focus on the trade-off between performance and price.

It is relatively easier to define and manage the quality of goods. Goods being tangible in nature, quality can be measured objectively by measuring outcome against the predefined measurable standards. On the other hand, service quality is relatively difficult to measure objectively because of the characteristics of service including intangibility, heterogeneity, perishability and inseparability.

2.2.3 Service Quality

Service quality is defined by researchers in different ways.

Lehtinen and Lehtinen (1982) defined service quality in terms of physical quality, interaction quality and corporate (image) quality. They suggested that among these dimensions, corporate quality tended to be more stable over time. Grönroos (1984) defined service quality as the result of an evaluation process, where the consumer compares his service expectations with the service actually received. According to Parasuraman et al. (1985), service quality may be defined as the overall evaluation of a service firm by comparing firm's performance as perceived by its customers with general expectations of customers regarding how firms in that industry should perform. Bitner and Hubbert (1994) defined service quality as the consumer's overall sense of the relative superiority/inferiority of the company and its services.

The quality of services has been the focus of research primarily during the last several years. Although researchers have a consensus about the importance of service quality, but there is a lack of agreement between them regarding the methods to measure service. There is a division amongst academicians regarding how service quality should be conceptualized. Two main conceptualizations of service quality exist in the literature, of which one is based on the disconfirmation approach (Grönroos, 1984;

Parasuraman et al. 1985 and 1988), and the other is based on performance only approach (Cronin and Taylor, 1992; Cronin and Taylor, 1994).

Lee et al. (2000) showed that perception/performance based measures of service quality capture more of the variation in service quality than considering the difference between perception and expectation. Moreover, the performance-based scale decreases the items to be measured by half in comparison to disconfirmation scale. Studies (Teas, 1993, 1994) found that the disconfirmation method of finding service quality has several theoretical, conceptual and measurement problems. Researcher argued that the disconfirmation approach face problems with respect to measuring expectations. This is because expectations are dynamic in nature (keeps on changing from time to time). This problem with the disconfirmation model had encouraged researchers to move towards considering perceptions only as an indicator of service quality (Jayawardhena, 2004). Babakus and Boller (1992) and Cronin and Taylor (1992) in their work compared the computed difference scores with perceptions and found perceptions only as a better predictor of service quality than disconfirmation. Page and Spreng (2002) also found that performance only measure is more reliable and stronger indicator of service quality than the measure considering both performance as well as expectation. Cronin and Taylor (1992), Babakus and Boller (1992) and Dabholkar et al. (2000) showed that the shared variation for performance alone is larger than for the difference score. Moreover, Yang and Jun (2002) found that majority of consumers were not fully aware of expectations in an electronic environment like expectation for online services.

Considering the issues associated with the disconfirmation approach of service quality, this study measured service quality using performance only approach.

2.2.4 Electronic Service Quality/Automated Service Quality

The continuing advancement in information and communication technology stressed upon the need for service quality research beyond the interpersonal dyad of service encounters to technology based service delivery (Buckley 2003; Meuter et al, 2000).

Zeithaml (2002) defined electronic service quality with a particular focus on the internet. He defined it as the degree to which a website facilitates effective and efficient shopping, purchasing and delivery. Most of the literature on e-service focuses only on the service quality of those services delivered through websites as seen in the research by Parasuraman et al. (2005) and Zeithmal (2002). Automated service refers to the electronic provision of a service to customers (Buckley 2003; Santos 2003). Automated service quality may be defined as the customer's overall evaluation of the excellence of the services provided through electronic channels, such as the internet, telephone, and ATMs (Santos, 2003).

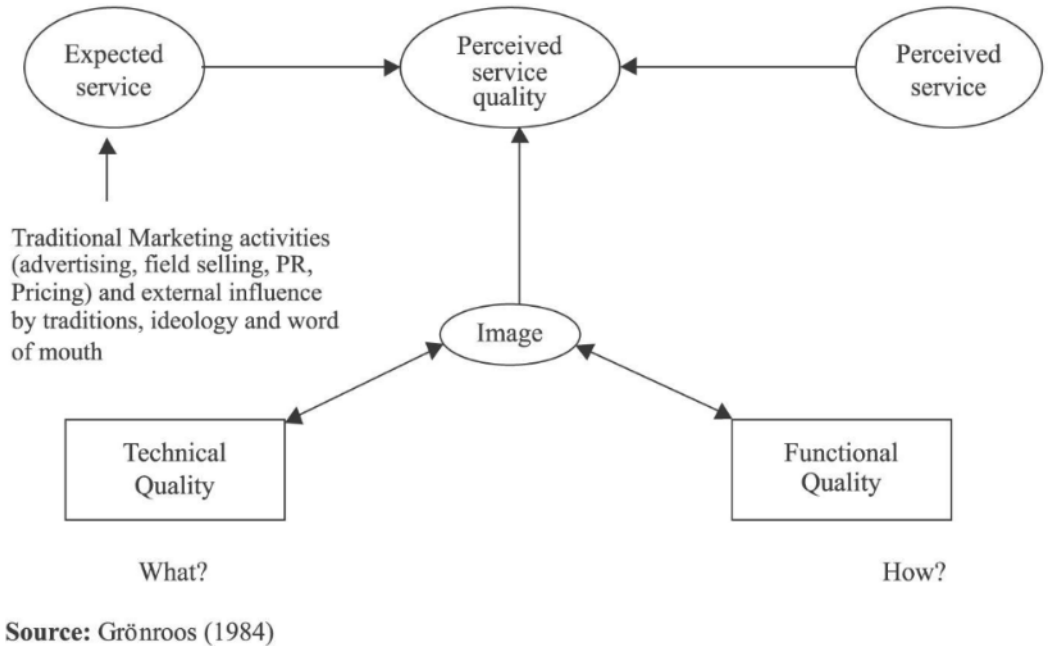
2.3 SERVICE QUALITY MEASUREMENT

2.3.1 Popular Service Quality Models

Grönroos (1984) was of the view that a service organization needs to have a clear understanding of customer perception of quality and the means by which service quality is influenced. Managing service quality means that the organization has to provide expected service in harmony with perceived service to achieve customer satisfaction. The researcher presented three component model of service quality including technical quality, functional quality, and image. The model is shown in figure 2.1.

- Technical quality is related to the quality of 'what' customer actually gets as the outcome of his dealings with the firm and is important in his evaluation of the service quality.
- Functional quality is concerned with 'how' customer gets the technical outcome. This is important to his views of service he has received.
- Image is important to service organization and this is expected to be created largely by technical and functional service quality along with other factors such as tradition, ideology, word of mouth, pricing and public relations.

The major contribution of this research was that this was among the pioneer attempts to conceptualize service quality from the customers' viewpoint and the study laid the foundation for future service quality research.



Source: Grönroos (1984)

Figure 2.1: Grönroos service quality model

Parasuraman et al. (1985) developed a service quality model called GAP model which was based on gap analysis. The model is presented in figure 2.2. The researchers proposed that service quality is a function of the differences between customer expectation and firm performance along the quality dimensions. The various gaps presented in the model are

Gap 1: Gap (Difference) between customer expectation and management perceptions of those expectations

Gap 2: Gap between management perceptions of customer expectations and service quality specifications

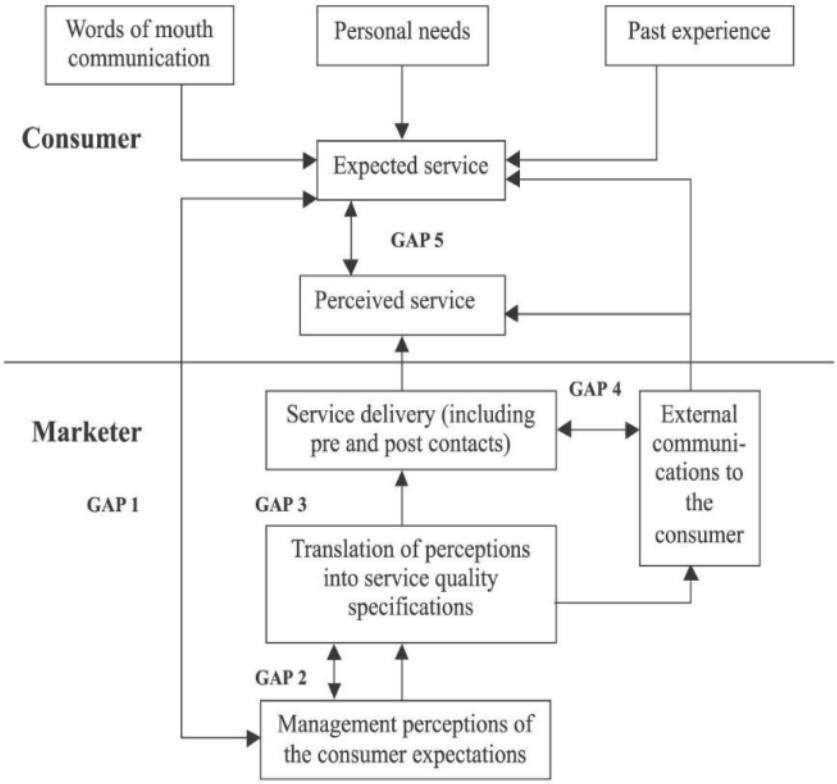
Gap 3: Gap between service quality specifications and service actually delivered

Gap 4: Gap between actual service delivery and the communications to consumers about service delivery

Gap 5: Gap between customer expectation of service and perceived service

As per the researchers, service quality can be assessed by measuring the gap between customer expectations from the service provider and their actual evaluation of the service performance. The perception of service quality was measured originally on ten different dimensions. They extended their work and Parasuraman et al. (1998) identified some correlations between ten dimensions, thus they reduced them to just five dimensions namely reliability, tangibility, assurance, empathy, and responsiveness. They proposed a 22 item instrument to measure customer expectations and perceptions for the five dimensions.

This multiple-item instrument was named as `SERVQUAL', which measures service quality based on five dimensions. SERVQUAL instrument has the provision to capture response corresponding to in total 44 items, 22 items measuring expectations of customers and 22 items measuring perceptions or experiences of customers. Each quality dimension can be measured by expectations and perceptions of performance levels for service attributes corresponding to each dimension, calculating the difference between expectations and perceptions of actual performance on these attributes, and then averaging across attributes. SERVQUAL was designed as a diagnostic instrument to assess the strengths and weaknesses of a service provider, in terms of various service dimensions. Four to five items were used to measure each dimension. Three dimensions namely tangibles, responsiveness and assurance were having four items each and the other two dimensions namely reliability and empathy had five dimensions each.



Source: Parasuraman *et al*. (1985)

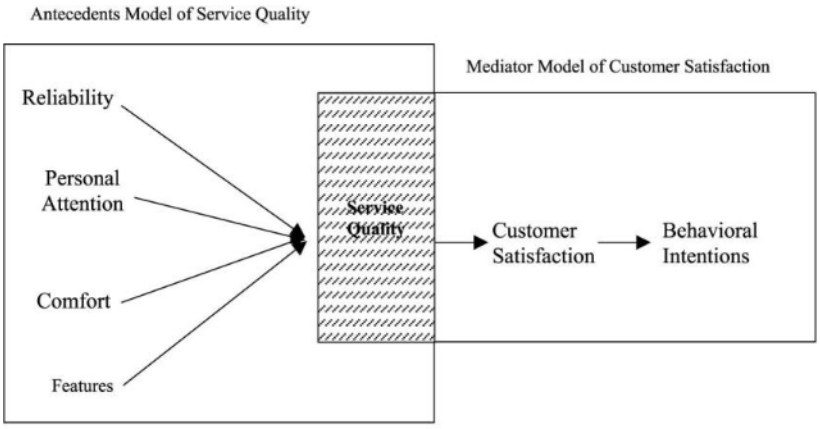
Figure 2.2: GAP model of service quality

Cronin & Taylor (1992) examined the conceptualization and measurement of service quality. Researchers argued on the framework proposed by Parasuraman et al. (1985) for conceptualizing and measuring service quality. They developed performance only measurement of service quality called SERVPERF. SERVPERF did not include expectations component, but measures customer perceptions based on actual service performance. They emphasized that service quality is a form of consumer attitude and the performance only measure of service quality is a superior means of measuring service quality. They re-examined the original SERVQUAL scale. In the first application, they used an importance-weighted SERVQUAL scale. Then they used a performance-based approach to the measurement of service quality called SERVPERF scale, and ultimately, they employed an importance-weighted version of the SERVPERF scale. Their study reported that the performance-base scale named as SERVPERF scale was an improved way of measuring the service quality in comparison with the SERVQUAL scale. It reduced the number of items to be

measured by fifty percent from 44 to 22 items. They compared perception and expectation difference scores with perception score to conclude that perceptions only were a better predictor of service quality. The analysis of structural models also supported the theoretical superiority of the SERVPERF scale.

Teas (1993) examined the operational as well as conceptual problems related to the popular SERVQUAL model. His study pointed out many problems in the model. He discussed issues in the measurement of service quality using SERVQUAL scale such as ambiguity in the conceptual definition, justification of using expectations in service quality measurement, the usefulness of the probability specification in the evaluated performance measurement and the relation between service quality and consumer satisfaction. Among the issues mentioned above, the first issue was related to the definition of the expectations and the revised expectations element of the model. This resulted in uncertainty related to the interpretation and theoretical justification of the P-E perceived quality concept. The researcher proposed and tested Evaluated Performance (EP) model and Normed Quality (NQ) model of perceived quality. The criterion and construct validity tests led to the conclusion that when compared to the SERVQUAL performance-expectation and Normed Quality (NQ) frameworks, the Evaluated Performance (EP) framework showed greater construct and concurrent validity.

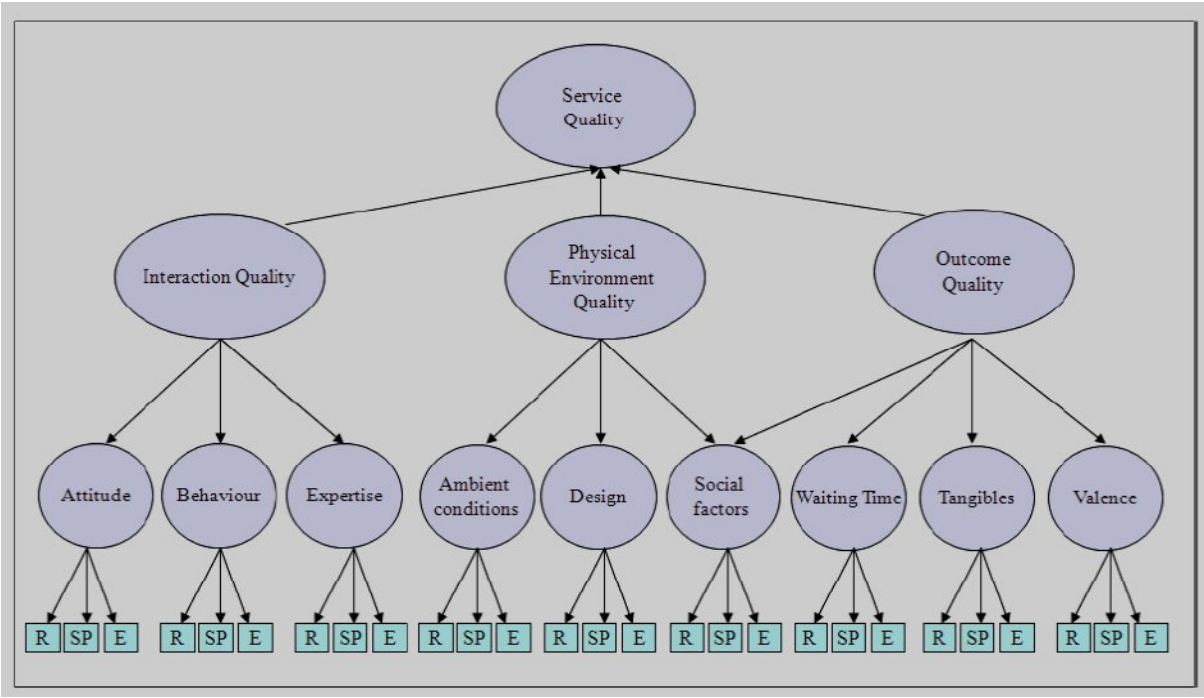
Dabholkar et al. (2000) proposed a model of service quality covering the investigation of its antecedents, mediators, and consequences to present an in-depth comprehension of service quality. The model is portrayed in figure 2.3. They found reliability, Personal attention, Comfort and Features as the antecedents to service quality. Researchers found that factors relevant to service quality were better conceived as its antecedents rather than its components. They also found that customer satisfaction strongly mediates the effect of service quality on behavioural intentions.



Source: Dabholkar *et al*. (2000)

Figure 2.3: Antecedents and mediator model

Brady and Cronin (2001) developed a hierarchical service quality model in which service quality was conceptualized as a multilevel construct consisting of three dimensions namely interaction quality, physical environment quality and outcome quality (Figure 2.4). Each of these three dimensions consisted of sub-dimensions that define the basis of service quality perceptions. The interaction quality dimension was comprised of behaviour, attitude, and expertise of the service provider. The physical environment quality dimension comprised of design, ambient conditions, and social factors. The outcome quality dimension comprised of tangibles, waiting time and valence sub-dimension. The researchers suggested that for each of these sub-dimensions to contribute to improved service quality perceptions, the quality received by consumers must perceive to be reliable, responsive and empathetic. They tested and support this conceptualization across four service industries including fast-food, amusement parks, photograph developing and dry cleaning.



Note: R = a reliability item, SP = a responsiveness item, E = an empathy item

Figure 2.4: Hierarchical model of service quality

2.3.2 Measuring Service Quality in Banking Sector

Avkiran (1994) developed an instrument to measure branch banking service quality in Australia. The scale included 17 items which were grouped into four discriminating factors. Factors emerged were staff conduct, credibility, communications and access to teller services. The instrument fulfilled reliability, dimensionality and validity requirements.

Bahia and Nantel (2000) conducted a study in Canada and developed a new reliable and valid instrument called Bank Service Quality (BSQ) for measuring service quality in Retail Banking. The researchers started with 15 dimensions which were reduced to a set of six dimensions after two successive scale purifications. The final scale included 31 items classified across six dimensions – effectiveness and assurance, tangibles, reliability, access, price and services portfolio. The researchers also compared BSQ with SERVQUAL. They argued that the first advantage of the BSQ model was related to its content validity as the scale was exclusively dealing with service quality in banking. Also, the items covered under different dimensions of their construct were much more consistent than the SERVQUAL scale. The factor loadings

of BSQ variables were more satisfactory. Dimensions of BSQ were also found to be more reliable than the dimensions of SERVQUAL.

Aldlaigan and Buttle (2002) conducted a study in the UK and proposed an instrument named as System Transactional Service Quality Model (SYSTRA-SQ) to measure service quality in retail banking. They developed their model based on the Grönroos (1982, 1984) work on of service quality. Their scale consisted of 21 items and four dimensions: service system quality, behavioural service quality, service transactional accuracy and machine service quality. They found that customers evaluated service quality at two levels: organisational and transactional. The parsimony, reliability, and validity of the scale suggested the high utility of this scale to the banking industry.

Sureshchandar et al. (2002) proposed a model of perceived service quality by considering the dimensions that were already addressed in the existing literature and those which were overlooked in the literature. The scale was designed in the context of the banking sector. The study was conducted in India. The model constituted of five dimensions including Core service or service product, Tangibles of service (servicescapes), Human element of service delivery, Systematization of service delivery: non-human element and Social responsibility. The operationalization of the instrument was based on the performance-based approach. The five dimensions of service quality showed evidence of unidimensionality, reliability, and validity.

Jabnoun and Khalifa (2005) developed a measure of service quality in the UAE and then tested this measure in UAE conventional and Islamic banks. Their work was based on the assumption that service quality concerns are different from one culture to another. Using the 30 item questionnaire and applying factor analysis on the responses from customers of conventional and Islamic banks in the UAE, they identified four dimensions of service quality as personal skills, reliability, values, and image. The reliability and validity of dimensions were also tested. All four dimensions were significant in determining service quality in conventional banks. Using regression models, they found that values and image were the most important dimensions of service quality in UAE conventional banks. On the other hand, personal skills and values were the only significant service quality dimensions among the customers of Islamic banks. This showed that Islamic banks customers have

service quality concerns different from that of conventional bank customers. They highlighted the requirement for the development of service quality measure for different cultures.

Vanniarajan & Anbazhagan (2007) used SERVPERF scale to assess service quality in the Indian retail banking. Their study identified four dimensions of search quality in the financial services industry as reliability, responsiveness, assurance and tangibles. They investigated the relationship between these service quality factors and overall assessment of customer's bank. The important quality factors among the public, private and co-operative banks were also studied. The results pointed out that the customer's perception on the service quality factors in private sector banks are higher than in the public sector and co-operative banks. The significantly influencing quality factors on the overall attitude towards retail banking were the reliability and assurance. The most important discriminant service quality factor among private and public sector bank was 'responsiveness' and among public sector and cooperative banks was 'tangibility'. In the case of private and co-operative banks, the important discriminant service quality factors were found as 'reliability' and 'responsiveness'.

Hossain and Leo (2009) assessed the service quality in retail banking in Qatar region of Middle East. They revealed that customers' perceptions differ as per the nature of service. In the case of the banking sector, researchers found that customers' perception was maximum for tangibles aspects such as bank infrastructure facilities; this was followed by the empathy aspects such as bank timings and return on deposits. On the contrary, the lowest perception was for competence aspects, such as the method of imposing service charges followed by reliability.

Tsoukatos and Mastrojianni (2010) proposed 27-attribute BANQUAL-R scale constituting of twelve SERVQUAL items, seven BSQ scale items, two items common to SERVQUAL and BSQ scales and six other items specific to Greece banking. The key factors of BANQUAL-R were empathy/ assurance, effectiveness, reliability, and confidence. These factors were majorly a combination of SERVQUAL and BSQ dimensions. The Findings supported the domain-specific approach of service quality and the view that SERVQUAL offers the framework using which specific scales should be constructed.

Hanzaee and Salehi (2011) designed a model for evaluating service quality by conducting quantitative and qualitative research in Iranian private banks. They shortlisted items affecting banking service quality. The application of exploratory and confirmatory factor analyses resulted in 25 items grouped into 7 quality dimensions. These dimensions were named as general process quality, general outcome quality, diversity of services, behaviours, speed, servicescape and accuracy. This model reflected conditions specific to Iranian banking sector.

Coetzee et al. (2013) investigated the levels of perceived service quality among 550 clients and 559 branch contact personnel in retail banks in central South Africa. Respondents' perceptions were compared and the findings exposed that clients regard the levels of service they receive to be better than what the contact personnel perceives them to be experiencing. The physical branch environment was also shown to be a key dimension of perceived service quality among retail clients.

Choudhury (2015) used a contextually modified SERVQUAL instrument to capture customers' perceptions of service quality in retail banking. Their study revealed four dimensions of service quality in retail banking namely customer-orientedness, reliability, tangibles and convenience and showed that the service quality factor customer-orientedness comprising of the responsiveness and attitude of employees was the most important in influencing behavioural intentions in the case of private sector banks and reliability of the service was most influential in the case of public sector banks.

Mittal et al. (2015) extracted and validated the dimensions of retail banking service quality in India by using a hierarchical and integrated perspective of service quality determinants. They validated a multi-level and multi-dimensional model. The researchers examined a proposed second-order and compared it with a first-order model of service quality. The second-order service quality model was accepted based on parsimony. It consisted of five primary dimensions: Service delivery, tangibles, reliability, core service, and competence. The second-order model enhances the understanding of the structure of service quality for retail banking services in India. The most important dimension was tangibles, especially the physical environment which facilitates efficient delivery of service.

2.3.3 Measuring Automated Service Quality

Zeithaml (2002) worked towards conceptualizing and measuring automated service quality and finding the dimensions of electronic service quality. Using a three-stage process involving exploratory focus groups, followed by two phases of empirical data collection and analysis, the researcher proposed seven dimensions of e-service quality. The proposed seven dimensions were efficiency, privacy, fulfilment, reliability, responsiveness, compensation, and contact point.

Yang and Jun (2002) started with focus groups to develop items to measure e-service quality. Besides reviewing the literature and personal interviews, researchers adapted dimensions of SERVQUAL. Using factor analysis they found seven reliable and valid dimensions of electronic service quality. Dimensions were ease of use, reliability, access, personalisation, security and credibility.

Long and McMellon (2004) proposed a multidimensional measure of service quality based on customers' experience with online retailers. The quantitative analysis resulted in 19 items divided into 5 dimensions. The five identified dimensions were tangibility, assurance, reliability, purchasing process, and responsiveness.

Parasuraman et al. (2005) conducted a research on e-service quality considering traditional service quality as a base and developed an E-S-QUAL scale for measuring the online shopping website service quality. They proposed that two different scales were necessary for measuring electronic service quality. The E-S-QUAL scale proposed by them was a 22-item scale having four dimensions namely fulfilment, efficiency, system availability, and privacy. Their second scale, E-RecS-QUAL, was relevant only to customers who had non-routine service encounters with the websites and consisted of 11 items represented by three dimensions viz. responsiveness, compensation, and contact. Both scales were found to be reliable and valid.

Loiacono et al. (2007) proposed the WebQual instrument for consumer evaluation of websites. Researchers refined it through a literature review and interviews with Web designers and users and tested it using four samples of Web consumers. WebQual included 12 dimensions namely informational fit-to-task, trust, tailored information,

ease of understanding, response time, intuitive operations, innovativeness, emotional appeal, visual appeal, consistent image, relative advantage and on-line completeness. The scale showed strong measurement validity. As per the researchers, WebQual was a highly validated instrument that can provide both wide- and fine-grained measurements of organizational Web sites.

Li and Suomi (2008) examined electronic service quality from service providers' as well as customers' perspectives. On the basis of research, they proposed a scale constituting of ten dimensions to measure e-service quality. The dimensions included reliability, fulfillment, website design, security, personalization, responsiveness, empathy and information from the e-service providers' perspective, and trust & experience from the customers' perspective.

Janita and Miranda (2013) investigated quality dimensions in the context of B2B e-marketplaces in the construction sector. They identified four key B2B service quality dimension as perceived by online sellers as the utility of the information, reliability and privacy, value-added services and efficiency. The data for the research were collected from Spanish e-marketplace users. All the dimensions were found to have a significant positive impact on the outcome variable client loyalty. The reliability and privacy dimension was found to have the highest influence on loyalty.

2.3.4 Measuring Electronic Banking Service Quality

Joseph et al. (1999) conducted a study on Australian banking sector and investigated the impact of technology on the delivery of perceived service quality. The authors identified the relevant dimensions using the items generated from the focus groups. These were then examined in more detail for purposes of comparison between themselves and across respondents. The six factors of e-banking service quality identified were feedback/complaint management, convenience/accuracy, queue management, efficiency, customisation and accessibility.

Jun and Cai (2001) developed a model representing e-banking service quality by 17 dimensions instrument comprising of product variety/diverse features, aesthetics, reliability, responsiveness, competence, credibility, access, communication,

understanding the customer, courtesy, collaboration, continuous improvement, content, accuracy, ease of use, timeliness and security. They suggested that both e-banks and traditional banks offering electronic banking services should pay attention towards responsiveness, access and reliability dimensions.

Broderick & Vachirapornpuk (2002) developed a model of perceived service quality in Internet banking. They identified the five key factors of perceived service quality as customer expectations of the service, aspects of the service setting, the image and reputation of the service organization, customer participation and the actual service encounter. They further noted that among these elements, service setting and customer participation was having the most immediate impacts on service evaluation.

Al-Hawari et al. (2005) conducted a study in Australia to establish the important determinants of automated banking service quality by taking into consideration the attributes of three main automated banking services channel (ATM, Internet banking, and Telephone banking) along with attributes related to two more dimensions namely Core Service and Perceived Price. Their work proposed a conceptual model of automated banking service quality.

Mäenpää (2006) based on an extensive literature review, open-ended interviews, and quantitative analysis developed seven dimensions of Internet banking service quality: convenience, security, status, auxiliary features, personal finances, investment, and exploration. The researcher suggested that banks offering e-banking services need to focus more on the growing consumer cluster of youngsters, who are viewed as the prospects of tomorrow.

Khan et al. (2009) evaluated the service quality of internet banking services in India from customers' perspective. A structured questionnaire containing 44 quality items was administered to various target groups. They extracted seven internet banking service quality dimensions viz. Accessibility, reliability, user-friendliness, efficiency, privacy/security, fulfilment, and responsiveness. A mathematical model was formed to examine the relationship between the various dimensions and overall service quality. The results showed that customers were satisfied with the quality of service

on dimensions namely reliability, privacy/security, accessibility, responsiveness, and fulfilment, but least satisfied with the user-friendliness dimension.

Auta (2010) empirically examined the impact of e-banking on Nigeria's economy. He explored the major factors responsible for internet banking based on respondents' perception on various e-banking applications. He provided a framework of the factors which were taken to assess the e-banking perception. Factor analysis results indicated that security, user-friendly, queue management, accessibility, time factor and fund transfer were the major factors.

Kumbhar (2011) found service quality dimensions as System availability, e-Fulfillment, accuracy, efficiency, security, responsiveness, ease to use, convenience, cost effectiveness, problem handling, compensation, and contact.

Ganguli and Roy (2011) conducted a study on the university students in the USA and identified four generic service quality dimensions in the technology-based banking services as customer service, technology convenience, technology usage easiness and reliability, and technology security and information quality.

Lin (2013) identified 16 variables that impact service quality of mobile banking. These variables were grouped into four factors named as functionality, content, customer service and interface design. The study used fuzzy analytic hierarchy process with an extent analysis approach for developing a fuzzy evaluation model which prioritized the relative weights of m-banking quality factors between low- and high-experience groups. The research findings indicated that there were some similarities and differences between high- and low-experience groups with regard to the evaluation of m-banking quality. With respect to the final weights for the criteria level, both groups considered "customer service" to be the important factor affecting m-banking effectiveness.

Narteh (2013) identified the dimensions of Automated Teller Machine (ATM) service quality and also evaluated customers' perceptions of the relative importance of these dimensions. A structured questionnaire was used to collect data from ATM customers of banks in Ghana. The researcher extracted five dimensions of the "ATMqual"

model. In order of importance, these dimensions were reliability, convenience, responsiveness, ease of use and fulfillment.

Hussien and Aziz (2013) investigated e-banking service quality in one of Egypt's banks. The main subject of the research was to study the internet banking quality dimensions that affect customer satisfaction from the consumer and provider perspectives. The aim of this study was to investigate users' perception of e-banking quality dimensions in terms of importance, decision makers in banks perception of e-banking quality dimensions and whether each quality dimension directly affects users satisfaction of the service. Results were integrated to show that service quality has a significant effect on customer satisfaction.

Singh and Arora (2016) conducted a research to find service quality dimensions in case of traditional banking and internet banking service quality. The researchers explored five factors for measuring traditional banking service quality as Reliability, responsiveness, assurance, empathy and tangibility. Five dimensions of service quality in internet banking were identified as reliability, attentiveness, access, easy to use and security.

Jun and Palacios (2016) focused on exploring the dimensions of mobile banking (m-banking) service quality and their associated sub-dimensions. The researcher used the critical incident technique to uncover the mobile banking service quality dimensions as perceived by mobile banking customers, and to identify critical satisfiers/ dissatisfiers among the identified dimensions. They identified 17 dimensions of m-banking service quality classified into two broad categories as m-banking application quality (ease of use, speed, content, accuracy, diverse mobile application service features, aesthetics, security and mobile convenience) and m-banking customer service quality (responsiveness, reliability, competence, communication, courtesy, credibility, understanding the customer, access and continuous improvement). Researchers further found that out of these 17 dimensions, five dimensions namely mobile accuracy, convenience, ease of use, diverse mobile application service features and continuous improvement were considered as the main sources of customer satisfaction/dissatisfaction.

2.3.5 Conceptualising Technology Based Self Service Banking Service Quality

Ruyter et al. (2001) defined automated service as content-centered, interactive, and internet-based customer service. Surjadjaja et al. (2003) also explained automated service as web-based service delivered through the internet. On the same line, Parasuraman et al., (2005) also defined automated service in terms of websites based customer service.

Defining automated services only in terms of only internet based services will not present the complete picture of these services. A more comprehensive description provided by Buckley (2003) defined automated service as the electronic provision of a service to customers. This definition covers other automated service delivery channels along with services provided with the help of internet. Similarly, Santos (2003) defined automated service quality as the customer's overall assessment of the excellence of the provision of services through electronic networks. These two definitions explain service quality in better and more complete manner and therefore seem to be more appropriate fit for this research.

On the basis of a review of various mentioned studies on automated banking service quality, it was found that with time various scales have been developed to measure automated banking service quality but there was no generally accepted scale to measure automated banking service quality. Further analysis of the studies revealed that most of the studies on measuring automated banking service quality were having limited scope. They covered only one mode of automated banking service. These studies either cover internet banking, ATM banking or Mobile banking attributes for measuring service quality.

In this technology era, customers are using more than one automated banking channel to avail banking services. Therefore, restricting research to only one channel will not present the overall picture of technology based banking. To get the all-inclusive picture, it is required to cover service quality attributes of all the major channels offering automated banking services. One way to do this was to consider all the different channels (ATM, Internet banking, Mobile Banking etc) as different factors in automated banking service quality model as done in certain studies. But the major

drawback with this approach was that the many of attributes affecting service quality such as 24 x 7 service availability, user-friendly system, secure transactions, freedom of mobility, conducting error free transactions every time etc were equally applicable to all the channels.

Thus, on the basis of the review, it was found that there is a need to design a scale in Indian context for measuring automated banking service quality by considering the attributes related to all the channels of automated banking. This research focussed on measuring service quality of technology based banking services offered in a self service mode by banks in India. These services may be called as technology based self service banking services. The TBSSB service quality model proposed in this research is designed to cover all the possible TBSSB attributes and dimensions that may shape customer perceptions.

2.4 CUSTOMER SATISFACTION

Customer satisfaction is important for success in competitive business environment. Customer satisfaction will influence the revenue of a company (Fornell, 1992). Therefore maximizing customer satisfaction is a goal for a company to pursue. Traditionally, satisfaction was considered as a transaction-specific construct resulted from immediate postpurchase judgment (Oliver, 1993). Most of the customer satisfaction studies considered satisfaction as a cumulative concept (Gupta and Zeithaml, 2006). From cumulative satisfaction perspective, customer satisfaction is defined as an overall customer experience with a product offered or with a service provider (Krepapa et al., 2003). There are many definitions of customer satisfaction given by different researchers.

Klaus (1985) defines satisfaction as the customer's subjective evaluation of a consumption experience based on some relationship between the customer's perceptions and objective attributes of the product.

Yi (1990) defined satisfaction as an attitude like judgment following a purchase act or series of consumer-product interactions.

Andreassen (1995) defines customer satisfaction as the accumulated experience of a customer's purchase and consumption experiences.

Jamal & Nasar (2003) defined customer satisfaction as the feelings or judgments of the customer towards products or services after they have been used.

The common factor in these definitions is that the satisfaction is a post-consumption evaluative judgement (Westbrook & Oliver 1991). Researchers are in agreement that service quality and satisfaction are two different but closely related constructs (Sureshchandar et al., 2002; Dabholkar, 1995). Oliver's (1993) work explained consumer satisfaction as a consumer's fulfillment response and satisfaction judgments are influenced by both positive and negative, affective or emotional responses and cognitive disconfirmation.

2.5 CUSTOMER LOYALTY

To become successful, it is necessary for the firm to retain customers. Research has shown that new customers acquisition cost is usually higher than existing customers retention cost. Intended customer behaviour is more closely related to actual customer behaviour and offer richer diagnostic value in comparison to service quality and satisfaction. Thus behavioural intentions prove to be helpful indicators to know whether the customer will remain with the company or defect (Zeithaml et al., 1996). As per Oliver (1999), customer loyalty is a deeply-held commitment to re-patronize or re-buy a preferred product/ service consistently in the future despite situational influences and marketing efforts having the potential to cause switching behaviour. Singh and Sirdeshmukh (2000) defined customer loyalty as a behavioural intention to maintain an ongoing relationship with a service provider. Intentions are subjective judgments with respect to the future behaviour of a person and generally act as dependent variables in service research and satisfaction models (Boulding et al., 1993). Many researchers have used service recommendation to other customers as a proxy to customer loyalty (Ganesh et al., 2000; Dabholkar et al., 2000; Caruana, 2002; Reichheld, 2003; Collier and Bienstock, 2006). In addition to recommendation, other parameters which have been used widely for measurement of customer loyalty are consideration of the company as the first choice for services (Zeithaml et al.,

1996; Caruana, 2002) and continuing business with the same company (Zeithaml et al., 1996; Ganesh et al., 2000; Van Riel et al., 2001; Caruana, 2002; Olorunniwo and Hsu, 2006).

It has been argued that loyalty is considered as the main goal of relationship marketing because it may help in delivering a superior economic relationship, to gain a competitive advantage, to expand market share, and to organization performance (Ahmad and Buttle 2002; Gremeler and Brown 1996, Allred and Addams 1999, Swailes and Dawes 1999; Levesque and McDougall 1996; Reichheld and Kenny 1990).

In order to measure customer satisfaction and loyalty, different researchers have used different types of scales: single item and multi-item scales (Sureshchandar et al., 2002b; Al-Hawari and Ward, 2006). For instance, Cronin and Taylor (1992) had defined and measured customer satisfaction using a one-item scale asking customers overall satisfaction. But other researchers (Sureshchander et al., 2002b; Danaher and Haddrel; 1996) are of the opinion that customer satisfaction is multidimensional in nature, so a single-item scale fails to capture the complexity of customer satisfaction. The present study has used multi-item scales to measure customer satisfaction and customer loyalty.

2.6 SERVICE QUALITY AND CUSTOMER SATISFACTION

Good service quality is regarded as an important prerequisite for creating and maintaining a satisfying relationship with customers (Lassar et al., 2000). Increasing the level of customer satisfaction may result in reduced marketing expenditure, good word-of-mouth communication and improved profits (Beerli et al., 2004; Reichheld, 1996). Therefore, examining the relationship of service quality with satisfaction is considered significant. In literature, strong weight is placed on the relationship between service quality and customer satisfaction (Cronin and Taylor, 1992; Gilbert et al., 2004). Service quality and satisfaction share a close relationship, however, they have generally been conceptualised as distinctive (Jamal and Naser, 2003; Cronin and Taylor, 1992; Oliver, 1993). The majority of the researchers are of the opinion that the concepts of service quality and satisfaction are primarily different in terms of their

underlying causes and outcomes (Bitner, 1990; Bolton and Drew, 1991; Cronin and Taylor 1992; Boulding et al. 1993; Spreng and Mackoy, 1996). Rust and Oliver (1994) posited that perceived service quality is a more specific concept based on product and service features, whereas satisfaction can result from any dimension. Moreover, perceived service quality can be controlled to a certain extent by a company whereas satisfaction cannot. Bitner and Hubert (1994) established that service quality involves a general impression of the superiority or inferiority of the services and service provider whilst customer satisfaction results from individual and global transactions. So, satisfaction can be considered as a broader concept while service quality assessment focuses particularly on service dimensions. Liljander and Strandvik (1994) put forward that perceived service quality can be observed from an outsider perspective, it need not even be experienced; it can be based on knowledge about the service provider (word-of-mouth communication, advertising etc). However, usually, it is based on experiences with the service. Whereas, satisfaction refers to an insider perspective, the customer's own experiences of a service where the outcomes are assessed in terms of the value that has been received. Further, it is argued that both service quality and customer satisfaction concepts are determined by different antecedents (Oliver 1993). So, these two concepts were considered different in this research.

The impact of service quality on customer satisfaction was examined in the past many studies. The impact of service quality on customer satisfaction has been investigated by researchers in different service sectors like Banks, Dry Cleaning, Pest control, Fast Food (Cronin and Taylor, 1992), Investment consulting firm, entertainment park and Aerobic school (Lee et al., 2000), online purchase (Sheng and Liu, 2010). In a banking context, studies have investigated the impact of bank service quality on customer satisfaction (Yavas et al., 1997; Amin and Isa, 2008; Dinh and Pickler, 2012). The effect was also studied in an electronic banking environment (Al-Hawari and Ward, 2006; Rod et al., 2009; Ganguli and Roy, 2011). Some empirical studies that investigated the relationship between service quality and customer satisfaction in banks and other service companies are explained below.

Cronin and Taylor (1992) proposed SERVPERF scale as an alternative method for measuring service quality. The researchers also studied the relation between service quality, customer satisfaction, and purchase intentions. They conducted their research

in four sectors namely banking, pest control, dry cleaning and fast food. They found an empirical support for the notion that there is a significant relationship between service quality and customer satisfaction, and service quality was an antecedent of customer satisfaction.

Yavas et al. (1997) conducted a study in turkey and explored the relationships between service quality, and customer satisfaction, complaint behaviour, and commitment. Their research found a positive relationship between service quality and customer satisfaction in the banking sector. They concluded that the success of any service quality program depends on upon creating and retaining satisfied customers. They highlighted the significance of contact employees in the attainment of these goals and stressed that banks should not ignore the specific needs of internal publics (employees), particularly customer-contact employees in order to deliver excellent quality services to customers.

Lee et al. (2000) compared the gap model with the performance only model. They examined the direction of cause and effect relation between service quality and satisfaction. Moreover, they investigated whether the influence of dimensions of service quality differs across service industries. They considered three firms for their study namely Investment consulting firm, Entertainment park, and Aerobic school. The results of the analysis showed that the performance model seemed to be superior to the gap model. The result also showed that perceived service quality act as an antecedent to satisfaction, rather than vice versa. Analysis showed tangibles appeared to be a more significant factor in the equipment-based/ facility industries, whereas responsiveness is a more vital factor in the people-based industries.

Sureshchandar et al. (2002b) examined the relationship between service quality and customer satisfaction in a novice manner. As per researchers, the exact relationship between service quality and customer satisfaction (especially in the way the two constructs have been operationalized) was covered with uncertainty. They asserted that many researchers have operationalized customer satisfaction by using a single item scale and many others have used multiple item scales. Their study adopted a different approach and views customer satisfaction as a multi-dimensional construct

just as service quality but argues that customer satisfaction should be operationalized along the same factors (and the corresponding items) on which service quality is operationalized. Based on this approach, the relation between service quality and customer satisfaction was investigated. The results indicated that the two constructs were independent but are closely related, implying that an increase in one is likely to lead to an increase in another.

Al-Hawari and Ward (2006) investigated the relationship between service quality dimensions and customer satisfaction. They tested the relation between five critical automated banking service quality dimensions viz. ATM, Telephone banking, Internet banking, Price and Core product with customer satisfaction. The result of the analysis showed that all automated service quality factors except internet service quality were found to have a significant relationship with customer satisfaction. This finding supported their hypothesis that in an automated banking service context, service quality is positively related to customer satisfaction.

Amin and Isa (2008) investigated the relationship between service quality and customer satisfaction in the context of Malaysian Islamic banking. They used model consisted of six dimensions: tangibles, reliability, responsiveness, assurance, and empathy, and compliance to measure Malaysian Islamic banking service quality. Respondents were Muslim and non-Muslim bank customers, having an account with one of the full-fledged Islamic banking and dual-banking systems. The analysis showed that the Muslim customers' awareness level related to Islamic banking products and services were higher than non-Muslim customers. It was found that the majority of the Islamic banking customers were satisfied with the overall service quality provided by their respective banks. The findings suggested that the standard model of Islamic banking service quality dimensions should consist of the six dimensions and determinants of satisfaction. The relationship between service quality and customer satisfaction was found to be significant.

Rod et al. (2009) conducted a study in New Zealand and investigated the relationships among three dimensions of service quality that affect the overall internet banking service quality. They also studied the effect of overall internet banking on customer

satisfaction in the context of internet banking. The results showed significant relationships among online customer service quality, online information system quality, banking service product quality and overall internet banking service quality. The result also showed that overall internet banking service quality is positively related to customer satisfaction.

Sheng and Liu (2010) studied the effect of electronic service quality on online customer satisfaction and loyalty. They developed a conceptual model of customer satisfaction and loyalty in the context of online purchasing. They considered four dimensions of e-service quality including efficiency, requirement fulfillment, system accessibility, and privacy as the four predictors from the Parasuraman's E-S-QUAL scale. Data were collected from a sample of online buyers. Goods purchased included books, furniture, software, clothes, and digital products. The analysis results showed that efficiency and requirement fulfillment had a positive effect on customer satisfaction, and fulfillment and privacy had a positive effect on customer loyalty. However, the other dimensions had no significant effect on either customer satisfaction or customer loyalty.

Ganguli and Roy (2011) conducted a research on university students in the USA and identified four service quality dimensions of technology-based banking services – customer service, technology security and information quality, technology convenience, and technology usage easiness and reliability. They found that two dimensions customer service, and technology usage easiness and reliability had a positive significant impact on customer satisfaction.

Dinh and Pickler (2012) conducted a study in Vietnam and examined the interrelationship between dimensions of service quality (tangibility, reliability, responsiveness, assurance, and empathy). The researchers also examined the correlation between service quality and customer satisfaction in the retail banking sector. The findings of the study established that the five service quality dimensions were interrelated. Findings also showed that service quality was found to be positively correlated with customer satisfaction. Although all five dimensions were significant determinants of customer satisfaction in banks, but reliability and empathy were found to be the most important dimensions.

Prakash et al. (2016) conducted a study to find a relation between service quality dimensions and customer satisfaction in the context of the hotel industry. The researchers identified Reliability, Empathy, Safety, Responsiveness and Professionalism as the key dimensions of hotel service quality. The study explored that professionalism and reliability dimensions had a significant impact on customer satisfaction.

Paul et al. (2016) examined the effect of service quality variables on the overall customer satisfaction and compared the private and public sector banks in India. The researchers depicted that the service quality components that were positively associated were not the same in private sector banks as they were in public sector banks. In the case of private sector banks, fast service, response to need, knowledge of products, solving questions, efforts to reduce queuing time and quick connection to the right person were found to be the factors that are positively associated with overall satisfaction. Appearance, Assistance to the customer and follow up are negatively associated with customer satisfaction. Whereas, in the case of public sector banks, fast service and the knowledge of the product were positively associated and appearance was found to be negatively associated with customer satisfaction.

The studies in banking and non-banking context found service quality dimensions have an effect on customer satisfaction. So the following hypothesis is proposed

H1: Technology based self service banking quality dimensions have a direct positive effect on customer satisfaction.

2.7 SERVICE QUALITY AND CUSTOMER LOYALTY

Maintaining and expanding the relationship with existing valuable customers is very important for long-term survival and profitability. It has been found that increasing customer retention by 5 percent may enhance profitability by 25 percent to 95 percent (Reichheld and Schefter, 2000). Moreover, the cost of acquiring a new customer is about five to eight times more than retaining an existing customer (Reichheld, 1996). Firms are focusing more on strategies for maintaining and expanding the relationship with existing customers (Caruana, 2002). This is equally applicable to banking sector

where banks are increasingly devoting their resources on customer relationship management. Ranaweera and Neely (2003) found service quality as an important component in retaining customers. Various studies have investigated the relationship between service quality and loyalty both theoretically and empirically in the past.

The effect of service quality dimensions on loyalty has been tested for different services including online purchase (Parasuraman et al., 2005), computer manufacturer, retail chain, automobile insurer, life insurer (Zeithaml et al., 1996), commercial airline (Ostrowski et al., 1993), banking (Kheng et al., 2010; Kranias and Bourlessa, 2013), e-banking (Ganguli and Roy, 2011; Asgari et al; 2014). Some of the empirical studies that investigated the relationship between service quality and customer loyalty in banking and other services are explained below.

Ostrowski et al. (1993) examined the relation between service quality and customer loyalty in the commercial airline industry. The results of the study pointed out that the current levels of service quality were below potential, and there was low airlines customer loyalty. The study found a significant relationship between service quality of airlines and retained preference (a measure of customer loyalty).

Zeithaml et al. (1996) proposed a conceptual model of the effect of service quality on particular behaviours that indicate whether customers will remain with the company or churn from a company. Results from a multi-company research investigating the relationships from the model concerning customers' behavioural intentions showed strong evidence of being influenced by service quality. The findings also exposed differences in the nature of the quality-intentions connection across different dimensions of behavioural intentions. Their worked found that customer perception of service quality is positively linked with behavioural intentions.

Bloemer et al. (1999) refined the scale for measuring loyalty and also tested the relationships between service quality and loyalty dimensions. They conducted the research on customers from four different service industries and identified four dimensions of loyalty as word-of-mouth communication, purchase intentions, complaining behaviour and price sensitivity. Further analysis yielded a complex

model of service quality-loyalty relationships at the level of the individual dimensions with significant differences across industries.

Ranaweera and Neely (2003) proposed a model of customer retention including service quality perceptions, customer indifference, inertia and price perceptions. Results of analysis of data of telephone users in England confirmed that service quality had a direct linear relationship with customer retention even in services having low customer contact. Price perceptions and customer indifference were also found to have a direct linear relation with retention.

Wong and Sohal (2003) examined the effect of service quality dimensions on customer loyalty in the retail sector at two levels relationships: person-to-person level and person-to-firm level. They considered six dimensions of service quality in the study namely Reliability, Assurance, Responsiveness, Tangibles, and Empathy. Hypotheses testing results advocated that the service quality was positively associated with customer loyalty. The loyalty relation was stronger at the company level as compared to interpersonal level. 'Tangibles' was found to be a most significant predictor of customer loyalty at a company level, whereas the 'empathy' was the major significant predictor of customer loyalty at the interpersonal level.

Lei and Mac (2005) examined the relation between service quality and customer loyalty in the transport service sector in South China. On the basis of a study conducted on respondents, they found that tangibles, empathy, assurance and responsiveness were the key determinants of customer loyalty. They suggested that the bus service providers should focus on offering differentiated service along with improving existing service quality.

Hazra and Srivastava (2009) investigated the relation of service quality with commitment, customer loyalty and trust in the Indian banking sector from the customer's perspective. The results showed that service quality dimensions including empathy, assurance, tangibles, and reliability were the predictors of customer commitment and trust. Results also showed that service quality had a positive impact on customer loyalty.

Sousa and Voss (2012) conducted a study in multi-channel e-service environment. The researchers examined the effect of e-service quality on e-loyalty intentions and customer channel behaviour. Data were collected from retail e-banking service. Analysis results showed that e-service quality had a strong impact on e-loyalty intentions and no impact on customer channel behaviour.

Prentice (2013) carried out a study in an Asian casino to examine the relation between casino service quality, player segments, and customer loyalty. The researcher operationalized service quality into SERVQUAL five dimensions and conducted focused group interviews with different categories of gamblers. The findings suggested that service quality perception varies across different categories of casino players. It has also been found that different dimensions of service quality have a different impact on customer loyalty, and the intensity of loyalty varies across different categories.

Kranias and Bourlessa (2013) used the scale developed by Gounaris et al. (2003) to examine the service quality of eight Greek banks. Analysis results showed that customers perceive service quality of Piraeus Bank as high on all six dimensions including employee competence, physical evidence, convenience, reliability and product innovativeness. Two of the oldest Greece banks namely The National Bank of Greece and Emporiki bank secured low score on all the quality factors. Their research pointed out that only the convenience dimension had an impact on customer loyalty. None of the other dimensions had a significant impact on the bank customer loyalty.

Ivanauskienė and Volungėnaitė (2014) examined the relationship involving service quality and customer loyalty in three countries: Latvia, Lithuania, and Estonia. The research was carried out on customers of the household retail chain. They considered five dimensions of retail service quality including Personal Interaction, Reliability, Physical Aspects, Policy and Product Quality. The study revealed that the three dimensions of service quality viz. personal interaction, policy, and product quality have a positive impact on customer loyalty.

The studies in banking and nonbanking context found service quality dimensions have an effect on customer loyalty. To verify this relation in TBSSB environment, following hypothesis is developed

H2: Technology based self service banking quality dimensions have a direct positive effect on customer loyalty

2.8 CUSTOMER SATISFACTION AND CUSTOMER LOYALTY

The effect of customer satisfaction on loyalty has been examined by various researchers time to time. Some of the important studies examining the effect of customer satisfaction on loyalty are explained below

Anderson and Srinivasan (2003) examined the impact of customer satisfaction on loyalty in the e-commerce environment. Findings of this research pointed out that although e-satisfaction had an impact on e-loyalty, this relationship was moderated by consumers' individual level factors and firms' business level factors. As far as consumer's individual level factors were concerned, convenience motivation and purchase size were found to accentuate the impact of e-satisfaction on e-loyalty, whereas inertia restrained the effect of e-satisfaction on e-loyalty. Corresponding to business level factors, both trust and perceived value significantly enhanced the impact of e-satisfaction on e-loyalty.

Kim et al. (2004) conducted a study in the Korean mobile telecommunication industry and tested the effect of customer satisfaction and the switching barrier on customer loyalty. The results of hypotheses testing indicated that that customer satisfaction and the switching barrier had a significant positive effect on customer loyalty. They suggested that mobile operators must maximize customer satisfaction and raise the switching barrier for enhancing customer loyalty. They further suggested that building a switching barrier appears to an essential strategy to defend one's market share. Therefore, mobile operators must enhance the switching cost for increasing customer lifetime value and customer retention. Simultaneously, operators must develop and implement strategies to strengthen customer relationships.

Floh and Treiblmaier (2006) examined the significance of online loyalty antecedents like trust, quality of the service, quality of the Web site and overall satisfaction. They conducted a survey of the customers of an Austrian online bank to get insights on how customer retention in the online banking business can be assured. Analysis results revealed satisfaction as well as trust as the important antecedents of loyalty.

Mohsan et al. (2011) tried to examine the effect of customer satisfaction on customer loyalty and intentions to switch. The analysis results showed that customer satisfaction was positively related to loyalty and had a negative relation with customer intentions to switch.

Ganiyu et al. (2012) investigated whether customer satisfaction is an indicator of customer loyalty. The findings of the research supported the argument that strong relationship existed between customer satisfaction and loyalty. The researchers argued that alone customer satisfaction will not be able to attain the goal of building a loyal customer base.

Nayebzadeh (2013) conducted a study in Yard (Iran) and tested the relationship between customer satisfaction, customer loyalty and the financial performance of the bank. The results of hypotheses testing demonstrated that there was a significant positive relationship between customer satisfaction and loyalty. A significant relation was also found between satisfaction and bank performance, and loyalty and bank performance.

Ali et al. (2016) proposed a model to assess visitor experience and its effect on their delight, satisfaction, and loyalty in Malaysian theme parks. Findings showed that physical setting, interaction with staff and interaction with other customers had a significant impact on both customer delight and satisfaction. Moreover, customer delight influenced customer satisfaction and customer loyalty. Also, customer satisfaction influenced customer loyalty.

All these studies indicate that customer satisfaction influence customer loyalty. To test this claim in context of TBSSB, following hypothesis is proposed and tested

H3: Customer satisfaction has a direct positive effect on customer loyalty

2.9 SERVICE QUALITY, CUSTOMER SATISFACTION AND CUSTOMER LOYALTY

Some researchers tested the mediating role of satisfaction between service quality and loyalty (Cronin and Taylor, 1992; Caruana, 2002). Mediation refers to the existence of a factor between the independent and dependent factor. McDougall and Levesque (2000) proposed a causal relation showing service quality perception influencing satisfaction feelings, which in turn influenced future behavioural intentions of customers. Taylor and Baker (1994) suggested on the basis of research that ultimately satisfaction determines the future intentions of the customers towards the service.

Cronin and Taylor (1992) examined the causal relationships between service quality, consumer satisfaction, and purchase intentions. The data were collected from customers of four types of businesses in the United States including banking, pest control, dry cleaning and fast food. The analysis results recommended that service quality is an antecedent of consumer satisfaction. The results also showed that consumer satisfaction had a significant effect on purchase intentions and finally, service quality reduced the effect on purchase intentions as compared to consumer satisfaction. In short, the results illustrated that service quality influenced customer satisfaction, which in turn had an impact on customer retention.

Dabholkar et al. (2000) claimed that customer satisfaction strongly mediated the relation between service quality and behavioural intentions. The data used in their study were collected from churches. The result of structural equations modeling supported the assumption that customer satisfaction had a stronger effect on behavioral intentions as compared to the effect of service quality on behavioural intentions.

Olorunniwo et al. (2006) developed a conceptual model to test service quality construct and its relationship with customer satisfaction and behavioural intentions. The researchers found dimensions of service quality construct as recovery, responsiveness, tangibles, and knowledge. They further they asserted that although

the direct effect of service quality on behavioural intentions was significant, the indirect effect (with satisfaction playing a mediating role) was a stronger driver for behavioural intentions.

Clemes et al. (2009) proposed a model to examine the relationships between service quality, behavioural intentions, customer satisfaction, image and perceived value in the Taiwan hotel industry. Empirical analysis results explained that perceived value had the most influential moderating effect on the relationship between service quality and customer satisfaction. They also established that service quality had a direct impact on customer perceptions of value and customer satisfaction. Customer satisfaction and image directly impacted behavioural intentions.

Akbar and Parvez (2009) proposed a model to examine the impact of customer perceived service quality, customer satisfaction and trust on customer loyalty. The analysis results revealed that trust and customer satisfaction had a positive significant effect on customer loyalty. Customer satisfaction was found to mediate the relation between service quality and customer loyalty.

Siddiqi (2010) conducted a research on the retail banking sector in Bangladesh and studied the relationships between service quality, satisfaction, and loyalty. The researcher recognized that service quality attributes were positively related to customer satisfaction, and customer satisfaction was positively related to loyalty.

Kumar et al. (2010) conducted a study on Indian private banks and investigated the service quality dimensions. They tested overall service quality level as an antecedent to customer satisfaction. Overall service quality was further tested for any significant relationship with attitudinal loyalty. The results hinted that reliability and responsiveness service quality dimensions determine customer satisfaction more than the empathy, tangible and assurance aspects. They ascertained that overall perceived service quality affect customer loyalty through customer satisfaction.

Osman and Sentosa (2013) tested the mediating effect of customer satisfaction on service quality and customer loyalty relationship in Malaysian rural tourism industry. In view of this, an evaluation of the previous studies in the area of service quality,

customer satisfaction, and customer loyalty was conducted. On the basis of previous studies, they constructed a model and found that service quality had a significant direct positive effect on customer satisfaction and customer loyalty. After that, they introduced customer satisfaction as a mediating variable between service quality and customer loyalty. Researchers empirically tested the model and concluded that customer satisfaction mediates the service quality and customer loyalty relationship in Malaysia rural tourism industry.

Hussain (2016) tested the mediating effects of customer satisfaction in UAE airline industry with the help of three distinct models. The first model investigated the impact of service quality on brand loyalty as mediated by customer satisfaction, the second model examined the effect of the corporate image on brand loyalty as mediated by customer satisfaction and the final model tested the effect of perceived value on brand loyalty as mediated by customer satisfaction. The results confirmed the mediating role of customer satisfaction in the proposed models.

Some studies have reported a direct impact of service quality on customer loyalty while others found an indirect effect through a mediating variable. To test whether customer satisfaction will mediate the relation between TBSSB service quality and customer loyalty, the following hypothesis is required to be tested

H4: Customer satisfaction mediates relationship between TBSSB service quality and customer loyalty

2.10 DEMOGRAPHIC VARIABLES AND SERVICE QUALITY, CUSTOMER SATISFACTION & CUSTOMER LOYALTY

Demographic information permits researchers to get characteristics of their sample, which helps in classifying the data in a more meaningful manner (Elanain, 2003). Research suggests that demographics may have an effect on some service quality dimensions (Paulins, 2005). According to Ganesan-Lim et al. (2008), it is important to understand the relationship between the customer's perception of service quality and demographic information such as age, gender and income level. This information may

be useful for various purposes. Similarly, demographic variables may have an impact on customer satisfaction and loyalty.

Al-Tamimi & Al-Amiri (2003) conducted a research on Islamic banks in the UAE and found that there were differences in the perception of service quality based on age, education level and the number of years for which the customer has been associated with the bank.

Ganesan-Lim et al. (2008) found that age was the significant factor in the perception of service quality of passenger transport services, but gender and income were not found have a significant effect.

Ilias et al. (2008) investigated the effect of demographic factors on the higher education institutions students' satisfaction and service quality. Furthermore, their work also tested the relationship of age with students' satisfaction and service quality. The demographic variables gender, age, race, and a semester of studies were not found to have any significant effect on student satisfaction. Also, there was no significant difference in service quality on the basis of demographic variables gender, a semester of studies and ethnicity.

Kilic (2010) conducted a study on Internet banking service quality and customer satisfaction in Turkey. Results indicated that demographic variables, such as gender, age, income level, and education level do not have a significant effect on the satisfaction level of Internet banking customers.

Ramez (2011) studying the service quality of Bahraini commercial banks did not find any significant differences on the basis of demographics variables in the perception of service quality of the banks.

Kumbhar (2011b) studied the relationship of demographic characteristics of customers on service quality, service value and overall satisfaction in Internet banking services offered by Indian banks. He found that perceived service quality, perceived value from Internet banking services and overall satisfaction in Internet banking differ

by age group, education level, profession and income level of the customers, whereas no difference was found based on gender.

Gupta and Bansal (2011) analyzed the effect of demographic variables on customer perceptions of Internet banking service quality offered by banks in India. Demographic variables covered under study were gender, age, occupation, education level and income. Analysis revealed a significant difference between male and female customers' perceptions on Security/Privacy and Responsiveness dimensions. Results also suggested a significant difference in customers' perceptions by occupation and income groups whereas no significant difference was found on the basis of age and education level.

Palli and Mamilla (2012) conducted a study on the students studying in a higher education institution. The analysis showed that there was no significant difference in the overall satisfaction of the respondents in terms of age, occupation of the parent and total household income, but gender showed a significant difference in the students' opinion with regard to the service quality of departments of the university.

Min and Khoon (2013) investigated the role of demographic factors in the evaluation of service quality. The study used the data from a survey conducted in a private higher education institution in Singapore. The results revealed that gender, nationality and the present level of the study were influential in the evaluation of service quality, but the age factor did not make any significant difference in the key elements of the service quality evaluation. Nationality was found to be the most influential factor on service quality. Gender was found to have more impact on the level of satisfaction of the service than on service quality.

As customers come from different social and personal backgrounds, and that may influence an individual's overall evaluation of service quality, customer satisfaction, and loyalty. So, data corresponding to demographic profile of the respondents was collected in this study and the effect of demographic characteristics (Gender, Age, Highest completed qualification, Occupation, Annual Income) on customers' perceptions of TBSSB service quality, customer satisfaction, and loyalty was examined using the following hypotheses

H5: TBSSB Service quality dimensions vary across demographic characteristics of customers (Gender, Age, Highest completed qualification, Occupation, Annual Income).

H6: Customer satisfaction varies across demographic characteristics of customers (Gender, Age, Highest completed qualification, Occupation, Annual Income).

H7: Customer loyalty varies across demographic characteristics of customers (Gender, Age, Highest completed qualification, Occupation, Annual Income).

2.11 CONCLUSION

The chapter started with the introduction of services and service quality. Various models and scales developed by researchers for measuring service quality, Electronic service quality/ Automated Service quality, Service Quality in Banking Sector and Electronic Banking Service Quality were discussed in detail. The chapter explained the concept of customer satisfaction and loyalty. The relation between service quality and customer satisfaction, service quality and loyalty, and customer satisfaction with loyalty was also explored using past studies. Various studies showing the mediating role of customer satisfaction between service quality and loyalty were reviewed. The studies investigating the effect of demographic variables on service quality, customer satisfaction, and loyalty were also part of the chapter. To study the effect of Technology based self service banking quality on customer satisfaction and loyalty, and also to test the mediating role of customer satisfaction in the relationship various hypotheses were proposed.

CHAPTER III
RESEARCH METHODOLOGY

3.1 INTRODUCTION

Research methodology is a way to systematically solve the research problem. It may be comprehended as a science of studying how research is done scientifically (Kothari, 2009). This chapter explains the overall methodology used to find the dimensions of TBSSB service quality and also to examine the relationship between TBSSB service quality, customer satisfaction, and customer loyalty. The chapter covers the various objectives of the research and hypotheses that need to be tested to achieve those objectives. Under research design, there is a detailed discussion on types of research design used in this study, data sources, primary data collection method used in the study, the systematic process followed for the design of the structured questionnaire, various components of the questionnaire, sampling design and different statistical techniques used for the purpose of analysis.

3.2 RESEARCH OBJECTIVES

In the first chapter, an attempt was made to identify the various research gaps prevailing in the scope of the study. An in-depth analysis of the research gaps resulted in certain research questions. Considering those research questions, research objectives for this study were framed. The following research objectives were the focus of investigation in this research

1. To find the various dimensions of service quality in case of technology based self service banking services.
2. To determine the relationship between TBSSB service quality, customer satisfaction, and customer loyalty.
3. To examine the effects of various demographic variables on TBSSB service quality, customer satisfaction, and customer loyalty.
4. To quantify the overall effect of TBSSB service quality attributes in terms of a single numerical index.

3.3 HYPOTHESES

In order to achieve the research objectives, various hypotheses were proposed in this study. To achieve the second objective of the research related to determining the relationship between TBSSB service quality, customer satisfaction, and customer loyalty; four hypotheses H1, H2, H3, and H4 were proposed. To fulfill the third objective related to examining the effects of various demographic variables on TBSSB service quality, customer satisfaction, and customer loyalty; three hypotheses H5, H6 and H7 were proposed in this research. These are the main hypotheses. These hypotheses along with their sub-hypotheses are tested at appropriate places in the thesis. The seven hypotheses are presented below

H1: Technology based self service banking quality dimensions have a direct positive effect on customer satisfaction.
H2: Technology based self service banking quality dimensions have a direct positive effect on customer loyalty.
H3: Customer satisfaction has a direct positive effect on customer loyalty.
H4: Customer satisfaction mediates the relationship between TBSSB service quality and customer loyalty.
H5: TBSSB Service quality dimensions vary across the demographic characteristics of the customers (Gender, Age, Highest completed qualification, Occupation, Annual Income).
H6: Customer satisfaction varies across the demographic characteristics of the customers (Gender, Age, Highest completed qualification, Occupation, Annual Income).
H7: Customer loyalty varies across the demographic characteristics of the customers (Gender, Age, Highest completed qualification, Occupation, Annual Income).

3.4 RESEARCH DESIGN

3.4.1 Types of Research Design Used in this Study

The research designs can be classified into exploratory and conclusive research design. Conclusive research design can be further classified into descriptive and

causal research (Malhotra and Dash, 2011). The present study uses exploratory as well as descriptive research. The objective of exploratory research is to provide insights of the subject matter under study. In exploratory phase, a detailed examination of the literature was made regarding the studies conducted related to service quality, customer satisfaction, and customer loyalty in the banking and other sectors. The review also covered numerous studies on automated service quality. This helped in the defining the problem, development of research instrument and hypotheses. The objective of descriptive research is to illustrate the characteristics of the population under study. It was carried out with the help of representative sample. A survey method was used to collect the data by employing a structured questionnaire to measure technology based self service banking service quality, customer satisfaction, customer loyalty and the importance level of technology based self service banking service quality attributes. Descriptive research may be classified as cross-sectional and longitudinal. In cross-sectional studies, information is collected from a given sample of the population only once while in the case of longitudinal design the same sample of the population is measured repeatedly (Malhotra and Dash, 2011). Due to time and other resource constraints, this study used a cross-sectional research design to capture customer perceptions.

3.4.2 Sources of Data

In this study, both primary and secondary data sources were used. The secondary data sources consisted of published studies in various international journals, national journals, and conference proceedings. The secondary data also included published thesis, information available on various banks sites, other websites etc. To collect primary data, a structured questionnaire was designed. Data were collected from the customers of public, private and foreign national banks in Delhi, Faridabad, Gurgaon, Noida and Panipat cities in India using self-administered questionnaire having closed-ended questions. Bank customers who were above 18 years of age and use at least one of the modes of automated banking were considered in the survey.

3.4.3 Questionnaire Design

The aim of this study was to develop a reliable and valid instrument for measuring TBSSB service quality and to understand its relationship with customer satisfaction and loyalty. The aim also covered representing TBSSB service quality in terms of the single numerical index. Taking into consideration various objectives, a scale has been developed.

The first stage in the questionnaire development process involved finding items related to TBSSB service quality, customer satisfaction, and loyalty. To generate items, an extensive review of measurement scales used in previous studies on service quality, banking service quality, electronic service quality, customer satisfaction and loyalty was conducted. The review produced a list of items. These items were discussed in detail with bank customers, academicians and banking professionals. The discussion focussed on the issues like the relevance of the items (questions) with the study, the wording of the items for readability and unambiguousness, and repetition of items. To address these issues, the people were asked to give feedback by answering the following questions: Are the items easily understandable? Does each item represent each variable appropriately? Should any items be added, deleted or modified? What instructions need to be given to respondents? What should be the length and format of the questionnaire to make it user-friendly? Necessary corrections were made in the items on the basis of the feedback so obtained. Based on the suggestions, some of the statements were re-worded to make them clearer to the respondents. The suggestions related to questionnaire's appearance and layout were also implemented. Based on the recommendations a scale having 20 items to measure TBSSB service quality, 3 items to measure customer satisfaction, 6 items to measure loyalty and 20 items to measure the importance of TBSSB service quality was developed. Six questions to capture the profile of the respondents were also included.

Pilot Testing

The questionnaire developed by identifying and adapting items through a comprehensive review and suggestions was subjected to pretesting to determine its suitability in Indian settings and to further refine it. One of the main purposes of the

pilot testing was to assess the reliability of the items used in the survey (Cooper and Schindler, 2006). The revised instrument was pilot tested with fifty experienced automated banking customers. During the pilot testing stage, respondents were encouraged to give feedback on instructions and questions readability, comprehensibility, wording, order effects and ambiguity. They were also asked to share suggestions for improvement of the questionnaire. On the basis of pilot testing suggestions, some minor changes in questionnaire instructions were made. Reliability and validity of the research construct were also confirmed during the pilot study. These measures used in designing instrument were consistent with best practices (Churchill, 1979).

Final Questionnaire

The final questionnaire consisted of five parts. To remove ambiguities, the concept of technology based self service banking (TBSSB) was briefly explained to respondents at the start of the questionnaire. Respondents were requested to answer the questions on the basis of their overall experience with their bank. Respondents were further clarified that if they were using services of more than one bank, then choose the bank that they use the most for TBSSB services. In that case, that will be considered as their main bank for the survey. Respondents were requested to complete the survey if they are minimum 18 years of age and use at least one channel of technology based self service banking. The assurance was given to respondents that the information gathered will be kept confidential and would be used only for research purposes. The five parts of the questionnaire are described below.

Part I: Demographic details

Part one contained questions related to the demographic profile of the respondents. This includes questions related to gender, age, education, occupation, annual income and frequency of monthly usage of technology based self service banking services of the main bank. Respondents were asked to circle the appropriate option out of the given options.

Part II: TBSSB service quality

In Part two of the questionnaire respondents were asked about their perception regarding the service quality of TBSSB. It was having 20 items related to the service quality of TBSSB services as shown in table 3.1. The TBSSB service quality items were identified and adapted by conducting a comprehensive review of different studies on automated and banking service quality. The final TBSSB service quality items along with their literature source are presented in table 3.1. The respondents were requested to indicate their level of agreement with the following statements related to service quality on a 5-point scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree) by circling one appropriate number for each statement.

Table 3.1: TBSSB service quality attributes

Attribute No.	TBSSB Attribute Name	Attribute adapted from
A1	TBSSB services are able to conduct error-free transactions every time	Joseph et al. (1999), Joseph and stone(2003), Yang et al. (2004), Ibrahim et al. (2006), Ganguli and Roy (2011)
A2	TBSSB services are available 24 x 7 (7 days, 24 hours)	Joseph et al.(1999), Meuter et al. (2000), Joseph and stone(2003), Ibrahim et al. (2006), Ganguli and Roy (2011), Al-Hawari(2011), Hussien and Abd El Aziz (2013)
A3	TBSSB give directions to new users	Joseph and stone (2003)
A4	I receive prompt responses to my requests while using TBSSB	Yang et al. (2004), Ho and Lin (2010), Hussien and Abd El Aziz (2013)
A5	TBSSB provides consistent services	Sureshchandar et al. (2002), Narteh(2013)
A6	TBSSB provides customer feedback services	Joseph et al. (1999), Joseph and stone (2003), Ibrahim et al. (2006), Al-Hawari (2011)
A7	TBSSB acknowledges me by name	Joseph et al.(1999), Joseph and stone(2003), Ibrahim et al. (2006), Ganguli and Roy (2011), Al-Hawari(2011)

A8	TBSSB provides the precise and sufficient information I need	Kim and Lim (2001), Ganguli and Roy (2011)
A9	TBSSB provides product offerings according to my preferences	Joseph et al. (1999), Joseph and stone (2003) , Ganguli and Roy (2011), Al-Hawari (2011), Ibrahim et al. (2006)
A10	TBSSB services provide accurate records of all transactions that have taken place	Narteh (2013), Joseph et al.(1999), Joseph and stone(2003), Ibrahim et al. (2006), Hussien and Abd El Aziz (2013)
A11	I feel secure that my personal information will not be shared with the third party in using TBSSB	Ganguli and Roy (2011), Kim and Lim (2001), Parasuraman et al. (2005), Yang et al. (2004), Al-Hawari(2011), Hussien and Abd El Aziz (2013)
A12	Financial transactions done using TBSSB are secure	Yang et al. (2004), Ganguli and Roy(2011), Ibrahim et al;(2006), Al-Hawari (2011)
A13	TBSSB services are cost effective	Kumbhar (2011), Narteh(2013)
A14	TBSSB services are easy to use	Joseph et al.(1999), Joseph and stone(2003) , Ibrahim et al;(2006), Ganguli and Roy(2011), Meuter et al. (2000), Al-Hawari(2011), Kumbhar (2011)
A15	TBSSB has adequate menu options for everyday banking needs	Joseph et al.(1999), Joseph and stone(2003), Ibrahim et al; (2006), Al-Hawari(2011), Narteh (2013), Hussien and Abd El Aziz (2013)
A16	Elements of security are incorporated in TBSSB by bank and I am made aware of them	Al-Hawari(2011), Hussien and Abd El Aziz (2013)
A17	TBSSB services have a user-friendly system	Parasuraman et al. (2005), Ibrahim et al; (2006), Ganguli and Roy (2011), Al-Hawari (2011)
A18	TBSSB gives me more freedom of mobility	Meuter et al. (2000), Parasuraman (2000), Ganguli and Roy (2011)
A19	When problems occur, the TBSSB system guides me to solve them	Liu and Arnett (2000), Wolfinbarger and Gilly (2003), Ho and Lin (2010)
A20	TBSSB is less time consuming as compared to branch banking	Meuter et al. (2000), Ganguli and Roy (2011)

Part III: Customer Satisfaction

Part three of the questionnaire was related to the satisfaction of the respondents with actually received bank services. It included 3 items pertaining to customer satisfaction with the bank. The items related to customer satisfaction were adapted from the past studies. Final customer satisfaction items along with their literature source are presented in table 3.2. The respondents were asked to indicate their level of agreement with the following statements related to customer satisfaction on a 5-point scale ranging from 1(Strongly Disagree) to 5(Strongly Agree) by circling one appropriate number for each statement.

Table 3.2: Customer Satisfaction attributes

Attribute No.	Attribute Name	Attribute adapted from
S1	I am satisfied with TBSSB services of my bank	Yang et al. (2004), Al-Hawari and Ward (2006), Rod et al. (2008), Zeng et al. (2009)
S2	I am satisfied with the products offered by my bank	Yang et al. (2004), Al-Hawari and Ward (2006), Rod et al. (2008), Zeng et al. (2009)
S3	Overall I am satisfied with my bank	Woo and Fock (1999), Ganesh et al. (2000), Krepapa et al.(2003), Yang et al. (2004), Al-Hawari and Ward (2006), Zeng et al. (2009), Ganguli and Roy (2011)

Part IV: Customer Loyalty

Part four of the questionnaire covered 6 questions related to customer loyalty towards the bank. Customer loyalty items were finalized on the basis of various studies shown in table 3.3. Respondents were requested to indicate how likely they would undertake actions mentioned in the following statements by circling one appropriate number for each statement on a scale ranging from 1 (extremely unlikely) to 5 (extremely likely).

Table 3.3: Customer Loyalty attributes

Attribute No.	Attribute related to Customer Loyalty	Attribute adapted from
L1	I would say positive things about my bank to other people	Zeithaml et al. (1996), Zeng et al. (2009), Al-Hawari et al. (2009)
L2	I would encourage friends and relatives to do business with my bank	Zeithaml et al. (1996), Zeng et al. (2009), Al-Hawari et al. (2009)
L3	I expect to do more business with my bank in future	Zeithaml et al. (1996), Ganesh et al. (2000), Caruana (2002), Olorunniwo et al. (2006), Zeng et al. (2009), Ganguli and Roy (2011)
L4	I would consider my bank as my first choice for banking services	Zeithaml et al. (1996), Caruana (2002), Al-Hawari et al.(2009), Ganguli and Roy (2011)
L5	I would recommend my bank to someone who seek my advice	Zeithaml et al. (1996), Ganesh et al. (2000), Al-Hawari et al. (2009), Ganesh et al. (2000), Ganguli and Roy (2011)
L6	I will remain with the same bank even if bank fees increase marginally	Zeithaml et al. (1996), Ganesh et al. (2000), Al-Hawari et al. (2009)

Part V: Level of Importance of TBSSB attributes

Part five of the questionnaire was linked with the importance of the TBSSB service quality attributes. It included 20 items as shown in table 3.4. It covers the same TBSSB attributes identified in Part II of the questionnaire. For measuring the importance level of TBSSB attributes, these items were reframed accordingly. The respondents were requested to indicate the importance level of the TBSSB service quality attributes on an 11-point scale ranging from 1 (exceptionally low) to 11 (exceptionally high) by circling one appropriate number for each statement.

Table 3.4: Level of Importance of TBSSB attributes

S. No.	Attribute
1	Security that customer personal information will not be shared with the third party
2	Guiding customers to solve problem, in case it occurs
3	Conducting error free transaction every time
4	Security in doing financial transaction
5	Providing precise and sufficient information as per customer need
6	Providing consistent services
7	24x7 service availability
8	Giving prompt responses to customer request
9	Providing accurate records of all transactions that have taken place
10	Ease of use
11	Providing customer feedback services
12	Cost-effective Services
13	Giving directions to new users
14	Having adequate menu options for everyday banking needs
15	Acknowledging customer by name
16	Having security features and customers awareness of the same
17	Consuming less time as compared to branch banking
18	Giving more freedom of mobility to customers
19	Offering product according to customer preferences
20	Having user-friendly system

The final version of the complete questionnaire is shown in appendix I.

3.4.4 Sampling Design

Like most of the research studies, in this study also it was almost impossible to examine the entire universe. So the best alternative was to work with a representative sample. A sample is a part of the population which is studied in order to make inferences about the whole population. A representative sample

possesses the characteristics same as that of the population (Zikmund, 2003). The findings of the representative sample can be applied to the population. A sampling unit is a basic unit containing the elements of the population to be sampled (Malhotra and Dash, 2011). Population for the study was all the banking customers who were using at least one of the electronic banking channels and aged above eighteen years. A sample was taken from the population being researched. Sample size refers to a number of elements included in the study. Sample size determination is a complex task and involves considering various factors such as the number of variables, the nature of research, the sample size used in similar studies, data analysis techniques to be used, resource constraints and the accessibility of the sampling frame (Malhotra and Dash, 2011). Hair et al. (2010) suggested that a sample size larger than 100 is needed for factor analysis and as a general rule of thumb the observations should be 5 times the number of variables. Usually, a sample size of 200 would satisfy the requirement for data analysis using structural equation modeling (Nunnally and Bernstein 1994). A sample of 200 is required to give parameter estimates with any degree of confidence (Sweeney 2000; Gerbing and Anderson 1988). Taking into consideration all the factors and guidelines for sample size determination, 600 questionnaires were distributed to potential respondents, out of which 440 were received back. Of the 440 responses, 414 were found usable for the analysis purpose.

3.4.5 Statistical Techniques Used

After data collection, responses from the questionnaires were recorded with appropriate coding. Then data were analyzed to make sense of the study and to report various findings. Simple descriptive statistics were used to summarize the respondents' characteristics. The data was further analyzed using various statistical techniques including exploratory factor analysis, confirmatory factor analysis, structural equation modeling, t-test and analysis of variance. The purpose of using exploratory factor analysis was to determine the underlying factors. Confirmatory factor analysis was used to confirm the factor structure. Structural equation modeling was used to test the proposed structural model and test various related hypotheses. t-test and analysis of variance were used to compare the results based on the demographic variables.

The various software used for the data analysis were SPSS 16.0 and AMOS 20.0. The different techniques used for data analysis are explained under various headings.

Respondents' Profile Analysis

To have a better understanding of the sample, an analysis of the demographic characteristics of respondents (gender, income, age, qualification) and their TBSSB usage per month was carried out. Descriptive statistics were used to understand the characteristics of the respondents.

Scale Evaluation

To evaluate the accuracy and applicability of the instrument, its reliability and validity need to be assessed. But prior to assessing reliability and validity, Unidimensionality should be assessed (Hair et al., 2010). This is because the analysis of validity and reliability is based on the assumption of unidimensionality (Nunnally and Bernstein 1994). The dimensionality of the model can be assessed by testing the factor loadings. If items have a high factor loading on the intended factors and no significant loading on other factors, the scale is considered as unidimensional (Hair et al., 2010).

Reliability of the instrument

Reliability is the degree to which consistency of results is obtained in the case of repeat measurements of the characteristic (Malhotra and Dash, 2011). Reliability can be checked during exploratory as well as confirmatory factor analysis.

During exploratory factor analysis, the reliability of the model was examined using the value of Cronbach's alpha coefficient for all the dimensions and overall instrument. Cronbach's alpha coefficient represents the internal consistency of the indicators measuring each construct and is widely used (Nunnally and Bernstein, 1994). The internal consistency means that the indicators of the scale are highly correlated and therefore measure the same construct (DeVellis, 1991). The value of Cronbach alpha coefficient ranges from 0 to 1. The suggested value of Cronbach's alpha is above 0.7 (Nunnally and Bernstein, 1994).

During confirmatory factor analysis, the reliability was tested by finding composite reliability (CR) and average variance extracted (AVE) of all the factors. The suggested minimum acceptable limit of CR and AVE are 0.70 and 0.50 respectively (Holmes-Smith 2001; Hair et al., 201 0). The composite reliability and average variance extracted were computed with the help of Fornell and Larker's (1981) formula, which are given below

Composite Reliability (CR)

$$CR = \frac{\left(\sum_{i=1}^{n} \lambda_i\right)^2}{\left(\sum_{i=1}^{n} \lambda_i\right)^2 + \left(\sum_{i=1}^{n} e_i\right)},$$

Average Variance Extracted (AVE)

$$AVE = \frac{\sum_{i=1}^{n} \lambda_i^2}{\sum_{i=1}^{n} \lambda_i^2 + \sum_{i=1}^{n} e_i},$$

Where λ_i = the standardized factor loading for each measurement item

e_i= the error variance related to each indicator

Validity

Validity is the extent to which a scale or set of measures accurately represents the concept of interest (Hair et al. 2010). It is related with how well the concept is defined by the measure. Most commonly researchers assess content and construct validity.

Content validity:

Content validity covers the subjective but systematic assessment of how well the content of a scale represents the measurement task under study (Malhotra and Dash, 2011). It refers to a consensus between area experts that the scale is measuring what it is supposed to measure and the scale items cover the whole sphere of the construct under consideration. Content validity can be established by taking the attributes (items) from the past studies using similar scales and adapting them. Items of the scale may be reviewed by professionals and subject area experts.

Construct validity:

Construct validity refers to the extent to which a set of measured items (variables) portray the theoretical latent construct they are designed to measure (Hair et al., 2010). This is generally assessed through convergent and discriminant validity.

Convergent validity is the degree to which variables of a particular construct converge or share a high proportion of variance in common (Hair et al., 2010). It measures the extent to which the scale correlates positively with the other measures of the same construct. Convergent validity can be assessed by examining the AVE and factor loadings of the constructs as suggested by Fornell and Larcker (1981). All the variables should have high factor loadings (>0.5) onto the respective latent constructs. Moreover, the average variance extracted (AVE) for each construct need to be higher than the minimum suggestive value of 0.50 to support the convergent validity of the constructs.

Discriminant validity is the extent to which a construct is distinct from the other constructs (Hair et al., 2010). It measures the degree to which a measure does not correlate with other constructs from which it is assumed to differ (Malhotra and Dash, 2011). Discriminant validity can be assessed by comparing the average variance extracted (AVE) with the corresponding inter-construct squared correlation estimates. The higher value of AVE as compared to inter-construct squared correlation supports the discriminant validity of the construct (Holmes-Smith, 2001).

Exploratory Factor Analysis (EFA)

Factor analysis is largely used to find out reduced number of dimensions (factors) based on the inter-correlation between the variables. Factor analysis helps in summarizing the data in a way to make it more manageable and simultaneously without any loss of information, thereby making it easier to test theories (Tabachnick and Fidell, 2007).

Determining the suitability of data for Factor Analysis

Before applying exploratory factor analysis, the suitability of data for factor analysis needs to be ascertained. Two tests Kaiser-Meyer-Olkin (KMO) measure for sampling adequacy and Bartlett's test of sphericity is usually used for this purpose.

Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy:

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy is an index used to inspect the appropriateness of data for factor analysis. A measure of sampling adequacy quantifies the extent of inter-correlations among the variables and thus supports the appropriateness of data for factor analysis. The small magnitude of KMO represents that the correlations between the pair of variables cannot be explained by other variables and factor analysis may not be suitable. The KMO statistic ranges from 0 to 1 with 0.60 considered as the minimum value for a good factor analysis (Tabachnick and Fidell 2007).

Bartlett's Test of Sphericity:

Bartlett's test of sphericity is another popular test to determine the appropriateness of factor analysis. The Bartlett test of sphericity tests the existence of correlations among the variables. It is used to test the null hypothesis that the variables are uncorrelated in population. A statistically significant value of Bartlett's test of sphericity (sig. < 0.05) points out that the sufficient correlations exist among the variables to continue with factor analysis (Hair et al., 2010).

Factor Extraction and Rotation

For applying factor analysis, it is essential to choose appropriate factoring method: component analysis or factor analysis. Principal Axis Factoring is used in this research, as it the suggested technique when a researcher wants to obtain parameter reflecting latent constructs or factors (Widaman, 1993).

Factor rotation is the method of adjusting the factor axes to achieve a simpler and more meaningful factor solution (Hair et al., 2010). The rotation method used in this study was Varimax rotation, as it is the most common method of factor rotation (Kinnear and Gray, 2010). Varimax rotation was favored over other rotation methods as this minimizes the correlation across factors and maximizes within the factors. This helps to produce 'clear' factors (Nunnally, 1978).

Researchers are increasing using Principal Axis Factoring along with Varimax rotation for factor extraction and rotation purpose in research work related to service quality and other areas (Avkiran, 1994; Halic et al., 2010; Karjaluoto et al., 2002; Gilbert and Kendall, 2003; Suoranta et al., 2005).

Guidelines for factors extraction

For factor extraction, following guidelines were followed

- The eigenvalue of each generated factor should be greater than one (Malhotra and Birks, 2007). Eigenvalue represents the total variance explained by each factor.

- Only variables with factor loadings of 0.4 or more were included in the analysis (Hair et al., 2010). The inclusion of items in the dimensions was determined by their factor loadings. Factor loading indicates the strength of the relationship between the item and the latent construct and thus, is used to ascertain the validity of the scales (Hair et al., 2010). Values close to 1 represent high loadings and those close to 0 reflect low loadings. High loadings

signify that the variable can be assigned to that particular factor. As a general rule of thumb, loadings above 0.71 are excellent, 0.63 very good, 0.55 good, 0.45 fair, and 0.32 poor (Tabachnick and Fidell 2007).

- The factor must be defined by at least three variables. A factor with fewer than three items is generally weak and unstable (Osborne and Costello, 2009). Variable having a loading of 0.32 or higher on two or more factors were not considered (Tabachnick and Fidell 2007).

Structural Equation Modeling (SEM)

SEM is a multivariate technique which combines the features of both multiple regression as well as factor analysis, that helps in the simultaneous examination of a series of interrelated dependence relationships among the measured variables and latent constructs and also between several latent constructs (Hair et al., 2010). SEM is characterized by two basic parts: (1) the measurement model and (2) the structural model.

The measurement model represents the theory that specifies the manifest variables for each construct and allows the evaluation of construct validity (Malhotra and Dash, 2011). The structural model is set of one or more dependent relationships that link the hypothesized model's constructs. The structural model is helpful to represent the interrelationships of variables between constructs (Hair et al., 2010).

SEM involves defining the individual constructs, specifying the measurement model using confirmatory factor analysis (CFA), assessing the reliability and validity of measurement model, specifying the structural model for the valid measurement model, assessing the validity of the structural model and finally drawing conclusions (Malhotra and Dash, 2011). For developing and testing the measurement and structural model AMOS 20.0 software is used in this study.

Assessing the model fit

The model testing procedure using SEM was used to test the goodness-of-fit between the hypothesized model and the sample data. It is suggested to use a variety of goodness-of-fit indices for evaluating the measurement model (Byrne, 2001). As per Hair et al. (2010), using three to four fit indices provides adequate support for model fit. The researcher requires reporting at least one incremental index and one absolute index, in addition to the chi-square value and the associated degrees of freedom (df). Therefore, reporting the value of chi-square and degrees of freedom, the Comparative Fit Index (CFI) or Tucker-Lewis Index (TLI) and the Root Mean Square Error of Approximation (RMSEA) will usually provide adequate unique information for model evaluation. Table 3.5 presents the various goodness-of-fit indices along with the corresponding acceptable fit criteria generally used to assess the model fit as suggested by Holmes-smith et al. (2006) and Hair et al. (2010).

Table 3.5: Goodness of fit indices

Goodness of Fit Indices	**Fit Criteria**
Chi-square	
degrees of freedom(df)	
Chi-square/df (cmin/df)	1.0 <(cmin/df) <3.0 (Values close to 1 indicate good fit but less than 1 indicate overfit)
Comparative fit index (CFI)	>.95 (Values between 0.90 and 0.95 may also indicate satisfactory fit)
Root mean squared error of approximation (RMSEA)	0.05 ≤ RMSEA< 0.08 (Reasonable model fit) RMSEA<0.05(Good model fit)
Tucker-Lewis Index (TLI)	>0.95 (Values between 0.90 and 0.95 may also indicate satisfactory fit)

Independent Sample t-test

An independent sample t-test is used to assess the statistical significance of the difference between two sample means for a single dependent variable (Hair et al., 2010). One of the main assumptions for the t-test is that the populations from which the samples are drawn have equal variances. Levene's test was used to measure for

the homogeneity of variance among the various categories. The significance value greater than 0.05 indicates that the samples were drawn from the populations having equal variance. The null hypothesis for the independent sample t-test is that there is no significant difference between the two population means. For the t-test to be considered as significant, the p value should be less than 0.05. This indicates that there is there is a significant difference between two means.

Analysis of Variance (ANOVA)

ANOVA is a statistical method used to determine whether samples are drawn from populations with equal means, on the basis of one dependent variable (Hair et al., 2010). It is used to compare the statistical differences between more than two means (Hair et al. 2010). Like t-test, the assumptions that the populations from which the samples are drawn have equal variances also need to be tested for ANOVA using Levene's test. ANOVA tests the null hypothesis that there is no significant difference between means. If the ANOVA test is significant, it indicates that at least two of the groups have means that are significantly different from each other. The critical value of 0.05 is generally taken. P value should be smaller than 0.05 for the F ratio to be significant. For detailed analysis, Post hoc analysis was also carried out in this research.

In this study, t-test and Analysis of Variance (ANOVA) were used to find out whether there is any significant difference in TBSSB service quality, customer satisfaction, and loyalty dimensions on the basis of demographic variables. The demographic variables covered under the study were gender, age, highest completed education, occupation and an annual income of respondents.

3.5 CONCLUSION

In this chapter, all the objectives and hypotheses of the research were presented. The chapter explained two types of research designs: exploratory and descriptive research designs used in this study. The chapter covered the discussion on primary and secondary data sources used in this research. This was followed by a detailed

discussion on questionnaire design process including pilot testing as per the best practices. The five parts of the final questionnaire and corresponding literature sources were discussed in detail. The chapter highlighted the sampling design used in the study. The chapter also covered the various statistical techniques including exploratory factor analysis, confirmatory factor analysis, structural equation modeling, t-test and analysis of variance used for analyzing the data.

CHAPTER IV
DATA ANALYSIS PART I:
DIMENSIONS OF TECHNOLOGY BASED SELF SERVICE BANKING SERVICE QUALITY

4.1 INTRODUCTION

After data collection, data preparation, and data analysis was carried out. Of the 440 filled questionnaires, 26 were not considered for analysis as they were found incomplete. The captured responses were entered, coded and tabulated in SPSS software.

Data analysis is divided into three parts. This chapter presents the first part of the data analysis which fulfils the objective to find various dimensions of technology based self service banking service quality. This chapter starts with the discussion on the demographic profile and TBSSB usage of the respondents. This is followed by identifying the key factors of technology based self service banking (TBSSB) service quality. The conceptual model of TBSSB and TBSSBsqual scale to measure TBSSB service quality is also proposed in the chapter. To accomplish the objective, the collected data from the sample was split into two equal size sub-samples. The dimensions of TBSSB service quality were identified by applying an exploratory factor analysis (EFA) on half of the data collected using SPSS 16.0. To confirm the factor structure of TBSSB service quality, confirmatory factor analysis (CFA) was applied on the remaining half of the data collected using AMOS 20.0. The proposed model was empirically tested for unidimensionality, reliability, and validity.

4.2 PROFILE OF THE RESPONDENTS

To get an overview of sample characteristics, an analysis of the demographic characteristics of 414 respondents and their TBSSB usage per month was carried out. With the help of simple descriptive statistics the respondents' characteristics were summarised. Table 4.1 presents the profile of the respondents.

Analysis result shows that 236 (57 percent) of the respondents were male while 178 (43 percent) were female, indicating the considerable number of both the genders in the survey. Age was classified into four groups and minimum participation of 42 (10.10 percent) was from respondents having age more than 45 years, which indicate the substantial participation of each age group respondents in the survey. The biggest group of respondents 159 (38.4 percent) were having age more than 25 and up to 35 yrs, this was followed by respondents having age more than 35 years and up to 45 yrs (30 percent). Out of 414 respondents, 250 respondents had completed graduation and 120 were post graduate and above, which points out that respondents were well qualified. As far as an occupation was concerned, the majority of respondents (234) were salaried class but a sizeable number of respondents from all the four categories of student, salaried, self-occupied and others (housewives, retired persons, pensioners, non-employed etc.) were part of the sample. Similarly, respondents from all income groups participated in the survey. Approx 40 percent respondents were having income more than 2 lacs and up to 5 lacs. Moreover, an analysis of the TBSSB usage pattern showed that majority of the respondents (54.83 percent) on an average use technology based self service banking services (including ATM banking, internet banking, mobile banking, telebanking etc.) maximum five times in a month.

The analysis results pointed out that the sample represented the entire population as survey captured responses from people from various age groups, income level, education, occupation, gender and frequency of TBSSB usage.

Table 4.1: Profile of the respondents

		Frequency
Gender	Male	236
	Female	178
Age	18- up to 25 yrs	89
	More than 25 -up to 35 yrs	159
	More than 35- up to 45 yrs	124
	More than 45 yrs	42
Highest Completed Education	12th or Below	44
	Graduate	250
	Post Graduate and above	120
Occupation	Student	45
	Salaried	234
	Self employed	92
	Others	43
Annual Income (in INR per annum)	up to 2 Lacs	87
	More than 2- up to 5 Lacs	157
	More than 5- up to 10 Lacs	120
	More than 10 Lacs	50
TBSSB usage per month	Up to 5 times	227
	More than 5 – up to 10 times	130
	More than 10 – up to 20 times	44
	More than 20 times	13

4.3 DIMENSIONS OF TBSSB SERVICE QUALITY

The 20 items (attributes) of TBSSB service quality are shown in table 4.2. These items and their literature source are discussed under Questionnaire Design in chapter III. For the purpose of further analysis, a data sample of 414 was divided into two sub-samples: sample I (n = 207) and sample II (n = 207). The sample I was used for exploratory factor analysis and sample II for the confirmatory purpose. The

Exploratory factor analysis was applied to identify the service quality dimensions of technology-based self service banking while confirmatory factor analysis was conducted to confirm the factor structure of service quality in technology based self service banking.

Table 4.2: Attributes of TBSSB service quality

Attribute Code	Attribute Name
A1	TBSSB services are able to conduct error-free transactions every time
A2	TBSSB services are available 24 x 7 (7 days, 24 hours)
A3	TBSSB give directions to new users
A4	I receive prompt responses to my requests while using TBSSB
A5	TBSSB provides consistent services
A6	TBSSB provides customer feedback services
A7	TBSSB acknowledges me by name
A8	TBSSB provides the precise and sufficient information I need
A9	TBSSB provides product offerings according to my preferences
A10	TBSSB services provide accurate records of all transactions that have taken place
A11	I feel secure that my personal information will not be shared with the third party in using TBSSB
A12	Financial transactions done using TBSSB are secure
A13	TBSSB services are cost effective
A14	TBSSB services are easy to use
A15	TBSSB has adequate menu options for everyday banking needs
A16	Elements of security are incorporated in TBSSB by bank and I am made aware of them
A17	TBSSB services have a user-friendly system
A18	TBSSB gives me more freedom of mobility
A19	When problems occur, the TBSSB system guides me to solve them
A20	TBSSB is less time consuming as compared to branch banking

4.3.1 Exploratory Factor Analysis (EFA)

Exploratory factor analysis (EFA) is a statistical technique used to reveal the underlying structure of the variables. One of the major roles of factor analysis is to summarise the data in a more manageable manner without losing any of the important information, therefore, making it easier to test theories (Tabachnick and Fidell, 2007). Hair et al. (2010) suggested a preferable sample size of 100 or more cases for applying exploratory factor analysis. It is also suggested that for applying exploratory factor analysis the number of observations should be minimum five times the number of variables to be analysed. Parasuraman et al. (1988) while refining their 97-item instrument took a sample size of 200, considering the sample sizes used by other marketing researchers. Therefore, a sample size of 207 for applying exploratory factor analysis in this study was adequate.

Statistical measures that are usually used to check the suitability of data for factor analysis are Bartlett's test of sphericity (Bartlett, 1954) and the Kaiser- Meyer- Olkin (KMO) measure of sampling adequacy (Kaiser 1970, Kaiser and Rice, 1974). For the factor analysis to be considered appropriate, Bartlett's test of sphericity needs to be significant ($p < 0.05$). The suggested minimum value of KMO index is 0.60 (Tabachnick & Fidell 2007). In this study KMO measure of sampling adequacy was found as 0.860, which was higher than the minimum acceptable value and result of Bartlett's test of sphericity was also significant. The KMO and Bartlett's Test results are presented in table 4.3.

Table 4.3: KMO and Bartlett's Test results

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.860
Bartlett's Test of Sphericity	Approx. Chi-Square	2.258E3
	Df	190
	Sig.	.000

To identify the underlying dimensions, Factor analysis was applied to the captured responses corresponding to 20 TBSSB service quality attributes. Factors were extracted under the restriction that the eigenvalue of each generated factor was more than one (Malhotra and Birks, 2007). Only variables with loadings of at least 0.4 (Hair et al., 2010) were considered in the analysis.

In the initial exploration, two variables ('TBSSB services are cost effective') and ('TBSSB services provides accurate records of all transactions that have taken place') were deleted as they were having loading value of < 0.4. The remaining 18 variables yielded four factors structure. Exploratory factor analysis SPSS outputs are shown in appendix III. The four factors satisfactory explained 70.346 percent of the total variance. Total variance explained by four factors is higher than the 60 percent, which is commonly used as a threshold value in social sciences (Hair et al., 2010).

The extracted factors were then rotated using Varimax rotation method, which is a most widespread method of factor rotation (Kinnear and Gray, 2010). These rotated factors with their variable constituents and factor loadings are given in table 4.4.

Table 4.4: Rotated factor matrix for TBSSB

Factors	Items	Factor Loadings
Convenience	TBSSB is less time consuming as compared to branch banking	0.699
	TBSSB services are easy to use	0.744
	TBSSB services are available 24 x 7 (7 days, 24 hours)	0.706
	TBSSB gives me more freedom of mobility	0.786
	TBSSB services have a user-friendly system	0.770
	TBSSB has adequate menu options for everyday banking needs	0.592
Reliability and Security	Elements of security are incorporated in TBSSB by bank and I am made aware of them	0.698
	I feel secure that my personal information will not be shared with the third party in using TBSSB	0.802
	TBSSB services are able to conduct error-free transactions every time	0.856
	TBSSB provides consistent services	0.818
	Financial transactions done using TBSSB are secure	0.792
Responsiveness	TBSSB give directions to new users	0.682
	TBSSB provides customer feedback services	0.642
	I receive prompt responses to my requests while using TBSSB	0.643
	When problems occur, the TBSSB system guides me to solve them	0.729
Personalization	TBSSB acknowledges me by name	0.752
	TBSSB provides product offerings according to my preferences	0.854
	TBSSB provides the precise and sufficient information I need	0.829

Reliability of the factors was calculated using the Cronbach's alpha test and values are presented in table 4.5. Reliability testing outputs are shown in appendix II. A Cronbach's alpha value of greater than or equal to 0.7 is considered acceptable for the factor to be reliable (Nunnally and Bernstein, 1994). In this research, all the factors were found to have a satisfactory value of Cronbach's alpha.

Table 4.5: TBSSBsqual dimensions and Reliability test results

Dimension	**Cronbach's Alpha (Reliability Coefficient)**
Convenience	0.889
Reliability and Security	0.919
Responsiveness	0.800
Personalization	0.875
Overall Scale	**0.896**

Taking into consideration variables loaded on different factors and relevant literature, four factors were named as Convenience, Reliability and Security, Responsiveness and Personalization.

Factor Name: Convenience

Convenience is concerned with customer's ease, comfort and work simplification using TBSSB. Total six items loaded on this factor, which was a maximum number of items on any factor in this study. The factor included following items: TBSSB is less time consuming as compared to branch banking, TBSSB services are available 24 x 7, TBSSB services are easy to use, TBSSB services has a user-friendly system , TBSSB gives me more freedom of mobility and TBSSB has adequate menu options for

everyday banking needs. On close observation, it has been found that all the items under this factor were related to making the banking more comfortable and easy for the customers. Hence this factor was named as Convenience. The reliability coefficient of this factor was 0.889 which is more than the acceptable value of 0.7 (Nunnally and Bernstein, 1994).

Factor Name: Reliability and Security

Reliability is concerned with the correct technical functioning of TBSSB services and the accuracy in providing promised services consistently. Security is related to the extent to which the customer believes the TBSSB banking is safe from intrusion and customers' personal information is protected (Parasuraman et al., 2005). There were in total five items loaded on this factor. Items include TBSSB services are able to conduct error-free transactions every time, Elements of security are incorporated in TBSSB by bank and I am made aware of them, TBSSB provides consistent services, I feel secure that my personal information will not be shared with the third party in using TBSSB and Financial transactions done using TBSSB are secure. All five loaded items were related to correct functioning, consistency in providing services and security features and therefore, the factor was labelled as 'Reliability and Security'. The factor showed an excellent internal consistency as Cronbach's alpha value of the factor was found to be 0.919.

Factor name: Responsiveness

Responsiveness is related with quick response and the ability to get help if there is a problem or question related to TBSSB (Parasuraman et al., 2005). There were four items which loaded on this factor. These items were I receive prompt responses to my requests while using TBSSB, TBSSB gives directions to new users, TBSSB provides customer feedback services and When problems occur, the TBSSB system guides me to solve them. It seemed that the basic objective of all these features of TBSSB was to guidance and support to customers. In their pioneer work (parasuraman et al., 1988) represented a willingness to help the customer and provide prompt service as Responsiveness. Therefore, this factor was tagged as Responsiveness. The Cronbach's alpha coefficient for this factor was found to be 0.800.

Factor Name: Personalization

Personalization involves the extent to which and the ease with which the TBSSB services can be tailored to individual customers' preferences. In total, there were three items which loaded on this factor. These items included TBSSB provides product offerings according to my preferences, TBSSB acknowledges me by name, and TBSSB provides the precise and sufficient information I need. The focus areas of all these features were to provide one to one services as per the customer preferences and needs. This factor was labelled as Personalization in accordance with Parasuraman et al. (2005), who defined Personalization in the context of websites as the extent and ease at which site can be tailored to customers' preferences, histories, and habits of shopping. The result of the reliability test for this dimension using Cronbach's alpha was found to be 0.875.

Four factors were extracted using EFA. Next step was to confirm the factor structure using sample II. To confirm the factor structure, Structural equation modeling (SEM) using AMOS 20.0 was used to perform the CFA. Two important assumptions of SEM are that the data is multivariate normal and free from outliers. Thus, before further analysing the data, it was important to test these assumptions.

4.3.2 Normality and Outliers

Researchers are of the view that results will be better if measured variables are normally distributed (Tabachnick and Fidell, 2007). All of the variables in this study were subjected to the test of normality. Some variables showed signs of skewness and kurtosis. Anderson and Fornell (2000) identified the tendency for the data to be skewed in their study related to customer satisfaction. Green & Salkind (2003) acknowledged that it is extremely hard to find variables which are normally distributed. These deviations from normality were not considered to be a major problem in SEM analysis when Maximum Likelihood (ML) estimation is used. The ML estimation method used in this research moderated the non-normality effects as ML estimation is robust against departure from multivariate normality (Anderson and Gerbing, 1988; Diamantopoulos, 1994; Kline, 1998; Sweeney, 2000; Tabachnick and Fidell, 2007).

Statistics also provide methods to deal with multivariate non-normal data, one such method is the Bollen-Stine bootstrap procedure (Bollen and Stine, 1992). This method re-samples the data of which the original sample is perceived as the population. If the Bollen-Stine p-value is less than 0.05 ($p < 0.05$), the model will be rejected. Usually, bootstrap samples are taken from 250–2000 (Bollen and Stine, 1992). In this study, Bollen-Stine bootstrap procedure was used to test the hypothesised model under non-normal data. This research considered 1,000 bootstrap samples. Using 1000 bootstrap procedure, the p-value of Bollen-Stine was found to be 0.160 (> 0.05). Hence it can be concluded that the model fits the data very well.

Outliers are extreme observations that are substantially different from the other observations on one or more characteristics or variables (Hair et al., 2010). According to Hair et al. (2010), outliers may be problematic and they may distort various statistical test results. Hair et al. (2010) also suggested that the outliers should be retained unless there is a demonstrable proof indicating they are abnormal and not representative of the observations in the population. If they do describe a representative element or segment of the population, they should be retained to ensure generalizability to the entire population. Moreover, according to Delman (2001), the decision to remove outliers from the set of data should be made with utmost care as their deletion generally results in the generation of further outliers. The results of outliers' detection showed the presence of some outliers in this research. After a detailed examination, it was decided to retain the outliers since they represented a segment of the population and may hold important information about the variables.

4.3.3 Confirmatory Factor Analysis

In CFA two approaches were used to assess the measurement model. This includes testing the goodness of fit (GOF) criteria indices and to evaluate the validity and reliability of the measurement model. The measurement Model of TBSSB service quality is shown in figure 4.1.

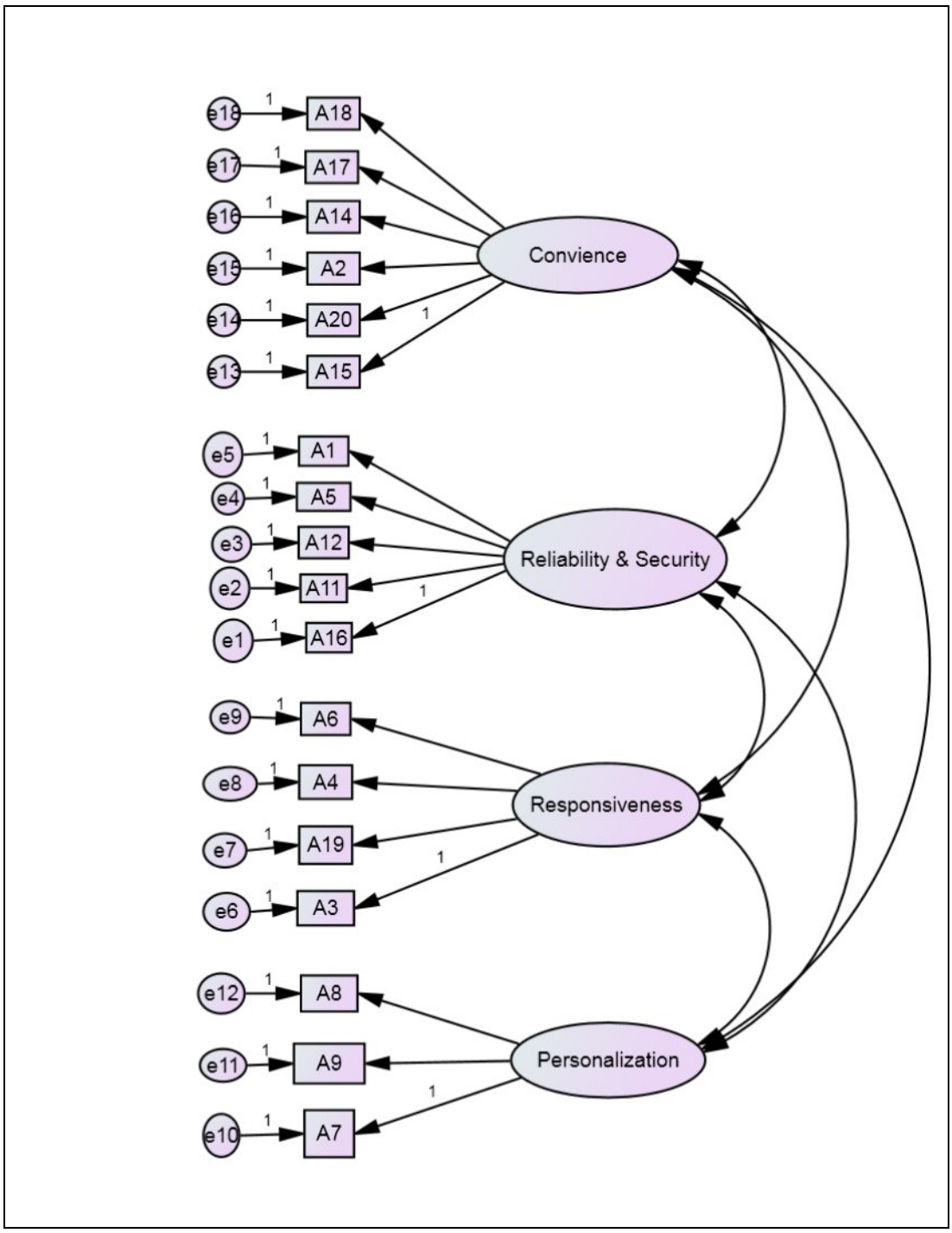


Figure 4.1: Measurement model of TBSSB service quality

Goodness of fit indices

CFA was conducted on the measurement model consisting of four factors namely Reliability & Security, Convenience, Responsiveness, and Personalization. These factors were measured using their corresponding indicators (items). CFA was applied using 18 items which were derived from the exploratory factor analysis. Convenience

dimension was measured by 6 items, Reliability and Security dimension was measured using 5 items, Responsiveness by 4 items and personalization by 3 items.

Confirmatory factor analysis illustrated that the variables loaded in the same pattern as found during exploratory factor analysis. There are particular measures that are generally used to test the model fit. Byrne (2001) suggested reporting multiple goodness-of-fit indices for evaluating the measurement model. As per Hair et al. (2010), reporting three to four fit indices provides sufficient information to test the model fit. The researcher is required to report at least one incremental index and one absolute index, in addition to the chi-square value and the associated degrees of freedom (df). Therefore, reporting the chi-square value and degrees of freedom, the Comparative Fit Index (CFI) or Tucker-Lewis Index (TLI) and the Root Mean Square Error of Approximation (RMSEA) will usually provide sufficient information to evaluate a model.

Table 4.6 shows the threshold value of fit criteria suggested by Holmes-Smith et al. (2006) and Hair et al. (2010) along with the computed values of TBSSB service quality fit indices. All of the fit indices values of the measurement model signified that the model fitted well in representing the data. Moreover, all the attributes were having significant factor loading on the related factors.

Table 4.6: Goodness of fit indices for the TBSSB service quality model

Goodness of Fit indices	Fit Criteria	TBSSB Model Measured Values
Chi-square		184.188
degrees of freedom(df)		129
Chi-square/df (cmin/df)	1.0 < (cmin/df) < 3.0 (Values close to 1 indicate good fit but less than 1 indicate overfit)	1.428
CFI	> .95 (Values between 0.90 and 0.95 may also indicate satisfactory fit)	0.977
RMSEA	0.05 ≤ RMSEA< 0.08 (Reasonable model fit) RMSEA<0.05(Good model fit)	0.046
TLI	>0.95 (Values between 0.90 and 0.95 may also indicate satisfactory fit)	0.973

CFI = Comparative Fit index, **RMSEA** = Root mean square error of approximation, **TLI =** Tucker Lewis index

Unidimensionality, Reliability and Validity of the TBSSBsqual Instrument

Unidimensionality

Unidimensionality means that a set of measured variables (indicators) can be explained by only one underlying construct. The dimensionality of the model was tested by checking the loadings of the factors. Each item had a sufficiently high loading on the intended factors and no significant loading on other factors was found. The scale was therefore found to be unidimensional (Hair et al., 2010).

Reliability

The reliability of the model was checked using Cronbach's alpha test (Hair et al., 2010). The Cronbach's alpha coefficient for all the factors and the overall scale was found to be higher than the lower acceptability limit of 0.7 (Hair et al., 2010). Moreover, Composite Reliability (CR) and Average Variance Extracted (AVE) of all the factors were higher than the acceptable limit of 0.70 and 0.5 respectively (Fornell and Larcker, 1981; Hair et al., 2010) as shown in table 4.7, confirming the reliability of the instrument.

Table 4.7: Reliability and Convergent Validity

Factors	**Composite Reliability (CR)**	**Average Variance Extracted (AVE)**
Convenience	0.912	0.636
Reliability & Security	0.930	0.725
Responsiveness	0.829	0.550
Personalization	0.917	0.788

Validity

Most commonly researchers establish validity by assessing content and construct validity.

Content validity was established by taking the attributes in the study from the existing literature and adapting them. Moreover, items were thoroughly reviewed by professionals and academicians.

Construct validity is generally assessed through convergent and discriminant validity.

Convergent validity was assessed by examining the average variance extracted (AVE) and factor loadings of the constructs as suggested by Fornell and Larcker

(1981). All the variables had significant factor loadings onto the respective latent constructs. Moreover, the average variance extracted (AVE) for each construct was greater than 0.50 as shown in table 4.7, further supporting the convergent validity of the constructs.

Discriminant validity can be assessed by comparing the average variance extracted (AVE) with the corresponding inter-construct squared correlation estimates (Fornell and Larcker, 1981). In table 4.8, Diagonal elements in the correlation matrix of constructs are the AVE values and off-diagonal elements represent inter-construct squared correlations. The greater values of diagonal elements as compared to the off-diagonal elements supported the discriminant validity of the constructs.

Table 4.8: Discriminant validity

	Responsiveness	Convenience	Reliability & Security	Personalization
Responsiveness	0.55000			
Convenience	0.00032	0.63600		
Reliability and Security	0.00036	0.17640	0.72500	
Personalization	0.0025	0.11903	0.05712	0.78800

Taken together, the measurement model confirmed the four-factor structure of the service quality in case of TBSSB.

4.4 CONCLUSION

The objective of this chapter was to explore the service quality dimensions of technology based self service banking (TBSSB). The study was conducted on 414 Indian retail banking customers using the structured questionnaire. The descriptive statistics of the respondents showed that the sample represented the population as there was the significant participation of people from various age groups, income level, education, occupation, gender and frequency of TBSSB usage. For analysis purpose, a data sample of 414 was split into equal sub-samples. The sample I was used

for exploratory factor analysis and sample II for confirmatory factor analysis purpose with the help of SPSS 16.0 and AMOS 20.0 software respectively. The Exploratory factor analysis was used to identify the dimensions of service quality for technology-based self service banking while confirmatory factor analysis was used to confirm the factor structure of service quality in technology based self service banking. The analysis confirmed four dimensions of TBSSB service quality as Convenience, Reliability and Security, Responsiveness and Personalization. The proposed four-factor structure of TBSSB service quality displayed evidence of unidimensionality, reliability, and validity (content, convergent and discriminant validity). Moreover, various criteria indices for the TBSSB service quality model also exceeded the mandatory requirements. As a result, TBSSB service quality was conceptualised as a model consisting of four factors.

CHAPTER V

DATA ANALYSIS PART II:

THE RELATIONSHIP BETWEEN SERVICE QUALITY DIMENSIONS, CUSTOMER SATISFACTION AND CUSTOMER LOYALTY IN TECHNOLOGY BASED SELF SERVICE BANKING

5.1 INTRODUCTION

This chapter explores the relationship between TBSSB service quality, customer satisfaction, and customer loyalty, and also examines the effect of various demographic variables on these factors. A conceptual model consisting of TBSSB service quality, customer satisfaction, and loyalty dimensions was developed and tested in this chapter. Confirmatory factor analysis was used to develop and test the model. The six-factor model was empirically tested for unidimensionality, reliability, and validity. Various hypotheses were also tested using SEM. Partially and fully mediated structural models were developed and compared. Lastly, t-test and Analysis of Variance (ANOVA) were used to find out whether there is any significant difference in TBSSB service quality, customer satisfaction, and loyalty dimensions on the basis of demographic variables.

5.2 CONCEPTUAL MODEL OF TBSSB SERVICE QUALITY, CUSTOMER SATISFACTION AND CUSTOMER LOYALTY

A model was developed relating customer satisfaction and loyalty with TBSSB service quality. Structural Equation Modeling (SEM) was used to develop and test the conceptual model. SEM is characterized by two parts: (1) the measurement model and (2) the structural model. The measurement model is used to validate the relationships between factors and items with the help of confirmatory factor analysis (CFA) and relationships between constructs are tested with the help of structural model (Hair et al., 2010).

5.2.1 Exploratory Factor Analysis (EFA)

Items representing customer satisfaction and loyalty are presented in Table 5.1. These items and their literature source are discussed under Questionnaire Design in chapter III.

Table 5.1: Attributes related to Customer Satisfaction and Loyalty

No.	Attribute Name
S1	I am satisfied with TBSSB services of my bank
S2	I am satisfied with the products offered by my bank
S3	Overall I am satisfied with my bank
L1	I would say positive things about my bank to other people
L2	I would encourage friends and relatives to do business with my bank
L3	I expect to do more business with my bank in future
L4	I would consider my bank as my first choice for banking services
L5	I would recommend my bank to someone who seek my advice
L6	I will remain with the same bank even if bank fees increase marginally

Customer Satisfaction

The outcome of literature review and the pilot study maintained the conclusion derived from the exploratory factor analysis that customer satisfaction was represented by three items. All the three items S1, S2, and S3 were loaded on a single dimension as shown in table 5.2. The three items were also checked for their factor loadings and Cronbach's alpha value of the customer satisfaction factor. Results showed that all the items variables had high loadings and Cronbach's alpha reliability coefficient of the factor was found to be 0.748. Thus, the three variables formed a dimension that measured consumer's perception of customer satisfaction with banking services.

Table 5.2: EFA results of Customer Satisfaction dimension

Factor Name	Items	Factor Loadings	Cronbach's Alpha
Customer Satisfaction	I am satisfied with TBSSB services of my bank	0.620	0.748
	I am satisfied with the products offered by my bank	0.709	
	Overall I am satisfied with my bank	0.790	

Customer Loyalty

The extensive literature review and the pilot study findings were supported by exploratory factor analysis results that customer loyalty was represented by six items. All six items L1, L2, L3, L4, L5, and L6 loaded on a single factor. All the six items had a high factor loading in the range of 0.681 and 0.880. Loyalty factor constituting of six items yielded a high internal consistency of 0.894 as shown in table 5.3.

Table 5.3: EFA results of Customer Loyalty dimension

Factor Name	Items	Factor Loadings	Cronbach's Alpha
Customer Loyalty	I would say positive things about my bank to other people	0.880	0.894
	I would encourage friends and relatives to do business with my bank	0.770	
	I expect to do more business with my bank in future	0.685	
	I would consider my bank as my first choice for banking services	0.789	
	I would recommend my bank to someone who seek my advice	0.681	
	I will remain with the same bank even if bank fees increase marginally	0.793	

The final dataset comprised of six dimensions and twenty seven observed variables. There were four dimensions of TBSSB service quality: Convenience (represented by 6 indicators), Reliability and Security (represented by 5 indicators), Responsiveness (represented by 4 Indicators) and Personalization (represented by 3 indicators). Along with that, there were two more dimensions representing Customer Satisfaction (3 indicators) and Customer Loyalty (6 indicators).

5.2.2 Confirmatory Factor Analysis (CFA)

AMOS 20.0 software was used to carry out the confirmatory factor analysis. Table 5.4 shows the acceptable fit criteria and the fit indices values of measurement model in accordance with the guidelines suggested by Holmes-Smith et al. (2006) and Hair et al. (2010).

Table 5.4: Goodness of fit indices for the measurement model

Goodness of Fit Indices	Fit Criteria	Measured Values
Chi-square		457.748
degrees of freedom (df)		309
Chi-square/df (cmin/df)	1.0 <(cmin/df) <3.0 (Values close to 1 indicate good fit but less than 1 indicate overfit)	1.481
CFI	>.95 (Values between 0.90 and 0.95 may also indicate satisfactory fit)	0.960
RMSEA	0.05 ≤ RMSEA< 0.08 (Reasonable model fit) RMSEA<0.05(Good model fit)	0.048
TLI	>0.95 (Values between 0.90 and 0.95 may also indicate satisfactory fit)	0.954

CFI = Comparative Fit index, RMSEA = Root mean square error of approximation,
TLI= Tucker Lewis index

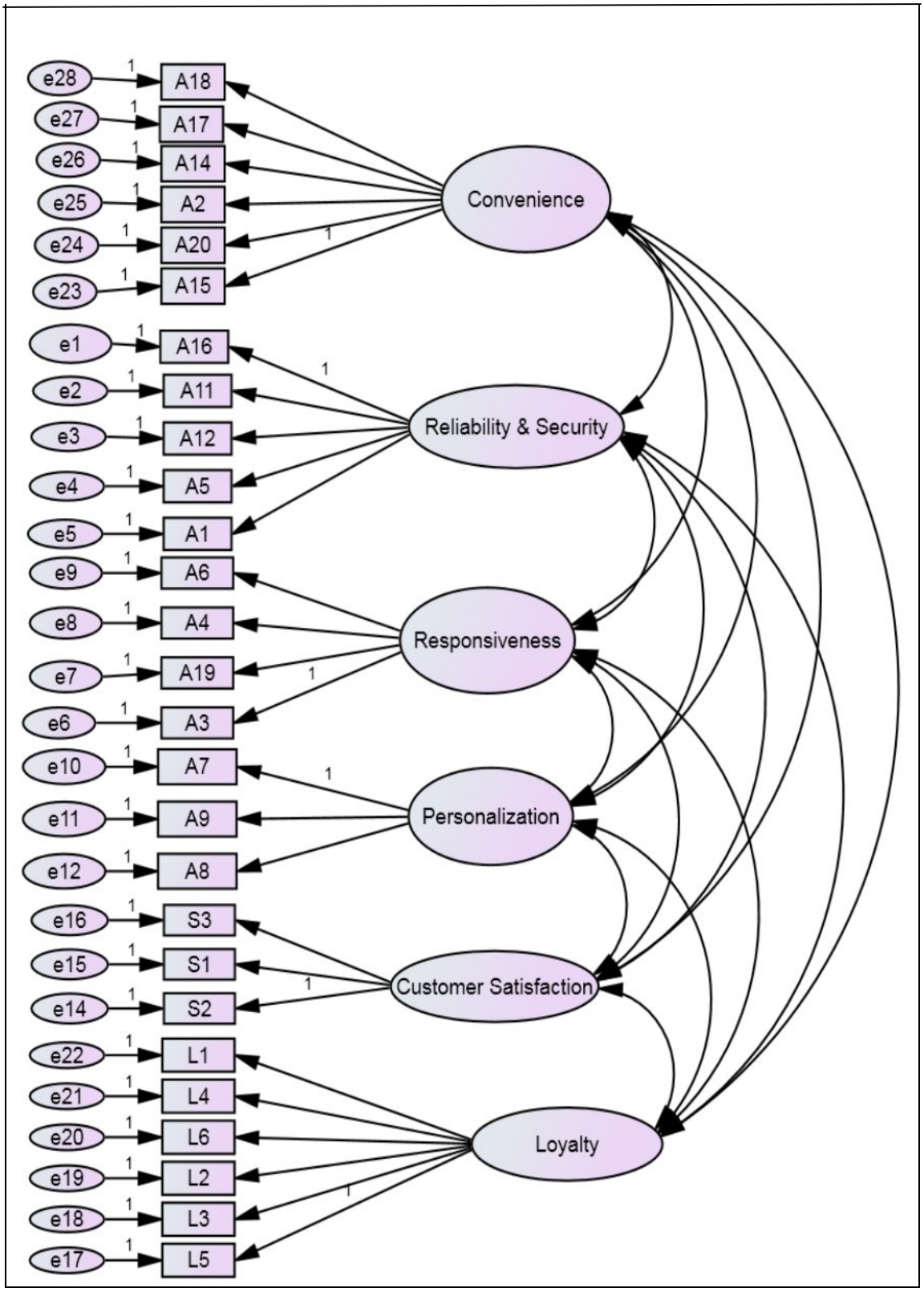


Figure 5.1: Measurement model of TBSSB service quality, Customer Satisfaction and Customer Loyalty

The measurement Model of TBSSB service quality, customer satisfaction, and loyalty is shown in figure 5.1. All the test result values of the final measurement model indicated that the model fitted well in representing the data. The measurement model confirmed the structure constituting of four factors of TBSSB service quality, one factor of customer satisfaction and one of customer loyalty.

5.2.3 Unidimensionality, Reliability and Validity of the Measurement Model

Unidimensionality

Each item was having a sufficiently high loading on the intended factors and no significant loading on another factor. The scale was therefore found to be unidimensional (Hair et al., 2010).

Reliability

The Cronbach's alpha coefficient for all the factors was found to be above the threshold limit of acceptability of 0.7 (Hair et al., 2010). The reliability coefficient for the factors was computed as Convenience (0.889), Reliability and Security (0.919), responsiveness (0.800), Personalization (0.875), Customer Satisfaction (0.748) and Customer Loyalty (0.894). The Cronbach's alpha coefficient for the TBSSB service quality, Customer Satisfaction and Loyalty instrument was 0.872.

Moreover, Composite reliability (CR) and Average Variance Extracted (AVE) of all the factors were higher than the adequate limit of 0.70 and 0.5 respectively (Fornell and Larcker, 1981; Hair et al., 2010) as shown in table 5.5**.** The values of Cronbach's alpha coefficients, CR and AVE confirmed the reliability of the instrument.

Table 5.5: Reliability and Convergent Validity of measurement model

	Composite Reliability (CR)	Average Variance Extracted (AVE)
Convenience	0.912	0.636
Reliability & Security	0.929	0.725
Responsiveness	0.829	0.550
Personalization	0.917	0.787
Customer Satisfaction	0.808	0.586
Customer Loyalty	0.910	0.629

Validity

Validity was established in this study by ascertaining the content and construct validity. Construct validity is generally assessed through convergent and discriminant validity.

Content validity: This was established by taking the attributes in the research from the existing studies and adapting them as per the context. Moreover, items were thoroughly reviewed by professionals and academicians to ascertain their suitability for the study.

Convergent validity: All the variables were having sufficient factor loadings onto the respective latent constructs. Moreover, the average variance extracted (AVE) for each construct was greater than 0.50 as shown in table 5.5, further supporting the convergent validity of the constructs.

Discriminant validity: In table 5.6 diagonal elements in the correlation matrix of constructs are the AVE values and off-diagonal elements represent inter-construct squared correlations. The higher magnitude of the diagonal elements in comparison to the off-diagonal supported the discriminant validity of the constructs (Fornell and Larcker, 1981).

Table 5.6: Discriminant validity of measurement model

	Customer Loyalty	Reliability & Security	Responsiveness	Personalization	Customer Satisfaction	Convenience
Customer Loyalty	0.629					
Reliability & Security	0.066	0.725				
Responsiveness	0.0018	0.00036	0.550			
Personalization	0.4251	0.0576	0.0023	0.787		
Customer Satisfaction	0.490	0.0778	0.0004	0.3672	0.586	
Convenience	0.1136	0.1756	0.0003	0.1197	0.1584	0.636

5.2.4 Structural Model Evaluation (Evaluation of Hypotheses)

The proposed structural model portraying the relationship between dimensions is shown in figure 5.2. The fit indices and threshold fit criterion for the structural model were found as follows: Chi-square= 457.748, degrees of freedom (df) = 309, Chi-square/df = 1.481(<3), CFI =0.960(>0.95), RMSEA=0.048 (<0.05) and TLI=0.954 (>0.95). All of the statistical values of the structural model indicated a good model fit.

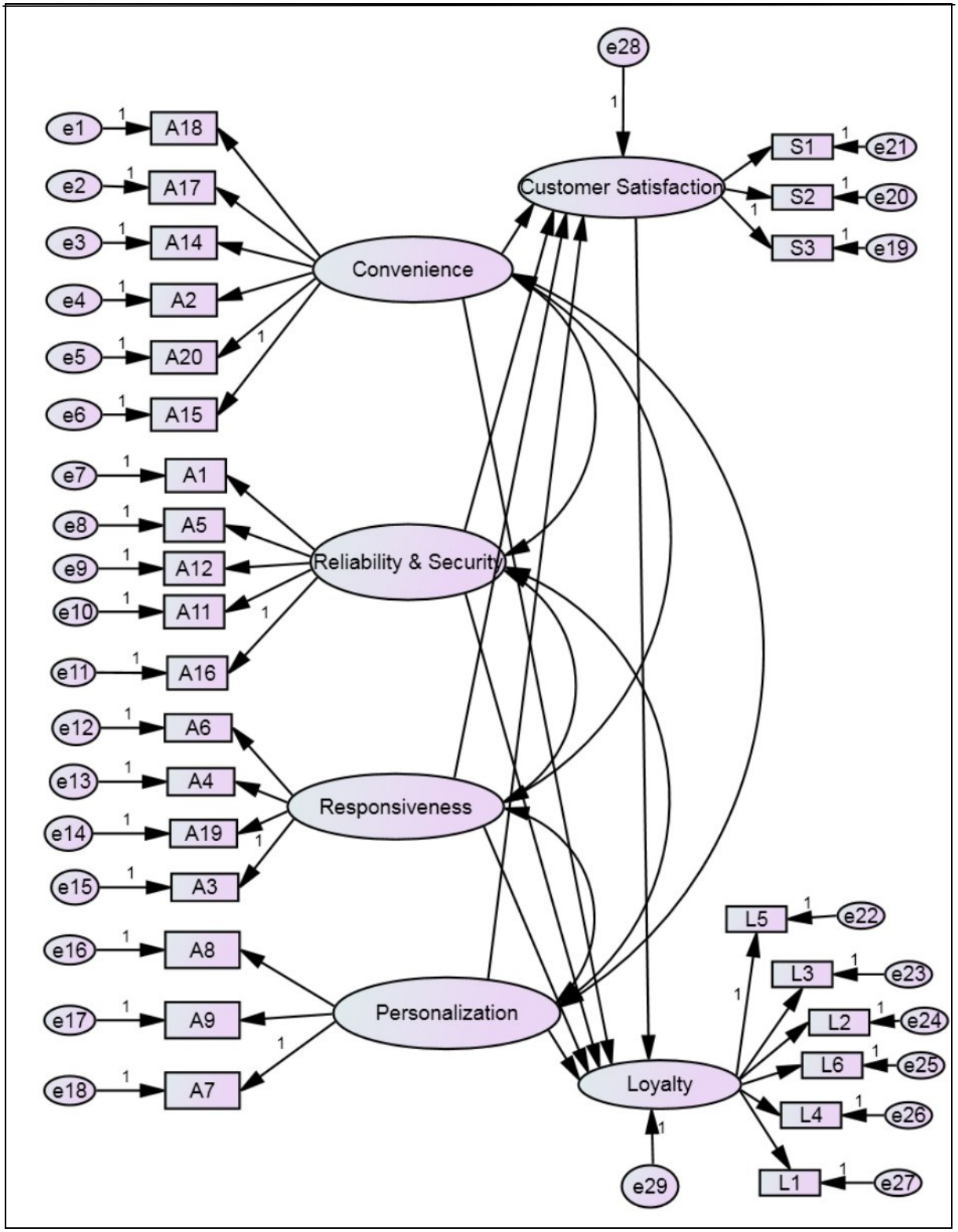


Figure 5.2: Model showing relationship between TBSSB service quality dimensions, Customer Satisfaction and Customer Loyalty (partially mediated model)

After establishing the structural model, various hypotheses were evaluated. Hypotheses were tested with the help of structural equation modeling (SEM) using AMOS 20.0. To study the effect of Technology based self service banking quality on customer satisfaction and loyalty, and also to test the mediating role of customer satisfaction in the relationship the hypotheses proposed in the chapter on Literature Review were tested. The measurement model and structural model AMOS results are shown in appendix IV. These were evaluated by examining the path coefficients and corresponding significance levels. The standardized regression weights and significance value of paths are shown in table 5.7.

H1: Technology based self service banking quality dimensions have a direct positive effect on customer satisfaction

Corresponding to four dimensions of TBSSB, the sub-hypotheses are

H1.1: Convenience dimension has a direct positive effect on customer Satisfaction
H1.2: Reliability and Security dimension has a direct positive effect on customer satisfaction
H1.3: Responsiveness dimension has a direct positive effect on customer satisfaction
H1.4: Personalization dimension has a direct positive effect on customer satisfaction

Table 5.7: Standardized regression weights and significance level for each path

Relation between Constructs	Standardized Regression Weights	Significance level
Convenience ⟶ Satisfaction	0.185 * *	0.018
Reliability & Security ⟶ Satisfaction	0.076 (NS)	0.301
Responsiveness ⟶ Satisfaction	0.007 (NS)	0.918
Personalization ⟶ Satisfaction	0.524* * *	0.000
Convenience ⟶ Loyalty	0.012 (NS)	0.856
Reliability & Security ⟶ Loyalty	0.037 (NS)	0.551
Responsiveness ⟶ Loyalty	-0.017 (NS)	0.762
Personalization ⟶ Loyalty	0.353 * * *	0.000
Satisfaction ⟶ Loyalty	0.471* * *	0.000

NS implies "not significant"; * * Implies significant at $p < 0.05$; * * *Implies significant at $p < 0.001$

Hypothesis H1.1 proposed that Convenience dimension has a direct positive effect on customer satisfaction.

As shown in table 5.7, standardized regression weight was 0.185 and significance value was 0.018. As significance value was less than 0.05 and relation was positive, therefore H1.1 was supported. It means that Convenience dimension was found to have a positive significant effect on customer satisfaction.

Hypothesis H1.2 proposed that Reliability & Security dimension has a direct positive effect on customer satisfaction.

The results in table 5.7 show that the path coefficient for the relation between constructs Reliability & Security and Customer Satisfaction was 0.076 but it was not significant as the corresponding significance level was 0.301. Thus the hypothesis H1.2 was not supported.

Hypothesis H1.3 states that Responsiveness dimension has a direct positive effect on customer satisfaction.

From the table 5.7, it can be seen that the path coefficient was 0.007. The significance value was 0.918, which was higher than 0.05. Although the relationship between Responsiveness dimension and customer satisfaction was positive but path coefficient for the relation was not significant at 5% level of significance. Thus the hypothesis H1.3 was not supported. Therefore we can conclude that there was no significant effect of Responsiveness on customer satisfaction.

According to Hypothesis H1.4, Personalization dimension has a direct positive effect on customer satisfaction.

For the dimension Personalization, the path coefficient between Personalization and customer satisfaction was 0.524. The relationship between Personalization and Customer Satisfaction was positive. The p-value was less than 0.001. Therefore, the hypothesis H1.4 was supported and we can conclude that Personalization dimension was having a direct positive effect on customer satisfaction.

H2: Technology based self service banking quality dimensions have a direct positive effect on customer loyalty

Following four sub-hypothesis have were formulated to test H2

H2.1: Convenience dimension has a direct positive effect on customer loyalty
H2.2: Reliability & Security has a direct positive effect on customer loyalty
H2.3: Responsiveness dimension has a direct positive effect on customer loyalty
H2.4: Personalization dimension has a direct positive effect on customer loyalty

Hypothesis H2.1 proposed that Convenience dimension has a direct positive effect on customer loyalty.

The results in table 5.7 show that the path coefficient for the relation between constructs convenience and loyalty was 0.012 but it was not significant as the

corresponding significance level was 0.856. Thus the hypothesis H2.1 was not supported. It implies that convenience dimension was not found to have a direct positive effect on customer loyalty.

Hypothesis H2.2 stated that Reliability and Security has a direct positive effect on customer loyalty.

From the table 5.7, it can be seen that the path coefficient is 0.037. The significance value was 0.551, which was higher than 0.05. Although the relationship between Reliability & Security dimension and loyalty was positive but path coefficient for the relation was not significant at 5% level of significance. Hence the hypothesis H2.2 was not supported. Therefore we can conclude that there was no significant relationship between Reliability & Security and customer loyalty.

According to hypothesis H2.3, Responsiveness dimension has a direct positive effect on customer loyalty.

For the factor Responsiveness, the path coefficient was -0.017. The p-value was 0.762, which was higher than 0.05. The relationship between Responsiveness and customer loyalty was negative and the path coefficient for this relationship was not significant at 5% level of significance. Thus the hypothesis H2.3 was not supported. Therefore it can be concluded that there was no significant effect of Responsiveness on customer loyalty.

Hypothesis H2.4 states that Personalization dimension has a direct positive effect on customer loyalty.

The path coefficient between Personalization and loyalty dimension was 0.353. The relationship between Personalization and customer loyalty was positive, and the p-value was less than 0.001. Consequently, the hypothesis H2.4 was supported. As a result, we can conclude that Personalization dimension was found to have a direct positive effect on customer loyalty.

H3: Customer satisfaction has a direct positive effect on customer loyalty

Hypothesis H3 states that customer satisfaction has a direct positive effect on customer loyalty

As shown in table 5.7, standardized regression weight was 0.471 and significance value was less than 0.001. Consequently, H3 was supported. It means that customer satisfaction was found to have a direct positive effect on customer loyalty.

H4: Customer satisfaction mediates relationship between TBSSB service quality and customer loyalty

To test the mediating role of customer satisfaction in the structural model two models were developed and compared using AMOS 20.0. The first model (Figure 5.2) illustrated the direct as well as the indirect relationship between TBSSB service quality dimensions and customer loyalty. In the second model (Figure 5.3), TBSSB service quality influenced customer loyalty through customer satisfaction. The method of testing mediation hypothesis by developing and comparing two models was consistent with other studies (Yen and Gwinner, 2003; Al-Hawari and Ward, 2006). Both partially and fully mediated models fitted the data well. There was no significant chi-square difference between the two models (Chi-square difference= 0.053, df= 3, sig. = 0.996). As there was no significant chi-square difference between the two models, four criteria (overall model fit as measured by CFI, percentage of the proposed significance paths, amounts of variance explained by R^2 and parsimony assessed by the parsimonious normed fit index (PNFI)) developed by Morgan and Hunt (1994) cited in Yen and Gwinner (2003) and Al-Hawari and Ward (2006) were used to compare the two models.

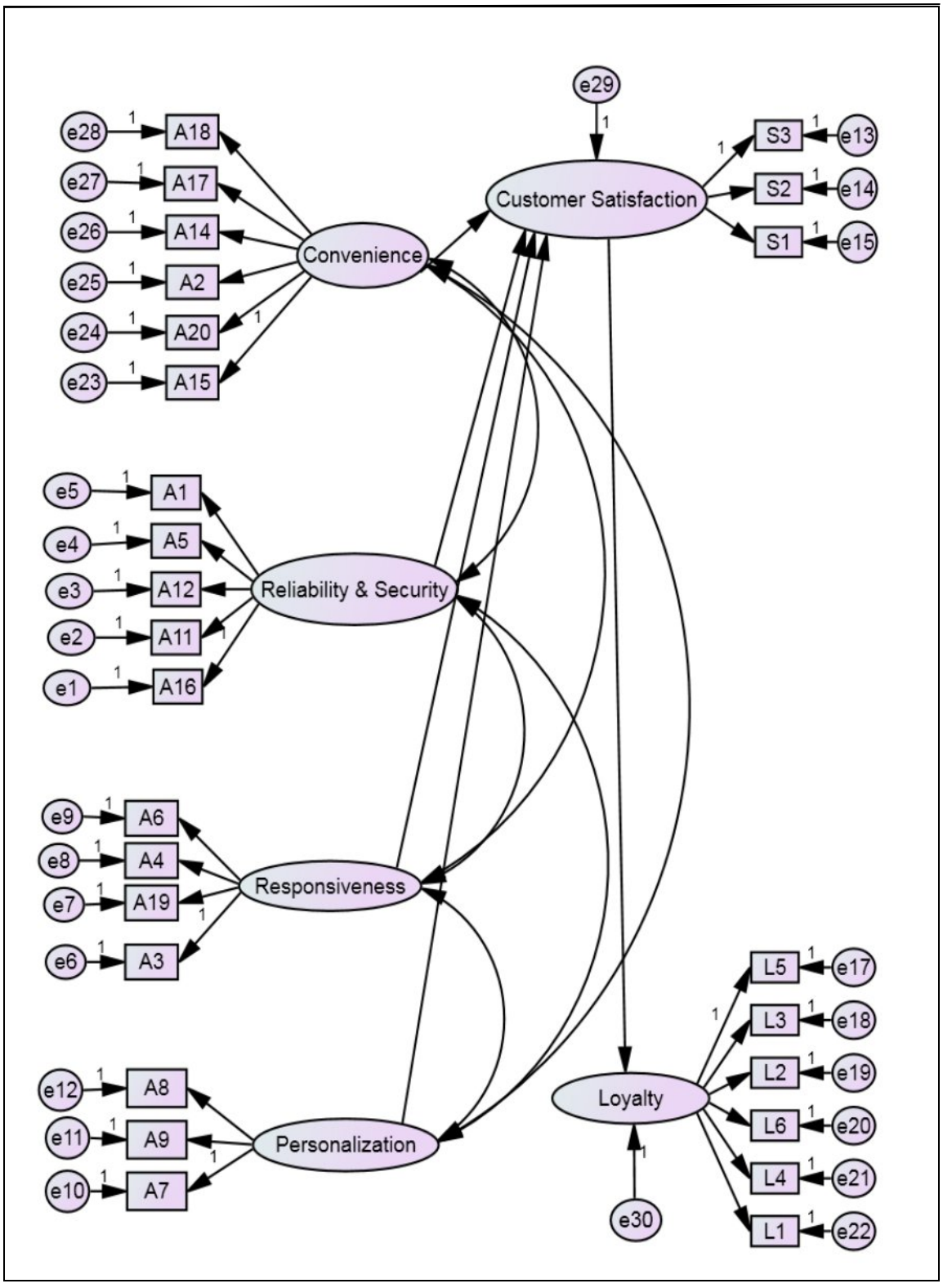


Figure 5.3: Model showing linkage between TBSSB service quality dimensions and Customer Loyalty through mediating Customer Satisfaction (fully mediated model)

Table 5.8 represents the results of structural equation analysis.

Table 5.8: Results of structural equation analysis

Relation between Constructs	Original Structural model (partially mediated)	Fully mediated model
Covenience ⟶ Satisfaction	0.185 * *	0.185 * *
Reliability & Security⟶ Satisfaction	Not significant	Not significant
Responsiveness ⟶ Satisfaction	Not significant	Not significant
Personalization ⟶ Satisfaction	0.524* * *	0.597* * *
Convenience ⟶ Loyalty	Not significant	Not applicable
Reliability & Security ⟶ Loyalty	Not significant	Not applicable
Responsiveness ⟶ Loyalty	Not significant	Not applicable
Personalization ⟶ Loyalty	0.353 * * *	Not applicable
Satisfaction ⟶ Loyalty	0.471* * *	0.792* * *
Chi-square	457.748	457.801
degrees of freedom(df)	309	312
Chi-square/df (cmin/df)	1.481	1.467
CFI	0.960	0.960
Significant Paths	44.44%	60%
PNFI	0.780	0.788
R^2 (Customer Satisfaction)	0.412	0.509
R^2 (Customer Loyalty)	0.574	0.627

* * Implies significant at $p < 0.05$; * * *Implies significant at $p < 0.001$

As shown in the table 5.8, CFI value of both the models was equal. Four out of nine path coefficients of original structural model paths were significant at $p < 0.05$, resulting in significant path percentage of 44.4 percent. On the other hand, three out of five path coefficients of the fully mediated model's paths were significant at $p < 0.5$, which means significant path percentage of 60 percent. R^2 (squared multiple correlations) explains variance in the outcomes of the factor. Comparison of R^2 values

made clear that the fully mediated model explained variance in customer satisfaction as well as customer loyalty better than the original structural model. Moreover, the fully mediated model had a higher PNFI value than the original structural model. Though the difference between the two models was not huge, but the fully mediated model explained relationships in the model in better and logical manner. Thus H4 was supported. Hence, customer satisfaction mediated the relationship between TBSSB service quality and customer loyalty.

5.3 EFFECT OF DEMOGRAPHIC VARIABLES ON TBSSB SERVICE QUALITY, CUSTOMER SATISFACTION & LOYALTY DIMENSIONS

The t-test and Analysis of Variance (ANOVA) were used to find whether there is any significant difference in TBSSB service quality, customer satisfaction, and loyalty dimensions on the basis of demographic variables. The demographic variables covered under the study were gender, age, highest completed education, occupation and annual income. To examine the effect of demographic variables, significance value of 0.05 is used in this study. In case a significant difference was found in any factor on applying ANOVA test results, Post hoc analysis was carried out for detailed analysis.

The t-test and ANOVA assume that the populations from which the samples are drawn have equal variances. Levene's test is generally used to test the homogeneity of variance. If significance value corresponding to Levene's statistic is higher than 0.05, then the samples are considered to be drawn from the populations having equal variance. Following hypotheses were tested to study the effect of demographic variables

H5: TBSSB Service quality dimensions vary across demographic characteristics of customers (Gender, Age, Highest completed qualification, Occupation, Annual Income)

H6: Customer satisfaction varies across demographic characteristics of customers (Gender, Age, Highest completed qualification, Occupation, Annual Income)

H7: Customer loyalty varies across demographic characteristics of customers (Gender, Age, Highest completed qualification, Occupation, Annual Income)

The sub-hypotheses corresponding to these hypotheses are tested in this section

Effect of Gender

To analyze the significant difference in TBSSB service quality dimensions on the basis of gender, following four sub-hypotheses are tested

H5.1: There is a significant difference in perception of Convenience dimension between males and females
H5.2: There is a significant difference in perception of Reliability and Security dimension between males and females
H5.3: There is a significant difference in perception of Responsiveness dimension between males and females
H5.4: There is a significant difference in perception of Personalization dimension between males and females

As shown in table 5.9, the results of the t-test indicate that there was no significant difference in all four TBSSB service quality dimensions (Convenience, Reliability and Security, Responsiveness and Personalization) by gender at the significance level of 0.05. Therefore, H5.1, H5.2, H5.3, and H5.4 were not supported.

Table 5.9: Effect of Gender on TBSSB service quality dimensions (t test results)

	Levene's Test for Equality of Variances		**t-test results**	
TBSSB SQ Dimension	**Levene Statistic**	**Sig.**	**t value**	**Sig.**
Convenience	0.186	0.666	-0.977	0.33
Reliability and Security	1.764	0.185	-0.729	0.47
Responsiveness	0.823	0.365	-0.299	0.77
Personalization	0.966	0.326	0.612	0.54

To test the significant difference in customer satisfaction and loyalty dimensions on the basis of gender, following two sub-hypothesis are tested

H6.1: There is a significant difference in customer satisfaction dimension between males and females
H7.1: There is a significant difference in customer loyalty dimension between males and females

As per Table 5.10, the results of t-test pointed out that there was no significant difference in customer satisfaction and loyalty dimension by the demographic variable gender at a significance value of 0.05. Consequently, H6.1 and H7.1 were not supported.

Table 5.10: Effect of Gender on Customer Satisfaction and Loyalty (t-test results)

	Levene's Test for Equality of Variances		**t-test results**	
Dimension	**Levene Statistic**	**Sig.**	**t value**	**Sig.**
Satisfaction	1.885	0.171	0.341	0.73
Loyalty	1.176	0.279	0.686	0.49

Effect of Age

As for age, education, occupation and income demographic variables, the number of categories were more than two, therefore one way ANOVA was used to analyze the significant differences in TBSSB service quality, customer satisfaction, and loyalty dimensions. Various ANOVA results are presented in appendix V.

To analyze the difference in TBSSB service quality dimensions on the basis of age, following four sub-hypothesis were tested

H5.5: There is a significant difference in perception of Convenience dimension across age groups

H5.6: There is a significant difference in perception of Reliability and Security dimension across age groups

H5.7: There is a significant difference in perception of Responsiveness dimension across age groups

H5.8: There is a significant difference in perception of Personalization dimension across age groups

As per Table 5.11, the results indicated that the significance value of dimensions Convenience, Responsiveness, and Personalization dimension was higher than 0.05. Only for the Reliability & Security dimension, the p-value was less than 0.05, which means F value of Reliability dimension was significant. Thus H5.6 was supported and H5.5, H5.7, and H5.8 were not supported.

Table 5.11: Effect of Age on TBSSB service quality dimensions (ANOVA results)

	Levene's Test for Equality of Variances		**ANOVA test results**	
TBSSB SQ Dimension	**Levene statistic**	**Sig.**	**F value**	**Sig.**
Convenience	0.457	0.712	2.207	0.087
Reliability and Security	2.044	0.107	2.645	0.049
Responsiveness	0.551	0.648	1.692	0.168
Personalization	1.433	0.233	1.911	0.127

For further analysis, Post hoc analysis of Reliability & Security dimension was carried out. Post hoc analysis in table 5.12 revealed that respondents of age group “18-25 years” differ significantly from the respondents having age more than 45 years on Reliability and Security dimension. The positive mean difference indicates that respondents in age group “18-25 years” considered TBSSB services as more reliable

and secure as compared to respondents having age more than 45 years. However, there was no significant difference between age group "18-up to 25 years" & "more than 25-up to 35 years" and age group "18-up to 25 years" & "More than 35- up to 45 years".

Table 5.12: Post hoc analysis of Age on Reliability & Security dimension

(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
18- up to 25 yrs	More than 25 - up to 35 yrs	0.18687	0.11105	0.334	-0.0996	0.4733
	More than 35- up to 45 yrs	0.20368	0.11654	0.3	-0.097	0.5043
	More than 45 yrs	.43018*	0.15704	0.032	0.0251	0.8353
More than 25 -up to 35 yrs	18- up to 25 yrs	-0.18687	0.11105	0.334	-0.4733	0.0996
	More than 35- up to 45 yrs	0.01681	0.10051	0.998	-0.2425	0.2761
	More than 45 yrs	0.24331	0.14554	0.34	-0.1321	0.6187
More than 35- up to 45 yrs	18- up to 25 yrs	-0.20368	0.11654	0.3	-0.5043	0.097
	More than 25 - up to 35 yrs	-0.01681	0.10051	0.998	-0.2761	0.2425
	More than 45 yrs	0.2265	0.14977	0.431	-0.1598	0.6128
More than 45 yrs	18- up to 25 yrs	-.43018*	0.15704	0.032	-0.8353	-0.0251
	More than 25 - up to 35 yrs	-0.24331	0.14554	0.34	-0.6187	0.1321
	More than 35- up to 45 yrs	-0.2265	0.14977	0.431	-0.6128	0.1598

*. The mean difference is significant at the 0.05 level.

To test the difference in customer satisfaction and loyalty dimensions on the basis of gender, following two sub-hypothesis are tested

H6.2: There is a significant difference in satisfaction dimension across age groups
H7.2: There is a significant difference in customer loyalty dimension across age groups

As shown in table 5.13, there was a significant difference in the measure of customer satisfaction in terms of age at significance value of 0.05. But there was no significant difference in customer loyalty dimension across age groups. As a result, H6.2 was supported and H7.2 was not supported.

Table 5.13: Effect of Age on Customer Satisfaction and Loyalty (ANOVA results)

	Levene's Test for Equality of Variances		**ANOVA test results**	
Dimension	**Levene statistic**	**Sig.**	**F value**	**Sig.**
Satisfaction	0.397	0.755	4.782	0.003
Loyalty	0.66	0.577	1.759	0.154

Post hoc analysis in table 5.14 revealed that respondents of age group “18-25 years” differ significantly from the respondents of age group “more than 35 years- up to 45 years” on customer satisfaction dimension. Similarly, there was a significant difference between age group “more than 25 years- up to 35 years” and “more than 35 years- up to 45 years” as far as customer satisfaction with the bank services is concerned. “18-25 years” respondents were more satisfied than respondents in age group “more than 35 years- up to 45 years”. Also respondents in age group “more than 25 years- up to 35 years” were having higher satisfaction level as compared to customers in age group “more than 35 years- up to 45 years”.

Table 5.14: Post hoc analysis of Age on Customer Satisfaction

(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
18- up to 25 yrs	More than 25 -up to 35 yrs	0.0147	0.07339	0.997	-0.1746	0.204
	More than 35- up to 45 yrs	.23792*	0.07701	0.011	0.0393	0.4366
	More than 45 yrs	0.1318	0.10378	0.583	-0.1359	0.3995
More than 25 -up to 35 yrs	18- up to 25 yrs	-0.0147	0.07339	0.997	-0.204	0.1746
	More than 35- up to 45 yrs	.22322*	0.06642	0.005	0.0519	0.3945
	More than 45 yrs	0.1171	0.09618	0.616	-0.131	0.3652
More than 35-up to 45 yrs	18- up to 25 yrs	-.23792*	0.07701	0.011	-0.4366	-0.0393
	More than 25 -up to 35 yrs	-.22322*	0.06642	0.005	-0.3945	-0.0519
	More than 45 yrs	-0.10612	0.09897	0.707	-0.3614	0.1492
More than 45 yrs	18- up to 25 yrs	-0.1318	0.10378	0.583	-0.3995	0.1359
	More than 25 -up to 35 yrs	-0.1171	0.09618	0.616	-0.3652	0.131
	More than 35- up to 45 yrs	0.10612	0.09897	0.707	-0.1492	0.3614

*. The mean difference is significant at the 0.05 level.

Highest completed education

Four sub-hypothesis are tested to find the difference in TBSSB service quality dimensions on the basis of highest completed education

H5.9: There is a significant difference in perception of Convenience dimension across highest completed education levels

H5.10: There is a significant difference in perception of Reliability and Security dimension across highest completed education levels

H5.11: There is a significant difference in perception of Responsiveness dimension across highest completed education levels

H5.12: There is a significant difference in perception of Personalization dimension across highest completed education levels

When ANOVA test was applied to TBSSB service quality dimensions and highest completed education (table 5.15), the results demonstrated that there was a significant difference in Personalization dimension, as the p-value was less than 0.05. Other service quality dimensions were not influenced by highest completed education variable. Accordingly, H5.12 was supported and H5.9, H5.10, H5.11 were not supported.

Table 5.15: Effect of Education on TBSSB service quality dimensions (ANOVA results)

	Levene's Test for Equality of Variances		**ANOVA test results**	
TBSSB SQ Dimension	**Levene statistic**	**Sig.**	**F value**	**Sig.**
Convenience	0.611	0.544	0.043	0.958
Reliability and Security	1.065	0.346	0.177	0.838
Responsiveness	0.203	0.816	0.07	0.932
Personalization	0.882	0.415	3.131	0.045

Post hoc analysis in table 5.16 confirmed that respondents having highest completed education “Graduate” differ significantly from the respondents with education “Post Graduate and above” on Personalization dimension. Positive mean difference indicated that Graduate respondents considered TBSSB services as more personalized as compared to Post Graduate respondents.

Table 5.16: Post hoc analysis of Education on Personalization

(I) Education	(J) Education	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
12th or Below	Graduate	0.04473	0.10455	0.669	-0.1608	0.2502
	Post Graduate and above	0.20884	0.1127	0.065	-0.0127	0.4304
Graduate	12th or Below	-0.04473	0.10455	0.669	-0.2502	0.1608
	Post Graduate and above	.16411*	0.07102	0.021	0.0245	0.3037
Post Graduate and above	12th or Below	-0.20884	0.1127	0.065	-0.4304	0.0127
	Graduate	-.16411*	0.07102	0.021	-0.3037	-0.0245

*. The mean difference is significant at the 0.05 level.

To test the difference in customer satisfaction and loyalty dimensions on the basis of highest completed education, following two sub-hypothesis are tested

H6.3: There is a significant difference in satisfaction dimension across highest completed education levels

H7.3: There is a significant difference in loyalty dimension across highest completed education levels

Analysis of Variance illustrated that neither customer satisfaction nor loyalty differ significantly on the basis of highest completed education (table 5.17). Consequently, both H6.3 and H7.3 were not supported.

Table 5.17: Effect of Education on Customer Satisfaction and Loyalty (ANOVA results)

	Levene's Test for Equality of Variances		ANOVA test results	
Dimension	**Levene statistic**	**Sig.**	**F value**	**Sig.**
Satisfaction	0.569	0.567	0.134	0.875
Loyalty	0.039	0.962	0.437	0.646

Occupation

To test the difference in TBSSB service quality dimensions on the basis of occupation, following four sub-hypothesis are tested

H5.13: There is a significant difference in perception of Convenience dimension across Occupations
H5.14: There is a significant difference in perception of Reliability and Security dimension across Occupations
H5.15: There is a significant difference in perception of Responsiveness dimension across Occupations
H5.16: There is a significant difference in perception of Personalization dimension across Occupations

Results in table 5.18 indicated that none of the TBSSB service quality dimension differs significantly on the basis of occupation at a significance level of 5%. Therefore, H5.13, H5.14, H5.15, and H5.16 were not supported.

Table 5.18: Effect of Occupation on TBSSB service quality dimensions (ANOVA results)

	Levene's Test for Equality of Variances		ANOVA test results	
TBSSB SQ Dimension	**Levene statistic**	**Sig.**	**F value**	**Sig.**
Convenience	0.963	0.41	2.367	0.07
Reliability and Security	0.553	0.646	2.456	0.063
Responsiveness	1.322	0.267	1.498	0.214
Personalization	1.193	0.312	2.067	0.104

Two sub-hypothesis were tested to determine the difference in customer satisfaction and loyalty dimensions on the basis of occupation

H6.4: There is a significant difference in satisfaction dimension across Occupations

H7.4: There is a significant difference in customer loyalty dimension across Occupations

ANOVA test result in table 5.19 explained that neither customer satisfaction nor loyalty differ significantly on the basis of occupation. Consequently, H6.4 and H7.4 were not supported.

Table 5.19: Effect of Occupation on Customer Satisfaction and Loyalty (ANOVA results)

	Levene's Test for Equality of Variances		ANOVA test results	
Dimension	**Levene statistic**	**Sig.**	**F value**	**Sig.**
Satisfaction	0.973	0.405	0.447	0.720
Loyalty	0.178	0.911	0.440	0.724

Annual Income

To test the difference in TBSSB service quality dimensions on the basis of annual income, following four sub-hypothesis are tested

H5.17: There is a significant difference in perception of Convenience dimension across income groups
H5.18: There is a significant difference in perception of Reliability and Security dimension across income groups
H5.19: There is a significant difference in perception of Responsiveness dimension across income groups
H5.20: There is a significant difference in perception of Personalization dimension across income groups

As shown in table 5.20, none of the TBSSB service quality dimension differed significantly on the basis of demographic variable annual income. As a result, H5.17, H5.18, H5.19, and H5.20 were not supported.

Table 5.20: Effect of Income on TBSSB service quality dimensions (ANOVA results)

	Levene's Test for Equality of Variances		ANOVA test results	
TBSSB SQ Dimension	**Levene statistic**	**Sig.**	**F value**	**Sig.**
Convenience	1.202	0.309	1.172	0.320
Reliability and Security	0.605	0.612	2.001	0.113
Responsiveness	1.089	0.353	0.201	0.896
Personalization	1.484	0.218	2.198	0.088

To test the difference in customer satisfaction and loyalty dimensions on the basis of annual income, following two sub-hypothesis were tested

H6.5: There is a significant difference in satisfaction dimension across income groups

H7.5: There is a significant difference in loyalty dimension across income groups

ANOVA test result in table 5.21 illustrated that neither customer satisfaction nor loyalty differ significantly on the basis of annual income. Consequently, H6.5 and H7.5 were not supported.

Table 5.21: Effect of Income on Customer Satisfaction and Loyalty (ANOVA results)

	Levene's Test for Equality of Variances		ANOVA test results	
Dimension	**Levene statistic**	**Sig.**	**F value**	**Sig.**
Satisfaction	0.310	0.818	1.174	0.319
Loyalty	0.653	0.582	0.760	0.517

5.4 CONCLUSION

This chapter investigated the relationship between TBSSB service quality, customer satisfaction, and loyalty dimensions. The paper also examined the mediating role of customer satisfaction in the relationship. CFA was used to develop and validate the six-factor measurement model consisting of four dimensions of TBSSB service quality (Convenience, Reliability & Security, Responsiveness, and Personalization) along with customer satisfaction and loyalty dimensions. The two structural models (Partially and Fully mediated model) were also developed and compared in this chapter. AMOS 20.0 was used to investigate the relationship between dimensions using SEM. It was found that Convenience and personalization have a significant effect on customer satisfaction, and Personalization and customer satisfaction have a significant effect on loyalty. Customer satisfaction was also confirmed as a mediating factor. The chapter also presented the t-test and Analysis of Variance (ANOVA) tests to understand the effect of demographic variables on TBSSB service quality,

customer satisfaction, and loyalty dimensions. The results of t-test illustrated that none of the TBSSB service quality, customer satisfaction, and customer loyalty dimensions differ significantly on the basis of gender. However, ANOVA results confirmed that there was a significant difference in perception of 'Reliability & Security' and customer satisfaction dimensions across age groups. Also, there was a significant difference in perception of Personalization dimension across highest completed education levels.

CHAPTER VI

DATA ANALYSIS PART III: QUANTITATIVE EVALUATION OF TECHNOLOGY BASED SELF SERVICE BANKING SERVICE QUALITY USING GRAPH THEORETIC APPROACH

6.1 INTRODUCTION

This chapter covers the objective related to quantifying the effect of TBSSB service quality attributes in terms of the single numerical index. Banks invest a large sum of money for offering TBSSB services. So there must be a method that can assist banks to quantify TBSSB service quality in a single numerical value, which may be used by the banks for the purpose of self assessment and for doing comparisons with other banks. In this chapter, a process to quantify the overall effect of TBSSB service quality attributes in terms of a numerical index is discussed. For quantification purpose, the importance level of the attributes affecting TBSSB service quality was measured by conducting a survey. The TBSSB service quality index was computed by using fuzzy along with graph theoretic approach. The minimum and maximum values of TBSSB index were also computed.

6.2 GRAPH THEORETIC APPROACH

Graph theoretic approach (GTA) is a multi-disciplinary systematic and logical approach to build and analyze systems (Gandhi and Agrawal, 1996). Graph theoretic and matrix model consists of digraph representation, matrix representation and permanent representation (Grover et al., 2006). GTA technique is used to calculate single numerical index by evaluating critical attributes related to a problem. Researchers have applied graph theoretic approach in different areas as given in table 6.1.

Table 6.1: A few areas in which graph theory has been employed

S. No.	Paper Title	Researcher (s)
1	'FMEA – a digraph and matrix approach'	Gandhi and Agrawal (1992)
2	'Selection of automobile vehicle by evaluation through graph theoretical methodology'	Venkatasamy and Agrawal (1996)
3	'A digraph approach to TQM evaluation of an industry'	Grover et al. (2004)
4	'Graph theory and matrix approach for performance evaluation of TQM in Indian industries'	Kulkarni (2005)
5	'A material selection model using graph theory and matrix approach'	Rao (2006)
6	'Human resource performance index in TQM environment'	Grover et al.(2006)
7	'Selection, identification and comparison of industrial robots using digraph and matrix methods'	Rao and Padmanabhan (2006)
8	'Selection of power plants by evaluation and comparison using graph theoretical methodology'	Garg et al. (2006)
9	'Quantification of risk mitigation environment of supply chains using graph theory and matrix methods'	Faisal et al. (2007)
10	'Graph models and mathematical programming in biochemical network analysis and metabolic engineering design'	Lanzeni et al. (2008)
11	'Critical factors of website performance: a graph theoretic approach'	Saha and Grover (2011)
12	'A fuzzy multi attribute decision making approach for evaluating effectiveness of advanced manufacturing technology – in Indian context'	Goyal and Grover (2013)

6.2.1 Digraph

A digraph is a graph with directed edges. It is used to represent the attributes (variables) and their interdependency within the system. A digraph portrays the attributes through its nodes and interdependency of the attributes is depicted by the edges connecting the nodes. The number of nodes in the digraph represents the total number of attributes considered for evaluation. A node V_i represents the *i*th attribute and the edges show the relative importance between the attributes. In the digraph method, if a node 'V*i*' exhibits relative importance over node 'V*j*' during the evaluation, then a directed edge is drawn from node 'V*i*' to node 'V*j*' (i.e., v_{ij}). But, if a node 'V*j*' exhibits relative importance over node 'V*i*' then a directed edge is drawn from node 'V*j*' to node 'V*i*' (i.e., v_{ji}). Figure 6.1 shows a digraph having 6 attributes (nodes) connected through edges.

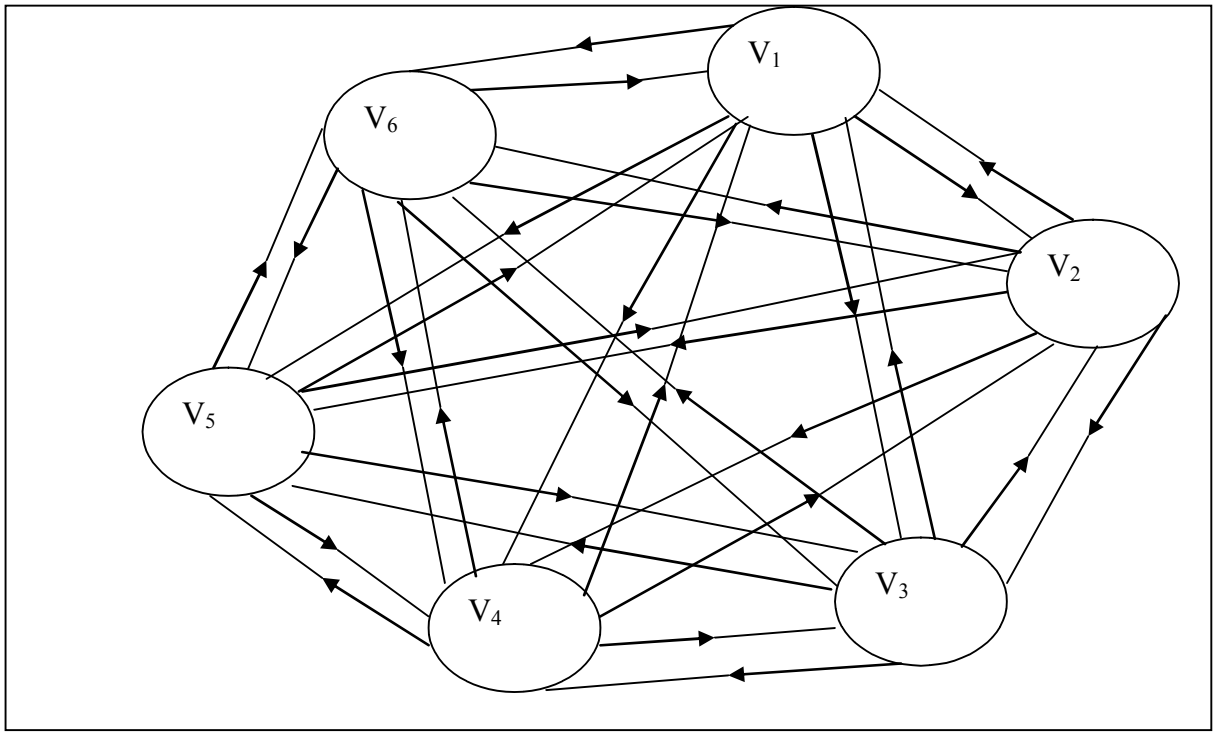


Figure 6.1: Digraph representing six attributes and their interdependency

6.2.2 Matrix Representation of a Digraph

For mathematical calculations, the digraph is represented in the matrix form. The matrix represents all the attributes and their interrelations. Matrix 6.1 is an example of 6 × 6 matrix and considers all the attributes (V*i*) and their relative importance (i.e. v_{ij}) with respect to each other in the system.

Matrix 6.1: Matrix representation of a six attributes digraph

Attribute	1	2	3	4	5	6
1	V_1	v_{12}	v_{13}	v_{14}	v_{15}	v_{16}
2	v_{21}	V_2	v_{23}	v_{24}	v_{25}	v_{26}
3	v_{31}	v_{32}	V_3	v_{34}	v_{35}	v_{36}
4	v_{41}	v_{42}	v_{43}	V_4	v_{45}	v_{46}
5	v_{51}	v_{52}	v_{53}	v_{54}	V_5	v_{56}
6	v_{61}	v_{62}	v_{63}	v_{64}	v_{65}	V_6

In the matrix, 'Vi' symbolizes the *i*th evaluation attribute representing the node 'Vi'. v_{ij} represents the relative importance of the attributes and is represented by the edge drawn from 'V*i*' to 'V*j*' in the digraph.

6.2.3 Permanent Function of the Attribute Matrix

The permanent function of the attribute matrix is represented as 'Per A'. The method used for computing the permanent function is similar to calculating the determinant of the matrix but by keeping all the signs positive. This provides complete information about the system and no information is lost. Equation (6.1) shows the sigma form of the permanent function for six attributes matrix. Depending upon the number of attributes, it can be extended further.

$$\text{Per A} = \prod_{i=1}^{6} V_i + \Sigma_i\Sigma_j\Sigma_k\Sigma_l\Sigma_m\Sigma_n\,(v_{ij}v_{ji})V_kV_lV_mV_n$$

$$+ \Sigma_i\Sigma_j\Sigma_k\Sigma_l\Sigma_m\Sigma_n\,(v_{ij}v_{jk}v_{ki} + v_{ik}v_{kj}v_{ji})V_lV_mV_n$$

$$+ [(\Sigma_i\Sigma_j\Sigma_k\Sigma_l\Sigma_m\Sigma_n\,(v_{ij}v_{ji})(v_{kl}v_{lk})V_mV_n$$

$$+ \Sigma_i\Sigma_j\Sigma_k\Sigma_l\Sigma_m\Sigma_n\,(v_{ij}v_{jk}v_{kl}v_{li} + v_{il}v_{lk}v_{kj}v_{ji})V_mV_n)]$$

$$+ [\Sigma_i\Sigma_j\Sigma_k\Sigma_l\Sigma_m\Sigma_n(v_{ij}v_{ji})(v_{kl}v_{lm}v_{mk} + v_{km}v_{ml}v_{lk})V_n$$

$$+ \Sigma_i\Sigma_j\Sigma_k\Sigma_l\Sigma_m\Sigma_n(v_{ij}v_{jk}v_{kl}v_{lm}v_{mi} + v_{im}v_{ml}v_{lk}v_{kj}v_{ji})V_n]$$

$$+ [\Sigma_i\Sigma_j\Sigma_k\Sigma_l\Sigma_m\Sigma_n(v_{ij}v_{ji})\,(v_{kl}v_{lm}v_{mn}v_{nk} + v_{kn}v_{nm}v_{ml}v_{lk})$$

$$+ \Sigma_i\Sigma_j\Sigma_k\Sigma_l\Sigma_m\Sigma_n(v_{ij}v_{jk}v_{ki})\,(v_{lm}v_{mn}v_{nl})$$

$$+ \Sigma_i\Sigma_j\Sigma_k\Sigma_l\Sigma_m\Sigma_n(v_{ij}v_{ji})\,(v_{kl}v_{lk})\,(v_{mn}\,v_{nm})$$

$$+ \Sigma_i\Sigma_j\Sigma_k\Sigma_l\Sigma_m\Sigma_n\,(v_{ij}\,v_{jk}v_{kl}v_{lm}v_{mn}v_{ni} + v_{in}v_{nm}v_{ml}v_{lk}v_{kj}v_{ji})] \qquad (6.1)$$

In equation (6.1), in total (n + 1) i.e. (6 + 1) groups were made. These groups represented the measure of attributes and their relative importance. So, in total seven groups were made, and their importance is discussed below. The first group represented the measures of inheritance level of implementation factors. The second group was absent as there is no self-loop in the digraph. The third group contained interrelationships between the subfactors (i.e., $v_{ij}v_{ji}$) and measures of four remaining factors. The fourth group represented a set of three factors relative importance loop and a measure of three factors. The fifth group constituted of two subgroups. The terms of the first subgroup represent the relative importance between the two factors and the measure of two implementation factors. The second subgroup represented the relative importance among the four factors and the measure of the two implementation factors. The sixth group was having two subgroups. The first sub-group was a set of two factor's interdependence, i.e., $v_{ij}v_{ji}$, a set of three factor interdependence, i.e., $v_{kl}v_{lm}v_{mk}$ or its pair $v_{km}v_{ml}v_{lk}$ and measure of remaining implementation factor. The second sub-group was a set of five implementation factors interdependence, i.e., $v_{ij}v_{jk}v_{kl}v_{lm}v_{mi}$ or its pair $v_{im}v_{ml}v_{lk}v_{kj}v_{ji}$ and measure of remaining implementation factor. Similarly, seventh group analyses sub-grouping in terms of a set of two and four factor interdependence, 2 – three factor interdependence, 3 – two factor interdependence and six implementation factors interdependence.

Permanent function ‘Per A’ defined in the equation (6.1) consists of all the attributes and their relative importance. The numerical value of the permanent function represents the system in terms of a single numerical index.

6.3 MEASUREMENT USING FUZZY NUMBERS

We usually hear terms like ‘Not very good’, ‘very likely’, and ‘extremely important’ in our everyday life. These terms represent a human opinion. As per Kahraman et al. (2007), such opinion from humans is usually subjective and vague. Fuzzy set theory, introduced by Zadeh (1965) may be used to tackle the subjectivity and vagueness of human opinion, particularly linguistic terms since it can represent vague expressions such as “usually,” “fair” and “very satisfied,” which are considered as the natural representation of respondents’ preference and judgment. Bellman and Zadeh (1970) were the first to relate fuzzy set theory to decision-making problems. With time many researchers have applied fuzzy set theory to deal with uncertain fuzzy problems (Zimmermann, 1991; Yager, 1977). With such an idea in mind, this study used fuzzy decision-making theory, considering the possible fuzzy subjective judgment of the respondents at the time of evaluating the importance level of TBSSB service quality attributes.

Rao (2012) illustrated the conversion of the linguistic terms into triangular fuzzy numbers and then the fuzzy numbers into crisp scores using the method proposed by Chen and Hwang (1992) on various scales including 5 point, 7 point and 11 point scale. Eleven point scale was used in this study to represent the attributes. The advantage of using triangular fuzzy numbers is their computational simplicity. Figure 6.2 shows the linguistic terms to fuzzy numbers conversion on the 11 point scale.

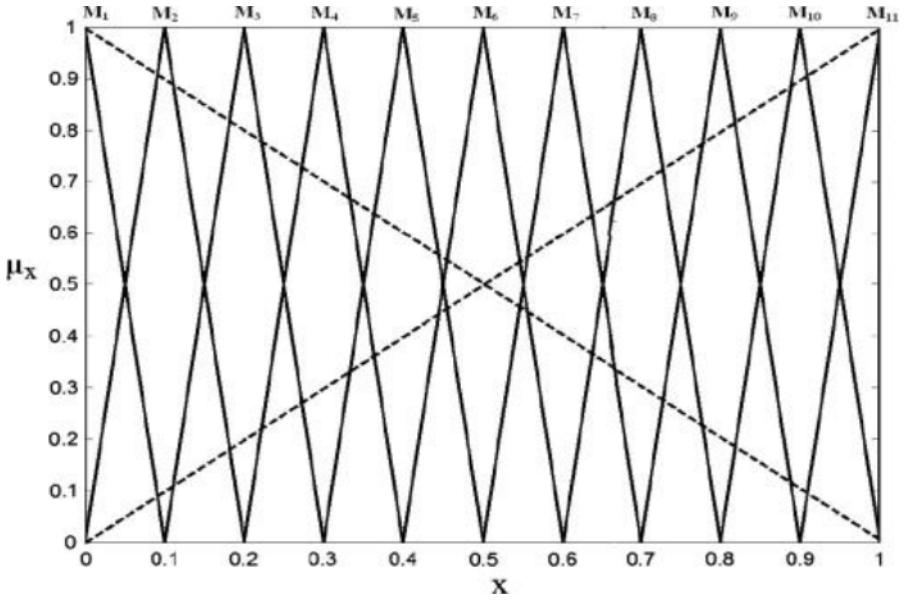


Figure 6.2: Linguistic terms to fuzzy numbers conversion (11-point scale)

Source: Chen and Hwang (1992)

The crisp score of a fuzzy number 'M' is obtained as follows:

$$\mu_{\max}(x) = \begin{cases} x, & 0 \le x \le 1 \\ 0, & \text{otherwise} \end{cases} \tag{6.2}$$

$$\mu_{\min}(x) = \begin{cases} 1-x, & 0 \le x \le 1 \\ 0, & \text{otherwise} \end{cases} \tag{6.3}$$

The fuzzy max and fuzzy min of fuzzy numbers were defined in a manner such that absolute locations of fuzzy numbers can be automatically incorporated in the comparison cases. The left score of each fuzzy number 'Mi' is defined as

$$\mu_L(M_i) = \text{Sup}_X\left[\mu_{\min}(x) \wedge \mu_{M_i}(x)\right] \tag{6.4}$$

The left score is a unique, crisp, real number in (0, 1). It is the maximum membership value of the intersection of fuzzy number Mi and the fuzzy min. The right score may be obtained in a similar manner:

$$\mu_R(M_i) = \text{Sup}_X\left[\mu_{\max}(x) \wedge \mu_{Mi}(x)\right] \tag{6.5}$$

Again, the right score is a crisp number (0, 1). Given the left and right scores, the total score of a fuzzy number Mi is defined as:

$$\mu_T(M_i) = [\mu_R(M_i) + 1 - \mu_L(M_i)]/2 \quad (6.6)$$

By using the equations (6.2) to (6.6), the crisp score (total score) can be computed. Linguistic terms, Fuzzy Numbers and Crisp Scores for 11-point scale as calculated in Rao (2012) are shown in table 6.2.

Table 6.2: Conversion of linguistic terms into crisp scores (11-point scale)

S.No.	Linguistic term	Fuzzy number	Crisp score
1	Exceptionally low	M1(0,0,0.1)	0.0455
2	Extremely low	M2(0,0.1,0.2)	0.1364
3	Very low	M3(0.1,0.2,0..3)	0.2273
4	Low	M4(0.2,0.3,0.4)	0.3182
5	Below average	M5(0.3,0.4,0.5)	0.4091
6	Average	M6(0.4,0.5,0.6)	0.5000
7	Above average	M7(0.5,0.6,0.7)	0.5909
8	High	M8(0.6,0.7,0.8)	0.6818
9	Very high	M9(0.7,0.8,0.9)	0.7727
10	Extremely high	M10(0.8,0.9,1)	0.8636
11	Exceptionally high	M11(0.9,1,1)	0.9545

Source: Rao (2012)

The relative importance among the attributes can also be described using the same 11-point scale as shown in table 6.3.

Table 6.3: Conversion of linguistic terms into fuzzy scores
(Relative importance value on an 11-point scale)

Linguistic term	Fuzzy number	Crisp score
One attribute is exceptionally less important than the other	M1(0,0,0.1)	0.0455
One attribute is extremely less important than the other	M2(0,0.1,0.2)	0.1364
One attribute is very less important than the other	M3(0.1,0.2,0..3)	0.2273
One attribute is less important than the other	M4(0.2,0.3,0.4)	0.3182
One attribute is slightly less important than the other	M5(0.3,0.4,0.5)	0.4091
Two attributes are equally important than the other	M6(0.4,0.5,0.6)	0.5000
One attribute is slightly more important than the other	M7(0.5,0.6,0.7)	0.5909
One attribute is more important than the other	M8(0.6,0.7,0.8)	0.6818
One attribute is much more important than the other	M9(0.7,0.8,0.9)	0.7727
One attribute is extremely more important than the other	M10(0.8,0.9,1)	0.8636
One attribute is exceptionally more important than the other	M11(0.9,1,1)	0.9545

Source: Rao (2012)

Appropriate values of attributes and interrelationships among the attributes can be chosen from tables 6.2 and 6.3. Using these values a system may be represented in matrix form, which can be used for computing the value of the permanent function.

6.4 METHODOLOGY FOR COMPUTING TBSSB INDEX

Based on the study of Goyal and Grover (2013), the methodology for computing TBSSB index using graph theory can be summarized in the following five steps

Step I: To identify and rank the various attributes that affect the service quality in TBSSB system.

Step II: To establish the relative importance of the attributes.

Step III: To develop a digraph of the attributes depending upon their interdependency.

Step IV: To develop a permanent function matrix on the basis of a digraph.

Step V: To calculate the permanent function (index number) of the TBSSB system by using the values of the evaluation measures and their interdependency.

6.5 ILLUSTRATION

The illustration of above methodology is given below

Step I: Identifying and ranking of the various attributes affecting the service quality in TBSSB system

Data were collected from 414 respondents to find out importance level of TBSSB attributes using an 11-point scale ranging from exceptionally low to exceptionally high. These items are discussed under Questionnaire Design in chapter III. Although the level of importance data were collected corresponding to all the twenty TBSSB attributes but two variables which were rejected at the factor analysis stage were not considered for computing TBSSB index. The attributes used for measuring the importance level TBSSB service quality is shown in table 6.4.

Table 6.4: List of attributes

No.	Attribute
V1	Security that customer personal information will not be shared with the third party
V2	Guiding customers to solve problem, in case it occurs
V3	Conducting error free transaction every time
V4	Security in doing financial transaction
V5	Providing precise and sufficient information as per customer need
V6	Providing consistent services
V7	24x7 service availability
V8	Giving prompt responses to customer request
V9	Ease of use
V10	Providing customer feedback services
V11	Giving directions to new users
V12	Having adequate menu options for everyday banking needs
V13	Acknowledging customer by name
V14	Having security features and customers awareness of the same
V15	Consuming less time as compared to branch banking
V16	Giving more freedom of mobility to customers
V17	Offering product according to customer preferences
V18	Having user-friendly system

The eighteen attributes were then ranked on the basis of the mean values of an importance level. Mean values and ranking of the attributes are shown in table 6.5. Attribute V4 had the highest mean value of 10.39 on the importance scale, so highest rank 18 was assigned to V4. Therefore, this attribute represents exceptionally high attribute. Attribute V10 had the lowest mean value of 4.15, so lowest rank 1 was assigned to V10. Correspondingly, V10 represented exceptionally low attribute. For other attributes in-between the highest and lowest rank, the range was decided and attributes falling within a given range were assigned a particular linguistic term as shown in table 6.5.

Table 6.5: Mean values, rank and importance level of various attributes

Variables	Mean	Ranking	Importance Level (on a scale of 11)
V4	10.39	18	Exceptionally high
V3	9.85	17	Extremely high
V9	9.75	16	Extremely high
V7	9.20	15	Very high
V15	8.88	14	High
V1	8.58	13	High
V2	8.51	12	High
V14	7.89	11	Above average
V6	7.75	10	Above average
V18	7.67	9	Above average
V12	7.47	8	Average
V8	7.32	7	Average
V11	7.24	6	Average
V5	6.61	5	Below average
V17	6.16	4	Low
V16	5.25	3	Very low
V13	4.65	2	Extremely low
V10	4.15	1	Exceptionally low

Using table 6.2, attributes of table 6.5 were assigned crisp score as shown in table 6.6

Table 6.6: Importance level and corresponding crisp score of attributes

Variable	Importance Level	Crisp Values
V4	Exceptionally high	0.9545
V3	Extremely high	0.8636
V9	Extremely high	0.8636
V7	Very high	0.7727
V15	High	0.6818
V1	High	0.6818
V2	High	0.6818
V14	Above average	0.5909
V6	Above average	0.5909
V18	Above average	0.5909
V12	Average	0.5000
V8	Average	0.5000
V11	Average	0.5000
V5	Below average	0.4091
V17	Low	0.3182
V16	Very low	0.2273
V13	Extremely low	0.1364
V10	Exceptionally low	0.0455

Step II: Establishing the relative importance among the attributes

The relative importance of the attributes was established on the basis of their ranking (Goyal and Grover, 2013). To compare the two attributes, their corresponding mean values were subtracted. For example, to compare V1 with V2, their corresponding means (8.58, 8.51) were subtracted, which gave 0.07 (positive sign indicates that the first attribute is more important than the second one). Similarly, the difference of means was calculated for each pair as shown in table 6.7. The difference of means presented the extent to which one attribute was important than the other.

Table 6.7: Pairwise difference of mean between attributes

Var	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V16	V17	V18
V1	0	0.07	-1.27	-1.81	1.97	0.83	-0.62	1.26	-1.17	4.43	1.34	1.11	3.93	0.69	-0.30	3.33	2.42	0.91
V2	-0.07	0	-1.34	-1.88	1.90	0.76	-0.69	1.19	-1.24	4.36	1.27	1.04	3.86	0.62	-0.37	3.26	2.35	0.84
V3	1.27	1.34	0	-0.54	3.24	2.10	0.65	2.53	0.10	5.70	2.61	2.38	5.20	1.96	0.97	4.60	3.69	2.18
V4	1.81	1.88	0.54	0	3.78	2.64	1.19	3.07	0.64	6.23	3.15	2.92	5.74	2.50	1.51	5.14	4.23	2.71
V5	-1.97	-1.90	-3.24	-3.78	0	-1.14	-2.59	-0.71	-3.14	2.46	-0.63	-0.86	1.96	-1.28	-2.27	1.36	0.45	-1.06
V6	-0.83	-0.76	-2.10	-2.64	1.14	0	-1.45	0.43	-2.00	3.60	0.51	0.28	3.10	-0.14	-1.13	2.50	1.59	0.08
V7	0.62	0.69	-0.65	-1.19	2.59	1.45	0	1.88	-0.55	5.05	1.96	1.73	4.55	1.31	0.32	3.95	3.04	1.53
V8	-1.26	-1.19	-2.53	-3.07	0.71	-0.43	-1.88	0	-2.43	3.17	0.08	-0.15	2.67	-0.57	-1.56	2.07	1.16	-0.35
V9	1.17	1.24	-0.10	-0.64	3.14	2.00	0.55	2.43	0	5.60	2.51	2.28	5.10	1.86	0.87	4.50	3.59	2.08
V10	-4.43	-4.36	-5.70	-6.23	-2.46	-3.60	-5.05	-3.17	-5.60	0	-3.09	-3.32	-0.50	-3.73	-4.73	-1.10	-2.01	-3.52
V11	-1.34	-1.27	-2.61	-3.15	0.63	-0.51	-1.96	-0.08	-2.51	3.09	0	-0.23	2.59	-0.65	-1.64	1.99	1.08	-0.43
V12	-1.11	-1.04	-2.38	-2.92	0.86	-0.28	-1.73	0.15	-2.28	3.32	0.23	0	2.82	-0.42	-1.41	2.22	1.31	-0.20
V13	-3.93	-3.86	-5.20	-5.74	-1.96	-3.10	-4.55	-2.67	-5.10	0.50	-2.59	-2.82	0	-3.24	-4.23	-0.60	-1.51	-3.02
V14	-0.69	-0.62	-1.96	-2.50	1.28	0.14	-1.31	0.57	-1.86	3.73	0.65	0.42	3.24	0	-0.99	2.64	1.73	0.21
V15	0.30	0.37	-0.97	-1.51	2.27	1.13	-0.32	1.56	-0.87	4.73	1.64	1.41	4.23	0.99	0	3.63	2.72	1.21
V16	-3.33	-3.26	-4.60	-5.14	-1.36	-2.50	-3.95	-2.07	-4.50	1.10	-1.99	-2.22	0.60	-2.64	-3.63	0	-0.91	-2.42
V17	-2.42	-2.35	-3.69	-4.23	-0.45	-1.59	-3.04	-1.16	-3.59	2.01	-1.08	-1.31	1.51	-1.73	-2.72	0.91	0	-1.51
V18	-0.91	-0.84	-2.18	-2.71	1.06	-0.08	-1.53	0.35	-2.08	3.52	0.43	0.20	3.02	-0.21	-1.21	2.42	1.51	0

To assign the crisp score corresponding to each difference, the mean differences were divided into 11 ranges on the 11-point scale and using the table 6.3 crisp score was assigned to values falling in a particular range as shown in table 6.8

Table 6.8: Mean ranges on 11-point scale (on the basis of table 6.3)

Linguistic terms	Fuzzy Numbers	Mean Range	Crisp Score
One attribute is exceptionally less important than the other	M1	-5.83 to -7	0.0455
One attribute is extremely less important less than the other	M2	-4.67 to -5.83	0.1364
One attribute is very less important than the other	M3	-3.50 to -4.67	0.2273
One attribute is less important than the other	M4	-2.34 to -3.50	0.3182
One attribute is slightly less important than the other	M5	-1.17 to -2.34	0.4091
Two attributes are equally important than the other	M6	-1.17 to 1.17	0.5000
One attribute is slightly more important than the other	M7	1.17 to 2.34	0.5909
One attribute is more important than the other	M8	2.34 to 3.50	0.6818
One attribute is much more important than the other	M9	3.50 to 4.67	0.7727
One attribute is extremely more important than the other	M10	4.67 to 5.83	0.8636
One attribute is exceptionally more important than the other	M11	5.83 to 7	0.9545

Each Pairwise difference of mean between attributes of table 6.7 was converted into a crisp score using table 6.8 and is shown in table 6.9. For example, the difference of means between V1 and V2 in table 6.7 is 0.07, which was assigned crisp score 0.5000 as per table 6.8. Crisp values were assigned to other mean differences in the same way, using table 6.8.

Table 6.9: Relative importance among attributes in terms of crisp score

Var	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V16	V17	V18
V1	0	0.5000	0.4091	0.4091	0.5909	0.5000	0.5000	0.5909	0.4091	0.7727	0.5909	0.5000	0.7727	0.5000	0.5000	0.6818	0.6818	0.5000
V2	0.5000	0	0.4091	0.4091	0.5909	0.5000	0.5000	0.5909	0.4091	0.7727	0.5909	0.5000	0.7727	0.5000	0.5000	0.6818	0.6818	0.5000
V3	0.5909	0.5909	0	0.5000	0.6818	0.5909	0.5000	0.6818	0.5000	0.8636	0.6818	0.6818	0.8636	0.5909	0.5000	0.7727	0.7727	0.5909
V4	0.5909	0.5909	0.5000	0	0.7727	0.6818	0.5909	0.6818	0.5000	0.9545	0.6818	0.6818	0.8636	0.6818	0.5909	0.8636	0.7727	0.6818
V5	0.4091	0.4091	0.3182	0.2273	0	0.5000	0.3182	0.5000	0.3182	0.6818	0.5000	0.5000	0.5909	0.4091	0.4091	0.5909	0.5000	0.5000
V6	0.5000	0.5000	0.4091	0.3182	0.5000	0	0.4091	0.5000	0.4091	0.7727	0.5000	0.5000	0.6818	0.5000	0.5000	0.6818	0.5909	0.5000
V7	0.5000	0.5000	0.5000	0.4091	0.6818	0.5909	0	0.5909	0.5000	0.8636	0.5909	0.5909	0.7727	0.5909	0.5000	0.7727	0.6818	0.5909
V8	0.4091	0.4091	0.3182	0.3182	0.5000	0.5000	0.4091	0	0.3182	0.6818	0.5000	0.5000	0.6818	0.5000	0.4091	0.5909	0.5909	0.5000
V9	0.5909	0.5909	0.5000	0.5000	0.6818	0.5909	0.5000	0.6818	0	0.8636	0.6818	0.5909	0.8636	0.5909	0.5000	0.7727	0.7727	0.5909
V10	0.2273	0.2273	0.1364	0.0455	0.3182	0.2273	0.1364	0.3182	0.1364	0	0.3182	0.3182	0.5000	0.2273	0.1364	0.5000	0.4091	0.2273
V11	0.4091	0.4091	0.3182	0.3182	0.5000	0.5000	0.4091	0.5000	0.3182	0.6818	0	0.5000	0.6818	0.5000	0.4091	0.5909	0.5000	0.5000
V12	0.5000	0.5000	0.3182	0.3182	0.5000	0.5000	0.4091	0.5000	0.4091	0.6818	0.5000	0	0.6818	0.5000	0.4091	0.5909	0.5909	0.5000
V13	0.2273	0.2273	0.1364	0.1364	0.4091	0.3182	0.2273	0.3182	0.1364	0.5000	0.3182	0.3182	0	0.3182	0.2273	0.5000	0.4091	0.3182
V14	0.5000	0.5000	0.4091	0.3182	0.5909	0.5000	0.4091	0.5000	0.4091	0.7727	0.5000	0.5000	0.6818	0	0.5000	0.6818	0.5909	0.5000
V15	0.5000	0.5000	0.5000	0.4091	0.5909	0.5000	0.5000	0.5909	0.5000	0.8636	0.5909	0.5909	0.7727	0.5000	0	0.7727	0.6818	0.5909
V16	0.3182	0.3182	0.2273	0.1364	0.4091	0.3182	0.2273	0.4091	0.2273	0.5000	0.4091	0.4091	0.5000	0.3182	0.2273	0	0.5000	0.3182
V17	0.3182	0.3182	0.2273	0.2273	0.5000	0.4091	0.3182	0.5000	0.2273	0.5909	0.5000	0.4091	0.5909	0.4091	0.3182	0.5000	0	0.4091
V18	0.5000	0.5000	0.4091	0.3182	0.5000	0.5000	0.4091	0.5000	0.4091	0.7727	0.5000	0.5000	0.6818	0.5000	0.4091	0.6818	0.5909	0

Step III: Developing a digraph of the attributes depending upon their interdependency

The Digraph for evaluation of attributes is presented in figure 6.3. A TBSSB service quality digraph represented 18 attributes in the form of 18 nodes from V1 to V18. The edges between the nodes represented the interdependency of the attributes.

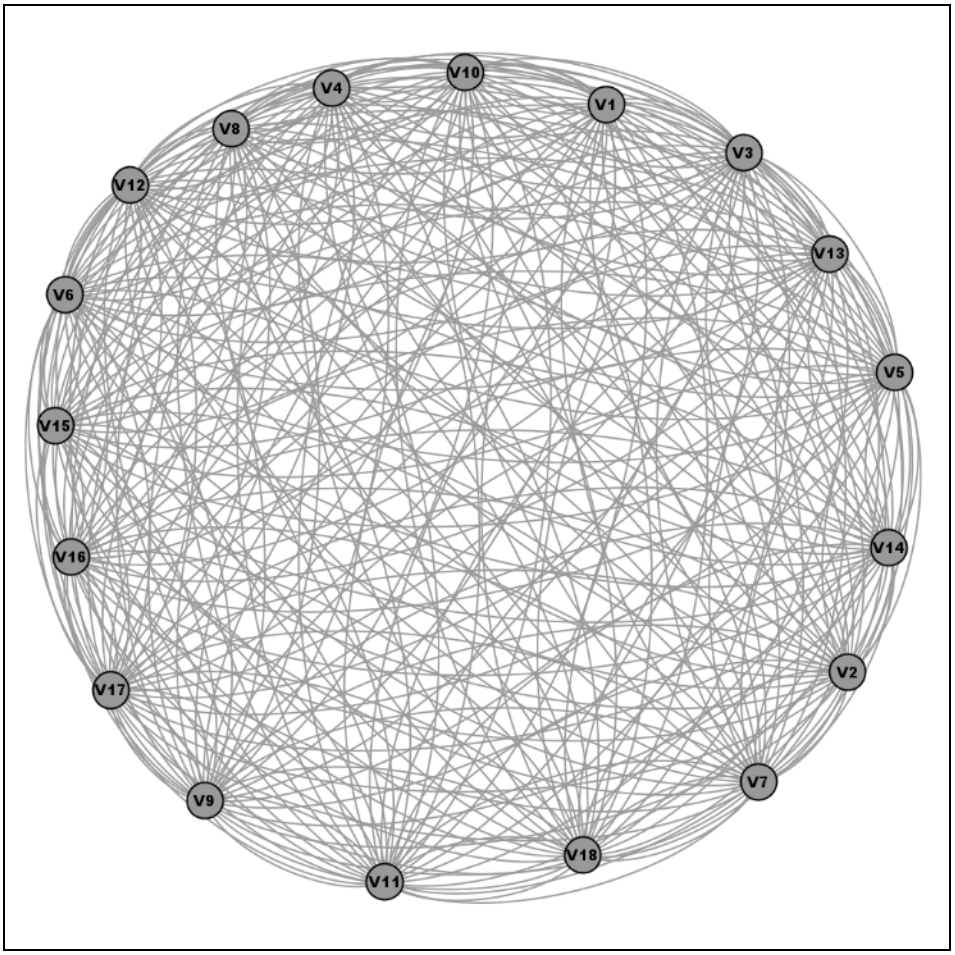


Figure 6.3: Digraph for attributes evaluation of TBSSB system

Step IV: Developing an attribute permanent function matrix on the basis of a digraph.

An 18X18 matrix with diagonal elements representing the attributes and non-diagonal elements representing the relative importance among the attributes was prepared for calculating the permanent of a matrix. In the matrix, the off-diagonal elements represented the relative importance values as shown in table 6.9. The crisp scores of attributes (table 6.6) were used as diagonal element values for the purpose of calculation of permanent function of the matrix. The resultant matrix is shown in matrix 6.2.

Matrix 6.2: Matrix for computing permanent function of TBSSB

Var	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V16	V17	V18
V1	0.6818	0.5000	0.4091	0.4091	0.5909	0.5000	0.5000	0.5909	0.4091	0.7727	0.5909	0.5000	0.7727	0.5000	0.5000	0.6818	0.6818	0.5000
V2	0.5000	0.6818	0.4091	0.4091	0.5909	0.5000	0.5000	0.5909	0.4091	0.7727	0.5909	0.5000	0.7727	0.5000	0.5000	0.6818	0.6818	0.5000
V3	0.5909	0.5909	0.8636	0.5000	0.6818	0.5909	0.5000	0.6818	0.5000	0.8636	0.6818	0.6818	0.8636	0.5909	0.5000	0.7727	0.7727	0.5909
V4	0.5909	0.5909	0.5000	0.9545	0.7727	0.6818	0.5909	0.6818	0.5000	0.9545	0.6818	0.6818	0.8636	0.6818	0.5909	0.8636	0.7727	0.6818
V5	0.4091	0.4091	0.3182	0.2273	0.4091	0.5000	0.3182	0.5000	0.3182	0.6818	0.5000	0.5000	0.5909	0.4091	0.4091	0.5909	0.5000	0.5000
V6	0.5000	0.5000	0.4091	0.3182	0.5000	0.5909	0.4091	0.5000	0.4091	0.7727	0.5000	0.5000	0.6818	0.5000	0.5000	0.6818	0.5909	0.5000
V7	0.5000	0.5000	0.5000	0.4091	0.6818	0.5909	0.7727	0.5909	0.5000	0.8636	0.5909	0.5909	0.7727	0.5909	0.5000	0.7727	0.6818	0.5909
V8	0.4091	0.4091	0.3182	0.3182	0.5000	0.5000	0.4091	0.5000	0.3182	0.6818	0.5000	0.5000	0.6818	0.5000	0.4091	0.5909	0.5909	0.5000
V9	0.5909	0.5909	0.5000	0.5000	0.6818	0.5909	0.5000	0.6818	0.8636	0.8636	0.6818	0.5909	0.8636	0.5909	0.5000	0.7727	0.7727	0.5909
V10	0.2273	0.2273	0.1364	0.0455	0.3182	0.2273	0.1364	0.3182	0.1364	0.0455	0.3182	0.3182	0.5000	0.2273	0.1364	0.5000	0.4091	0.2273
V11	0.4091	0.4091	0.3182	0.3182	0.5000	0.5000	0.4091	0.5000	0.3182	0.6818	0.5000	0.5000	0.6818	0.5000	0.4091	0.5909	0.5000	0.5000
V12	0.5000	0.5000	0.3182	0.3182	0.5000	0.5000	0.4091	0.5000	0.4091	0.6818	0.5000	0.5000	0.6818	0.5000	0.4091	0.5909	0.5909	0.5000
V13	0.2273	0.2273	0.1364	0.1364	0.4091	0.3182	0.2273	0.3182	0.1364	0.5000	0.3182	0.3182	0.1364	0.3182	0.2273	0.5000	0.4091	0.3182
V14	0.5000	0.5000	0.4091	0.3182	0.5909	0.5000	0.4091	0.5000	0.4091	0.7727	0.5000	0.5000	0.6818	0.5909	0.5000	0.6818	0.5909	0.5000
V15	0.5000	0.5000	0.5000	0.4091	0.5909	0.5000	0.5000	0.5909	0.5000	0.8636	0.5909	0.5909	0.7727	0.5000	0.6818	0.7727	0.6818	0.5909
V16	0.3182	0.3182	0.2273	0.1364	0.4091	0.3182	0.2273	0.4091	0.2273	0.5000	0.4091	0.4091	0.5000	0.3182	0.2273	0.2273	0.5000	0.3182
V17	0.3182	0.3182	0.2273	0.2273	0.5000	0.4091	0.3182	0.5000	0.2273	0.5909	0.5000	0.4091	0.5909	0.4091	0.3182	0.5000	0.3182	0.4091
V18	0.5000	0.5000	0.4091	0.3182	0.5000	0.5000	0.4091	0.5000	0.4091	0.7727	0.5000	0.5000	0.6818	0.5000	0.4091	0.6818	0.5909	0.5909

Step V: Calculation of permanent function

The TBSSB service quality permanent function is represented as:

TBSSB service quality permanent function = Per (TBSSB) (6.7)

Per (TBSSB) or TBSSB index was calculated by considering the data from Matrix 6.2. The expanded form of the equation 6.7 in terms of various groups and sub-groups can be developed in the same manner as that of equation 6.1.

Permanent function value was calculated with the help of computer program (wxMaxima version 13.04.2). The computed value is

Per (TBSSB) =10181961183 (i.e. $1.0181961183 \times 10^{10}$)

TBSSB index will be minimum when the performance effect of all the attributes is minimum. Minimum TBSSB index was calculated by replacing diagonal elements of Matrix 2 with 0.0455 (lowest crisp value). The calculated value of minimum permanent function of TBSSB matrix is

Per ($TBSSB_{Min}$) = 3565249961 (i.e. $3.565249961 \times 10^{9}$)

Similarly, TBSSB index will be maximum when the performance effect of all the attributes is maximum. For obtaining Per ($TBSSB_{Max}$), the diagonal elements of the Matrix 2 were replaced by 0.9545 (highest crisp value) and off-diagonal elements were kept same. The calculated value of maximum permanent function of TBSSB matrix is

Per ($TBSSB_{Max}$) = 24579293935 (i.e. $2.4579293935 \times 10^{10}$)

The minimum and maximum value of TBSSB index indicated the range within which it may vary. Banks may conduct a survey and find TBSSB index for their organisation.

6.6 CONCLUSION

In this chapter, an attempt was made to quantify the overall effect of TBSSB service quality. In total 18 attributes affecting TBSSB service quality were taken into consideration for the purpose of evaluation. Fuzzy numbers and Graph Theoretic Approach (GTA) were used to compute the single numerical index for the TBSSB service quality system using a five step sequential process. Firstly, various attributes affecting service quality of TBSSB system were ranked on the basis of data collected through a survey. After that, the relative importance among the attributes was established. The survey data was converted into a crisp score by using an 11-point

scale. Then a digraph was developed on the basis of the interdependency between the attributes. Using the digraph, an attribute permanent function matrix was developed. Ultimately, using the values of the evaluation measures and their interdependency, the index number for the TBSSB system was calculated. Calculations were also made for minimum and maximum values of TBSSB index.

Chapter VII
FINDINGS AND CONCLUSION

7.1 INTRODUCTION

This chapter discusses the findings and conclusion of the research. The findings are discussed corresponding to all the research objectives of the study. The implications for the bankers are presented in detail. Implications cover the various useful insights for bankers about TBSSB, which may assist them in enhancing satisfaction and loyalty. This is followed by the discussion on the contributions of the study in the world of academics as well as for the banking sector. Thereafter limitations of the study and scope for future work are highlighted. Finally, the conclusion of the research is presented.

7.2 RESEARCH FINDINGS

The research findings are presented below in relation to all the research objectives

7.2.1 Dimensions of Service Quality in Case of Technology Based Self Service Banking Services

The various items related to TBSSB service quality were generated by conducting an extensive review of measurement scales used in previous service quality studies on electronic and other services. The review produced a list of items. These items were discussed in detail with bank customers, academicians and banking professionals considering relevance, ambiguity, and repetition aspects. A detailed literature review and discussions resulted in a 20 item instrument to measure TBSSB service quality. Using the instrument data were collected from bank customers in Delhi and NCR region. Customers having age more than 18 years and using at least one of the modes of electronic banking were considered in the survey. The collected data from the sample was divided into two equal size sub-samples. Exploratory factor analysis (EFA) was applied on half of the collected data using SPSS in order to identify the dimensions of technology based self service banking service quality. In the initial

exploration, two variables having factor loading value < 0.4 and no loading on any of the factor were eliminated. EFA on the 18 items extracted four dimensions of TBSSB service quality as Convenience (6 items), Reliability and Security (5 items), Responsiveness (4 items) and Personalization (3 items). Four-factor structure of TBSSB service quality was confirmed by applying confirmatory factor analysis using AMOS on the remaining half of the data collected. The unidimensionality, reliability, and validity of the four-factor model were also empirically tested. Moreover, various criteria indices for the TBSSB service quality model were found to surpass the mandatory requirements. As a result, TBSSB was conceptualized as a model consisting of four dimensions.

7.2.2 Relationship between TBSSB Service Quality, Customer Satisfaction and Customer Loyalty

In order to understand the relationship between TBSSB service quality, customer satisfaction, and customer loyalty, four hypotheses were tested in this research. Findings related to these tests are explained below.

The effect of the technology based self service banking quality dimensions on Customer Satisfaction

In the literature, the relationship between service quality and satisfaction has been probed theoretically as well as empirically in the past (Spreng and Mackoy 1996; Lassar et al., 2000; Jamal and Naser 2003; Al-Hawari and Ward, 2006). In general, there has been a trend in the literature to expect a significant positive relation between service quality and customer satisfaction. Four sub-hypotheses were framed to test the effect of Convenience, Reliability & Security, Responsiveness and Personalization dimensions of technology based self service banking quality on customer satisfaction using the structural equation modeling (SEM).

Path coefficients and the significance level between the constructs were used for hypotheses testing. Result illustrated that Convenience and Personalization dimensions had a significant positive significant impact on Customer Satisfaction.

Reliability & Security and Responsiveness dimensions were found to have non-significant relation with Customer Satisfaction.

The effect of the technology based self service banking quality dimensions on Customer Loyalty

In the literature, the relationship between service quality and loyalty has been examined in many studies (Cronin and Taylor 1992; Zeithaml et al., 1996; Caruana, 2002; Ranaweera and Neely 2003; Asgari et al., 2014). Literature suggests that service quality dimensions effects loyalty. Four sub-hypotheses were framed to test the effect of Convenience, Reliability & Security, Responsiveness and Personalization dimensions of technology based self service banking quality on Customer Loyalty.

The result of hypotheses testing showed that Personalisation dimension had a significant positive effect on Customer Loyalty. However, the relation of Convenience, Responsiveness, and Reliability & Security dimensions with Customer Loyalty was found to be non- significant.

The effect of Customer Satisfaction on Customer Loyalty

The effect of customer satisfaction on customer loyalty has been examined in the past studies like Kim et al., (2004), Mohsan et al., (2011), Ganiyu et al., (2012), Nayebzadeh et al., (2013). Hypothesis testing was used to understand the effect of customer satisfaction on customer loyalty. Results showed that customer satisfaction has a positive significant relationship with customer loyalty.

Customer Satisfaction mediates the relationship between TBSSB service quality and Customer Loyalty

Some researchers have indicated that service quality influenced loyalty only through satisfaction (McDougall and Levesque; 2000; Dabholkar et al., 2000; Olorunniwo et al., 2006; Caruana, 2002; Cronin and Taylor 1992), while others argued for a direct effect of service quality on loyalty. To verify whether Customer Satisfaction is

actually mediating the relationship between service quality and customer loyalty, the indirect relationship was examined.

To test the mediating role of customer satisfaction in the structural model two models were developed and compared using AMOS. The first model illustrated direct as well as indirect relationships between TBSSB service quality dimensions and customer loyalty. In the second model TBSSB service quality influenced customer loyalty through customer satisfaction. The method of testing mediation hypothesis by developing and comparing two models was consistent with other studies (Yen and Gwinner, 2003; Al-Hawari and Ward, 2006). The findings of this research asserted that customer satisfaction mediates the relationship between TBSSB service quality and customer loyalty. This finding is similar to the studies conducted by Cronin and Taylor (1992), Patterson and Spreng (1997) and Dabholkar et al. (2000). The final model portraying the relationship between TBBSB service quality, Customer Satisfaction, and Customer Loyalty is reproduced in figure 7.1

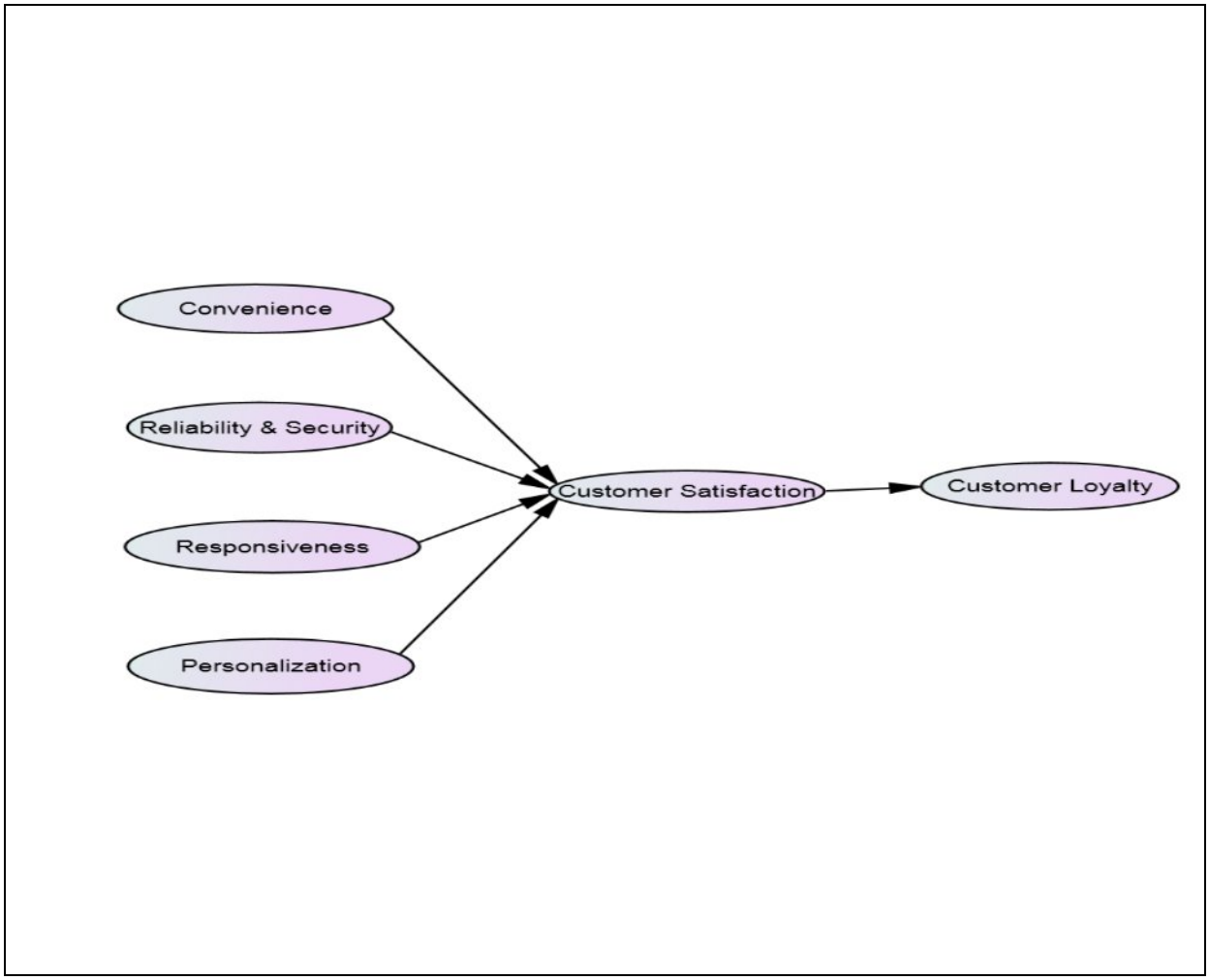


Figure 7.1: The final model portraying the relationship between TBBSB service quality, Customer Satisfaction and Customer Loyalty

There are many interesting findings in studying the relationship between TBSSB service quality, customer satisfaction, and customer loyalty. First one is that the Convenience was found to have a positive significant effect on customer satisfaction and non-significant effect on loyalty. This may be attributed to the fact that in India every bank is focusing on making TBSSB convenient for the customer, resulting in a non-significant effect on loyalty. The second interesting finding was the non-significant relationship of Reliability and Security with customer satisfaction and loyalty. This can be explained in a way that availing consistent error free banking services in a secure environment has become basic expectations of customers and usually, banks ensure this for their TBSSB services, as a lack in this may have serious implications for banks as well as customers. Another finding is that the Responsiveness was having a non-significant effect on customer satisfaction and

loyalty. Every year banks in India spend a huge sum of money for providing and promoting TBSSB services. If the adequate focus on responsiveness will not be found in TBSSB, huge investment will go in vain. Generally speaking, hardly any difference is found between banks in this regard; therefore, it was not found to impact customer satisfaction and loyalty. Finally, Personalization was the only dimension having a positive significant effect both on customer satisfaction and loyalty. This result can be due to the fact that in India, Personalization is relatively new in case of TBSSB services. Banks have started offering personalized services like personalized menu options in various automated banking channels, resulting in a significant effect on satisfaction and loyalty. The results of hypothesis testing also show that customer satisfaction is acting as a mediating factor between TBSSB service quality factors and customer loyalty.

7.2.3 The Effect of Various Demographic Variables on TBSSB Service Quality, Customer Satisfaction and Customer Loyalty

The t-test and ANOVA were used to find out whether there was any significant difference in TBSSB service quality, Customer Satisfaction, and Loyalty dimensions on the basis of demographic variables. The demographic variables covered under the study were gender, age, highest completed education, occupation and an annual income of respondents. The statistical inferences were drawn at 5% level of significance (p=0.05). For detailed analysis, Post hoc analysis was carried out. The results of hypotheses testing are summarized in table 7.1

Table 7.1: Summary of effect of various demographic variables on TBSSB service quality, Customer Satisfaction and Customer Loyalty dimensions

TBSSB Service Quality Dimensions	Gender	Age	Qualification	Occupation	Annual Income
Convenience	----	----	----	----	----
Reliability and Security	----	***	----	----	----
Responsiveness	----	----	----	----	----
Personalization	----	----	***	----	----
Customer Satisfaction	----	***	----	----	----
Customer Loyalty	----	----	----	----	----

(***) indicates significant difference at 0.05 level, (----) indicates difference is not significant

The results of the t-test indicated that there was no significant difference in all four TBSSB service quality, Customer Satisfaction and Loyalty dimensions by gender.

The ANOVA results for variable age showed that the significance value of Convenience, Responsiveness, Personalization and Customer Loyalty dimensions were higher than 0.05. Only for the Reliability & Security and Customer Satisfaction dimension, the p value was less than 0.05. Therefore, the findings suggest that for the variable age there was a significant difference in the evaluation of dimensions – Reliability & Security and Customer Satisfaction. Post hoc analysis revealed that respondents of age group "18-25 years" differ significantly from the respondents having age more than 45 years on Reliability & Security dimension. However, there was no significant difference between other age group respondents on Reliability & Security dimension. Post hoc analysis also revealed that respondents of age group "18-25 years" differ significantly from the respondents of age group "more than 35 years- up to 45 years" on Customer Satisfaction dimension. Similarly, there was a significant difference between age group "more than 25 years- up to 35 years" and "more than 35 years- up to 45 years" as far as Customer Satisfaction is concerned.

When ANOVA test was applied considering TBSSB service quality, customer satisfaction and loyalty dimensions as the dependent variable and highest completed education as an independent variable, the results showed that there was a significant difference in Personalization dimension, as the p-value is less than 0.05. Other dimensions were not influenced by highest completed education variable. The findings of Post hoc analysis revealed that respondents having highest completed education "Graduate" differ significantly from the respondents with education "Post Graduate and above" on Personalization dimension.

The ANOVA results also displayed that none of TBSSB service quality, customer Satisfaction, and Customer Loyalty dimensions differ significantly on the basis of Occupation and Annual income.

7.2.4 Quantification of the Overall Effect of TBSSB Service Quality Attributes in Terms of Single Numerical Index

The overall effect of TBSSB service quality attributes in terms of the single numerical index was computed using graph theoretic approach. To quantify the overall effect, various attributes impacting TBSSB service quality were considered. Fuzzy numbers and Graph Theoretic Approach (GTA) were used to compute index value for the TBSSB service quality system using a five step sequential process. Firstly, the importance level of the various attributes affecting TBSSB service quality was measured by conducting a survey and these attributes were ranked on the basis of survey results. Then the relative importance between the attributes was established. The survey results were converted into a crisp score by using an 11-point scale. A digraph was drawn considering the interdependency between the attributes. Considering the nodes and interdependencies displayed in the digraph, an attribute permanent function matrix was developed. Finally, using the values of the evaluation measures and their interdependency, the index number for the TBSSB system was calculated. The value of Permanent function represented the effect of attributes on TBSSB service quality uniquely in terms of a single number/index, which is helpful for ranking, comparison, and optimum selection. Calculations were also made for maximum and minimum values of the TBSSB index. The minimum and maximum

value of TBSSB index provided the range within which the value of index may vary. This procedure may be useful for self-analysis and comparison with other banks.

7.3 MANAGERIAL IMPLICATIONS

- The four TBSSB dimensions identified in this study are Convenience, Reliability & Security, Responsiveness, and Personalization. These dimensions will help bankers to understand the key factors that customers consider at the time of appraising the quality of TBSSB. Focus on these dimensions is essential because if customers feel that there is hardly any difference between banks on technology attributes, it will be difficult to keep them satisfied and loyal. However, considering customer requirements and bank objectives, the bank may vary the extent of emphasis on these dimensions.

- The results of hypotheses testing show that customer satisfaction acts as a mediating factor between TBSSB and customer loyalty. It implies that customer satisfaction should be considered as the key construct for customer loyalty in case of technology based self service banking. This suggests that banks should also give due importance to customer satisfaction along with service quality dimensions.

- As customer satisfaction is playing a vital role in relationship and TBSSB service quality may not the only factor determining customer satisfaction, so, banks are also required to find other factors such as value, reputation, trust etc. that are critical in enhancing satisfaction.

- In this research, it has been found that 'Reliability & Security' and 'Responsiveness' dimensions have a non-significant effect on customer satisfaction. As all the banks are providing almost similar kind of services on 'Reliability & Security' and 'Responsiveness' aspects, a bank may enhance customer satisfaction by either further improving various attributes covered under these two dimensions or come up with more new attributes which

competing banks are not presently offering and which are difficult to replicate. So it has become essential for banks to be innovative on technology front to upgrade themselves with new technology related attributes for a better quality of service and to get an advantage over the competitors. While developing new technology or upgrading the existing one, the banks may encourage customer participation at the design stage. This will help them to understand what quality aspects the customers expect in upcoming banking services. Banks should also work towards adding more options in existing automated banking channels and to make existing services more customer-friendly. To make automated services more customer-friendly, banks may devote adequate resources to the education and training of customers.

- In this research, a method to quantify the overall effect of TBSSB system in terms of the single numerical index is proposed. The banking sector which keeps on trying out new technologies can use this method to evaluate their technology. Banks may find TBSSB quality index for their automated banking services. They may assess themselves by comparing their TBSSB quality index with computed minimum and maximum values of TBSSB. Similar banks may be compared and rated by computing their TBSSB indices. The index can be computed for different modes of automated banking separately and index values may be used for the purpose of inter-banking mode comparison. The index may also be computed for the service quality of branch banking services by designing an appropriate scale. This will enable banks to compare their automated banking quality with that of branch banking. This will help them to improve their services and they may justify their investments in technology based services.

These guidelines will provide useful insights for bankers about TBSSB and help them to enhance satisfaction and loyalty.

7.4 CONTRIBUTIONS

7.4.1 Theoretical Contributions (Contributions to the world of academics)

- The research identified dimensions (key factors) of technology based self service banking (TBSSB), proposes a TBSSBsqual scale to measure TBSSB service quality and presents a conceptual model for understanding the relationship between service quality of the TBSSB services, customer satisfaction, and loyalty.

- The relationships among service quality, customer satisfaction, and loyalty have been widely discussed in the literature. However, the majority of past studies considered one banking channel and investigated the relationships involving two constructs (Service quality and Customer Satisfaction or Service quality and Customer Loyalty). The simultaneous investigation of the relationships among all three constructs in the case of TBSSB provided a more accurate and comprehensive picture of the nature of the relationship.

- Most of the studies involving the assessment of these constructs have been carried out in developed economies. Only a limited number of studies have been carried out in developing economies.

- Finally, this research presents an evaluation method that can be used to quantify TBSSB service quality in a single numeric value called TBSSB index. It is observed that there is hardly any literature on mathematical modeling of automated banking service quality using Graph Theoretic Approach resulting in the single numerical index.

So, the study will lead to the development of a structure for understanding the service quality of the technology based self service banking, thereby extending the knowledge base in the area of self service technologies.

7.4.2 Contributions to the Banking Sector

- This study may help banks to investigate and analyze the quality perceptions about technology based self service banking services using the TBSSBsqual scale.

- The present study will help bankers to understand which service delivery attributes of technology based self-service impact customer satisfaction and enlighten banks about which aspects of services to focus upon.

- This research presses the need for the banks to upgrade themselves with new technology related attributes periodically for a better quality of service. This is essential so that the customers will be able to differentiate the service quality of technology based services provided by the bank from that of counterparts. This will help in increasing customer satisfaction.

- This research found TBSSB service quality impact customer loyalty through customer satisfaction. So to enhance customer loyalty, banks should pay appropriate attention towards various factors affecting customer satisfaction.

- This research explains the methodology to quantify the overall effect of key TBSSB service quality attributes in terms of the single numerical index using graph theoretic approach. This may be used by the bank to evaluate their technology. This method may be used by banks for self-analysis and also for comparison with other banks.

These guidelines will provide useful insights for bankers about TBSSB. In brief, this study may help banks to assess their technology based services and also take decisions related to various aspects of technology based banking services including future investments, which ultimately will result in better quality of services, higher levels of customer satisfaction and loyalty.

7.5 LIMITATIONS

- The study is restricted to the technology based banking Services. Therefore the model developed in this study cannot be generalized for all technology based self services without further testing in a specific service context.

- The study is confined to retail banking customers of commercial banks only.

- The geographical area of the study is restricted to the Delhi and NCR region of India.

- The center of attention of the study was service quality, so the other antecedent of customer satisfaction and customer loyalty were not explored.

7.6 SCOPE FOR FUTURE WORK

- The current study is conducted in Delhi and NCR region of India. So further research is needed to validate and generalize the findings to other regions in India.

- Technology offered by banks and its adoption patterns may vary across different countries. As a result, the effect of four dimensions of TBSSB service quality on customer satisfaction and loyalty may change from country to country. So to test findings and implications outside India, further research may be conducted.

- The model developed in this study is on the basis of attributes of technology based banking services. Further research may be carried out to develop a generic model applicable to all the technology based services.

- The method for establishing a relationship between service quality, customer satisfaction, and loyalty may also be used for other multi-channel technology based services like online insurance and commodity trading by considering their self service technology attributes.

- The Graph Theoretic Approach using fuzzy numbers for computing an index value of the system may also be replicated for other services like online retailing, telecommunications, and insurance.

7.7 CONCLUSION

This research investigated the service quality and its relationship with customer satisfaction and loyalty in case of technology based self service banking services. In this research, considering four research objectives, seven hypotheses were proposed and tested. The study identified four dimensions of technology based self service banking (TBSSB) service quality, proposed a TBSSBsqual scale to measure TBSSB service quality and presented a conceptual model of the TBSSB service quality. Four TBSSB service quality dimensions were named as Convenience, Reliability & Security, Responsiveness, and Personalization. A conceptual model of TBSSB service quality, customer satisfaction, and customer loyalty was also proposed in this study. Study results showed that Convenience and Personalization dimension have a positive significant effect on customer satisfaction and Personalisation is the only dimension that has found to have a positive significant effect on customer loyalty. The Customer satisfaction was also found to have a positive impact on customer loyalty. The study found that service quality has an influence on customer satisfaction, which in turn had a stronger influence on customer loyalty. The testing results showed that customer satisfaction acts as a mediating factor between TBSSB and customer loyalty. The research also quantified the overall effect of key TBSSB service quality attributes in terms of the single numerical index using graph theoretic approach.

This study may help bank managers to investigate the customers' quality perceptions about TBSSB services and suggest banks about the aspects of services to be focussed. This will help them to formulate strategies for improving the quality of service, resulting in increased customer satisfaction which in turn will lead to higher customer loyalty. It will support academicians in better comprehension of TBSSB services. This study may also assist bankers to take various decisions related to TBSSB service quality using TBSSB index.

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APPENDICES

Appendix I
Survey Questionnaire

Dear Respondent,

My name is Rajiv Sindwani (rajiv_sindwani@yahoo.co.in) and I am a PhD student in Department of Management Studies at YMCA University of Science and Technology, Faridabad (Haryana). I am conducting a research on "Service Quality in Technology based Self Service Banking". Technology based self service banking (TBSSB) refer to services availed by the customers in self service mode using various technology based banking channels such as ATM, Internet banking, Tele banking, Mobile banking etc.

Please complete this survey if you are **minimum 18 years of age** and **use at least one channel of technology based self service banking**. I assure you that information gathered will remain confidential and would be used only for research purposes. Results of this research will be published in a number of ways.

Answer the questions on the basis of your overall Technology based self service banking (TBSSB) experience with your bank. If you use services of more than one bank, then choose the bank that you use the most for TBSSB services. In that case, that will be considered as your main bank for the survey.

Name the bank with which you usually have the maximum number of TBSSB transactions: .....

For all questions simply circle the number that corresponds to your answer

For example:

1. Your Gender

   1. Male (2) Female

Part 1

Survey Participant background information

1) Your Gender

1. Male **2.** Female

2) Your Age

1. 18 -- up to 25 years **2.** More than 25 -- up to 35 years **3.** More than 35 -- up to 45 years **4.** More than 45 years

3) Your highest completed level of education

1. HSC (12^{th}) or Below **2.** Graduate **3.** Post Graduate and above **4.** Others

4) Your occupation

1. Student **2.** Salaried **3.** Self employed **4.** Others

5) Your annual income (in Rupees)

1. Up to 2 lacs **2.** More than 2 lacs -- up to 5 lacs **3.** More than 5 lacs -- up to 10 lacs

4. More than 10 lacs

6) Your frequency of monthly usage of TBSSB services of the main bank

1. Up to 5 times **2.** More than 5 -- up to 10 times **3.** More than 10 -- up to 20 times

4. More than 20 times

Part 2

Your perception about Technology based self service banking (TBSSB) Service Quality

Please find below the statements related to TBSSB services provided by your main bank. For each statement, please show the extent to which you believe TBSSB has the feature described by the statement. Circling a '1' means that you feel strongly disagree that your main bank TBSSB has that feature, and Circling a '5' means that you feel strongly agree. You may circle any one of the number in the middle that shows how strong your feelings are. We are just interested in a number that best shows your perception about the service.

Strongly Disagree	**1**	**2**	**3**	**4**	**5**	**Strongly Agree**

1	**TBSSB services are able to conduct error-free transactions every time**	**1**	**2**	**3**	**4**	**5**
2	**TBSSB services are available 24 x 7 (7 days, 24 hours)**	**1**	**2**	**3**	**4**	**5**
3	**TBSSB give directions to new users**	**1**	**2**	**3**	**4**	**5**
4	**I receive prompt responses to my requests while using TBSSB**	**1**	**2**	**3**	**4**	**5**
5	**TBSSB provides consistent services**	**1**	**2**	**3**	**4**	**5**
6	**TBSSB provides customer feedback services**	**1**	**2**	**3**	**4**	**5**
7	**TBSSB acknowledges me by name**	**1**	**2**	**3**	**4**	**5**
8	**TBSSB provides the precise and sufficient information I need**	**1**	**2**	**3**	**4**	**5**
9	**TBSSB provides product offerings according to my preferences**	**1**	**2**	**3**	**4**	**5**
10	**TBSSB services provide accurate records of all transactions that have taken place**	**1**	**2**	**3**	**4**	**5**
11	**I feel secure that my personal information will not be shared with the third party while using TBSSB**	**1**	**2**	**3**	**4**	**5**
12	**Financial transactions done using TBSSB are secure**	**1**	**2**	**3**	**4**	**5**
13	**TBSSB services are cost effective**	**1**	**2**	**3**	**4**	**5**
14	**TBSSB services are easy to use**	**1**	**2**	**3**	**4**	**5**
15	**TBSSB has adequate menu options for everyday banking needs**	**1**	**2**	**3**	**4**	**5**

16	**Elements of security are incorporated in TBSSB by bank and I am made aware of them**	**1**	**2**	**3**	**4**	**5**
17	**TBSSB services has a user-friendly system**	**1**	**2**	**3**	**4**	**5**
18	**TBSSB gives me more freedom of mobility**	**1**	**2**	**3**	**4**	**5**
19	**When problems occur, the TBSSB system guides me to solve them**	**1**	**2**	**3**	**4**	**5**
20	**TBSSB is less time consuming as compared to branch banking**	**1**	**2**	**3**	**4**	**5**

Part 3

Your satisfaction with the bank services you received

Please indicate your level of agreement or disagreement with the following statements by circling one appropriate number for each statement

Strongly Disagree	**1**	**2**	**3**	**4**	**5**	**Strongly Agree**

1	**I am satisfied with TBSSB services of my bank**	**1**	**2**	**3**	**4**	**5**
2	**I am satisfied with the products/services offered by my bank**	**1**	**2**	**3**	**4**	**5**
3	**Overall, I am satisfied with my bank**	**1**	**2**	**3**	**4**	**5**

Part 4

Your behaviour towards your bank

Please indicate how likely you are to undertake actions mentioned in the following statements by circling one appropriate number for each statement

Extremely Unlikely	**1**	**2**	**3**	**4**	**5**	**Extreme Likely**

1	**I would say positive things about my bank to other people**	**1**	**2**	**3**	**4**	**5**
2	**I would encourage friends and relatives to do business with my bank**	**1**	**2**	**3**	**4**	**5**
3	**I expect to do more business with my bank in future**	**1**	**2**	**3**	**4**	**5**
4	**I would consider my bank as my first choice for banking services**	**1**	**2**	**3**	**4**	**5**
5	**I would recommend my bank to someone who seek my advice**	**1**	**2**	**3**	**4**	**5**
6	**I will remain with the same bank even if bank fees increase marginally**	**1**	**2**	**3**	**4**	**5**

Part 5

Your perception about Level of Importance of TBSSB attributes

Please indicate the level of importance of the following aspects of TBSSB by circling one appropriate number for each statement

Exceptionally Low	1	2	3	4	5	6	7	8	9	10	11	Exceptionally High

1	Security that customer personal information will not be shared with third party	1	2	3	4	5	6	7	8	9	10	11
2	Guiding customers to solve problem, in case it occurs	1	2	3	4	5	6	7	8	9	10	11
3	Conducting error free transaction every time	1	2	3	4	5	6	7	8	9	10	11
4	Security in doing financial transaction	1	2	3	4	5	6	7	8	9	10	11
5	Providing precise and sufficient information as per customer need	1	2	3	4	5	6	7	8	9	10	11
6	Providing consistent services	1	2	3	4	5	6	7	8	9	10	11
7	24x7 service availability	1	2	3	4	5	6	7	8	9	10	11
8	Giving prompt responses to customer request	1	2	3	4	5	6	7	8	9	10	11
9	Providing accurate records of all transactions that have taken place	1	2	3	4	5	6	7	8	9	10	11
10	Ease of use	1	2	3	4	5	6	7	8	9	10	11
11	Providing customer feedback services	1	2	3	4	5	6	7	8	9	10	11
12	Cost effective Services	1	2	3	4	5	6	7	8	9	10	11
13	Giving directions to new users	1	2	3	4	5	6	7	8	9	10	11
14	Having adequate menu options for everyday banking needs	1	2	3	4	5	6	7	8	9	10	11
15	Acknowledging customer by name	1	2	3	4	5	6	7	8	9	10	11
16	Having security features and customers awareness of the same	1	2	3	4	5	6	7	8	9	10	11
17	Consuming less time as compared to branch banking	1	2	3	4	5	6	7	8	9	10	11
18	Giving more freedom of mobility to customers	1	2	3	4	5	6	7	8	9	10	11
19	Offering product according to customer preferences	1	2	3	4	5	6	7	8	9	10	11
20	Having user friendly system	1	2	3	4	5	6	7	8	9	10	11

Thank you for participating in this survey

(Rajiv Sindwani)

Appendix II

Reliability Analysis

Table A: Reliability Statistics – Convenience

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.889	0.890	6

Table B: Item-Total Statistics- Convenience

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
A18	14.98	14.538	0.761	0.685	0.861
A17	14.87	14.431	0.744	0.688	0.864
A14	15.21	15.214	0.723	0.563	0.868
A2	14.91	15.089	0.7	0.533	0.871
A20	14.98	14.728	0.676	0.504	0.875
A15	15.07	15.582	0.637	0.425	0.88

Table C: Reliability Statistics- Reliability and Security

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.919	0.920	5

Table D: Item-Total Statistics- Reliability and Security

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
A1	9.73	11.885	0.828	0.695	0.894
A5	9.6	11.473	0.815	0.713	0.895
A11	9.6	11.202	0.806	0.672	0.897
A12	9.67	11.775	0.791	0.677	0.900
A16	9.46	11.706	0.724	0.542	0.914

Table E: Reliability Statistics- Responsiveness

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.800	0.801	4

Table F: Item-Total Statistics- Responsiveness

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
A19	8.85	6.225	0.658	0.458	0.726
A3	8.8	6.298	0.615	0.418	0.748
A4	9.03	6.577	0.59	0.369	0.76
A6	8.42	7.157	0.593	0.373	0.761

Table G: Reliability Statistics- Personalization

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.875	0.875	3

Table H: Item-Total Statistics- Personalization

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
A9	8.08	1.421	0.795	0.636	0.790
A8	8.12	1.52	0.761	0.594	0.821
A7	8.07	1.539	0.722	0.525	0.856

Appendix III

Exploratory Factor Analysis- SPSS Results

Additional Factor Analysis results of TBSSB Service Quality Attributes

KMO and Bartlett's Test results

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.86
Bartlett's Test of Sphericity	Approx. Chi-Square	2.258E3
	Df	190
	Sig.	0

Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.654	36.964	36.964	6.288	34.931	34.931	3.47	19.275	19.275
2	2.285	12.694	49.658	1.971	10.949	45.88	3.432	19.069	38.344
3	1.954	10.855	60.513	1.608	8.931	54.811	2.158	11.989	50.333
4	1.77	9.833	70.346	1.325	7.363	62.174	2.131	11.841	62.174
5	0.777	4.319	74.665						
6	0.669	3.719	78.384						
7	0.535	2.971	81.355						
8	0.494	2.745	84.099						
9	0.465	2.585	86.685						
10	0.386	2.144	88.829						
11	0.365	2.025	90.854						
12	0.313	1.738	92.591						
13	0.299	1.659	94.25						
14	0.275	1.53	95.78						
15	0.222	1.236	97.016						
16	0.207	1.152	98.167						
17	0.182	1.011	99.178						
18	0.148	0.822	100						

Rotated Factor Matrix

	Factor			
	1	2	3	4
A1		0.856		
A2	0.706			
A3			0.682	
A4			0.643	
A5		0.818		
A6			0.642	
A7				0.752
A8				0.829
A9				0.854
A11		0.802		
A12		0.792		
A14	0.744			
A15	0.592			
A16		0.698		
A17	0.77			
A18	0.786			
A19			0.729	
A20	0.699			

Appendix IV

Measurement Model and Structural Model - AMOS Results

CFA of TBSSB Service Quality Measurement Model

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
A16	<---	Rel_Sec	1				
A11	<---	Rel_Sec	1.066	0.076	14.071	***	
A12	<---	Rel_Sec	0.975	0.069	14.206	***	
A5	<---	Rel_Sec	1.014	0.067	15.238	***	
A1	<---	Rel_Sec	0.975	0.064	15.161	***	
A3	<---	Resp	1				
A19	<---	Resp	1.139	0.128	8.88	***	
A4	<---	Resp	1.107	0.128	8.651	***	
A6	<---	Resp	1.127	0.121	9.294	***	
A7	<---	Pers	1				
A9	<---	Pers	1.148	0.066	17.351	***	
A8	<---	Pers	1.039	0.066	15.723	***	
A15	<---	Conv	1				
A20	<---	Conv	1.149	0.105	10.943	***	
A2	<---	Conv	1.073	0.105	10.237	***	
A14	<---	Conv	1.063	0.105	10.162	***	
A17	<---	Conv	1.319	0.109	12.072	***	
A18	<---	Conv	1.331	0.108	12.325	***	

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
A16	<---	Rel_Sec	0.812
A11	<---	Rel_Sec	0.837
A12	<---	Rel_Sec	0.842
A5	<---	Rel_Sec	0.884
A1	<---	Rel_Sec	0.881
A3	<---	Resp	0.676
A19	<---	Resp	0.749
A4	<---	Resp	0.723
A6	<---	Resp	0.811
A7	<---	Pers	0.837
A9	<---	Pers	0.956
A8	<---	Pers	0.865
A15	<---	Conv	0.709
A20	<---	Conv	0.795
A2	<---	Conv	0.743
A14	<---	Conv	0.737
A17	<---	Conv	0.88
A18	<---	Conv	0.901

Additional CFA Results of TBSSB Service Quality, Customer Satisfaction and Customer Loyalty Measurement Model

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
A16	<---	Reliability_Security	1				
A11	<---	Reliability_Security	1.066	0.076	14.064	***	
A12	<---	Reliability_Security	0.976	0.069	14.228	***	
A5	<---	Reliability_Security	1.013	0.066	15.239	***	
A1	<---	Reliability_Security	0.974	0.064	15.159	***	
A3	<---	Responsiveness	1				
A19	<---	Responsiveness	1.139	0.128	8.877	***	
A4	<---	Responsiveness	1.108	0.128	8.653	***	
A6	<---	Responsiveness	1.128	0.121	9.289	***	
A7	<---	Personalization	1				
A9	<---	Personalization	1.155	0.065	17.873	***	
A8	<---	Personalization	1.037	0.066	15.645	***	
S2	<---	Customer_Satisfaction	1				
S1	<---	Customer_Satisfaction	0.83	0.087	9.588	***	
S3	<---	Customer_Satisfaction	1.087	0.096	11.284	***	
L5	<---	Loyalty	1				
L3	<---	Loyalty	0.995	0.095	10.462	***	
L2	<---	Loyalty	1.032	0.098	10.499	***	
L6	<---	Loyalty	1.046	0.092	11.321	***	
L4	<---	Loyalty	1.134	0.095	11.994	***	
L1	<---	Loyalty	1.265	0.098	12.891	***	
A15	<---	Convenience	1				
A20	<---	Convenience	1.149	0.105	10.941	***	
A2	<---	Convenience	1.075	0.105	10.25	***	
A14	<---	Convenience	1.066	0.105	10.182	***	
A17	<---	Convenience	1.319	0.109	12.073	***	
A18	<---	Convenience	1.329	0.108	12.308	***	

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
A16	<---	Reliability_Security	0.812
A11	<---	Reliability_Security	0.836
A12	<---	Reliability_Security	0.843
A5	<---	Reliability_Security	0.884
A1	<---	Reliability_Security	0.88
A3	<---	Responsiveness	0.676
A19	<---	Responsiveness	0.749
A4	<---	Responsiveness	0.723
A6	<---	Responsiveness	0.811
A7	<---	Personalization	0.836
A9	<---	Personalization	0.959
A8	<---	Personalization	0.862
S2	<---	Customer_Satisfaction	0.837
S1	<---	Customer_Satisfaction	0.668
S3	<---	Customer_Satisfaction	0.781
L5	<---	Loyalty	0.728
L3	<---	Loyalty	0.738
L2	<---	Loyalty	0.74
L6	<---	Loyalty	0.795
L4	<---	Loyalty	0.841
L1	<---	Loyalty	0.903
A15	<---	Convenience	0.709
A20	<---	Convenience	0.795
A2	<---	Convenience	0.744
A14	<---	Convenience	0.739
A17	<---	Convenience	0.88
A18	<---	Convenience	0.899

Additional SEM results of TBSSB Service Quality, Customer Satisfaction and Customer Loyalty Model

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P
Customer_Satisfaction	<---	Convenience	0.158	0.067	2.36	0.018
Customer_Satisfaction	<---	Reliability_Security	0.054	0.052	1.033	0.301
Customer_Satisfaction	<---	Responsiveness	0.006	0.057	0.103	0.918
Customer_Satisfaction	<---	Personalization	0.468	0.071	6.595	***
Loyalty	<---	Responsiveness	-0.015	0.048	-0.303	0.762
Loyalty	<---	Personalization	0.321	0.071	4.492	***
Loyalty	<---	Customer_Satisfaction	0.478	0.093	5.154	***
Loyalty	<---	Reliability_Security	0.026	0.044	0.597	0.551
Loyalty	<---	Convenience	0.01	0.057	0.181	0.856
A16	<---	Reliability_Security	1			
A11	<---	Reliability_Security	1.066	0.076	14.064	***
A12	<---	Reliability_Security	0.976	0.069	14.228	***
A5	<---	Reliability_Security	1.013	0.066	15.239	***
A1	<---	Reliability_Security	0.974	0.064	15.159	***
A3	<---	Responsiveness	1			
A19	<---	Responsiveness	1.139	0.128	8.877	***
A4	<---	Responsiveness	1.108	0.128	8.653	***
A6	<---	Responsiveness	1.128	0.121	9.289	***
A7	<---	Personalization	1			
A9	<---	Personalization	1.155	0.065	17.873	***
A8	<---	Personalization	1.037	0.066	15.645	***
S3	<---	Customer_Satisfaction	1			
S2	<---	Customer_Satisfaction	0.92	0.082	11.284	***
S1	<---	Customer_Satisfaction	0.763	0.083	9.247	***
L5	<---	Loyalty	1			
L3	<---	Loyalty	0.995	0.095	10.462	***
L2	<---	Loyalty	1.032	0.098	10.499	***
L6	<---	Loyalty	1.046	0.092	11.321	***
L4	<---	Loyalty	1.134	0.095	11.994	***
L1	<---	Loyalty	1.265	0.098	12.891	***
A15	<---	Convenience	1			
A20	<---	Convenience	1.149	0.105	10.941	***
A2	<---	Convenience	1.075	0.105	10.25	***
A14	<---	Convenience	1.066	0.105	10.182	***
A17	<---	Convenience	1.319	0.109	12.073	***
A18	<---	Convenience	1.329	0.108	12.308	***

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
Customer_Satisfaction	<---	Convenience	0.185
Customer_Satisfaction	<---	Reliability_Security	0.076
Customer_Satisfaction	<---	Responsiveness	0.007
Customer_Satisfaction	<---	Personalization	0.524
Loyalty	<---	Responsiveness	-0.017
Loyalty	<---	Personalization	0.353
Loyalty	<---	Customer_Satisfaction	0.471
Loyalty	<---	Reliability_Security	0.037
Loyalty	<---	Convenience	0.012
A16	<---	Reliability_Security	0.812
A11	<---	Reliability_Security	0.836
A12	<---	Reliability_Security	0.843
A5	<---	Reliability_Security	0.884
A1	<---	Reliability_Security	0.88
A3	<---	Responsiveness	0.676
A19	<---	Responsiveness	0.749
A4	<---	Responsiveness	0.723
A6	<---	Responsiveness	0.811
A7	<---	Personalization	0.836
A9	<---	Personalization	0.959
A8	<---	Personalization	0.862
S3	<---	Customer_Satisfaction	0.781
S2	<---	Customer_Satisfaction	0.837
S1	<---	Customer_Satisfaction	0.668
L5	<---	Loyalty	0.728
L3	<---	Loyalty	0.738
L2	<---	Loyalty	0.740
L6	<---	Loyalty	0.795
L4	<---	Loyalty	0.841
L1	<---	Loyalty	0.903
A15	<---	Convenience	0.709
A20	<---	Convenience	0.795
A2	<---	Convenience	0.744
A14	<---	Convenience	0.739
A17	<---	Convenience	0.880
A18	<---	Convenience	0.899

Appendix V

ANOVA Results

Effect of Age on dimensions

ANOVA

		Sum of Squares	Df	Mean Square	F	Sig.
Convenience	Between Groups	3.929	3	1.31	2.207	0.087
	Within Groups	243.3	410	0.593		
	Total	247.23	413			
Reliability & Sec	Between Groups	5.584	3	1.861	2.645	0.049
	Within Groups	288.531	410	0.704		
	Total	294.115	413			
Responsiveness	Between Groups	3.387	3	1.129	1.692	0.168
	Within Groups	273.627	410	0.667		
	Total	277.014	413			
Personalization	Between Groups	2.353	3	0.784	1.911	0.127
	Within Groups	168.282	410	0.41		
	Total	170.636	413			
Satisfaction	Between Groups	4.409	3	1.47	4.782	0.003
	Within Groups	125.998	410	0.307		
	Total	130.407	413			
Loyalty	Between Groups	2.001	3	0.667	1.759	0.154
	Within Groups	155.483	410	0.379		
	Total	157.484	413			

Effect of Highest Completed Education on dimensions

ANOVA						
		Sum of Squares	Df	Mean Square	F	Sig.
Convenience	Between Groups	0.051	2	0.026	0.043	0.958
	Within Groups	247.178	411	0.601		
	Total	247.23	413			
Reliability & Sec	Between Groups	0.253	2	0.127	0.177	0.838
	Within Groups	293.862	411	0.715		
	Total	294.115	413			
Responsiveness	Between Groups	0.095	2	0.047	0.07	0.932
	Within Groups	276.919	411	0.674		
	Total	277.014	413			
Personalization	Between Groups	2.561	2	1.281	3.131	0.045
	Within Groups	168.075	411	0.409		
	Total	170.636	413			
Satisfaction	Between Groups	0.085	2	0.042	0.134	0.875
	Within Groups	130.322	411	0.317		
	Total	130.407	413			
Loyalty	Between Groups	0.334	2	0.167	0.437	0.646
	Within Groups	157.15	411	0.382		
	Total	157.484	413			

Effect of Occupation on dimensions

ANOVA						
		Sum of Squares	Df	Mean Square	F	Sig.
Convenience	Between Groups	4.21	3	1.403	2.367	0.07
	Within Groups	243.02	410	0.593		
	Total	247.23	413			
Reliability & Sec	Between Groups	5.192	3	1.731	2.456	0.063
	Within Groups	288.924	410	0.705		
	Total	294.115	413			
Responsiveness	Between Groups	3.004	3	1.001	1.498	0.214
	Within Groups	274.01	410	0.668		
	Total	277.014	413			
Personalization	Between Groups	2.543	3	0.848	2.067	0.104
	Within Groups	168.093	410	0.41		
	Total	170.636	413			
Satisfaction	Between Groups	0.425	3	0.142	0.447	0.720
	Within Groups	129.982	410	0.317		
	Total	130.407	413			
Loyalty	Between Groups	0.506	3	0.169	0.440	0.724
	Within Groups	156.979	410	0.383		
	Total	157.484	413			

Effect of Annual Income on dimensions

ANOVA						
		Sum of Squares	Df	Mean Square	F	Sig.
Convenience	Between Groups	2.103	3	0.701	1.172	0.320
	Within Groups	245.127	410	0.598		
	Total	247.23	413			
Reliability	Between Groups	4.244	3	1.415	2.001	0.113
	Within Groups	289.872	410	0.707		
	Total	294.115	413			
Responsiveness	Between Groups	0.406	3	0.135	0.201	0.896
	Within Groups	276.607	410	0.675		
	Total	277.014	413			
Personalization	Between Groups	2.7	3	0.9	2.198	0.088
	Within Groups	167.935	410	0.41		
	Total	170.636	413			
Satisfaction	Between Groups	1.11	3	0.37	1.174	0.319
	Within Groups	129.297	410	0.315		
	Total	130.407	413			
Loyalty	Between Groups	0.871	3	0.29	0.760	0.517
	Within Groups	156.614	410	0.382		
	Total	157.484	413			

BRIEF PROFILE OF THE RESEARCH SCHOLAR

Rajiv Sindwani is a graduate in Computer Engineering and post graduate in Management. Currently, he is working as an Assistant Professor in the department of Management Studies at YMCA University of Science and Technology, Faridabad. He is having total 11 years of experience in various sectors including consumer durables, banking and education. His areas of interest include Services Marketing, Sales and Distribution Management, Marketing Research and Brand Management. He has published many papers in national and international journals. He has also presented papers in national and international conferences.

LIST OF PUBLICATIONS OUT OF THESIS

S.No.	Title of paper	Name of journal where Published	No.	Volume & Issue	Year	Pages
1	Dimensions of technology based self service banking service quality	YMCAUST International Journal of Research (Publisher: YMCAUST, India)	5	Vol. 2, Issue 2	2014	17-25
2	The impact of technology based self service banking dimensions on customer satisfaction	International Journal of Business Information Systems Strategies (Publisher: Wireilla Scientific Publications, Australia)	1	Vol. 4, Issue 1/2	2015	1-13
3	Technology Based Self Service Banking Service Quality Evaluation: a Graph Theoretic Approach	International Journal of Advanced Science and Technology (Publisher: SERSC, Australia)	1	Vol. 80	2015	1-18
4	The Impact of Technology Based self Service Banking Service Quality on Customer Loyalty	International Journal of Marketing and Business Communication (Publisher: PublishingIndia, India)	3	Vol. 4, Issue 3	2015	13-22
5	The Relationship between Service Quality Dimensions, Customer Satisfaction and Loyalty in Technology based Self Service Banking	International Journal of E-Services and Mobile Applications (Publisher: IGI Global, USA)	4	Vol. 8, Issue 2	2016	54-70