

Developing an Integrated Quality & Queuing Model for Performance Analysis: A Case of Commercial Bank of Ethiopia



Addis Ababa University

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School of Mechanical & Industrial Engineering

**A Thesis Submitted to the School of Graduate Studies of Addis
Ababa University in Partial Fulfillment of the Requirement for the
Degree of Masters of Science in Industrial Engineering**

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October 2020

Addis Ababa, Ethiopia

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School of Graduate Studies
Postgraduate Program in Industrial Engineering
**Developing an Integrated Quality & Queuing Model for
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Ethiopia**

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Declaration

I hereby announce that the work which is being portrayed in this thesis entitled **“Developing an Integrated Quality & Queuing model for Performance Analysis”** is original work of my own, has not been presented for a degree of any other university and all the resource of materials used for the thesis have been accordingly acknowledged.

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Acknowledgments

First and above all, I thank the Almighty God to whom I owe my very existence for providing me this opportunity and granting me the capability to accomplish this research.

I would like to thank my research thesis Advisor Dr. Gezahegn Tesfaye and Co-Advisor Shimelis Tilahun (Ph.D. Candidate) school of Mechanical and Industrial Engineering at Addis Ababa Institute of Technology. They always have sincere interest if I had an inquiry about my research or writing, they consistently allowed this paper to be my work and also guiding me on the right path.

I would also like to acknowledge the Internal and External Examiners of the school of Mechanical and Industrial Engineering at Addis Ababa Institute of Technology, as a reviewer of this thesis, and I am gratefully indebted to their valuable comment on this thesis.

Finally, I must express my very profound gratitude to my parents, my father Mekuria Abera, and my mother Shewaye Wedajo for providing me with unfailing support and continuous encouragement throughout my year of study and through the process of researching and writing this thesis. Thank you

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Abstract

Introduction: With the increasing progress in bank service in today's competitive market, people experience fast and prudent service delivery of bank service, this phenomenon has enhanced customer expectations about the bank service.

Purpose: The main aim of this research study is to determine the major factor that is contributing to high customer dissatisfaction and inadequate performance related to service quality and queuing (waiting time) in the Commercial Bank of Ethiopia.

Design/Methodology/Approach: The synergies of both syntheses (meta-analytic, interpretive approach) conceded out for literature review, besides, the research implemented to evaluate and to make service quality improvement for Commercial Bank of Ethiopia by integrating fuzzy SERVQUAL model, fuzzy Kano's model, and fuzzy Analytic Network Process into QFD. Structured survey questionnaires were adopted from SERVQUAL and Kano's model to collect data and survey questionnaires were distributed online through "hezrongetahun.blogspot.com", SPSS statistics 22, and from queuing (waiting time) aspect the data collection was undertaken over a week, and the stopwatch was utilized to record the arrival time and service time for every customer, and the data gathering was directed within a pinnacle period which is when many customers visit the bank.

Findings: From the SERVQUAL gap analysis the following result is obtained such as reliability (-3.637), responsiveness (-3.400), empathy (-2.787), assurance (-2.301), and tangible (-1.394). Alike, from the integrated HOQ analysis the following result is obtained such as, collecting customer feedback on a continuous basis with the value of (29.7%), update service standard and guidelines (19.88%), conducting adequate training, performance evaluation, and reward (18.8%), improve internal service quality by concentrating on employee issues (13.3%), establish experience sharing conducts (10.97) and finally identify the dissatisfied customer and frequent service failure issues (7.5%). Besides, from performance analysis the following result are obtained such as utilization rate (ρ) for each server respectively $S_1 = 98.9\%$, $S_2 = 49.5\%$, $S_3 = 32.7\%$, $S_4 = 24.6\%$, $S_5 = 19.6\%$, $S_6 = 16.4\%$, $S_7 = 14.0\%$.

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Practical Implication: The finding has a practical implication for service industries to explore their drawbacks related to service quality. Likewise, enhance customer satisfaction and increase their competitiveness in the current market place.

Originality/Value: This research paper indicates the influence of service quality and queuing (waiting time) on customer satisfaction, the performance of the bank. And also this research studies develop an integrated quality and queuing model framework for performance analysis.

Conclusion: The following conclusions are derived from the research findings see, for example, service quality dimensions such as reliability, responsiveness, empathy, assurance, tangible affect customer satisfaction correspondingly. And also from performance or service rate analysis, the company should improve the utilization of the server utilization. Also from integrated HOQ findings improving those technical requirements exclusively can improve the service quality of the bank in turn increases customer satisfaction.

Keywords: *fuzzy SERVQUAL model, fuzzy Kano's model, fuzzy ANP, QFD, customer satisfaction.*

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List of Acronyms

No.	Acronyms	Description
1	ATM	Automated Teller Machine
2	POS	Point Of Sales
3	EPRDF	Ethiopian People's Revolutionary Democratic Front
4	NBE	National Bank of Ethiopia
5	CBE	Commercial Bank of Ethiopia
6	SERVQUAL	Service Quality (reliability, responsiveness, assurance, empathy, & tangibles)
7	QFD	Quality Function Deployment
8	HOQ	House Of Quality
9	ANP	Analytic Network Process
10	AHP	Analytic Hierarchy Process
11	SPSS	Statistical Package for Social Sciences

Chapter One

1. Introduction

1.1. Background of the Research

The purpose of conducting this research is discussed as follows. See, for example when we visit the Commercial Bank of Ethiopia, most of the service branch are queuing up, as result, customers return without service or wait for a long time to get the service, which affects service accessibility and service quality.

In line with this, the customer is forced to look out for other service providers, which may result in the companies losing an existing customer and which make them vulnerable to higher cost such as (advertising cost, training cost, etc.) to acquire a new customer. Therefore, this research determines the major factors that affect the performance of the bank in line with service quality, queuing (waiting time) which results in higher customer satisfaction.

Besides, this research studies evaluate and analyze to make service quality improvement in the Commercial Bank of Ethiopia by using the integration of fuzzy SERVQUAL, fuzzy Kano's model, fuzzy Analytic Network Process (ANP) into QFD in line with this, SPSS statistics 22 were used for analysis. Alike, queuing (waiting time) analysis using multiple server queuing model with Poisson arrival and exponential service time (M/M/S). Consequently, this research paper develops an integrated quality and queuing model framework for performance analysis of the Commercial Bank of Ethiopia. Also, the integrated framework will be validated and executed accordingly.

In the current competitive market place organizations are mislay their clients due to the quality of service/product they deliver (Tesfaye, 2015). Hence, the main cause of customer loss is that service providers often do not fully understand the needs of their customers, and as a result, customers are dissatisfied with the service they receive. However, to overcome these issues companies must eliminate customer dissatisfaction, and they should focus on customer service (Berushie, 2014). Hence, "the longer customer stays with a bank the more utility the customer generates" (Kebede, 2017).

According to [Basari & Shamsudin \(2020\)](#); [Hamzah & Shamsudin \(2020\)](#); [Ilias & Shamsudin \(2020\)](#) customers recreate a significant persona in business performance. In line with this, customer satisfaction increments as the quality of services/products offered by the firm advanced ([Hasfar.M et al., 2020](#)).

[Johnston & Clark \(2001\)](#) cited in [Goldstein et al. \(2002\)](#) defines and pinpoint the concept of services as follow, services operations:- a method by which services extradited; services experiences:- the customer direct go through of the services; services outcome:- the welfare and upshot of the services; the value of the services:- the benefits the customer perceived as inherent in the weight of the service against the cost of the services.

Likewise, [Grönroos \(2001\)](#) defines the services concept as “ an idea how the quality – generating resource should function and what result the should achieve for the customer.” Besides, the services sector embrace a various and complex range of firms and initiatives. Accordingly, [Ghobadian et al. \(1994\)](#) categorize the services sector into three perspectives which includes: national and local government:- for instances, education, health, social security, police, military, transport, legal, information, and credits; non – profit private services:- for instances, charities, churches, research foundations, mutual societies, and art foundations; for-profit private services:- for instances, utilities, hotels, airlines, architects, restaurants, solicitors, retailers, entertainment, banks, insurance companies, advertising agencies, consultancy firms, market research companies, and communications.

[Hernon & Nitecki \(2001\)](#) defines services quality from a different perspective these include: - excellence, value, conformance to specification, and meeting and/or exceeding expectations. also, [Ramya et al. \(2019\)](#) define service quality as the ability of a services firm to gratify customers in an effective way through which advances its business performance.

The queuing systems theory goes back to the seminal work of [A.K. Erlang](#) from (1878 - 1929) in line with this, the application of the queuing theory has now gone beyond commercial activities, which comprehend other fields of human effort ([G. D. Paul et al., 2015](#)). For example, banking, vehicular traffic, logistics, trade, customer services, production lines, manufacturing

systems, hospitals, airline, and stock – in – trade, etc., then, queuing theory has appeal tending and advanced rapidly.

Malik et al. (2018) classify the queuing model into two these include: deterministic and probabilistic, whereas in the deterministic queuing model the probability distribution is not associated with the arrival of customer and service time, while in the case of the probabilistic model, the arrival of event/ entities and service time are associated with the probability distribution.

Mkoma (2014); stated that the commercial bank sector contributes a significant role in the development of the country, also the financial services fork out to the community to arouse economic opportunities. Alike, from an economic perspective, the main duties of bank and other financial firm is to act as intermediate, channeling saving to investment, investment consumption through them, the investment requirements of savers are reconciled with the credit needs of consumers and investors (Shanmugapriya & Sethuraman, 2014).

The major duties of commercial banks are to offer customers financial service that facilitates customers to ameliorate bring off their lives. In line with this, Cornett & Tehranian (2004) cited in Goshu & Gudu (2016) the major service which includes: information service, liquidity service, transaction cost service, maturity intermediation service, money supply transmission, credit allocation service, and payment service.

Moreover, according to Nokandeh et al. (2013) categorize banking service method into two these include traditional method: in this method, the services process is undertaken by manpower and customer existences is mandatory, new method: the method of service delivery is through by electronic banking which includes, home banking, remote banking, banking Abntr note, banking via ATM, point of sale banking (POS), and mobile banking and other methods.

Ethiopian banking history goes back a century ago, during the Axumite dynasty (Melkamu, 2018). However, “modernistic banking in Ethiopia commenced in 1905 with the constitution of Abyssinia bank, moreover, in 1908 a new development bank known as Societe Nationale d’Ethiope Pour le Developpement de l’Agriculture et du commerce and two other foreign banks such as Banque de l’Indochin and the Compagnie de l’Afrique Orientale was established” (Geda, 2006).

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Besides, after the overthrow of the Derge regime in 1991 that governed the country for 17 years under the rule of the command economy, the EPRDF stated a liberal economic system, considering this monetary and banking proclamation of 1994 established the national bank of Ethiopia a judicial entity, set - apart from the government and defined its briny routine.

In line with this, “monetary and banking proclamation No.83/1994 and the licensing and supervision of banking business No.84/1994” (National Bank of Ethiopia, 2019). set up the legal cornerstone for investment in the banking sector, consequently, after the proclamation, numerous private bank was launched such as Awash international bank, Dashen bank, bank of Abyssinia, Wegagen bank, United bank, Nib international bank, Cooperative Bank of Oromia, Lion international bank, Zemen bank, and Oromia international bank, etc.

Gebre (2017) in the Ethiopian bank services industry the major reasons for inadequate service quality is inadequate database management of customers lack adequate infrastructure and technology. Moreover, “employee’s competence and skills, reliability of the electronic system, reliability of the service system, impeccability banking system integrity, and accountability instrument were among other factors that affect the excellence of service quality of the bank services” (Pourmohammad et al., 2016).

Numerous research conducted on the influence of service quality, queuing (waiting time) on customer satisfaction in the case of commercial banks in Ethiopia as well as other countries. See for a case, service quality aspect, local Jaleta (2019); Kebede (2019); Tesgaye et al. (2014), and other countries Çirpin & Sarica (2014); Mamo (2015); Osei-poku (2012); Raza et al. (2020), and from queuing (waiting time) management, local Abebe (2014); Zewude (2016), and other countries (Agyei et al. 2015; Asogwa et al. 2018; Omondi, 2018).

To the best of the researcher's knowledge, from the service quality aspect, both local and foreign research studies only concentrate on customer satisfaction, customer loyalty, growth, and others. Whereas, from queuing (waiting time) management aspect both local and foreign research studies only focus on increasing the number of tellers or servers in the facilities.

However, no research that determines the principal factors concerning service quality, and queuing (waiting time) that influence the bank performance, also, there is no research conducted

on integrating quality and queuing models. Therefore this research is very essential to understand customer feedback or complain and to improve service delivery.

1.2. Statement of the Problem

Service quality is the most spectacular constituent that needs serious consideration for firms to exceed their competitors. In any government and private service banks, the key for its survival and successes depends on the capacity to provide quality service and meeting or exceeding customer expectations. It is a common phenomenon that many service providers encounter issues in delivering satisfactory service to its customer with the minimum cost that will increase the profits of the company.

In today's Commercial Bank of Ethiopia is playing a significant role in the development of the country and also the bank has many branches stretched across the country. Likewise, from the services sector particularly the banking services sector, thereby the Ethiopian financial sector has been broadly safe, sound, well-capitalized, and profitable. For a case, the Commercial bank of Ethiopia opened 807 new branches in 2018/19 alone which increased the total number of branches to 5,564, the bank also increased their deposit mobilization by 23.2 percent loan collection by 18.1 percent, and loan disbursement by 42.5 percent, their non-performing loan was within the required ceiling of 5 percent ([National Bank of Ethiopia, 2019](#)).

However, at present the bank is facing significant problems i.e. decreased customer satisfaction and quality service delivery. A moment all most all commercial banks branch are affected by long waiting time, and inadequate service quality which usually reduce customer satisfaction and cause negative feedback, see for instance the figure below.

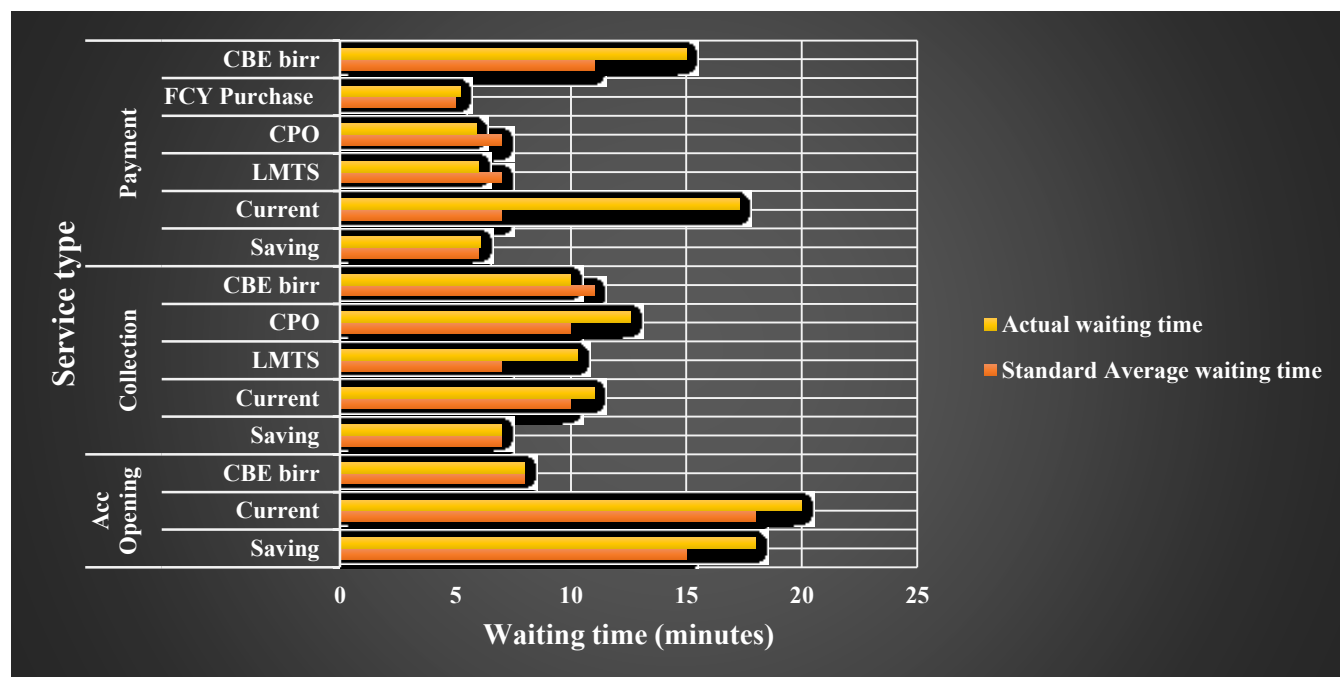


Figure 1. 1 Actual waiting time Vs. Standard average waiting time

Furthermore, this leads to the diminution of demand and also customers will look at other alternative service banks. Consequently, finding the main area of the problems and working on its improvement is very important for the commercial bank of Ethiopia to meet or exceed the customer perceptions and expectations with the quality of service, also by eliminating long waiting times.

So, the bank should survey the level of customer satisfaction to achieve its organizational aims. Moreover, in current situations, thoughtful consideration is absent in customer service delivery. Due to that, there is a gap between customer perceived service and their expectations.

Therefore, this research determines the major factors that affect the performance of the bank in line with service quality, queuing (waiting time) which results in higher customer satisfaction.

1.3. Research Question

This research attempted to provide answers to the following research questions:

- What are the main variables of service quality that influence customer satisfaction in the Commercial Bank of Ethiopia?
- What are the major knotty areas in the banking service and what is the cause of those problems?
- What is the influence of the queue (waiting time) on customer satisfaction in the Commercial Bank of Ethiopia?

1.4. Research Objectives

1.4.1. General Objective

The general objective of this research is to develop an integrated quality and queuing model on the performance of the bank service system. Alike, advanced service excellence, and customer satisfaction in the commercial bank of Ethiopia.

1.4.2. Specific Objective

This research sought to fulfill the following specific objectives:

- ✓ To identify the main dimension of service quality that influence customer satisfaction.
- ✓ To identify the problematic area in the bank service and their cause.
- ✓ To identify the impact of a queue (waiting time) on customer satisfaction.
- ✓ Develop an integrated quality and queuing model for the bank service system.

1.5. Significance of the Research

Through this research case company, the basic problem can be identified in terms of queuing and quality. Besides quality and queuing, model integration will enhance the performance of the bank service system.

Additionally, the new framework can serve as a service system to overcome queuing and quality problems experienced by banks. This research has great importance to individuals, societies or group who are interested in studying synergies of quality model and queuing system and other service sectors which needs to give high consideration of queuing and service quality management become the beneficiary.

1.6. Scope and Limitation of the Research

The scope of this research is to focus on developing a framework of quality and queuing model integration for the bank service system. And, in the meantime, there is a constraint during the research study like the sample size was large, it was difficult to distribute all survey questionnaires to the respondent due to the current COVID-19 pandemic, however, to overcome this issues the researcher developed a personal website known as, hezrongetahun.blogspot.com to collect the data online from the respondent.

1.7. Organization of the Research

The research comprises five-chapters and appendixes, the research is organized so that the entropy layout to the proofreader is staged in chronological order. Therefore, the research content listed as follows.

Chapter 1 – Introduction: This section provides a porta to the proofreader about the background of the research, statement of the problem, research question, research objective, significance of the research, scope & limitation of the research, and finally proceeding section highlight.

Chapter 2 – Literature review: Presents a related literature review of the concept, theory, definition, models, and findings such as on service, service quality, customer satisfaction, customer loyalty, queuing theory, research gap, services quality & process improvement, quality measurement tools for customer-oriented approaches, integration of customer-oriented tools for services quality improvement, and finally Ethiopian bank industry.

Chapter 3 – Research Methodology: Describes the methodologies employed in the research, i.e., the overall research plan which incorporates of what task should be through & the chronological order of the task, a method to execute the task, what major data required, what data collecting technique is taken, determine the research sample size, selecting a data source, what data analysis approach/tools/technique/method executed, and finally how research conclusion & recommendation is drawn.

Chapter 4 – Data Collection & Analysis: Demonstrate the sample data collected from the respondents using the Fuzzy SERVQUAL model, Kano's model, and analyze it using the synergy of the SERVQUAL model, Refined Kano's model, Fuzzy Analytical Network Process (FANP) into Fuzzy Quality Function Deployment (QFD), and finally construe the analysis result, also from queuing perspective recording the Interarrival time and analyze, cipher the performance improvement parameter with multiple servers queuing model and interpret the analysis result.

Chapter 5 – Conclusion, Recommendation & Future research work: shows a conclusion drawn from the research, forward a method of how the company can overcome issues related to service quality and queuing to enhance customer satisfaction, and at the end suggestions for future research in the area.

Chapter Two

2. Literature Review

2.1. Introduction

The excellence of service quality in the bank depends on the infrastructure, technology, employee competence, skills, reliability of the electronic system, reliability of the service system, impeccability banking system integrity, and accountability instrument, etc.

In this research study, other supportive service quality improvement tools for customer-oriented approaches such as SERVQUAL models, Kano's model, Quality Function Deployment (QFD) has been seen. In line with this, their application and their drawback of the tools has been discussed. Likewise, other helpful multi-criteria decision-making tools for improving service quality have been seen such as Analytic Hierarchy Process (AHP), Analytic Network Process (ANP). Concerning that, their application and their drawback of the tools has been discussed.

This research study tries to show the effectiveness of the synergies of customer-oriented tools with multi-criteria decision-making tools for improving the service quality. For this aim, numerous publication that discusses service quality issues, and various method or techniques used to solve them has been discussed. And also, queuing (waiting time) issues, and different method or approaches used to solve them has been discussed.

2.2. Concept of Service

Regardless of the challenges in defining the concept of service exactly, still, numerous scholars have defined service from various aspects. Accordingly, [Hill \(1977\)](#) defines service as changing the status of a person or something that belongs to some economic unit. Moreover, [Quinn et al. \(1987\)](#) define service as “all economic activities whose output is not a physical product or construction, is generally consumed at the time it is produced and provides added value in forms (such as convenience, amusement, timeliness, and comfort or health) that are essentially in intangible concerns of its first purchaser”.

Likewise, [Vargo & Lusch \(2004\)](#) define “service as the application of specialized competences (skill and knowledge), through deeds, processes, and performance for the benefit of another entity or the entity itself (self - service)”. Besides, [Gronroos & Gummerus \(2014\)](#) define service from the service logic (lexicon) perspectives which “service is support for an individual's or organization's everyday processes in a way that facilitates (or contributes to) this individual's or organization's value creation”.

[Gronroos \(1984\)](#) explained that service is a product that requires high consumer engagement in the intake process. On the other hand, service is a process of the interplay among customers, and service providers through the process service will be perceived ([Dawit et al., 2019](#)).

[Spohrer et al. \(2007\)](#) define the service system as value-creation, through arrangements of people, technology, and other internal and external service systems, and sharing information such as language, processes metrics, prices, and laws. In this respect, to be successful in service innovation, the service system should maintain information regarding the capacities and the requirements of its customers, competitors, and itself ([Maglio & Spohrer, 2008](#)).

The intricacy of analyzing service depends on their well-known characteristics. Such as Intangibility, inseparability, heterogeneity, and perishability, which have previously constituted and accented in many works of literature ([Lovelock & Gummesson, 2004](#); [Tagore, 2016](#); [Vargo & Lusch, 2004](#)). However, [Edvardsson et al. \(2005\)](#) declared that “ we should not generalize the characteristics of service, but use them when they are relevant and in a situation when they are useful and fruitful, more to that, we need to understand the conditions under which they apply”.

Perhaps, [Moeller \(2010\)](#) emphasizes that, due to a scarcity of proper characteristics, the term service remains vague (undefined). [Mosahab et al. \(2010\)](#) declared that service is comely predominant in various organizations, regionally, nationally, and globally and measured as a means for revenue streams. On the other hand, numerous scholars stated that service industries include such as management, education, hotels, banks, restaurants, retail shops, hospitals, insurance, catering, lodging, travel, entertainment, telecommunication, postal service, transport (rail, sea, and air), legal service, and accounting service and more ([Allen, 1988](#); [Behdioğlu et al., 2019](#); [Hong, Choi, & Chae, 2020](#); [Ramamoorthy, 2000](#)). Consequently, after completing the

discussion of the concept of service from several works of literature. Alike, in the next section, we will see the major aspects of service quality.

2.3. Concept of Service Quality

The concepts of quality have been chew over throughout centuries and proceed to be a significant research issue until now. Likewise, service quality is predominantly conceptualized in several academic works of literature, particularly associated with the supremacy of the service (Gera et al., 2017; Marković et al., 2015).

Harvey & Green (1993) they recapitulated, quality into two different relative concepts, first, quality means different things to different people, second, relative to “process” or “outcomes”, Subsequently, they reflected quality as an exception, fitness for purpose, value for money, and transformative. Considering, the concept of quality leads to meeting between what customers expect and what they perceive (Saghier & Nathan, 2013).

Ghobadian et al. (1994) summarized the definition of quality into five generic classes based on their importance to service organization such as transcendent, product, process or supply, customer, value approaches.

While Mackay & Crompton (1990) they defined service quality as “the relationship between what customer desire from a service and what they perceive that they receive”. On the other hand, Lenka et al. (2009) specified, service quality is the discrepancy within customer expectations and perceived service. Accordingly, Elmayer (2011) defines the quality of service level from a customer perspective, and it is a correlation between expected and perceived service. Likewise, Sawant (2016) defines service quality as “the overall assessment of service by the customer”.

Ali (2018) stated that definitions of service quality differ and are subject to various models, customer expectations, and satisfaction. Following that, Gupta et al. (2018) defined service quality as “consumer's satisfaction level from the service encounter and it also includes the expectations of the consumer before taking service and, the way, service is conveyed simultaneously”.

In particular, satisfaction is the outcome of a process of correlation between customer's expectations and perception of the service execution (Shayestehfar & Yazdani, 2018). Furthermore, meeting or exceeding the customers' service requirements, consequently, the higher the service quality and customer satisfaction (Uppal, 2019).

Companies should fill the gap between the expected and perceived service to fulfill customer satisfaction, considering that, the expectation of the customers determined by their outlook of the company's image, additionally, corporate image, is the result of how the customers perceive the companies, and consequently, corporate image is established mainly on technical and functional quality of service (Gronroos, 1984). Besides, service quality has two dimensions i.e., functional and technical quality, further, functional quality center on "how" the service is delivered, whereas, technical quality, present "what" the customer perceived at the end (Brady & Cronin, 2001; Kang, 2006). And also, Zameer et al. (2015) define a corporate image as "the perception about the organization that the customer holds in their memories".

Venetis & Ghauri (2004) they stated that the quality of service to be recognized as a significant Success Factors for present service companies, on the other hand, the influence of service quality to profitability, generally explained in two major processes, first, service quality is considered a few ways for service differentiation, and competitive advantage to attract new customers, increase the market share, whereas second, service quality is becoming a way for customer retention. Also, Ravichandran et al. (2001) explained that numerous approaches were formulated to retain the customers, and however the crux is to enhance the service quality. What is more, Sigit Parawansa (2015) stated that customer retention has main four stages which are known as "the four-stage model of loyalty power" such as, cognitive loyalty, affective loyalty, conative loyalty, and action loyalty.

Service quality is remarkably relevant for bank industries, as customers typically look for service they perceive. Successful bank business concentrates massively on presenting choicer quality service compared to its competitors. Likewise, quality of service is the principal determinant in which banks can invite new customers, and helps to retain the existing customers (M. Ahmed, 2017).

Service quality has become a crucial determinant for all organization that is driven by the need to survive and remain competitive (Hu et al., 2009). Therefore, service companies should plan, organize, implement, and control the quality system so that they can meet or exceed customer expectations and increase customer satisfaction (Ramdhani et al., 2011). Also, service quality is considered a significant causal factor of business competitiveness, and also has a direct influence on the cost and profit of the firms (Gounaris et al. , 2003; Gupta et al., 2018). Therefore, from the literature the researcher reason out that customer satisfaction is a prerequisite of service quality, thus in the upcoming section, the researcher will identify the major relationship between service quality and customer satisfaction.

2.3.1. Factor Influencing Service Quality

Different models have been developed by numerous authors to analyze and measure the factor that affects service quality (Ananda & Devesh, 2017). Accordingly, the discrepancy between customer expectation and management perception about customer expectations, due to that, perceived service quality will suffer (Berry et al., 1988). Hence, service quality fluctuates regarding customer service expectations, following that, customer distinguishes their expectations with perceived service to evaluate service quality (Donthu & Yoo, 1998). Besides, in the proceeding section below the researcher will identify the major antecedence and consequence of service quality through Meta-analysis, to manage which construct have a major influence on service quality on the banking service system, and also what are the consequence of it.

Method design

The meta-analysis method conceded out for this analysis, and it is a routine used for summarizing and investigation of statistical results across many independent researcher's discoveries related to similar issues or subject areas (Meghisan & Burger-Helmchen, pp-7, 2017).

2.3.1.1. Antecedence and Consequence of Service Quality in Banking Context

Generally, we identified 14, variables that exemplified the antecedence of service quality, and 4, variables that represented the consequence of service quality from numerous literature that is shown in the table below which is used for meta-analysis.

What are the principal antecedence and consequences of service quality?

Table 2. 1 The principal antecedence of service quality in banking contexts

No	Antecedence	Concept	Source
1	Customer focus	“The degree to which service providers are focused on assessing and satisfying changing customer needs”	Green Jr. et al. (2008)
	Individual performance	“The degree to which service providers accomplish their individual work-related goals and the degree to which those goals support the organization’s goal”	
	Zero – error commitment	“The degree to which service provider is committed to delivery service that is free from errors”	
2	Word – of – mouth	“Those individuals who consider this form of communication before purchasing decision have indirectly controlled for the result of their choice”	Gounaris et al. (2003)
	Comparison of shopping	“Consumer’s choices are frequently guided by the degree of experience to the individual has with a certain brand”	
	Personal relationship	“The extent to which a personal relationship of some kind has been developed between consumer and service provider either before or as a result of the exchange”	
	Perceived market orientation	“The company’s ability to drive superior performance is attributed to the subsequent skills it builds which allow for a better understanding of the needs of its target market”	
3	Speed of delivery	“The time is taken to perform the transactions”	

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	Ease of use	“The effort expended in using the service”	Shamdasani et al. (2008)
	Reliability	“The accuracy of the service outcome”	
4	Interpersonal interaction	“It is the two – way conversation between service provider and customer”	Hsirh & Hiang (2004)
	Physical environment	“Feel comfortable about the ambient conditions, practical about the facility design and trustworthy about its ability to manage customer needs”	
5	Technology	“High – tech service includes internet/ telephone/short messaging services (SMS), ATM whereas high – touch service consists of instruction and using the service”	Akinyele & Olorunleke (2010)
6	Employee competence	“Major role in delivering superior quality service to the customer”	Gunasekare (2016)

Table 2. 2 The principal consequences of service quality in the banking context

No	Consequences	Concept	Source
1	Customer satisfaction	“Feeling of happiness when his/her expectation meet”	Badara et al. (2013)
	Customer loyalty	“A deeply held commitment to re-buy or re – patronize a preferred service/product consistently in the future”	
2	Customer retention		Newman (2001)
	Recommendation		

From numerous literature reviews, we found a significant number of studies related to antecedences of service quality in the bank service context. Overall, these research studies examine only customer focus, zero-error commitment, technology, and employee competence.

Statistical analysis

Based on the information gathered from the research studies included for meta-analysis the r – family of the effect i.e. Pearson correlation coefficient of the construct was recorded, besides for studies that report statistical result such as (X^2 , f – test, t -test, Z – test, β – value, p -value) were converted into correlation coefficient (Ladeira et al.pp-804, 2016). In the meantime, a random effect size model is selected for the analysis (Hunter & Schmidt, 2004).

Result

The result section presents the meta-analytic finding for the antecedence of service quality in the bank services sector.

Table 2. 3 The meta-analytic finding for the antecedence of service quality in the bank services sector

Construct	K	N	r	p -value	Confidence interval		Q
					CI _{upper}	CI _{lower}	
Customer focus	2	820	0.457	0.3377	0.7313	0.2567	5.96
Zero-error commitment	2	1,188	0.325	0.5022	0.5356	0.1388	11.74
Technology	2	1,400	0.773*	0.0398	1.2924	0.7638	25.35
Employee competence	4	1,614	0.659*	0.0016	1.1727	0.4086	159.45

Note: k = number of study; N = total sample size; r = effect size; CI = confidence interval (95%); Q = chi square test from the random effect analysis.

Conclusion and Discussion

Based on the Meta analytic analysis, the effect size for customer focus ($r = 0.457$, $p < 0.05$); zero-error commitment ($r = 0.325$, $p < 0.05$) were positive however statistically insignificant. Whereas, technology ($r = 0.773^*$, $p < 0.05$); Employee competence ($r = 0.659^*$, $p < 0.05$) of service quality were positive and statistically significant.

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This result section presents the meta-analytic finding for the consequences of service quality in the bank services sector.

Table 2. 4 The meta-analytic finding for the consequences of service quality in the bank services sector

Construct	K	N	<i>r</i>	<i>p-value</i>	Confidence interval		Q
					CI _{upper}	CI _{lower}	
Customer satisfaction	20	7,807.00	0.716*	0.0000	1.1055	0.6926	1,591.07
Customer loyalty	13	5,247.00	0.525*	0.0000	0.7480	0.4171	426.16
Customer retention	5	1,886.00	0.690*	0.0000	1.1362	0.5581	148.44
Recommendation	2	659.00	0.520	0.2511	1.1432	0.0085	48.79

Note: k = number of study; N = total sample size; *r* = effect size; CI = confidence interval (95%); Q = chi square test from the random effect analysis.

Conclusion and Discussion

Based on the Meta analytic analysis, the effect size for customer satisfaction ($r = 0.716^*$, $p < 0.05$); customer loyalty ($r = 0.525^*$, $p < 0.05$); customer retention ($r = 0.690^*$, $p < 0.05$) of service quality were statistically significant. Whereas, recommendation ($r = 0.520$, $p < 0.05$) were positive however statistically insignificant.

2.3.2. Service Quality Model

Seth et al. (2005) recapitulated the existing service quality model from different literature and identified, examined 19 services quality model in line with the finding shows that the service quality outcome and measurement are reliant on the types of service setting, situation, time, needs, etc., besides the major service quality model includes such as technical and functional quality model, gap model, attribute service quality model, synthesized model of service quality, performance only model, ideal value model of service quality, evaluated performance and normed quality model, IT alignment model, attribute and overall effect model, a model of perceived quality and satisfaction, PCP attribute model, retail service quality and perceived value, service quality customer value and customer satisfaction model, antecedence and mediator model, internal service quality model, internal service quality DEA model, internet banking model, IT-based model, and finally the model of e-service quality.

Service quality gap model

Parasuraman et al. (1985) demonstrated a collection of essential variances exists concerning executive perceptions of service quality and duties related to service offering to customers.

Gap1. Discrepancy within customer expectations and management perceptions: a consequence of the absence of a marketing research orientation, incompetent upward communication, and too many layers of management.

Gap2. Discrepancy within management perceptions and service quality specifications: a consequence of an incompetent dedication to service quality, incompetent task regularity, and a lack of goal setting.

Gap3. Discrepancy within service quality specification and actual service delivery: a consequence of position doubtfulness and disagreement ordinary worker – task assignment and inadequate technology – task assignment, improper supervisory administration systems, and lack of collaboration.

Gap4. Discrepancy within actual service delivery and external communications: a consequence of incompetent horizontal communication and inclination to over-promises.

Gap5. Discrepancy within customer expectations and perceived service: a consequence of the impact exerted from the customer part and the inconsistency on the role of the service provider.

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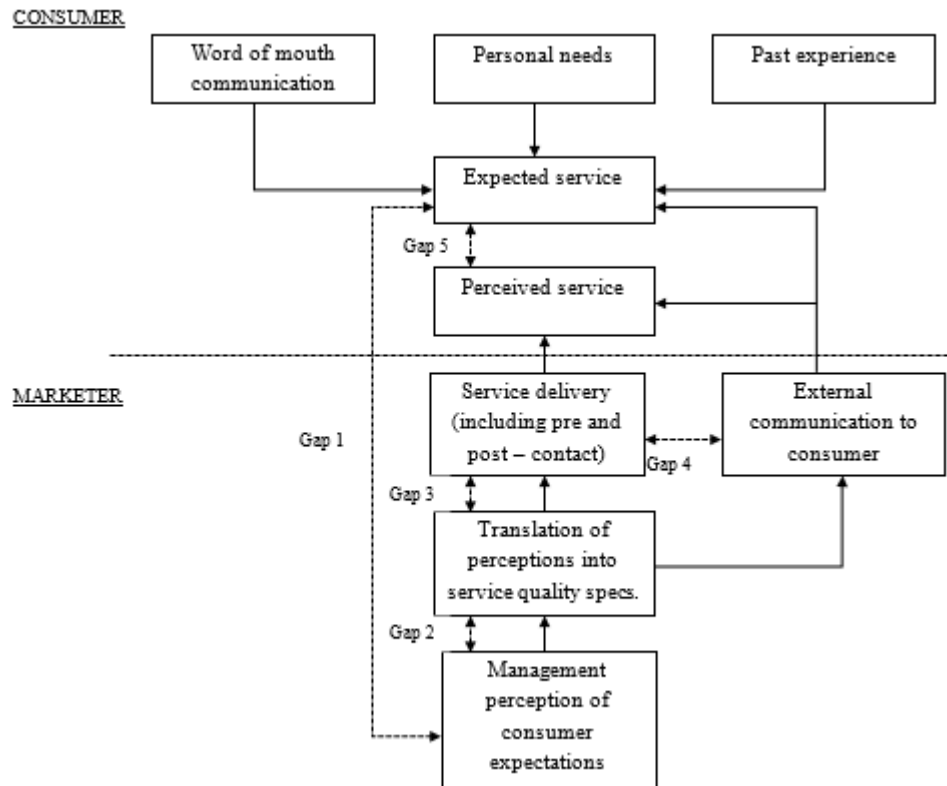


Figure 2. 1 Service quality model. Source: [Parasuraman et al. \(1985\)](#)

2.3.3. Relationship between Service Quality and Customer Satisfaction

Numerous types of researches conducted in several service industries and following that they have also studied the association between service quality and customer satisfaction, see, for instance, telecommunication ([Ishaq, 2011](#); [Ojo, 2010](#)); hypermarkets ([Mahfooz, 2014](#)); public hospital ([Arsanam & Yousapronpaiboon, 2014](#)); bank ([T. L. Hong & Marimuthu, 2014](#)); automotive insurance ([Arokiasamy & Tat, 2014](#)); fashion house ([Islam et al., 2011](#)); consulting service ([Wang et al., 2005](#)); life insurance ([Khurana, 2014](#)); hotel ([Sharma & Srivastava, 2018](#)) and more.

Likewise, [Amin & Isa \(2008\)](#) stated that “service quality is positively related to customer satisfaction”. As well, [Munusamy et al. \(2010\)](#) indicated, service quality and customer satisfaction are interrelated, having that, the higher the service quality, consequently the higher the customer satisfaction.

[Sadeghi & Bemani \(2011\)](#) recapped, the association between service quality and customer satisfaction, first, service quality is entered as a predecessor of customer satisfaction, in this respect, customer satisfaction expressed as an “investigation following quality perceived”, second, customer satisfaction is a predecessor of service quality, finally, the third concept considers the association between satisfaction and service quality that, neither, customer satisfaction nor, service quality another predecessor.

Furthermore, the relationship between service quality and customer satisfaction has earned exceptional consideration in marketing literature. See for a case, ([Adil, 2013](#); [Akhtar et al., 2011](#); [Aliata et al., 2016](#); [Dawit & Adem, 2018](#); [Khan et al., 2014](#)) and more. Having that the researcher will identify the principal construct of service quality to outlook which service quality variables or dimensions have a significant influence on customer satisfaction in the bank service industry.

What are the main variables of service quality that influence customer satisfaction?

The meta-analysis method was carried out for this study, and it is a routine used for recapitulate and examination of statistical results across many fencesitter researcher's discoveries related to similar issues or subject areas ([Meghisan & Burger-Helmchen, pp-7, 2017](#)).

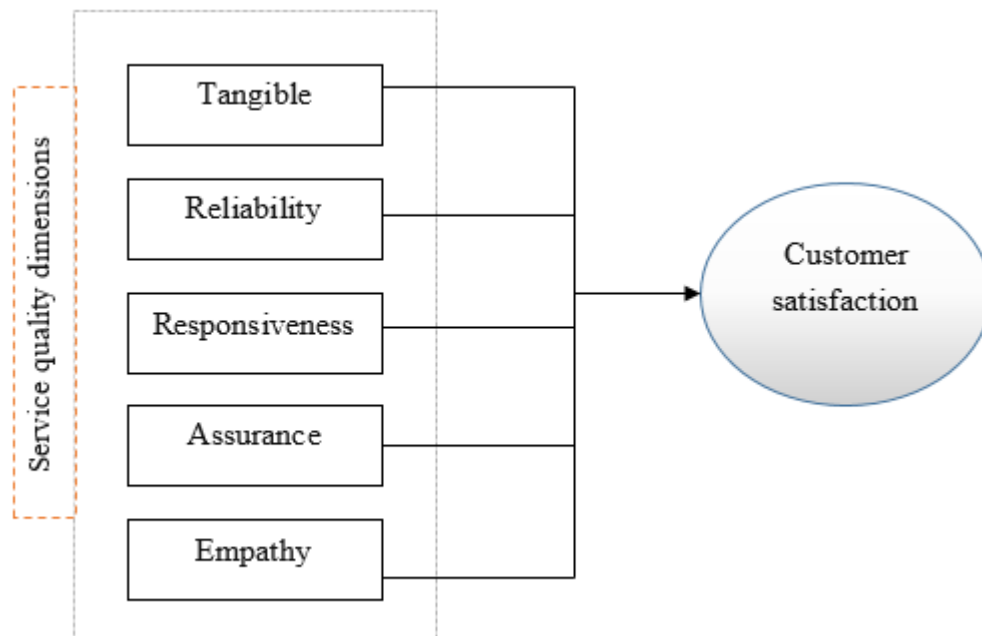


Figure 2. 2 Framework of service quality dimensions/ variables and customer satisfaction

Method design

Data source

Before starting for searching for a relevant research paper we should state the inclusion and exclusion criteria, accordingly, the inclusion and exclusion criteria specified in advance and documented see table and the figure below, after removing duplicated articles 106 of the research articles were identified through the database search and also 72 articles were excluded due to inconsistency result, non – empirical synthesis and so on.

No.	Description
1	Research articles that focus on the correlation between service quality dimensions or variables and customer satisfaction.
2	Research articles are conducted only in an empirical approach or synthesis.
3	Studies published from 2010 to 2020.

Otherwise, research studies that are not incorporated with the above inclusion criteria will be excluded from the meta-analytic synthesis.

Following the aforesaid step completed, next is to run a search on a various database such as *Emerald, Taylor & Francis, Elsevier Science Direct, Google Scholar, Springer Link, PubMed/Medline, Jstor, CrossRef, Worldcat, DOAJ, PsycINFO, Scopus, ProQuest, Scielo, Web of Science*. In the meantime the author search reliant on the concept using keywords and phrases like, “customer satisfaction”, “service quality”, and also keyword of methodology “empirical”. Furthermore, the author sought after dissertations and thesis to comprise unpublished research papers, thereby admitting to discussing the “the file drawer problem”.

Following that next step is data extraction, the extraction where the data includes the name of the author, publication year, and also the number of sample size, the correlation coefficient of the construct.

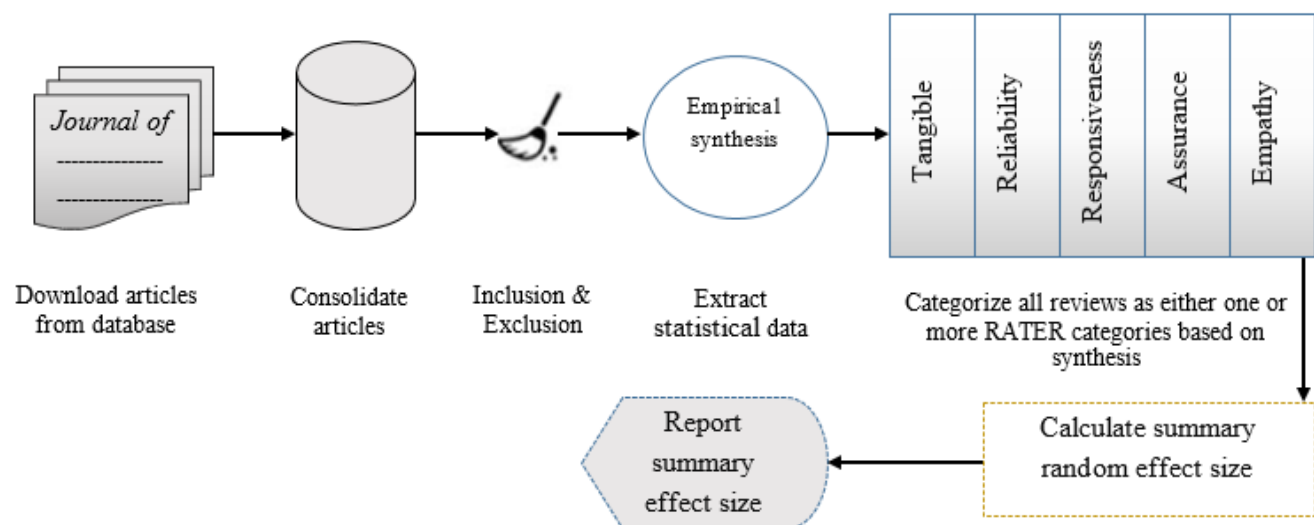


Figure 2. 3 Flow diagram of research paper selection and meta-analysis

Statistical analysis

Based on the information gathered from the research studies included for meta-analysis the r – family of the effect i.e. Pearson correlation coefficient of the construct was recorded, besides for studies that report statistical result such as (χ^2 , f – test, t – test, Z – test, β – value, p – value) were converted into correlation coefficient (Ladeira et al., pp-804, 2016). In the meantime, a random effect size model is selected for the analysis (Hunter & Schmidt, 2004).

Result

The result section presents the meta-analytic finding for the effects of service quality dimensions on customer satisfaction.

Table 2. 5 Meta-analytic appraisals of the effect of service quality on customer satisfaction

Construct	k	N	<i>r</i>	<i>p</i> -value	Confidence interval		Q	<i>I</i> ² index
					CI _{upper}	CI _{lower}		
Tangible	30	8,411	0.575*	0.0000	0.7700	0.5411	807.14	96.4%
Reliability	33	9,291	0.560*	0.0000	0.7359	0.5287	805.99	96.0%
Responsiveness	32	8,643	0.549*	0.0000	0.7149	0.5092	715.69	95.8%
Assurance	27	7,340	0.580*	0.0000	0.7939	0.5298	842.42	97.0%
Empathy	32	8,761	0.580*	0.0000	0.7804	0.5424	973.05	96.9%

Note: k = number of study; N = total sample size; *r* = effect size; CI = confidence interval (95%); Q = chi square test from the random effect analysis.

Conclusion and Discussion

The association between customer satisfaction and service quality dimensions

Based on the Meta analytic analysis, the effect size for tangible ($r = 0.575^*$, $p < 0.05$); reliability ($r = 0.560^*$, $p < 0.05$); responsiveness ($r = 0.549^*$, $p < 0.05$); assurance ($r = 0.580^*$, $p < 0.05$); empathy ($r = 0.580^*$, $p < 0.05$) of customer satisfaction were statistically significant. Following that from the Meta-analysis we can conclude that service quality dimensions broadly speaking have the impact on customer satisfaction especially such as tangible, empathy and assurance.

2.3.4. Impact of Service Quality on Customer Satisfaction

Ghobadian et al. (1994) they stated that service quality influences the repurchase aims of both existing and new potential customers, besides, they emphasized that positive word of mouth can use as a potent tool for inviting new customers, and negative word of mouth can have an overwhelming influence on the credibility and effectiveness of organization's attempt to attract new customers. What is more, service quality influences customer satisfaction due to the actual performance level of service they perceive (Mohammad & Alhamadani, 2011).

Also, service quality is the result of customers' existing appraisal of service they perceive, and consequently, which have a critical impact on overall customer satisfaction (Hidayat et al., pp-154, 2015). In this respect, Marković et al. (2015) argued that service quality impacts customers' perceived value, satisfaction, re-visit, and loyalty.

Despite the antecedent of service quality over customer satisfaction, thus, as service quality advances the likelihood of customer satisfaction boosts (Shanka, 2012). Likewise, Gong & Yi (2018) asserted that overall service quality has a significant impact on customer satisfaction, customer loyalty, and customer happiness. Many types of research conducted concerning the effect of service quality on customer satisfaction, see for instance, (Afroz, 2018; Girma, 2017; Gnawali, 2016; Kelemu, 2017; Mulat, 2017; Pakurár et al., 2019; Paul et al., 2016; Priyanath & Anjalika, 2018; Sanjuq, 2014; Yusup, 2019) and more. From this, we can see that customer satisfaction is reliant on service quality, and it is directly proportional to service quality (Raza et al., 2019).

2.4. Customer Satisfaction

Customer satisfaction has been a popular subject in marketing and academic research. See for example (Cengiz, 2010; Chiguvi et al., 2017; Kombo, 2015; Murugiah & Akgam, 2015; Narteh & Kuada, 2014; Ozatac et al., 2016) and more. Besides, any organization must keep customer satisfaction before company profit and other activities so that they can be competitive in the global market. Alike, customer satisfaction is essential for the successful continuation of any company (Mekonen et al., 2019).

Customer satisfaction is an essential concern for all company which to enhance customer loyalty and whereby design a more reliable business performance (Grønholdt et al., 2000). Further, Munusamy et al. (2010) define customer satisfaction as “global issues that affect all organizations, regardless of its size, whether profit or non – profit, local or multinational”. Alike, Lenka et al. (2009) explained, customer satisfaction is a synergy of their cognitive and affective response to the service encounter. Likewise, Gunasekare (2016) states that “customer satisfaction is a set of feelings or outcomes attached to customer's experience towards any product/ service”. However, Customer satisfaction has shifted remarkably vital and notable forerunner of customer retention and repeats purchase (Syed, 2019).

Numerous researches conducted about customer satisfaction in the various service sector. See, for instance, Hanif et al. (2010) explained that, in the telecommunication service sector, if the company needs to be prosperous over the long term, so that the company must satisfy its customers by crediting fair tariffs and high customer services thereby, dominate over the market. On the other hand, Vásquez et al. (2017) explained that measuring customer service satisfaction is a method that should be chronic in any company so that they can control the processes and activities that, executed to enhance their performance.

Also, the hospital is a major healthcare company, require to acknowledge the value of patients' choices, following that, patients call the hospital seeking relevant, high-quality medical care, a safe environment, and reasonably suitable amenities (R. G. Singh, 2012). Looking at that, Manzoor et al. (2019) stated that, patient satisfaction is noted as a touchstone to assess the potency of health service given in the hospital.

Furthermore, the hotel is a primary hospitality industry, and it is customer confined service, following that, in hotel service industries if it needs to be competitive, and be a brand in the market, it is essential to be a customer-centric, and also make sure that customer receives the best of the value (Pazir & Amin, 2015). Likewise, Luturlean & Anggadwita (2015) explained that the customer experience management concept can be implemented by companies so that they can retain customers and increase the revisit intention.

Nevertheless, in the bank service sector, the main component of customer satisfaction is the correlation between the customer, service provider, and service they perceive (Saghier & Nathan, 2013). Besides, Bena (2010) based on his findings there are two major issues which are first, the measurement of customer satisfaction must be established according to the area of the business and firms requirement, second, customers tend to state they are satisfied or check an undecided response.

2.4.1. Factor Influencing Customer's Satisfaction

The critical factors that influence bank customer satisfaction are perceived value, service quality, and corporate image (Zameer et al., 2015). On the other hand, customer service quality perception is affected by three factors, technical, theoretical, and image of a service provider (Ali, 2018).

Similarly, Anwar et al. (2019) described that perceived service quality, brand image, and perceived value have a significant impact on customer satisfaction, and customer loyalty. YuSheng & Ibrahim (2019) analyzed, the influence of service innovation, service delivery on customer satisfaction and customer loyalty, using survey data of 450 bank customers, the analysis result reveals that there is a positive association between service innovation, service delivery, customer satisfaction, and customer loyalty. Kamau (2012) asserted, the influence of perceived waiting time, the information provided, the waiting environment, and queue discipline on customer satisfaction in bank service.

What are the principal antecedence and consequences of customer satisfaction?

Method design

The meta-analysis method conceded out for this analysis, and it is a routine used for summarizing and investigation of statistical results across many independent researcher's discoveries related to similar issues or subject areas (Meghisan & Burger-Helmchen, pp-7, 2017).

2.4.1.1. Antecedence & Consequence of Customer Satisfaction in Banking Context

Overall, we identified 9, variables that exemplified the antecedence of customer satisfaction, and 3, variables that represented the consequence of customer satisfaction from several works of literature that are shown in the table below which is used for meta-analysis.

Table 2. 6 The principal antecedence of customer satisfaction in the banking context

No	Antecedence	Concept	Source
1	Service quality	"The customer's overall evaluation of the bank's performance with his/her expectation"	Leninkumar (2019)
	Perceived value	"Customer overall evaluation of all the benefits received from the provider relative to the costs sacrificed by customer"	
	Customer trust	"Customer willingness to rely on the banks in whom the customer has confidence"	
	Bank image	"Accumulated impressions consumers have about an organization"	
2	Customer expectation	"Customer has many sources of information that lead to expectation about upcoming service encounter with a particular company"	Almaslam (2014)
	Perceived service quality	"The evaluation of recent consumption experience of associated service"	
3	Benevolence	"To act in the best interest of the customers"	Hansen & Sand, pp-236 (2008)

Image	“Customer of firms holding a positive image often trust that the firm will not jeopardize”
Quality	“Quality perceptions derive from the level of service received compared with the level initially expected”

Table 2. 7 The principal consequences of customer satisfaction in the banking context

No	Consequences	Concept	Source
1	Word – of – mouth	“The extent to which a customer informs friends, relatives, and colleagues about an event that has created a certain level of satisfaction”	Söderlund (1998)
	Feedback	“The extent to which the customer provides feedback to the service provider”	
	Customer loyalty	“The extent to which the customer intends to purchase again from the service provider”	

Statistical analysis

Based on the information gathered from the research studies included for meta-analysis the r – family of the effect i.e. Pearson correlation coefficient of the construct was recorded, besides for studies that report statistical result such as (X^2 , f – test, t -test, Z – test, β – value, p -value) were converted into correlation coefficient (Ladeira et al., pp-804, 2016). In the meantime, a random effect size model is selected for the analysis (Hunter & Schmidt, 2004).

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Result

The result section presents the meta-analytic finding for the antecedence of customer satisfaction in the bank services sector.

Table 2. 8 The meta-analytic finding for the antecedence of customer satisfaction in the bank services sector

Construct	K	N	<i>r</i>	<i>p-value</i>	Confidence interval		Q
					CI _{upper}	CI _{lower}	
Service quality	6	1,627.00	0.666*	0.0000	1.0699	0.5367	145.80
Perceived value	12	3,707.00	0.676*	0.0000	0.9942	0.6498	307.29
Customer trust	9	2,618.00	0.587*	0.0000	0.8623	0.4833	187.56
Bank image	8	3,271.00	0.751*	0.0000	1.1407	0.8077	158.05
Customer expectation	3	963.00	0.741*	0.0000	1.3036	0.6027	56.97
Perceived service quality	5	2,685.00	0.549*	0.0000	0.7831	0.4495	57.56
Image	7	4,209.00	0.671*	0.0000	1.0382	0.5880	233.01
Quality	2	2,959.00	0.590*	0.0000	0.8005	0.5544	6.16

Note: k = number of study; N = total sample size; *r* = effect size; CI = confidence interval (95%); Q = chi square test from the random effect analysis.

Conclusion and Discussion

Based on the Meta analytic analysis, the effect size for service quality ($r = 0.666^*$, $p < 0.05$); perceived value ($r = 0.676^*$, $p < 0.05$); customer trust ($r = 0.587^*$, $p < 0.05$); bank image ($r = 0.751^*$, $p < 0.05$); customer expectation ($r = 0.741^*$, $p < 0.05$); perceived service quality ($r = 0.549^*$, $p < 0.05$); image ($r = 0.671^*$, $p < 0.05$); quality ($r = 0.590^*$, $p < 0.05$); of customer satisfaction were positive and statistically significant.

Table 2. 9 The meta-analytic finding for the consequence of customer satisfaction in the bank services sector

Construct	K	N	<i>r</i>	<i>p-value</i>	Confidence interval		Q
					CI _{upper}	CI _{lower}	
Word-of-mouth	5	3,303.00	0.460*	0.0000	0.8239	0.1694	284.57
Customer loyalty	23	9,226.00	0.606*	0.0000	0.8080	0.5960	532.04

Note: k = number of study; N = total sample size; *r* = effect size; CI = confidence interval (95%); Q = chi square test from the random effect analysis.

Conclusion and Discussion

Based on the Meta analytic analysis, the effect size for word-of-mouth ($r = 0.460^*$, $p < 0.05$); customer loyalty ($r = 0.606^*$, $p < 0.05$) of customer satisfaction were positive and statistically significant.

2.4.2. Customer Satisfaction Model

Numerous academic and marketing research has been done on customer satisfaction in the globe, in line with this they also have researched the customer satisfaction model in a different service and manufacturing companies see for example, (Barua et al., 2017; Engler et al., 2015; Ha & Janda, 2008; W. B. Lin, 2007; Serenko, 2011; Türkyilmaz & Özkan, 2007; Wong & Dioko, 2013; Yol et al., 2006). On the other hand, Rai & Srivastava (2014b) cited in Srivastava & Rai (2018) declared that “customer satisfaction/dissatisfaction is the cognitive judgment of a customer resulting out of an interaction between the customer’s personality and a company’s marketing practices from the perspective of the expectation the customer had with the product and perception of the benefits received”.

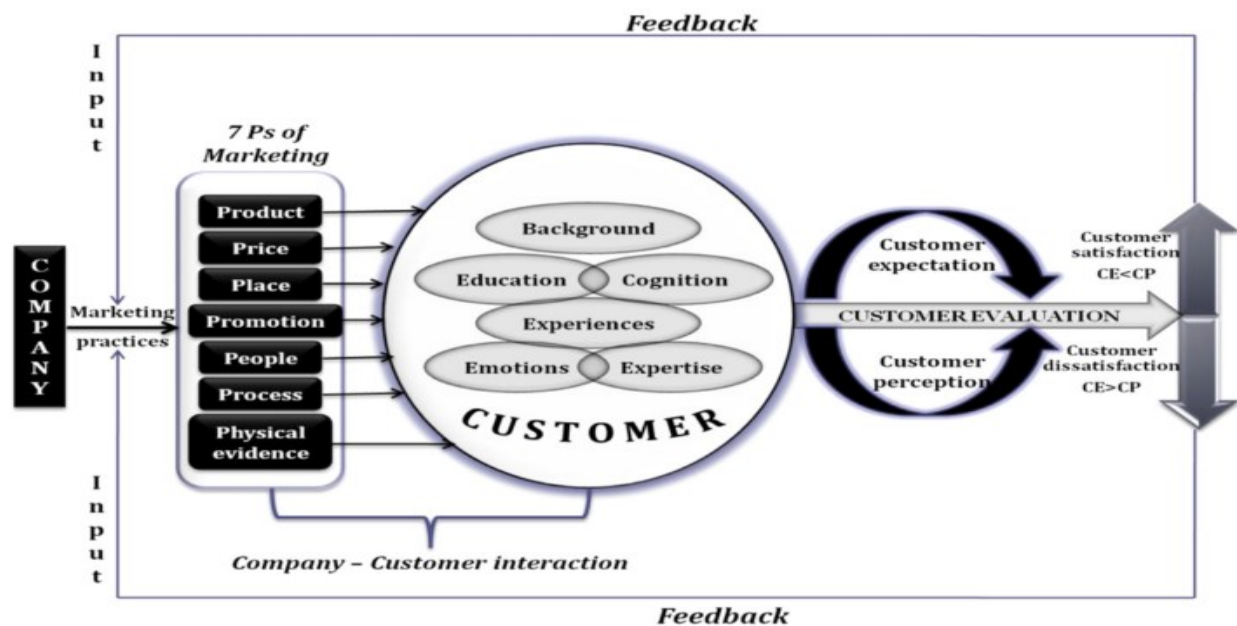


Figure 2. 4 Customer satisfaction model. Source: [Srivastava & Rai \(2018\)](#)

[Gunning \(2000\)](#) classifies four types of major customer satisfaction models these include the disconfirmation of expectations model, the performance model, the rational expectation model, and the expectations artifact model, besides, disconfirmation of expectations model: attest how customer satisfaction is influenced by the combining of the performance of the service/product; performance model: explain that perceived performance is delineate as value welfare received for costs obtained; rational expectations model: purport that the average expectation of agent in a market will be equal to the output of the market; expectation artifact model: evince the direct positive impact of perceived performance on customer satisfaction, and also a positive association among performance and expectations. [Piskóti & Nagy \(2009\)](#) asserted that “customer orientation shall be determining factor of business success at the strategic and operative level”.

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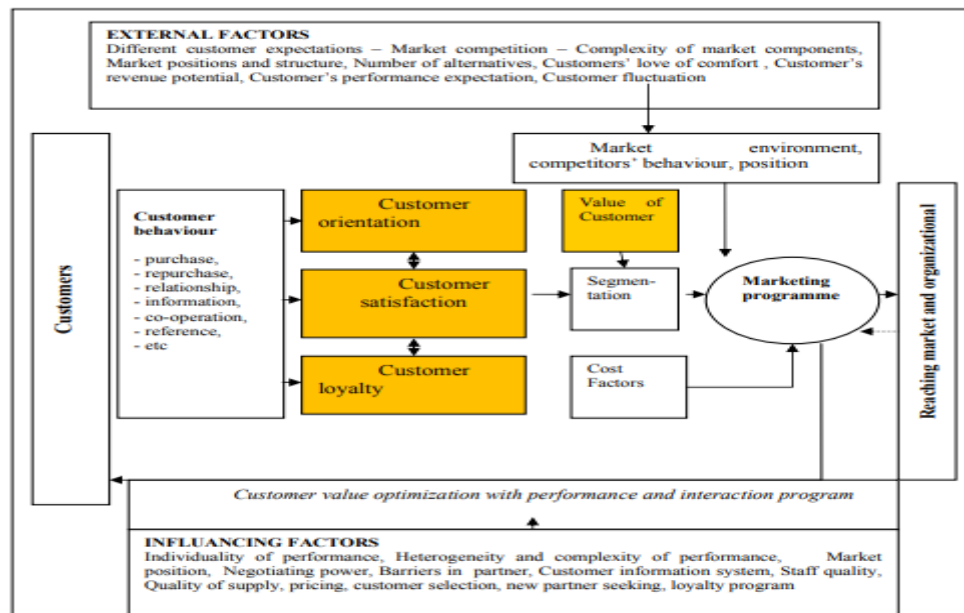


Figure 2. 5 New customer satisfaction management model (Piskoti & Nagy based on Krafft, 2007; Bruhn, 2007). Source: [Piskóti & Nagy \(2009\)](#)

[Maddern et al. \(2007\)](#) summarized and depicted the driving factor of customer satisfaction such as the service profit chain, satisfaction mirror, SERVQUAL, and BPM.

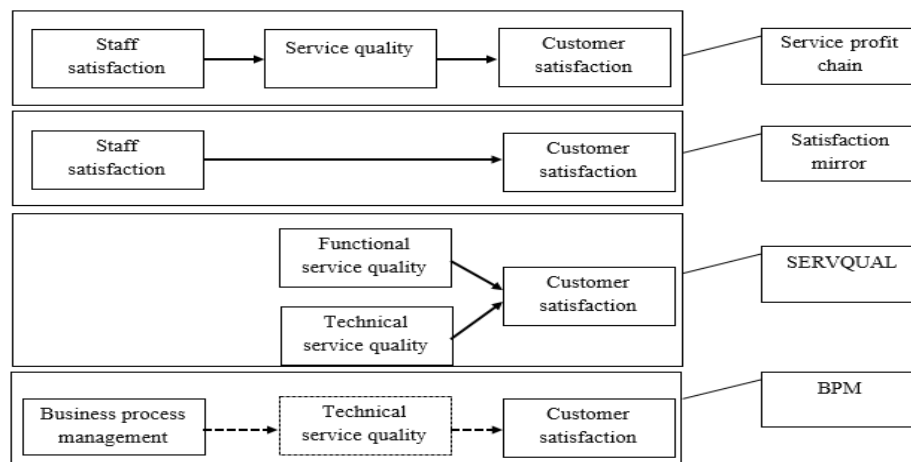


Figure 2. 6 Existing customer satisfaction model. Source: [Maddern et al. \(2007\)](#)

In the 21st-century business, companies strive more systematic methods for customer satisfaction and vie for service/product quality to fulfill the demand of the customer and or exceed their expectations. Therefore, the customer satisfaction model investigates starting from companies' market practices, customer service with customer cognitive behavior in line with looking for an evaluation of the gap between customer expectation and perceived service quality.

2.4.3. Relationship between Customer Satisfaction and Customer loyalty

Various studies were carried out concerning the association between customer satisfaction and customer loyalty. See for case, (Al-Msallam, 2015; Huo & Xu, 2011; Leninkumar, 2017; Nayebzadeh, 2013; Tweneboah-Koduah & Farley, 2016) and more. Looking at that, Famiyeh et al. (2018) argued that customer satisfaction and customer loyalty have a positive interrelation, and following that if the customer is satisfied with the product/service of the bank then, they are anticipated to persist loyally and will proceed to do business with the bank.

Does customer satisfaction have a positive effect on customer loyalty?

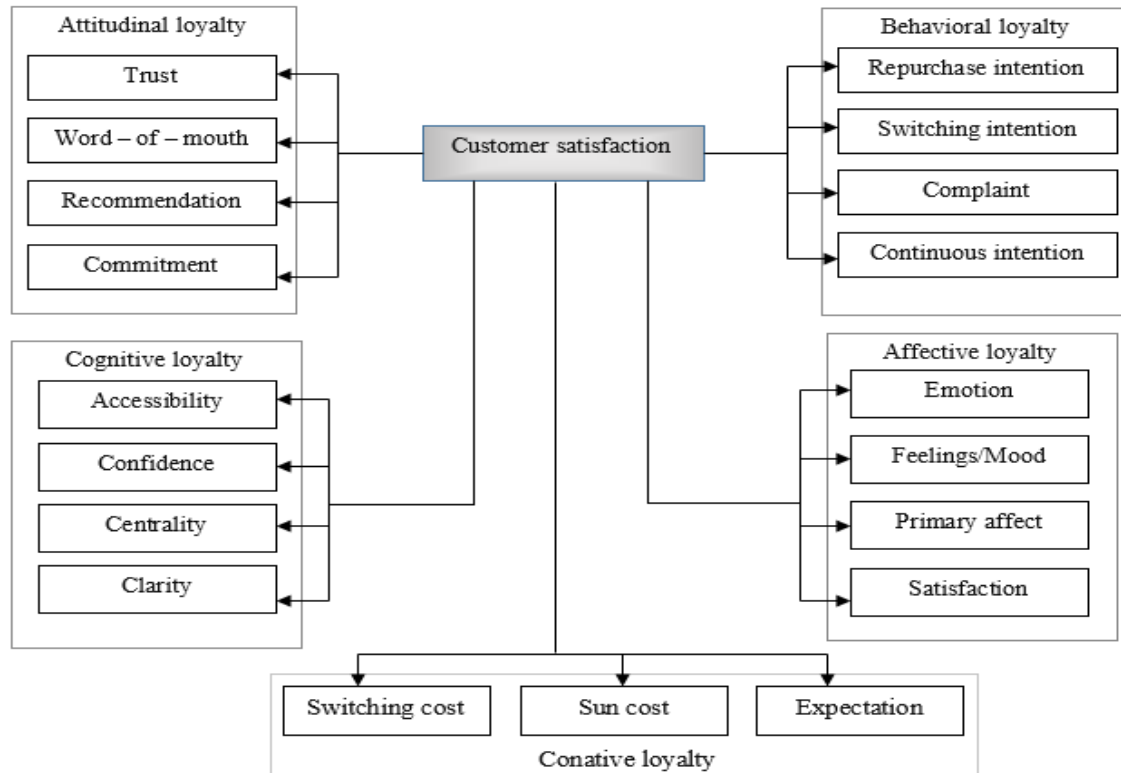


Figure 2. 7 Framework of Customer Satisfaction and Customer Loyalty

Method design

Data source

Inclusion and exclusion criteria, the inclusion criteria specified in advance and documented see figure below after removing the duplicated research study 178 research studies were identified through the database and search also 138 articles were excluded due to inconsistency result, non – empirical synthesis so on.

The required inclusion criteria include,

- ✚ Research studies that look into the relationship between customer satisfaction and loyalty or dimensions of customer loyalty.
- ✚ Research studies are conducted only in an empirical approach or synthesis.
- ✚ Studies published from 2004 to 2020.

Otherwise, research studies that are not incorporated with the above inclusion criteria, consequently excluded. After the aforesaid step completed, next is to run a search on a various database such as *Emerald, Taylor & Francis, Elsevier Science Direct, Google Scholar, Springer Link, PubMed/Medline, Jstor, CrossRef, Worldcat, DOAJ, PsycINFO, Scopus, ProQuest, Scielo, Web of Science*.

In the meantime the author search reliant on the concept using keywords and phrases like, “customer satisfaction”, “customer loyalty”, and also keyword of methodology “empirical”. Furthermore, the author sought after dissertations and thesis to comprise unpublished research papers, thereby admitting to discussing the “the file drawer problem”. Following that next step is data extraction, the extraction where the data includes the name of the author, publication year, and also the number of sample size, a correlation coefficient of the construct.

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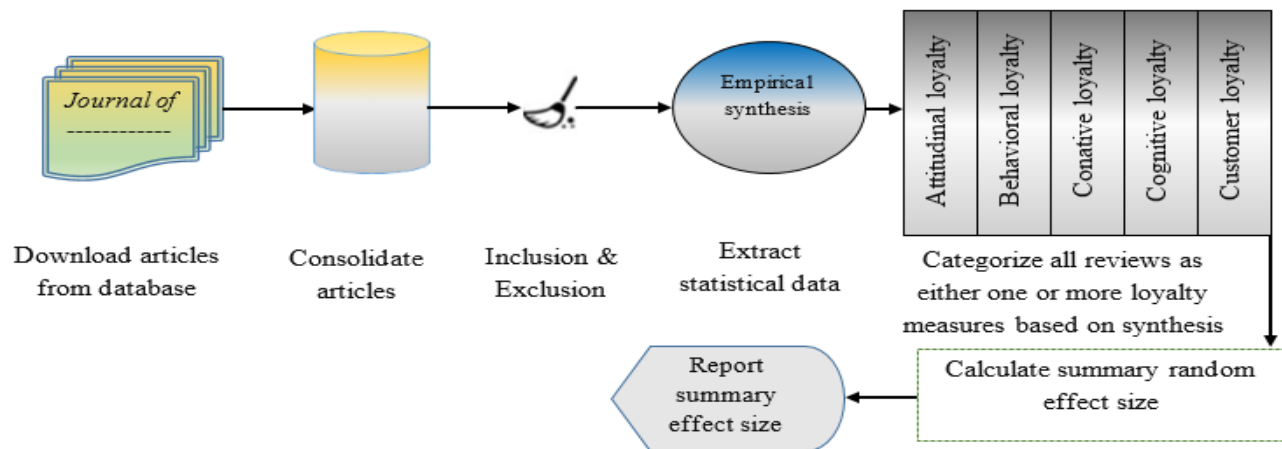


Figure 2. 8 Flow diagram of research paper selection and meta-analysis

Statistical analysis

Based on the information gathered from the research studies included for meta-analysis the r – family of the effect i.e. Pearson correlation coefficient of the construct was recorded, besides for studies that report statistical result such as (χ^2 , f – test, t -test, Z – test, β – value, p -value) were converted into correlation coefficient (Ladeira et al., pp-804, 2016). In the meantime, a random effect size model is selected for the analysis (Hunter & Schmidt, 2004).

Result

The result section presents the meta-analytic finding for the effects of customer satisfaction on customer loyalty.

Table 2. 10 Meta-analytic appraisals of the effect of customer satisfaction on customer loyalty

Construct	k	N	<i>r</i>	<i>p</i> -value	Confidence interval		Q
					CI _{upper}	CI _{lower}	
Attitudinal loyalty							
Trust	11	2,991	0.609*	0.0000	0.8562	0.5592	159.33
Word of Mouth	2	2,334	0.461	0.3197	1.1856	-0.1882	179.24
Recommendation	2	8,149	0.489	0.2994	1.1937	-0.1253	21.65
Commitment	4	971.00	0.489*	0.3391	0.9919	0.0684	147.44
Behavioral loyalty							
Repurchase intention	2	7,250	0.853*	0.0112	2.5959	-0.0614	770.93

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Switching intention	8	2,908	-0.317*	0.0086	-0.2010	-0.4561	125.97
Complaint	5	1,130	-0.739*	0.0001	-0.4330	-1.4649	296.78
Continuous intention	4	1,137	0.829*	0.0001	2.0533	0.3178	629.38
Conative loyalty							
Switching cost	5	9,887	0.191	0.1791	0.2544	0.1323	20.46
Expectation	2	851.00	0.639*	0.0000	1.0213	0.4922	15.35
Cognitive loyalty							
Accessibility	3	1,157	0.632*	0.0265	1.1555	0.3328	67.51
Customer loyalty	22	15,094	0.605*	0.0000	0.7937	0.6090	470.74

Note: k = number of study; N = total sample size; r = effect size; CI = confidence interval (95%);
Q = chi square test from the random effect analysis.

Conclusion and Discussion

The association between customer satisfaction and attitudinal loyalty

Based on the Meta analytic analysis, the effect size for trust ($r = 0.609^*$, $p < 0.05$); commitment ($r = 0.489$, $p < 0.05$) of customer satisfaction were positive and statistically significant. Whereas, word of mouth ($r = 0.461$, $p < 0.05$); recommendation ($r = 0.489$, $p < 0.05$) positive but statistically insignificant. Following that from the Meta-analysis we can conclude that satisfied customers broadly speaking have the features of trust and commitment.

The association between customer satisfaction and behavioral loyalty

Based on the Meta-analytic analysis, the effect size for repurchase intention ($r = 0.853$, $p < 0.05$); continuous intention ($r = 0.829$, $p < 0.05$) of customer satisfaction were positive and statistically significant. Whereas, switching intention ($r = -0.317^*$, $p < 0.05$); complaint ($r = -0.739^*$, $p < 0.05$) negative and statistically significant. From this we can conclude that satisfied customers have the repurchase intention and continuous intention.

The association between customer satisfaction and conative loyalty

Based on the Meta-analytic analysis, the effect size for switching cost ($r=0.191, p < 0.05$) positive but statistically insignificant. Whereas, expectation ($r=0.639^*, p < 0.05$) of customer satisfaction were positive and statistically significant.

The association between customer satisfaction and cognitive loyalty

Based on the Meta-analytic analysis, the effect size for accessibility ($r=0.632^*, p < 0.05$) of customer satisfaction was positive and statistically significant.

The association between customer satisfaction and customer loyalty

Based on the Meta-analytic analysis, the effect size for customer loyalty ($r=0.605^*, p < 0.05$) of customer satisfaction was statistically significant. Following that from the Meta-analysis, we can conclude that satisfied customers broadly speaking have the features of loyalty to their bank or services provider.

2.5. Customer Loyalty

Over the past years, customer loyalty has been a convenient research subject carried out in marketing literature. See for instance, (Coelho & Henseler, 2012; Duffy, 1998; Ehigie, 2006; McMullan & Gilmore, 2008; Uncles et al., 2003) and others. Considering this, customer loyalty is crucial to the direction of the business in the present rival market spot.

Bowen & Chen (2001) stated that customer loyalty is challenging to define, perhaps, in general, there are three different ways to measure loyalty such as behavioral, attitudinal, and composite measurement. Likewise, behavioral loyalty refers to the repeated purchase of product/service, while attitudinal loyalty refers to attitudinal commitment or favorable attitude towards a product/service resulting in repeat purchasing behavior (Auka et al., 2013). Dick & Basu (1994) Illustrated, customer loyalty is recognized as the intensity of the association within the particular relative attitude and repeat patronage, following that the association regarded as reconciled through social norms and situational factors.

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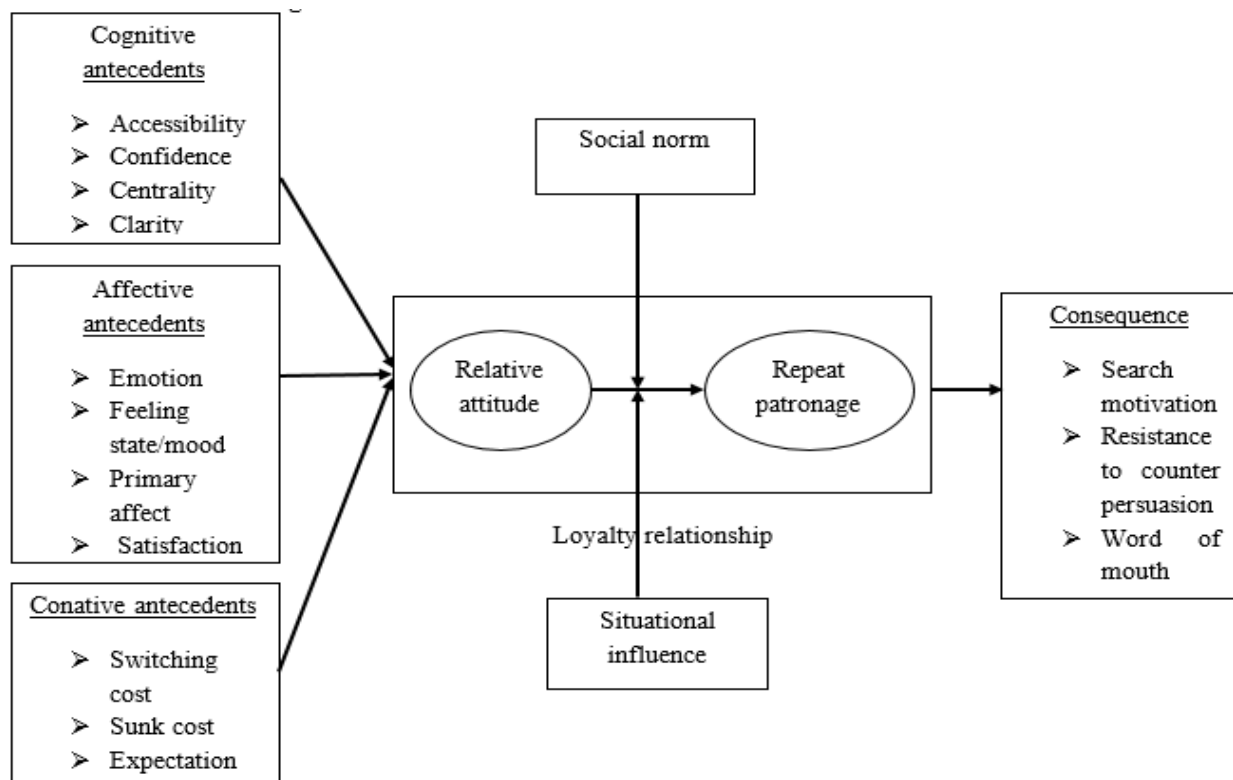


Figure 2. 9 A framework for customer loyalty. Source: [Dick & Basu \(1994\)](#)

What are the essential variables used to measure customer loyalty in the bank service sector?

Planning for recording procedure and eligibility criteria, which include the time frame for analyzing the existing journal articles, 5 years (i.e. from 2015 to 2020), and the research articles supposed to be address only in English – language, in the meantime all article should be focused on the bank service sector. After assaying to find usable study variables, alike the author excluded studies for which unable to get the required variables, duplicated studies while downloading from a different database, and also excluded studies that are not conducted in the bank service industry i.e.(Z. Khan et al., 2015; Pérez & Bosque, 2015; Taghipourian & Bakhsh, 2015); (Hinson et al., 2016; Izogo, 2016; Rahi & Ghani, 2016; Taghipourian & Bakhsh, 2016; Thaichon et al., 2016); (Ahn & Back, 2017; Al-dweeri et al., 2017; Aziz et al., 2017; Izogo et al., 2017; Jaiswal & Lemmink, 2017; Raaij, 2017); (Ruefenacht, 2018; Siddiqi et al., 2018); (Hoang, 2019; Monferrer et al., 2019; Palací et al., 2019; Susanti, 2019; Yao et al., 2019); (Mahadin et al., 2020; Massoudi, 2020).

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Following the writing of the etiquette and qualification guidelines, the next step is to run a search on a various database such as *Emerald, Taylor & Francis, Elsevier Science Direct, Google Scholar, Springer Link, PubMed/Medline, Jstor, CrossRef, Worldcat, DOAJ, PsycINFO, Scopus, ProQuest, Scielo, Web Science*. The search variables denoted based on studies that were used to measure customer loyalty in the bank sector. Furthermore, the author sought after dissertations and thesis to comprise unpublished research papers, thereby admitting to discussing the “the file drawer problem”.

After the aforesaid step finalized the next step is data collection and process for research variables, 56 articles were identified accordingly, of these 23 were outside the scope of inclusion criteria, and another 7 were not analyzed because they acquaint inadequate information, finally, 26 research papers were selected for meta-analysis that comes across the inclusion criteria.

The variables have been identified from different journals such as *Journal of Academy of Marketing Science, Global Journal of Management and Business Research: E-Marketing, Journal of Economics and Sociology, International Journal of Bank Marketing, International Journal of New Technology and Research (IJNTR), Global Journal of Interdisciplinary Social Sciences, Journal of Business Research, International Journal of Marketing Studies, Journal of Relationship Marketing, African Journal of Economic and Management Studies, Journal of Marketing Intelligence and Planning, Journal of Service Management, Journal of Economic Sciences, International Journal of Economics and Management, ASEAN Marketing Journal, Journal of Islamic Business and Management, Journal of Islamic Marketing, International Journal of Recent Technology and Engineering (IJRTE), Global Business and Economics Review, International Journal of Scientific and Technology Research, Journal of Sustainability*.

The final step is coding the selected research papers, coding included the article number, author's name, and year of publication, publication type, number of variables applied, and frequency of the variable applied in each research paper. Likewise, based on the coding process finalized the next steps will be data analysis of each selected research paper which is the frequency analysis of each variable and identify the major variables/dimensions of customer loyalty in the bank service industry.

Data analysis

Table 2. 11 Essential variables used to measure customer loyalty in the banking context

No.	Author	Year	Publication type						Variables	Frequency	Total
			Book	Unpublished	Dissertation	Thesis	Conference proceeding	Articles			
1	Iv et al. (2015)	2015						√	Attitudinal	1	1
									Behavioral	1	1
2	Husnain & Akhtar (2015)	2015						√	Conative	1	1
									Attitudinal	1	1
									Behavioral	1	1
3	Chochol'áková et al. (2015)	2015						√	Affective	1	1
									Cognitive	1	1
									Conative	1	1
4	Henrique (2015)	2015						√	Action	1	1
									Affective	1	1
									Cognitive	1	1
									Conative	1	1
5	Taghipourian & Bakhsh (2015)	2015						√	Behavioral	1	1
									Attitudinal	1	1
									Cognitive	1	1
									Conative	1	1
									Affective	1	1
6	Kaura (2015)	2015						√	Behavioral	1	1
									Attitudinal	1	1
7	Cossío-silva et al. (2016)	2016						√	Attitudinal	1	1
									Behavioral	1	1
8	Taghipourian & Bakhsh (2016)	2016						√	Affective	1	1

									Behavioral	1	1
									Attitudinal	1	1
									Cognitive	1	1
									Conative	1	1
9	Amoako et al. (2017)	2017						√	Behavioral	1	1
									Attitudinal	1	1
10	Assefa (2017)	2017					√		Behavioral	1	1
									Attitudinal	1	1
11	Bhatnagar et al. (2017)	2017						√	Behavioral	1	1
									Attitudinal	1	1
12	Jaiswal & Lemmink (2017)	2017						√	Behavioral	1	1
									Attitudinal	1	1
13	Makanyeza & Chikazhe (2017)	2017						√	Behavioral	1	1
									Attitudinal	1	1
14	Ramaseshan et al. (2017)	2017						√	Affective	1	1
									Behavioral	1	1
									Attitudinal	1	1
15	Mohammed et al. (2017)	2017						√	Behavioral	1	1
									Attitudinal	1	1
16	Suhartanto et al. (2018)	2018						√	Behavioral	1	1
									Attitudinal	1	1
17	Valipour et al. (2018)	2018						√	Cognitive	1	1
									Conative	1	1
									Affective	1	1
									Attitudinal	1	1
									Behavioral	1	1
18	Nemati et al. (2018)	2018						√	Attitudinal	1	1
									Behavioral	1	1

19	Kumar & Reinartz (2018)	2018	√						Attitudinal	1	1
									Behavioral	1	1
20	Thaker et al. (2018)	2018						√	Attitudinal	1	1
									Cognitive	1	1
21	Boonlertvanich (2019)	2019						√	Behavioral	1	1
									Attitudinal	1	1
22	Kataria et al. (2019)	2019						√	Behavioral	1	1
									Attitudinal	1	1
23	Coetzee & Coetzee (2019)	2019						√	Behavioral	1	1
									Attitudinal	1	1
24	Aldaihani & Ali (2019)	2019						√	Behavioral	1	1
									Attitudinal	1	1
25	Jung & Shin (2019)	2019						√	Brand	1	1
									Attitudinal	1	1
									Behavioral	1	1
26	Moliner-Tena et al. (2019)	2019						√	Attitudinal	1	1

Table 2. 12 Variables and their frequency identified from Meta-analysis data

Number	Variables	Frequency	Percent %
1	Attitudinal	24	36.36
2	Behavioral	22	33.33
3	Conative	6	9.09
4	Cognitive	6	9.09
5	Affective	6	9.09
6	Action	1	1.52
7	Brand	1	1.52
Total		66	100%



Figure 2. 10 Customer loyalty dimensions framework. Source: [Author Meta-analysis](#).

Conclusion and Discussion

Based on the meta-analysis 7 elements of customer loyalty were identified and 5 was chosen based on their frequency and it was concluded that the major variables i.e. attitudinal, behavioral, conative, cognitive, and affective loyalty are used to measure customer loyalty in the bank service sector. Alike the above frequency analysis table presents the share of each variable as a percent of the total, accordingly, the framework was developed based on the result of customer loyalty Meta-analysis.

2.6. Service Quality and Process Improvement

Today there are well-known quality assurance and quality management tools available, Accordingly, determination of the most relevant tool is not evermore a simple assignment, having that tools are indispensable constituents of a method and fundamental means for the achievement of the quality program (Soković et al., 2009).

Addressing excellent service is a successful strategy, in the meantime, quality service maintains customer confidence, and it's crucial for competitive advantage (Berry et al., 1994). Quality improvement strategy (QIS) consider two sorts of service gap to pinpoint excellent service reforms for a distinct company such as the gap within expected and perceived service afforded by the company, second the discrepancy within the company sensed service and service presented by competitors (Beach & Burns, 1995).

Edvardsson (1998) Stated quality improvement, appropriated as a combined representation for quality assurance, quality management, and quality control in service operations, on the other hand, he also introduced thirteen critical and prerequisite features for the successful quality improvement performance. Such as,

- 1) Top management commitment.
- 2) Develop a service quality strategy.
- 3) Customer-focused approaches.
- 4) A continuous quality improvement program.
- 5) Focus on innovative service development and design.
- 6) Process approaches.
- 7) Quality improvement leads to productivity and profitability.
- 8) Benchmarking.
- 9) Total quality management.
- 10) Develop service recovery (feedback system).
- 11) Encourage mutual respect and teamwork, also employee involvement.
- 12) Engagement of people (customer, employee, and owner) in the quality improvement process.
- 13) Rewarding and improve continuously.

Currently, quality incorporates a dedication towards continuous improvement and service hookup with customers, including demands for technological based services, innovative and enhanced product/service, e-service, similarly viewed as essential features of banking service quality that promote advanced and better quality service presented to a customer (Talib et al., 2012).

Quality assurance (QA) means the use of tools and logic to evaluate quality performance, while, quality improvement (QI) is the use of methods to improve quality performance, however, quality assurance/quality improvement (QA/QI) is a consolidative means for distinguishing present status of quality, and for improving quality performance (Wandersman et al., 2012). Antony (2006) stated and showed that, for problem-solving methodology or process improvement framework, the six sigma maneuvering uses a list of well-defined steps.

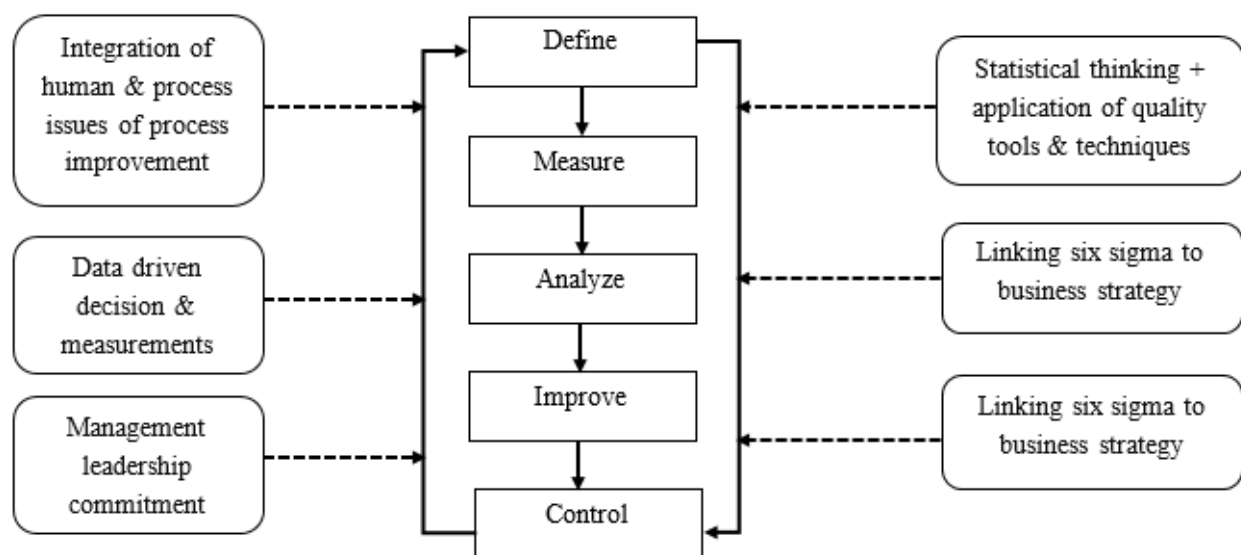


Figure 2. 11 Six sigma methodology. Source: Antony (2006)

2.7. Quality Measurement Tools for Customer-oriented Approaches

Giannikas et al. (2019) assert that “customer orientation concerns the degree to which an organization focus on the customer, recognizes their desires and places meeting their needs as a foremost priority”. According to the prior research findings, the impingement of customer orientation can be discussed in terms of two aspects that are closely related to customer satisfaction these include value-based customer orientation Wang et al. (2012), and action-based customer orientation (H. He & Li, 2011). Also, value-based concerns to meet customer demand by having awareness about the customer expectation for service quality and it can determine customer satisfaction (Blocke et al., 2011). Whereas action-based concerns the usage of feedback from customers and accommodation of that feedback while taking organizational decisions (Y. He et al., 2011).

Accordingly, Dragolea & Ungureanu (2008) state that the success of the organizations is reliant on the ability to manage customer expectations, facilitating loyalty and investment. In line with this, every business organization must be customer-centric, and should always listen to their voice to retain their existing customer. Therefore, in the proceeding section, we will discuss some of the major customer-oriented quality measurement tools.

2.7.1. SERVQUAL Model

Numerous research papers consolidate both theoretical and application of SERVQUAL in an assortment of industrial, profit, and non-profit firms, see for the case,

2.7.1.1. Analysis of the application of the SERVQUAL Model

Healthcare (hospital) (Anbari et al., 2014; Umath et al., 2015); higher education (Galeeva, 2016; Ulewicz, 2014); tourism service (Home, 2006); restaurant (Y. L. Lee & Hing, 1995; Yu-qiang & Jun-jia, 2011); bank (Ilyas et al., 2013; Lau et al., 2013); telecommunication (Alnsour et al., 2014); apparel retail (Bhaskar & Shekha, 2011); public service (Bryslan & Curry, 2001); local government (Donnelly et al., 1995); electronic commerce B2C (Alzola & Robaina, 2005); business – to – business service (Mehta & Durvasula, 1998); technical and vocational colleges (Akhlaghi et al., 2012) and more.

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SERVQUAL has different possible uses, it can assist as an extensive area of service and retailing firms, in appraising customer expectations and perception concerning service quality following that SERVQUAL has five universal dimensions (Parasuraman et al., 1988).

Table 2. 13 Essential dimensions of service quality

No.	SERVQUAL dimensions	Definitions	Source
1	Tangible	Physical facilities, equipment, and appearance of personnel.	Parasuraman et al. (1988)
2	Reliability	Ability to perform the promised service dependably and accurately.	
3	Responsiveness	Willing to help customers and provide prompt service.	
4	Assurance	Knowledge and courtesy of employees and their ability to inspire trust and confidence.	
5	Empathy	Carrying, individualized attention the firm provides its customer.	

SERVQUAL claims respondents to reply to inquiries regarding both their expectations and perceptions wherein service quality (Prakasha & Mohanty, 2012). Still, SERVQUAL contains 22 items (Likert - type) with five dimensions so that each item in the SERVQUAL tool is of pair classes, one to measure expectations thereby, firms in over-all within a business, and second measure perceptions about the particular company whose service evaluated (Mohd. Adil et al., 2013).

Accordingly, Robinson (1999) the gap within expectations and perceived service quality measured by the variance between the two results which performance minus expectations, following that for the particular respondent, the service quality for each dimension determined as follows.

$$SQ_j = \sum_{j=1}^{nj} \frac{P_{ij} - E_{ij}}{nj}$$

Where

SQ_j = service quality of dimensions

E_{ij} = expectations of the firms for item i in dimension j

P_{ij} = perceived performance of the form on item i in dimension j

n_j = number of items in dimension j

2.7.1.2. Critiques on the SERVQUAL Model

Regardless of its popularity and extensive use, SERVQUAL has bailed to various conceptual and functional criticisms. see for example, (Babakus & Boller, 1992; Bolton & Drew, 1991; Boulding et al., 1993; Cronin & Taylor, 1992; Genestre & Herbig, 1996; Teas, 1993) Accordingly, Buttle (1996) Pigeonhole the critiques into two first theoretical parts which include, paradigmatic objections, gaps model, process orientation, dimensionality, and second, operational which include, expectation, item composition, a moment of truth (MOT), polarity, scale points, too administrative and variance extracted.

2.7.2. Kano's Model

Kano's model has appeared in one of the most widespread models nowadays. According to Luor et al. (2012) investigated a literature review on Kano's model from 1998 to 2012, 14 years, following that they found 52 journal article published related to Kano's model, based on frequency analysis 44.7% of the 94 Kano's model published in the 52 journals from 1998 to April 2012 on major five journals i.e. *Total Quality Management & Business Excellence (Total Quality Management)* (22 articles or 23.4%); *African Journal of Business Management* (7 articles or 7.4%); *Expert System with Application* (6 articles or 6.4%); *International Journal of Production Economics* (4 articles or 4.3%), and *Quality and Reliability Engineering International* (3 articles or 3.2%).

Kano's model was high – developed by Doctor Noriaki Kano, Professor in Tokyo (1984) to define service quality based on customer satisfaction (Seyedi et al., 2012). Alike, Customer satisfaction in the meantime ascertains as single-dimensional operation, which implies the higher the perceived service quality consequently, the higher customer satisfaction (Kazemi et al., 2013).

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Perhaps, meeting the customer requirement does not lead to a higher level of customer satisfaction (Mostafa et al., 2013).

Based on Kano's model consumers need to be categorized into three phases such as basic, performance, and excitement needs (Bhattacharyya & Rahman, 2004).

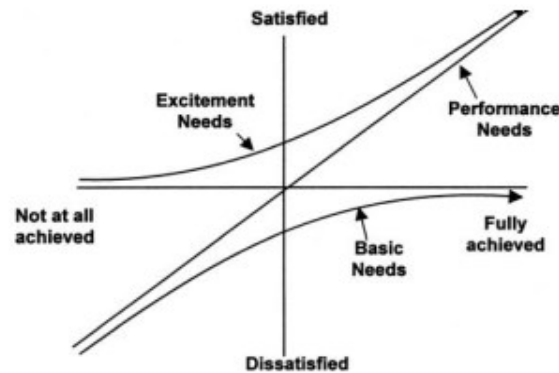


Figure 2. 12 Kano's model. Source: Bhattacharyya & Rahman (2004)

Similarly, customer satisfaction with a quality attribute can be classified into five categories such as, must – be, one – dimensional, attractive, indifferent, and reverse Kurt & Atrek (2012); Lin et al. (2017), and the quality attribute defined as follow,

Table 2. 14 Categories Kano's model of quality attributes

No.	Quality attribute	Definitions	Source
1	Must – be	“Sufficient quality attributes <i>do not</i> lead to customer satisfaction but insufficient quality attributes lead to customer dissatisfaction.”	(Kurt & Atrek, 2012; F. Lin et al., 2017)
2	One – dimensional	“Sufficient quality attributes lead to customer satisfaction but insufficient quality attributes <i>do not</i> lead to customer dissatisfaction.”	
3	Attractive	“Sufficient quality attribute leads to customer satisfaction but insufficient quality attributes <i>do not</i> lead to customer dissatisfaction.”	
4	Indifferent	“Sufficient quality attributes <i>do not</i> lead to customer satisfaction and insufficient quality attributes <i>do not</i> lead to customer dissatisfaction.”	
5	Reverse	“Sufficient quality attributes lead to customer dissatisfaction and insufficient quality attributes lead to customer dissatisfaction.”	

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Likewise, to categorize requirements or quality attributes it is necessary to use the Kano's questionnaires which is sorted into two types i.e. functional and dysfunctional form of questions see for example the figure below (Madzík et al.,pp-3, 2019).

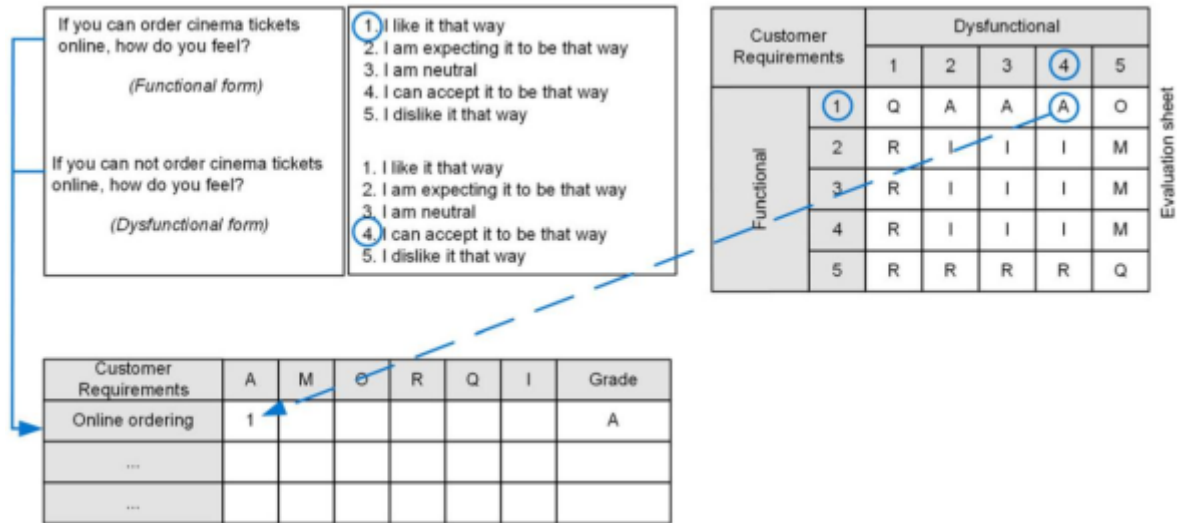


Figure 2. 13 Categorization of a requirement using the Kano approach. Source: Madzík et al.,pp-3 (2019)

2.7.2.1. Analysis of the Application of Kano's Model

Numerous research papers consolidate application of Kano's model in an assortment of industrial, profit, and non-profit firms, see for the instance,

Table 2. 15 Analysis of the application of Kano's model

No.	Author & year	Description	Kano's quality element	Model type
1	Madzík et al. (2019)	Understanding customer requirement in higher education	Kano method	CR
2	HSU et al. (2007)	Capturing passenger's voice in the airline industry	Kano method	CS
3	Chiang et al. (2019)	Classifying technological innovation attributes for hotel service	Use synergies of the Kano method, self-importance questioners, and factor analysis	CS
4	Gregory & Parsa (2013)	Hospitality and Tourism industry	Kano method	CS

5	Llinares & Page (2011)	Kansie Engineering to evaluate subjective real estate consumer preference	Use synergies of the Kano method, self-importance questioners, and factor analysis	CR
6	Ma et al. (2019)	Differentiate between future vehicle – driving services	Use synergies of the Kano method, self-importance questioners, and factor analysis	CS
7	Rozaq et al. (2019)	Assessing customer satisfaction of hospital service quality	Kano method	CS
8	Velikova et al. (2016)	Identification of wine festival satisfaction drivers	Penalty – Reward Contrast Analysis (PRCA)	CS

2.7.2.2. Critiques on the Kano's Model

Regardless of the numerous benefits of the Kano's model, possibly Kano's model has been subjected to criticisms for a case, [Gregory & Parsa, pp -40 \(2013\)](#) includes lengthy questionnaires, exclude the quantitative or qualitative performance of the specific attributes.

2.7.3. Quality Function Deployment (QFD)

[Bouchereau & Rowlands \(2000\)](#) define QFD as “a visual connective process that helps teams focus on the needs of the customer throughout the total development cycle”. Quality Function Deployment (QFD) is supported by a matrix approach to design and function the essentials (commencing with customer requirement) upon the way of attaining them ([Jagdev et al., 1997](#)). Wherefore, a set of the chart originated, which outlines the correlation among customer requirements on service characteristics right through to service planning. Likewise, “Quality Function Deployment (QFD) is a service planning and development support method, which provides a structured way for service providers to assure quality and customer satisfaction while maintaining a sustainable competitive advantage” ([Andronikidis et al., pp-320, 2009](#)).

2.7.3.1. Analysis of the Application of Quality Function Deployment (QED)

The all-inclusive acceptability of (QFD) method is exhibited from its stated uses in different service sectors. Such as bank service (Purba et al., 2018); hospitality (hotel service) (Paryani et al., 2010); healthcare service (Dijkstra & Bij, 2002; Gremyr & Raharjo, 2013); utility service (Jahanzaib et al., 2016); design/build project (Pheng & Yeap, 2001); software product development (Haag et al., 1996; Thackeray & Van Treeck, 1990) and more. Accordingly, For effectuation and advance of QFD count on many conditions or critical factors, which are presented in the illustrated beneath (Kathawala & Motwani, 1994).

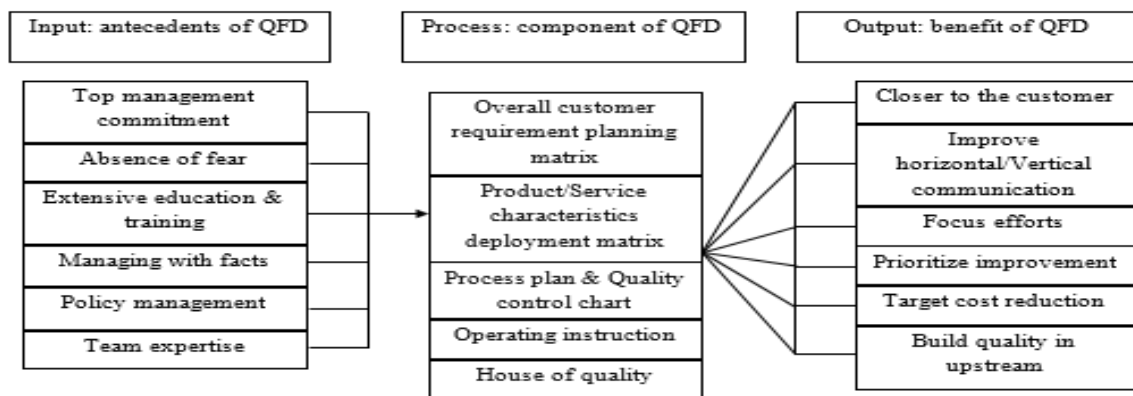


Figure 2. 14 The three components of QFD: A system model. Source: Kathawala & Motwani (1994) Modified

2.7.3.2. Critiques on the Quality Function Deployment (QFD)

Notwithstanding of the popularity and wide acceptability of QFD, quality function deployment exposed to many criticisms see for example, Wolniak, pp-16 (2018) not flexible, time – consuming, labor – intensive, only enable qualitative data, difficulty of cooperation within multidisciplinary teams; Andronikidis et al., pp-321 (2009) assumes linear association within customer requirement & service attributes, imposed to a large amount of data, bias may be simply added into any phase, quality function deployment is enduring process, consequently errors at one phase will spread; Poel (2007) criticize quality function deployment from methodological aspect which includes, “customer demands are product/service dependent, customer demand can not always be represented by a linear additive value function, individual customer performance can not

be aggregated into a collective customer preference ordering without violating a number of very reasonable conditions, the correlation between customer demand and engineering characteristics is not always non – negative and constant, the relative importance of customer demand can not be uniformly translated into a relative importance of the engineering characteristics, and the meaning of target values is unclear or disputable.”

2.8. Integration of Customer-oriented tools for Improving Service Quality

In today's worldwide competitive market place it is not adequate for firms to depend exclusively on continuous improvement to sustain and advance their competitive advantage.

Starting from the debut of integrated customer oriented tools for improving service quality has extensively implemented using synergy of modified methodologies in different service and manufacturing organizations see for instance, a fuzzy QFD approach using SERVQUAL and Kano's models (in case of hotel service) ([Beheshtinia & Farzaneh Azad, 2017](#)); integration of SERVQUAL and the Kano's model (case of airline service) ([Basfirinci & Mitra, 2015](#)); application of integration of Kano's model, AHP technique and QFD matrix (case of banking service) ([Pakizehkar et al., 2016](#)); integration of Kano's model and AHP (case of banking service) ([Kazemi et al., 2013](#)); application of integrating SERVQUAL and Kano's model into QFD (case of logistics service) ([Baki et al., 2009](#)); integrating SERVQUAL and Kano's model into QFD (case of simulation – based training on project management) ([Rahmana et al., 2014](#)); integrating SERVQUAL and Kano's model into QFD (case of hotel industry) ([P. Gupta & Srivastava, 2012](#)); a hybrid of Kano's model and QFD (case of banking service) ([Pourhasomi et al., 2013](#)); integrating fuzzy SERVQUAL into refined Kano's model (case of restaurant service) ([Hsieh et al., 2015](#)); integrating the Kano's model and QFD (case of designing new product) ([Tontini, 2007](#)); integrating SERVQUAL and Kano's model and QFD (case of PT POS Indonesia) ([Singgih & Ardhiyani, 2010](#)) and more.

Accordingly [Tan & Pawitra \(2001\)](#), stated and explained the basic details that are carried out involving the collaboration of SERVQUAL, Kano's model, and QFD to evaluate customer satisfaction so that to develop service excellence and innovation for business organizations.

Following that they recapitulate the major point or issues for integrating SERVQUAL and Kano's model into QFD.

Table 2. 16 The major point for integrating SERVQUAL and Kano's model into QFD

No.	SERVQUAL	Kano's model	QFD
1	Assumes linear relationship customer satisfaction & service attributes performance.	Helps SERVQUAL to prioritize the improvement of an organization's weakness based on the category of needs that can lead to the highest customer satisfaction.	
2	As a continuous improvement & innovation tool.	Helps SERVQUAL to address the innovation issues, besides attractive attributes are a source of customer delight so that it is one area where effort for improvement should be targeted.	Generally serves as the planning process for translating customer needs into an appropriate organizational requirement.
3	Provides important information on the gap between predicate service and perceived service, however, it is not able to address how the gaps can be closed.	Helps SERVQUAL to prioritize which service gap to focus and to make effort on.	

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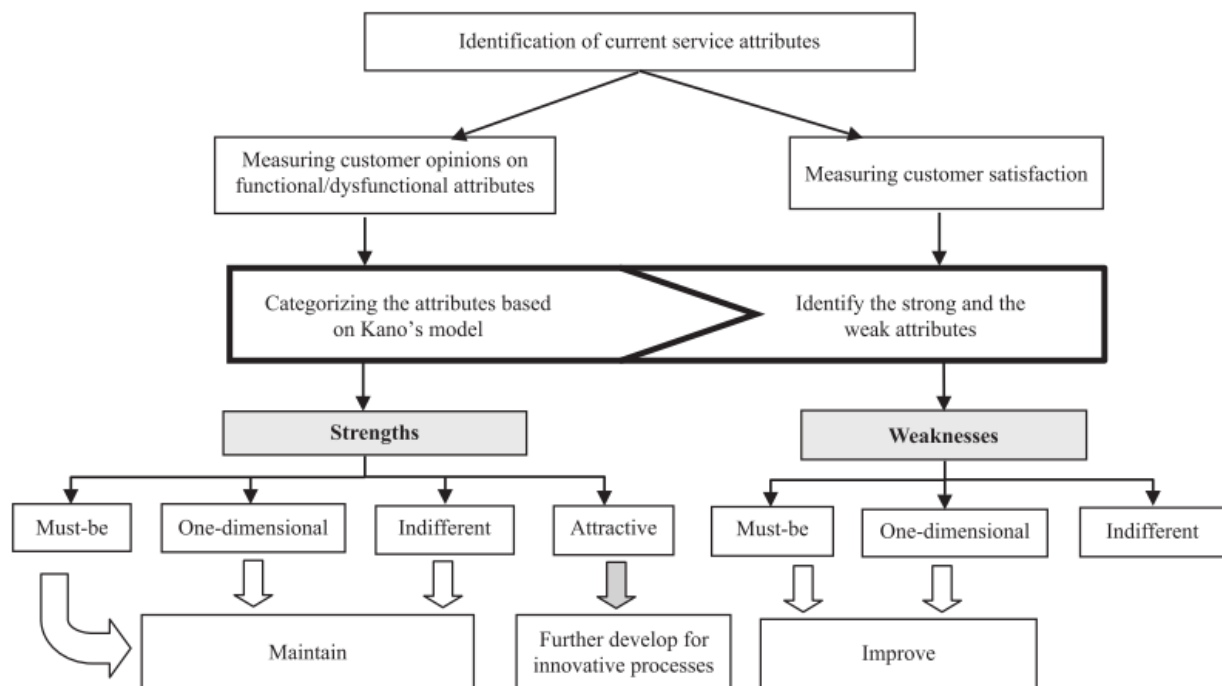


Figure 2. 15 Framework of integrated Kano's model into SERVQUAL. Source: Tan & Pawitra (2001)

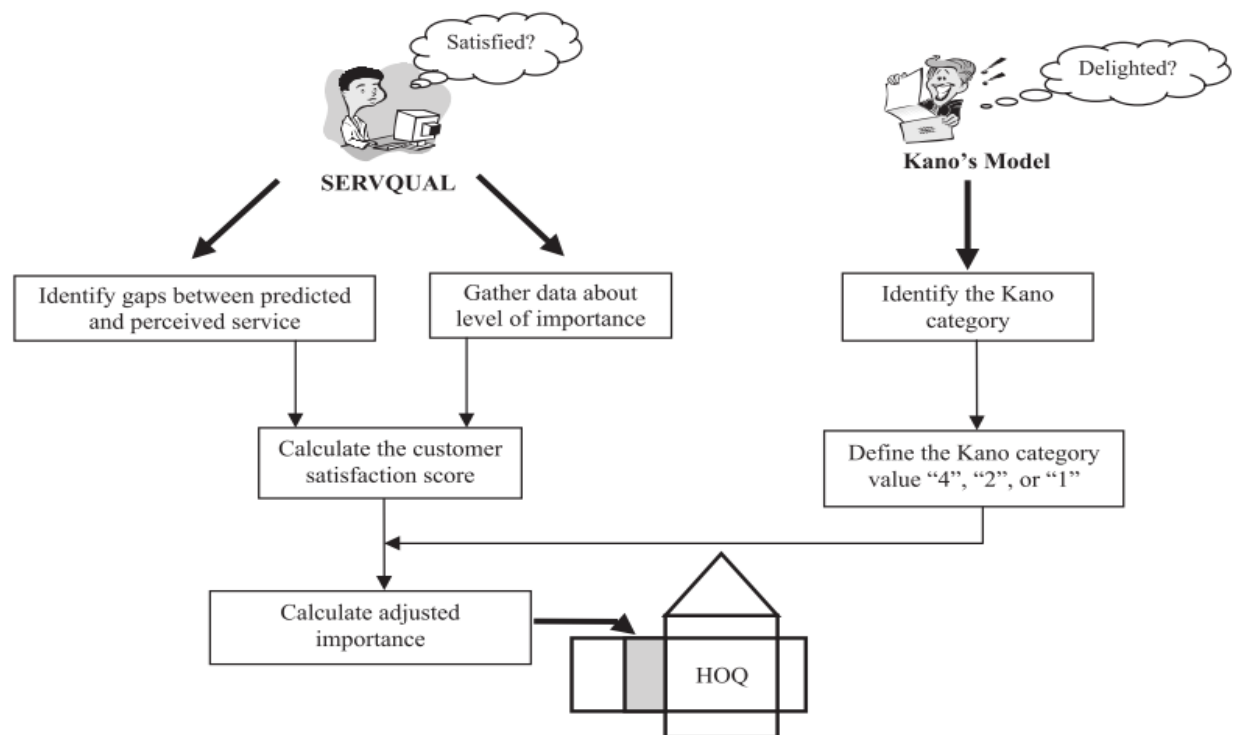


Figure 2. 16 Framework of integrated SERVQUAL and Kano's model into QFD. Source: [Tan & Pawitra \(2001\)](#).

Besides, according to [Hsu et al. \(2007\)](#) investigated to evaluate service quality using an integrated approach linking Kano's model and quality function deployment, alike they stated each step that is carried out through the integration process listed underneath.

Step1. Classifying customer attribute into Kano's model categories: to classify customer attribute survey questionnaires should be prepared and distributed among the respondent, similarly, each customer places their desired raw importance using a rating scale, in the meantime to execute the proposed integration approach customer also enquired to group properly their needs into Kano's categories' like, must – be quality, one – dimensional, so on.

Step2. Adjustment of importance ration by using Kano's model: to accomplish the desired customer satisfaction level, so adjusted improvement ration should be calculated.

We can calculate the adjusted improvement ratio using the equation below.

$$IR = \text{target} / \text{the current customer satisfaction value}$$

$$AIR = IR^{\frac{1}{k}}$$

Where:

AIR = Adjusted Improvement Ratio

IR = Improvement Ratio

k : k values (transformation function)

M, must be ($k = 0.5$); O, one dimensional ($k = 1$); A, attractive ($k = 2$)

Step3. The priority analysis of technical characteristics: in this stage QFD tool implemented to determine the correlation between each customer attribute (WHAT_s) and each technical characteristics (HOW_s) at the intersection of these what and how record the correlation, thus quality function deployment is a successful tool to translate the voice of the customer into final product/service specification.

Alike, [Chaudha et al. \(2011\)](#) argued the integration of the Kano's model with QFD offers for an organization to delight customer by including their voice into the product/service design process, moreover the application of the Kano's model is utile for ameliorate discrimination of customer needs whereas its integration in QFD matrix will assists product/service designer to

decide most important product/service development activities and to attain maximum customer satisfaction.

Likewise, [Bandyopadhyay \(2015\)](#) précis the pragmatic entailment of the integration of Kano's model into SERVQUAL as follows.

1. The collaboration empowers the managers to empathize with the service prerequisite from the customer's perspectives.
2. Application of Kano's model alleviates the managers to prioritize the amelioration of service quality attributes based on their instrumentality in satisfying customers, alike enables the manager to optimize output under constraint.
3. It caves in ambit for offering tailor-made service solutions for various customer groups to achieve the optimal level of customer satisfaction.
4. Enables the manager to emphasis on the training requirement for the frontline service employee's response, for instance, "courteousness" and "responsiveness".

[Andronikidis et al. \(2009\)](#) assessed and stated collaboration of quantitative methods link to QFD, various issues come across at some stage of the execution of QFD which is mentioned as follow, "QFD methodology imposes the need to deal with large amounts of data gathered from customer, competitors and cross-functional, time-consuming, need input and analyze a large amount of subjective data, bias may be easily inserted into any stage of the QFD, etc", consequently to overcome those issues it requires a new method so that the effectiveness of QFD could be achieved through the implementation of quantitative techniques such as the analytic hierarchy process (AHP), analytic network process (ANP) and Markov chains which enables to overwhelm better service delivery that meets or exceeds customer expectations and also points to improve sales, higher satisfaction.

2.9. Multi-Criteria Decision Making Tools

Multi-Criteria Decision Making Analysis (MCDA) was introduced as a subsection of operation research intended to assist in solving problems (Jato-Espino et al., 2014). Since then, numerous multi-criteria decision-making technique has been introduced to use them for different service and manufacturing sectors (Kiker et al., 2005; Lahdelma et al., 2000; Løken, 2007; Słowiński, 1986; Tonietto & Carbonneau, 2004). In line with this, we will discuss the most popular multi-criteria decision-making tools in the upcoming section.

2.9.1. Analytic Hierarchy Process (AHP)

Starting, from the introduction the analytical hierarchic process has extensively utilized, see, for instance, application of analytic hierarchy process.

2.9.1.1. Analysis of the Application of Analytic Hierarchy Process (AHP)

Industrial R&D project selection and resource allocation (Liberatore, 1987); hospital site selection (Şahin, Ocak, & Top, 2019); construction (Darko et al., 2018); site selection (Chen, 2006; Ubando et al., 2019; Yavaşoğlu et al., 2019); operation management (Subramanian & Ramanathan, 2012); maintenance strategy selection (Bevilacqua & Braglia, 2000); supplier selection (Aktepe & Ersoz, 2011; Zaim et al., 2003); sustainable development (Dos Santos et al., 2019); human factor technique selection (Petruni et al., 2017); life cycle assessment of agricultural production (Nikkhah et al., 2019); decision modeling for manufacturing sustainability (Ocampo, 2017) and more.

Likewise, the Analytic Hierarchy Process (AHP) is a multi-criteria decision-making tool developed by Professor Thomas L. Saaty (1980). The analytic hierarchy process is intentional to contend with both the noetic and visceral to blue-ribbon the greatest from different options judged with abide by respective criteria (Saaty & Vargas, 2001).

Accordingly, they have also mentioned the seven basic pillars of the analytic hierarchy process (AHP) such as,

1. Ratio scales; proportionality and normalized ratio scales.
2. Reciprocal paired comparisons.
3. The sensitivity of the principal right Eigenvector.
4. Homogeneity and clustering.

5. The synthesis that can be extended to dependence and feedback.
6. Rank preservation and reversal.
7. Group judgments.

Step 1. In the analytic hierarchy process, the first step is to generate a hierarchy of the problem (Taherdoost, 2017a). See for instance the figure below,

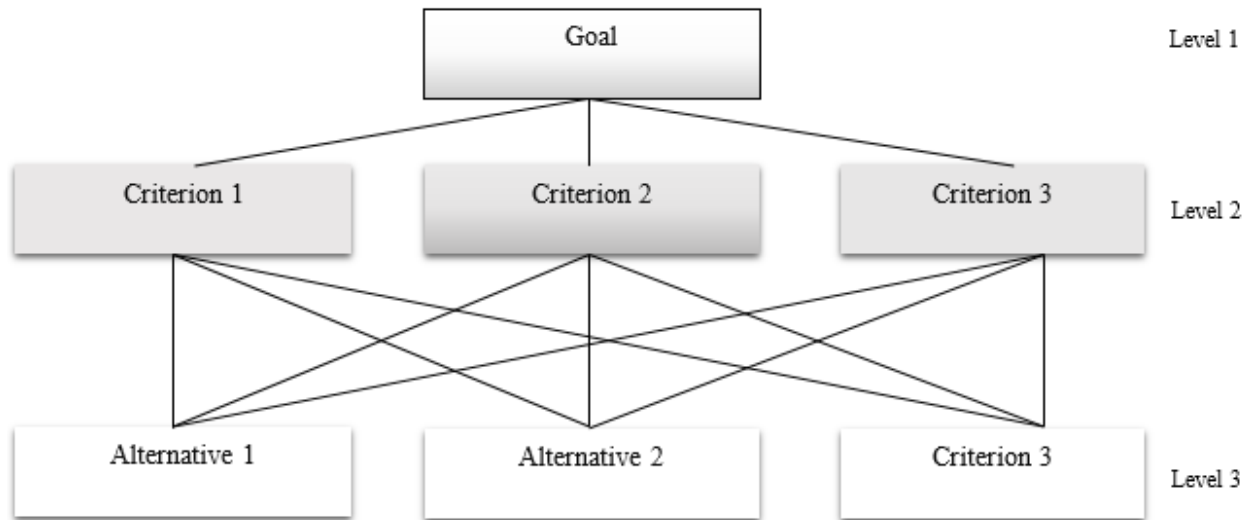


Figure 2. 17 Hierarchical trees. Source: Taherdoost (2017a)

Step 2. To conduct a pairwise comparison a survey questionnaire should be prepared and distributed among the respondent, likewise, each respondent place their desired figure for each set criteria, and scale range between one and nine for each judgment, that is shown the table below (Saaty, 2008).

Table 2. 17 The fundamental scale of absolute number. Source: Saaty (2008).

Intensity of importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
2	Weak or slight	
3	Moderate importance	Experience & judgment slightly favor one activity over another
4	Moderate plus	

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5	Strong importance	Experience & judgment strongly favor one activity over another
6	Strong plus	
7	Very strong/ demonstrated importance	An activity is favored very strongly over another; its dominance demonstrate in practice
8	Very, very strong	
9	Extreme importance	The evidence favoring one activity over another is of the highest possible order of affirmation
Reciprocal of above	If activity i has one of the above non – zero numbers assigned to it when compared with activity j then j has the reciprocal value when compared with i .	

Step 3. Pairwise comparison, in this step to get a suitable solution from a set of alternatives, consequently the calculation should be repeated several times to make decisions thereby facing an incompatible matrix (Taherdoost, 2017a).

Therefore the following equation is used to transform the raw data into meaningful absolute value and normalized weight $w = (w_1, w_2, w_3, \dots, w_n)$.

$$Aw = \lambda_{\max} * w, \lambda_{\max} \geq n$$

$$\lambda_{\max} = \sum a_j w_j - n / w_1$$

$$A = \{a_{ij}\}, a_{ij} = 1 / a_{ji}$$

Where

A = pairwise comparison

w = normalized weight vector

$\lambda_{\max}$ = maximum Eigenvalue of matrix A

a_{ij} = numerical comparison between the value i and j

Step 4. To validate the result of the analytical hierarchic process, consistency ratio (CR) is calculated using the equation, $CR = C.I. / R.I.$, and in which the consistency index of a matrix of comparison it's given by $C.I. = (\lambda_{\max} - n) / (n - 1)$, the value of R.I. is extracted from the table below.

Table 2. 18 Average Random consistency Index (R.I.). Source: [Saaty & Vargas \(2001\)](#).

N	1	2	3	4	5	6	7	8	9	10
Random consistency index (R.I.)	0	0	.52	.89	1.11	1.25	1.35	1.40	1.45	1.49

2.9.1.2. Critiques on the Analytic Hierarchy Process (AHP)

Despite its reputation and extensive use of AHP, perhaps AHP has subjected to various theoretical and practical criticisms, for instance, [Cheng et al. \(2002\)](#) “AHP only recognize the interaction between the elements of two adjacent level”; [Asadabadi et al. \(2019\)](#); [Karthikeyan et al. \(2016\)](#) inconsistency issue; [Taslicali & Ercan \(2006\)](#) linear relationships, rank reversal issues, information strategy selection issues.

2.9.2. Analytic Network Process (ANP)

The analytic network process consists of similar attributes as the analytic hierarchy process which includes, simplicity, flexibility, coincident implementation of both qualitative and quantitative measures, and can brush up eubstance in judgment process, besides analytical network process deals with every event i.e. a network of criteria, sub-criteria, alternatives, moreover, an analytic network process, every component in the network can interplay with each other by any means ([Kheybari et al., 2020](#)). Likewise, [Kheybari et al. \(2020\)](#) recapitulate the analytic network process in four main steps such as.

Step1. Building a model and converting a problem into a topic network structure.

Step2. Formulating a pairwise comparison matrix and determine priority vectors.

Step3. Generating a supermatrix and converting it to a weighted supermatrix.

Step4. Selecting the best option.

2.9.2.1. Analysis of the Application area of the Analytic Network Process (ANP)

Numerous research papers consolidate application of analytic network process (ANP) in an assortment of industrial, profit, and non-profit firms, see for the case,

Table 2. 19 Analysis of the application area of the Analytic Network Process (ANP)

No.	Author & year	Description	Area
1	Galankashi et al. (2015)	Prioritizing green supplier selection criteria	Green supply chain
2	Çelebi et al. (2010)	Logistics management	Small electronic appliance manufacturer
3	Simwanda et al. (2020)	Modeling the drivers of urban land-use change	Urban development
4	Abdi (2012)	Product family formation & selection for configurability	Manufacturing system
5	Gheshlaghi et al. (2019)	GIS-based forest fire risk mapping	Environmental planning
6	Bayazit (2006)	Vendor selection decisions	Supply chain
7	Boateng et al. (2015)	Risk prioritization in mega projects	Project management
8	Cheng & Li (2004)	Contractor selection	Project management
9	Cheng & Li (2005)	Project selection	Construction management
10	Cooper et al. (2012)	Selection of a third-party logistics provider	Pharmaceutical company
11	Dabestani et al. (2017)	Evaluation and prioritization of service quality dimension	4 – star hotel
12	Farman et al. (2017)	Optimum cluster head selection	Wireless sensor network
13	Genevois et al. (2015)	Automatic teller machine deployment problem	Bank service sector
14	Godse et al. (2008)	Web service selection	Web service industry
15	Hasanzadeh et al. (2013)	Coastal oil jetties site selection	Oil production industry
16	S. H. Chen et al. (2004)	Enterprise partner selection	Vocational education
17	Jharkharia & Shankar (2007)	Selection of logistics service provider	Logistics

18	Meade & Presley (2002)	R&D project selection	Research & Development program
19	Mulebeke & Zheng (2006)	Software selection in product development	Manufacturing industry
20	Wu et al. (2012)	Porter's Five Force analysis	Strategic management
21	Zhu et al. (2010)	A portfolio-based analysis for green supplier management	Supply chain management
22	Zare et al. (2018)	Prioritizing shift work disorder	Hospital service

2.9.2.2. Critiques on the Analytic Network Process (ANP)

Despite its reputation and extensive use of ANP, perhaps ANP has subjected to various theoretical and practical criticisms, for instance, The weakness of the analytic network process is related to the complexity of the method, the duration of implementation, and uncertainty in giving judgment, especially those on the cluster level (Kadoić et al., 2017).

2.10. Fundamental Concept of Queuing Theory

Queuing theory is implicated with the mathematical modeling and analysis of systems that offer service to random demands (Sztrik, 2010). Also, queuing theory is known as the random system theory which bailiwick the contented of the following three parts such as behavior issues: it deals with mainly about the queue length distribution, the waiting time distribution, and the busy period distribution in both transient and steady-state second, optimization issues: in this case, it classifies the optimization into two which is static optimization that concentrates on the optimal design and dynamic optimization which deals about the best operation of the queuing system, and finally the statistical inference of queuing system: which determines the model of the queuing system (Xiao & Zhang, 2010).

“Queuing theory is a branch of operational research, the objective of queuing theory is to understand queuing system behavior to predict its performance, control and optimize its performance” (B. Kumar et al., 2015). Queue or waiting line is a common phenomenon in the daily life of human effort (Zewude, 2016). See, for example, barbershop, traffic light, bank, airline, bus station, hospital, gas stations, restaurant, etc. Bose (2002) refers that the queuing system is a model

of a system that offers a service to the customer who is seeking service and exit after receiving the service.

Queuing theory is one of the most popular and widespread models in line with this queuing theory have implemented in different service and manufacturing sector see for instance bank service (Aa et al., 2018; S. Ahmed et al., 2018; Asogwa et al., 2018; Bakari et al., 2014; Joshi et al., 2019; Shastrakar & Pokley, 2019; S. Wang & Ahmed, 2018; Yakubu & Najim, 2014); seaport (El-Naggar, 2010); health sector (Adeleke et al., 2009; Ameh et al., 2013; Li et al., 2009; Mehandiratta, 2011; Peter & Sivasamy, 2019; Seun et al., 2019; Yaduvanshi et al., 2019); inventory system (Rashid et al., 2015; Seyedhoseini et al., 2015); traffic system (Kelathodi Kumaran et al., 2018; Pitts et al., 2006; Yang & Yang, 2014); small Earth observation satellites (W. Chen et al., 2008); logistics service (Nyhuis et al., 2005); air defense operation (Zhong & Zhang, 2020); disaster management (Bharkad & Khalsa, 2019); blockchain system (Memon et al., 2019) and more.

Y. Hu & Tian (2019) declared that “the general queuing system consists of three parts these include input process (customer arrival), queuing discipline, and server”. Also, Hongna & Zhenwei (2010) emphasized that the queuing system composed of two aspects these include: services provider and service recipient.

Devi et al. (2019) asserted that customer will be impatient if they are given to join the queue line only if in if waiting time is minimum, and will stay in the queue line if it's scant. In line with the impatient behavior of the customer plays a significant use while a transaction with a real condition of overcrowding issues skirmish in the daily working environment (Jain et al., 2018).

However, Trigos et al. (2019) refer that service capacity is the main factor for queuing length and waiting time, whereas service capacity is the number of servers available per time interval in line with this increasing the number of servers has a direct impact on the company since it will increase the direct labor cost.

Likewise, an increasing number of bank branches, changing of payment method, vulgarisation of electronic banking can not solve the issues of the banking queuing system, however, it is better if we concentrate on improving the queuing system of the bank (Hao & Yifei, 2011). Kaur & Singh (2017) declare that queuing systems that assist the bank to reduce the waiting time thru adequate queue management thereby increase the outturn. Houston et al. (1998) Stated and represented that, the time that customer consume in a service queue has an extensive influence on their appraisal of the providers overall quality, consequently by letting anger and uncertainty, the perceived duration of a wait seems to be more prominent than the quality of service delivered by the customer contact employee.

Customer's appraisal of service quality is influenced not only by the actual waiting time but also by the perceived waiting time (Yusuf et al., 2015). The waiting time of the customer at the time of receiving service has a significant consequence on their behavior (Ramachandran & Vijayabanu, 2012). Unes et al. (2019) from their analysis, they concluded that for more exceptional customer loyalty, there are relevant factors to be considered such as low fees and service charges compared to their competitors, providing a high service quality, easy access to the branch and ATMs, providing a flexible service, in addition to providing an acceptable waiting time service.

2.10.1. Basic Characteristics of Queuing Process

Kameda (1982) emphasized that the finite source queuing system is known as the “finite population”, “machine interference”, or “machine repairman model” which is used for dissecting the time-sharing system and multi-programmed computer systems.

Parimala (2008) describes the main characteristics of the queuing system these includes arrival pattern, service pattern, queue discipline, system capacity, service channels, markovian queuing model, non-markovian queuing model, server's vacation, repeated vacation, single vacation, and erlang distribution. Also, Mehri et al. (2006) identify the characteristics of queuing systems as follow which include the size of the calling population pattern of arrival at the system, behavior of the arrival, waiting lines, basic queuing system configuration, and service time distribution.

Mazalov & Gurtov (2012) states that queue length and waiting time are the major performance metrics. Zhou (2017) the queue system has two collective methods which are the general description: focus on mainly describing the basic elements of the system, simulation language description: it incorporates a programming language to show the statistical operation of the queuing system. Akhavian & Behzadan (2014) define queue discipline as “a rule or set of rules based on specific attributes of the entities”. There are different types of queue discipline such as First-In-First-Out (FIFO), Last-In-First-Out (LIFO), and Priority queues or PRI queue discipline.

Gumus et al. (2017); Medhi, (2003); Ogunfiditimi & Oguntade (2010) define arrival pattern as “the probability distribution of the pattern of arrivals of the customer in time, known as the input process, and determined by the interarrival time between any two consecutive arrivals.”; service pattern as “how service is rendered, also the service distribution, the probability distribution of the random time to serve a customer (or group of customer case of batch service).”; queue discipline as “the order in which customers are taken for service.”; system capacity as the ability to accommodate the customers within the facility; service channels as “the available number of a server which is single or multiple servers.”; queue length as “a system having an infinite or finite queue length”.

2.10.2. Queuing Theory Formula

2.10.2.1. Basic Queuing Theory Formula

Single server queuing model with Poisson arrival and exponential service time (M/M/1). The major assumption of the model is discussed as follows.

“Arrival is served on a FIFO basis, every arrival waits to be served regardless of the length of the line, arrivals are independent of preceding arrivals but the average number of arrivals (the arrival rate) does not change over time, arrivals are described by a Poisson probability distribution and come from an infinite or very large population, service times also vary from one customer to the next and are independent of one another but their average rate is known, service time occur according to the negative exponential probability distribution, the average service rate is greater than the average arrival rate” (Mehri et al., 2006).

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Table 2. 20 Performance improvement parameter and equations based on (M/M/1). Source: [Mehri et al. \(2006\)](#)

Result	Equation
Average server utilization/efficiency (ρ)	$\rho = \frac{\lambda}{\mu}$
The average number of customers in the queue(L_q)	$L_q = \frac{\lambda^2}{\mu(\mu - \lambda)}$
The average number of customers in the system(L_s)	$L_s = \frac{\rho}{1-\rho} = \frac{\lambda}{\mu - \lambda}$
The average waiting time in the queue(W_q)	$W_q = \frac{\lambda}{\mu(\mu - \lambda)}$
Average time in the system(W_s)	$W_s = \frac{1}{\mu - \lambda}$
Total Cost Based on Waiting (T_{cw})	$T_{cw} = \sum_{j=1}^N C_j S_j + \sum_{j=1}^N C_{wj} L_{qj}$
Total Cost Based on System (T_{cs})	$T_{cs} = \sum_{j=1}^N C_j S_j + \sum_{j=1}^N C_{wj} L_{sj}$

Multiple server queuing model with Poisson arrival and exponential service time (M/M/S). The main assumption of the model is deliberated as follows.

“The arrival of the customer is identically independent and follow the Poisson probability distribution with parameters λ and given by:

$$P_n(t) = \frac{e^{-\lambda t} (\lambda t)^n}{n!}; \quad n = 1, 2, 3 \dots t > 0 \quad \text{Eq. (1)}$$

Where $P_n(t)$ = probability of arriving n customers in the time interval t , the service time of customers is identically independent which meets negative distribution with parameter μ and given by:

$$F(t) = 1 - e^{-\mu t}; \quad t > 0 \quad \text{Eq. (2)}$$

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The waiting line is characterized by unlimited queue structure and the queue discipline is FCFS, due to the introduction of one window system each server has similar facilities however the queue configuration system is with several tellers or sever on duty and the customer has to wait in one common line for the first available server” (Berhan, 2015).

Table 2. 21 Performance improvement parameter and equations based on (M/M/s). Source: Berhan (2015)

Result	Equation
Average server utilization/efficiency (ρ)	$\rho = \frac{\lambda}{s\mu}$
The average number of customers in the queue(L_q)	$L_q = \frac{\rho^{(s+1)}}{s!s\left(1 - \frac{\rho}{s}\right)^2} P_0$
The average number of customers in the system(L_s)	$L_s = \left[\frac{\rho^s}{\mu s!s\left(1 - \frac{\rho}{s}\right)^2} P_0 + \frac{1}{\mu} \right] \lambda$
The average waiting time in the queue(W_q)	$W_q = \frac{\rho^s}{\mu s!s\left(1 - \frac{\rho}{s}\right)^2} P_0$
Average time in the system(W_s)	$W_s = \frac{\rho^s}{\mu s!s\left(1 - \frac{\rho}{s}\right)^2} P_0 + \frac{1}{\mu}$
Total Cost Based on Waiting (T_{cw})	$T_{cw} = \sum_{j=1}^N C_j S_j + \sum_{j=1}^N C_{wj} L_{qj}$
Total Cost Based on System (T_{cs})	$T_{cs} = \sum_{j=1}^N C_j S_j + \sum_{j=1}^N C_{wj} L_{sj}$

2.11. Ethiopian Bank Industry

“The history of banking in Ethiopia goes back nearly more than 100 year ago and the first bank was established in Addis Ababa, Ethiopia, during Emperor Menelek the second, which is known as the bank of Abyssinia, and also an agreement for launching the bank was signed by the two parties (Emperor of Ethiopia and National bank of Egypt), however due to many issues new state-owned bank was established known as the bank of Ethiopia” (Mauri, 2003).

According to [Lelissa \(2014\)](#) look into the antigenic determinants of Ethiopian bank performance regarding on bank-specific and external index of bank profitability from 1990 to 2012, in respect to that, the empirical finding showed that the bank achieves high performance if they control their credit risk, branch out their income source by integrating non – traditional banking service, and their overhead expenses, further, bank’s capital and liquidity status are not significant to influence the performance of the bank, besides bank size and macroeconomic variables such as real GDP growth rate have no significant effect on bank’s profitability, but the inflation rate has a significant impact on the performance of Ethiopian commercial banks.

Alike, [Shuremo \(2016\)](#) investigated the epitopes of Ethiopian bank profitability considering bank-specific, industry-specific and macroeconomic variables, from 2002 up to 2012, considering that, the empirical finding showed that, the correlation between capital and profitability is positive and statistically significant; association within credit risk and profitability are negative and strongly significant; the relationship among operating cost and performance of the bank in general, profitability, in particular, are negative and statistically significant; the correlation between employee, productivity and profitability are positive and statistically significant; the relationship between total loan and profitability is positive and statistically significant; finally association between liquidity risk and profitability are statistically significant.

Also, [Alemu \(2015\)](#) examined the major determinants of commercial bank's profitability, a sample of eight commercial banks from 2002 up to 2013, the empirical finding showed that bank size, adequacy, and GDP are statistically significant and positive correlation with bank's profitability, on the other hand, like liquidity risk, operational efficiency, funding cost, and banking sector development have a negative and statistically significant relationship with bank's profitability, however, management efficiency, employee efficiency, inflation, and foreign exchange rate are statistically insignificant.

Similarly, [Tesfay \(2016\)](#) appraised the major causal factors of commercial bank efficiency from 2003 – 2012, having that, the empirical finding showed that the relationship between deposit and efficiency is statistically significant and also the relationship between liquidity and efficiency is statistically significant, however, on the other hand, loan quality, expenses, profitability, bank's size, and diversification were statistically insignificant.

Besides, [Shibru \(2012\)](#) look into the determinants of the capital structure of commercial banks in Ethiopia, from 2000 – 2011, a sample of eight Ethiopian bank industry, the empirical findings show that profitability, size, tangibility, and liquidity are statistically significant determinants of the capital structure of banks in Ethiopia, though, on the other hand, growth and risk of the bank have statistically insignificant influence on the capital structure of banks in Ethiopia.

In general, [Mekonnen et al. \(2015\)](#) stated, the performance of Ethiopian bank are evaluated comprehensively based on international and national standards, so a tool to measure the performance of the bank are CAMEL framework which are a combination of Capital adequacy, Asset quality, Management quality, Earning ability and Liquidity position, therefore, banks are suggested to implement this tool.

2.12. Summary of Literature Review

After digging deep into the “related literature review” for each theory and concept of service, service quality, customer satisfaction, customer loyalty, and queuing (waiting time) a better understanding obtained. And also the aid of customer-oriented service quality improvement tools and multi-criteria decision-making tools has been discussed. Alike, the application and drawback of both tools have been seen to have a general understanding and detailed steps or procedure of each tool has been discussed.

Besides, the benefits and importance of synergies of both customer-oriented service quality improvement tools and multi-criteria decision-making tools are also been discussed in depth. The main limitation pointed out is that during a service quality evaluation we use a five Likert rating scale composed of opinion statements to measure respondent attitudes. However, it is difficult to capture the exact feelings of the respondent in detail, because the linguistic appraisal of the respondent expectation and perception perhaps incomplete, inconsistent, vague, and representing, analyzing the exact numerical value can be unrealistic.

Consequently, this research question raised “How can service quality, queuing (waiting time) affects the performance of the bank and customer satisfaction?” Likewise, from the meta-analysis findings, the major factor has identified these includes from service quality aspect (technology, employee competency) and customer satisfaction aspect (service quality, bank image, customer expectation, perceived service quality, repurchase intention, continuous intention,

Customer loyalty, complaint, switching intention). Alike from queuing (waiting time) aspect service rate. The related literature review showed that there is a theoretical gap between the quality model and the queuing model. Furthermore, the figure below shows that the theoretical gap that this research study tries to develop abridges that integrate the two concepts, moreover this research is motivated by the scarcity of research in this area.

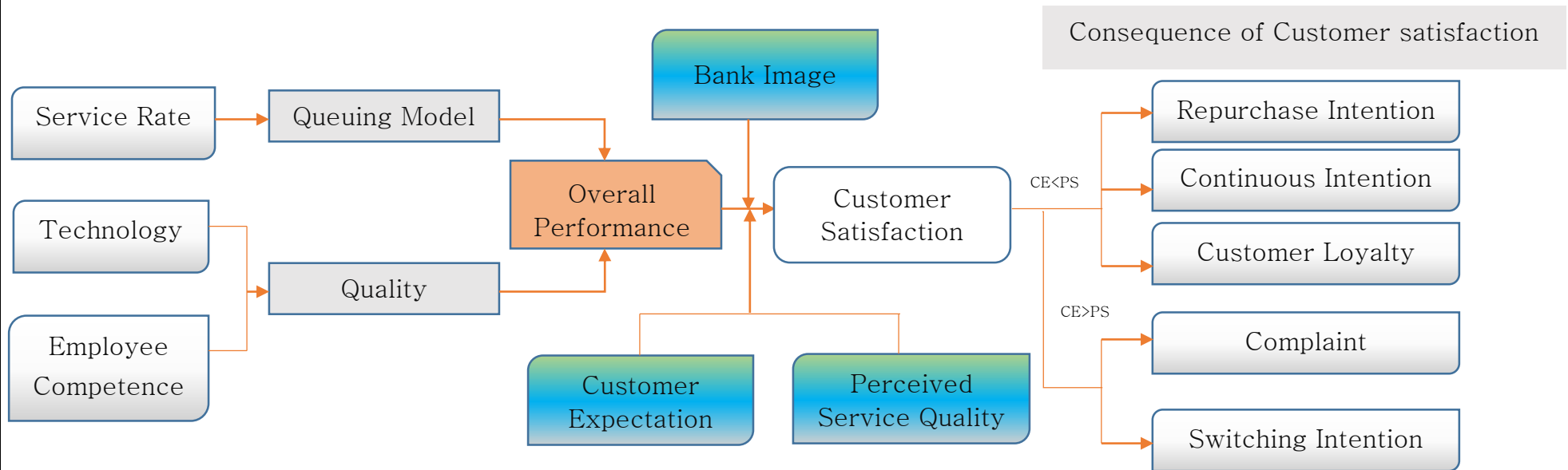


Figure 2. 18 Integrated Conceptual framework Quality & Queuing model. Source: [Author meta-analysis](#)

Chapter Three

3. Research Methodology

“Research methodology is an outline of the entire research plan which consists of what must be done, how it will be done, what data will be needed, what data-gathering devices will be employed, how sources of data will be selected, how the data will be analyzed, and a conclusion is drawn” (Y. K. Singh, 2006). Likewise, “Research methodology is the path through which researchers need to conduct their research” (Jilcha Sileyew, 2019).

3.1. Introduction

This section presents the research methodology, research design (research framework), research sample size, and population.

3.2. Research design

“A research design is a procedural plan that is adopted by the researcher to answer questions validly, objectively, accurately, and economically”(R. Kumar, 2011).



Figure 3. 1 Research framework

Literature Review: the literature review is classified into two sets, interpretative approaches, and meta-analytical analysis, which designates the combination of qualitative and quantitative methods that promotes a better understanding of the aspects of studies. Likewise, meta-analysis is a way of consolidation of statistical results from diverse studies to consider and liken and to distinguish patterns, associations, or correlations that look in the setting of numerous studies on a similar subject (Davis et al., 2014).

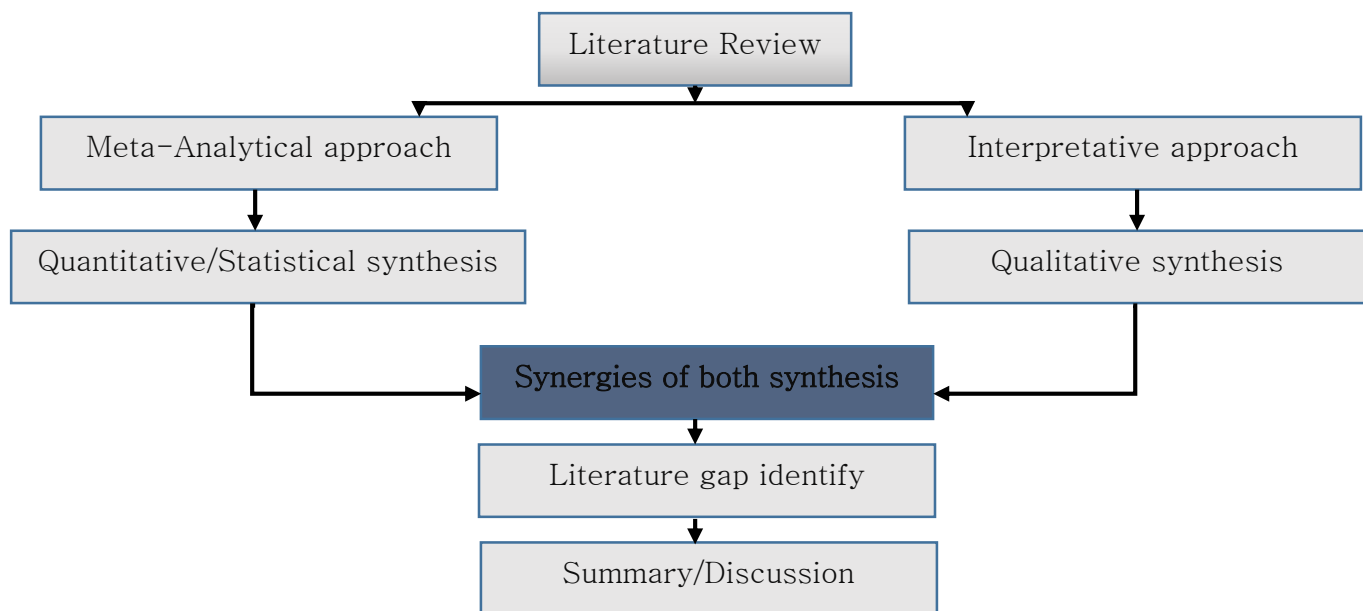


Figure 3. 2 Framework of the research literature review

Data Collection & Analysis: In summary, we have seen numerous services quality improvement tools for customer-oriented approaches such as the SERVQUAL model, Kano's model, Quality Function Deployment (QFD). Besides, we have discussed their application and also their drawback of the tools, in the meantime, we use survey questionnaires to know the services quality gap. Likert (1932) cited in Symeonaki et al. (2014) established a tool known as the Likert scale, used to measure respondent attitudes which are composed of opinion statements and five Likert rating scale in number. In line with this, most of the time we use survey questionnaires to gather data from a given sample of the population, and the respondent gives their opinion using a Likert scale.

However, during a service quality appraisal, the linguistic judgment of the customer perception and expectation perhaps incomplete, inconsistent, vague, and imprecise due to that representing the exact numerical value can be unrealistic (Lupo, 2015). Also, Russell & Bobko (1992) cited in Vonglao (2017) states that it is difficult for the respondent to distinguish their feelings honestly at such a level of detail.

Though, to overcome this concern fuzzy set theory, which is developed by Zadeh (1965) can be implemented in evaluating the equivocality affiliate with customer subjective judgment (Büyükožkan et al., 2011). Consequently, in the proceeding section, a detailed impression of the fuzzy set theory (FST) and its theoretical principles for the research are given. Subsequently, the major steps of the selected approach are discussed.

3.3. Fuzzy Set Theory and Linguistic Fuzzy Evaluation Scales

Personal judgment is uttered in terms of linguistic variables rather than accurate or exact numerical values, thus the schematic mathematical uttered were not fitted out with the essential appurtenance to deal with linguistic variables (Braendle et al., 2014). Consequently, the fuzzy set theory was innovated, and it is a mensuration theory that holds linguistic variables with a numerical value (Maisuroh et al., 2020). In many cases, customers have vice in anticipating quantitative values, thus in equivalence, they have an enjoyable level of estimation in qualitative predicting. In many situations, customers choose to evince their feelings with verbal expression (Gungor et al., 2009). However, the verbal evince of feelings is vague and oblique. In line with this, a fuzzy set was primitively aimed to bargain with the problem of subjective uncertainty, moreover, subjective uncertainty is an outcome from using linguistic variables to represent the problem or the event (Tzeng & Huang, 2011).

3.3.1. Analysis of the Application area of the Fuzzy Set Theory

Starting from the introduction of the fuzzy set theory, it has been implemented extensively by integrating with quality measurement tools for improving service quality in different services and manufacturing organizations see for example.

Table 3. 1 Analysis of the application area of the fuzzy set theory with quality measurement tools

No.	Author	Area/Sector
Fuzzy SERVQUAL model		
1	Faizah et al. (2018); Lupo (2013)	Higher education
2	Stefano et al. (2015); Wahyudi (2017)	Hotel industry
3	Aydin & Pakdil (2008); Chou et al. (2011)	Airlines services
4	Liu et al. (2015)	Certification & Inspection industry
5	H. Y. Hu et al. (2010); Janani & Suriya (2019)	Hospital service
6	Charles et al. (2013); Suprihatin & Hidayat (2018)	Bank service
Fuzzy Kano' model		
1	Zhang et al. (2018)	Product aspect preference
2	C. H. Wang & Fong (2016)	Airline services
3	Xu et al. (2019)	Virtual reality interior design software
4	Ilbahar & Cebi (2017)	e-commerce websites
5	Shokouhyar & Tavallaei (2017)	Food industry
Fuzzy Analytical Hierarchy Process (FAHP)		
1	Al-Shammari & Mili (2019); Mosavi & Afsar (2018)	Bank service
2	Huang & Wu (2005)	Semiconductor industry
3	Ahari et al. (2011)	Pharmaceutical industry
4	Ayodele et al. (2018)	Farm site selection
5	Xiaolong Li & Zhang (2013)	Logistic finance
Fuzzy Analytical Network Process (FANP)		
1	Q. He et al. (2015)	Mega construction project
2	Alireza Valipour et al. (2015)	Freeway ppp project

3	Larbi-Siaw et al. (2019)	Bank service
4	A. Sadeghi & Larimian (2018)	Sustainable electricity generation mix
5	Vinodh et al. (2011)	Supplier selection
Fuzzy Quality Function Deployment (FQFD)		
1	Sohn & Choi (2001)	Supply chain management
2	Bottani & Rizzi (2006)	Logistics service
3	Bevilacqua et al. (2006); Lima-Junior & Carpinetti (2016)	Supplier selection
4	Çevik Onar et al. (2016)	Computer workstation selection
5	A. H. I. Lee & Lin (2011)	New product development

Fuzzy set theory was established by [Lotfi A. Zadeh \(1965\)](#) ([Seikh et al., 2012](#)). In line with this, to solve the subjectivity problem [Zadeh \(1965\)](#) developed a method for quantitative expressions which is defined as, a fuzzy set $\tilde{A}$, $\tilde{A} = \{(x, \mu_A(x)) : x \in A, \mu_A(x) \in [0, 1]\}$, displays a real number $(x, \mu_A(x))$ the first element x belongs to classical A , the second element $\mu_A(x)$ belong to the interval $[0, 1]$ is known as the membership function, also fuzzy number described as if a fuzzy set $\tilde{A}$ on R must possess at least the following three parameters to be qualified as fuzzy number these include: $\tilde{A}$ must be a normal fuzzy set, ${}^\alpha\tilde{A}$ must be closed interval for every $\alpha \in [0, 1]$, the support of $\tilde{A}$, ${}^+\tilde{A}$, must be bounded ([Nagoor Gani & Mohamed Assarudeen, 2012](#)).

Triangular fuzzy number

It is a way by which a fuzzy number represented with three points as follows: $\tilde{A} = (a_1, a_2, a_3)$, this representation function and holds the following conditions.

1. a_1 to a_2 is increasing function
2. a_2 to a_3 is decreasing function
3. $a_1 \leq a_2 \leq a_3$

$$\mu_{\tilde{A}}(x) = \begin{cases} 0 & \text{for } x < a_1 \\ \frac{x - a_1}{a_2 - a_1} & \text{for } a_1 \leq x \leq a_2 \\ \frac{a_3 - x}{a_3 - a_2} & \text{for } a_2 \leq x \leq a_3 \\ 0 & \text{for } x > a_3 \end{cases}$$

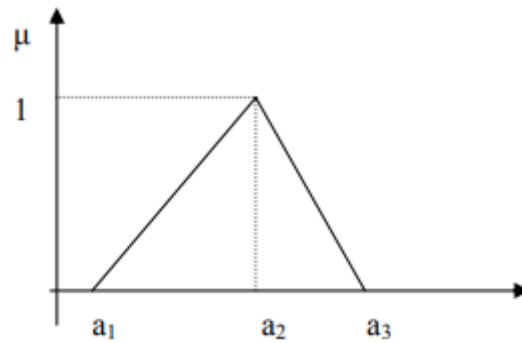


Figure 3. 3 Triangular fuzzy number. Source: [Nagoor Gani & Mohamed Assarudeen \(2012\)](#)

[Ayyub et al. \(1984\)](#) a linguistic variable is defined as the value of words, phrases, or string of words in a given language. Variables related to various semantic scales of customer linguistic categorized into adequate and efficient semantics measures for example, “very dissatisfied, somewhat dissatisfied, no opinion, somewhat satisfied, very satisfied, very unimportant, somewhat unimportant, no opinion, somewhat important, very important” which enable the respondent to select their semantic response ([Hsieh et al., 2015](#)).

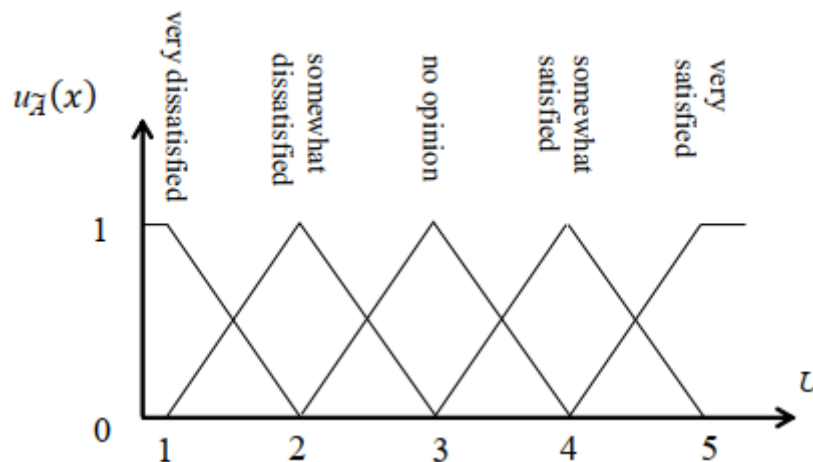


Figure 3. 4 Triangular fuzzy membership function of semantic responses. Source: [Hsieh et al. \(2015\)](#)

[Q. Li \(2013\)](#) defines that “fuzzification is the process of transforming input variables into fuzzy values that are described by membership degrees and their associated membership functions.” Likewise, [Chen & Hwang \(1992\)](#) cited in [Hsieh et al. \(2015\)](#) asserted that using the defuzzification method we can convert linguistic variables on the evaluation scale into fuzz evaluation values.

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Table 3. 2 Evaluation scale for fuzzy linguistic values, [Chen & Hwang \(1992\)](#). Source: [Hsieh et al. \(2015\)](#)

Fuzzy numbers	Linguistic variables	Triangular fuzzy numbers
$\tilde{5}$	Very satisfied / very important	(4, 5, 5)
$\tilde{4}$	Somewhat satisfied / somewhat important	(3, 4, 5)
$\tilde{3}$	No opinion	(2, 3, 4)
$\tilde{2}$	Somewhat dissatisfied / somewhat unimportant	(1, 2, 3)
$\tilde{1}$	Very dissatisfied / very unimportant	(1, 1, 2)

Also, defuzzification is a technique in which the fuzzy number is converted to a real number, alike they convert the fuzzy number into Crip number and compare them to the real value ([Chakraborty et al., 2020](#)).

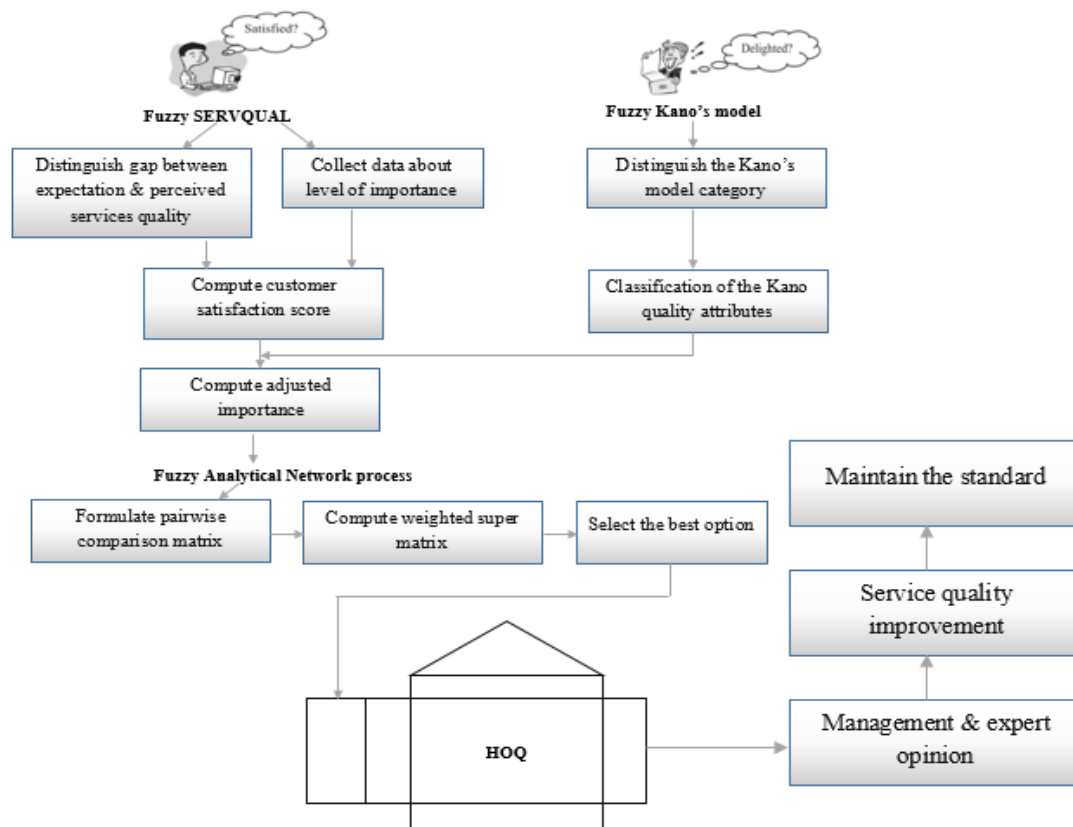


Figure 3. 5 Framework of integrated fuzzy SERVQUAL, fuzzy Kano's model, fuzzy analytical network process into QFD. Source: [Author](#)

3.4. Research Sample Size and Population

The sample size is an important lineament of any empirical research in which the aim is to make illation about a population from a sample (Taherdoost, 2017b). Also, the population of interest is the target population that is envisioned to canvas or analyze (Majid, 2018). Likewise, Nayak (2010) stated that whatsoever the objective we have, we can depict an accurate and exact determination only with the conquer sample size.

Bn & Rn (2012) list out the factor that affects the sample size includes “the effect size, the homogeneity of the sample, the risk of error considered appropriate for the question being studied, and the anticipated attrition (loss to follow up) for the study. “Sampling error is the discrepancy due to random sampling between the true value of the population parameter and the sample estimate (statistics) of that parameter, moreover the larger the sample size the smaller the expected sample error” (Draugalis & Plaza, 2009).

Sampling error is known as the precision of the sampling plan, in the meantime increasing the sample size will enhance the precision, however increasing the sample size has a drawback which is the larger the sample size the more cost incurred to collect the data, and also increase the systematic bias (Kothari, 2004).

Etikan & Bala (2017); Taherdoost (2016) categorizes sampling techniques into two which include probability sampling (Simple random sampling, Stratified random sampling, Cluster sampling, Systematic sampling, Multi-stage sampling) and non-probability sampling (Quota sampling, Snowball sampling, Judgment sampling, Convenience sampling). For our case, simple random sampling was selected. Moreover, according to Daniel (1999) cited in Naing et al. (2006) for sample size calculation, there are two types of equations these include:

$$n' = \frac{NZ^2P(1-P)}{d^2(N-1)+Z^2P(1-P)} \text{----- Eq. (1)}$$

&

$$n = \frac{Z^2P(1-P)}{d^2} \text{----- Eq. (2)}$$

The major difference between those equations is the first one is for a finite number of population and the later one is for the infinite number of population.

Where:

n' = sample size with a finite population

n = sample size with infinite population

N = population size

Z = Z statistic for a level of confidence

P = expected proportion (in a proportion of one) &

d = precision (in a proportion of one)

Therefore, for our research, we used the second equation by considering an infinite number of population, so the sample size was calculated as follows. “For confidence level which is 95% is conventional, the value of Z will be 1.96, whereas investigators who want to be more confident they can take 99% with the value of Z , 2.58” (Naing et al., 2006). $P = 0.5$, $Z = 1.96$, $d = 0.05$

$$n = \frac{1.96^2 0.5(1-0.5)}{0.05^2} = 384.16 \approx 384$$

A simple random sampling technique was used for the SERVQUAL model questionnaires' respondent. In line with this, the basic formula for calculating the sampling error for a sample estimate of a population parameter is as follows (Bozorgi, 2007; Telila, 2019).

$$\text{Sample error} = \frac{\text{Variability of the measurement (Values among the sampling units)}}{\sqrt{\text{Size of the sample}}} \text{----- Eq. (3)}$$

Next, in our case, we have executed a pilot test and the standard variation in factors of service quality measurement in the Grönroos model. Likewise, the mean standard variation of service quality variables is shown in the table below (Grönroos, 2000).

Table 3. 3 Mean standard variation of services quality measurement. Source: Grönroos (2000)

No.	Items	Mean standard variation
1	Tangibles	0.708
2	Reliability	0.301
3	Responsiveness	0.521
4	Assurance	0.263

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5	Empathy	0.755
7	Technical factor	0.605
8	Image	0.603

Therefore, for our research, the researcher considers using a 0.05 sample error is to conquer adequate for academic research. In line with this to get an accurate sample size, we should select the maximum value of the mean variation of a factor, so the sample size is calculated as follows.

$$0.05 = \frac{(0.755)}{\sqrt{\text{Size of the sample}}} = \mathbf{228.01 \approx 228}$$

The Snowball sampling technique was used for Kano's model questionnaires' respondent, having that the formula for calculating the sample size is shown below.

$$n = \frac{Z^2 * \sigma^2}{e^2} = \frac{Z^2 * P(1-P)}{e^2} \text{----- Eq. (4)}$$

Where:

n = sample size

Z = Z statistic for a level of confidence

P = expected proportion (in a proportion of one)

e = sample error

Naing et al. (2006) suggest that if we take the P value between 20% to 30%, we should select 30% because it will give as a maximum sample size, also if we look out the P value between 60% to 80%, we should select 60% because it will give as maximum sample size, finally, if we choose to select the P value between 40% to 60%, we should select 50% as it will give as a maximum sample size for more see the figure below.

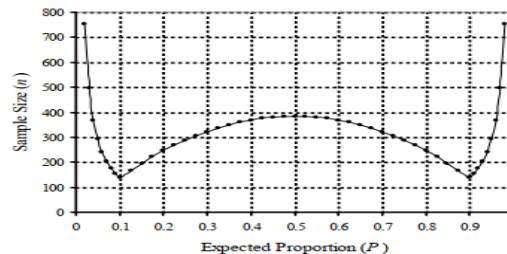


Figure 3. 6 Relationship between sample size and expected proportion (prevalence). Source: Naing et al. (2006)

$$n = \frac{1.96^2 * 0.3(1-0.3)}{0.05^2} = \mathbf{322.69 \approx 323}$$

Reliability and validity:

Reliability of the research can be explained as the extent at which other researchers need to be able to generate the same result using the same research method under similar conditions.

Test – retest reliability: - according to research study in order to increase the reliability of the research, test – retest method is selected. Furthermore this method analyzes the same test more than one time over period of time with same sample group. Validity of the research can be explained as an extent at which requirement of scientific research method have been followed during the process of generating the research findings.

Sampling validity: - based on the research study in order to increase the validity, sampling validity is selected. This method ensure that the area of coverage of the measure within the research are vast. Thus no measure is able to cover all items and elements within the phenomenon. Therefore important items and elements are selected using a specific pattern of sampling depending on aims and objective of the research.

Ethical considerations:

The researcher informed the factory about the study it is strictly performed for academic purpose and provide a letter attached with the prepared questionnaire to conduct a survey questionnaire before distributed among employees. After the permission is granted the author distributed the questionnaire for those who are voluntary and the returned data kept confidential that do not contain any specific data except demographic questions.

Result dissemination mechanism:

According to research study the result will be disseminated by preparing research report in order to communicate findings to the appropriate audience.

Chapter Four

4. Data Collection and Analysis

4.1. Analytical method

4.1.1. Exploratory factor analysis

The Kaiser-Meyer-Olkin (KMO) test is performed in this research to determine the sampling adequacy of a data that is to be used for exploratory factor analysis, also KMO test enables us to ensure that the data we have are suitable to run an exploratory factor analysis, and also it determines whether or not we have set out what we intended to measure.

Moreover, The KMO value between 0.8 and 1 indicates the sampling is adequate. But if the KMO value is less than 0.6 the sampling is inadequate for analysis. Consequently, the table below indicates that the KMO test value is 0.892 which is between 0.8 and 1, so the sampling is adequate for further exploratory factor analysis.

Table 4. 1 KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin measure of sampling adequacy.		.892
Bartlett's Test of Sphericity	Approx. Chi-Square	1848.058
	df	231
	Sig.	.000

Moreover, the appropriateness of exploratory factor analysis was supported by Bartlett's test of Sphericity, which is used as an indicator of the strength of the relationship between variables. Bartlett's test of Sphericity (Chi-Square) value is 1,848.058 which indicating the data were adequate to proceed for exploratory factor analysis.

Table 4. 2 Total Variance Explained

Total Variance Explained									
Component	Initial Eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings ^a		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	10.766	48.937	48.937	10.766	48.937	48.937	10.420	47.365	47.365
2	2.811	12.776	61.712	2.811	12.776	61.712	2.938	13.353	60.717
3	1.469	6.675	68.387	1.469	6.675	68.387	1.494	6.791	67.508
4	1.188	5.400	73.787	1.188	5.400	73.787	1.381	6.279	73.787
5	.712	3.238	77.025						

Note: Extraction Method: Principal Component Analysis.

When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

The main reason for conducting exploratory factor analysis is to determine the major variables or dimensions of competitive priorities. The researcher performed the principle of Kaiser's rule (Eigenvalue >1), with a more easily-interpretable factor loading and scree plot, to determine the number of factors to retain for service quality. Likewise, the leftmost part of the above table indicates the variance explained by the initial solution, only four factors in the initial solution have Eigenvalue >1, also the overall cumulative percentage weights 73.787% of the variability in the original variables. This indicates that four latent influence is associated with service quality. However, the reaming factors are unexplained variations because their Eigenvalue is less than one.

Likewise, the middle part of the above table indicates the variance explained by the extraction factors before rotation. However, the cumulative variability explained by these four factors in the extraction solution is unchanged. Alike, the rightmost part of the above table indicates the variance explained by the extraction factor after rotation. The rotation factor model makes some small adjustments in all four factors. Besides, the scree plot confirms the selection of four components.

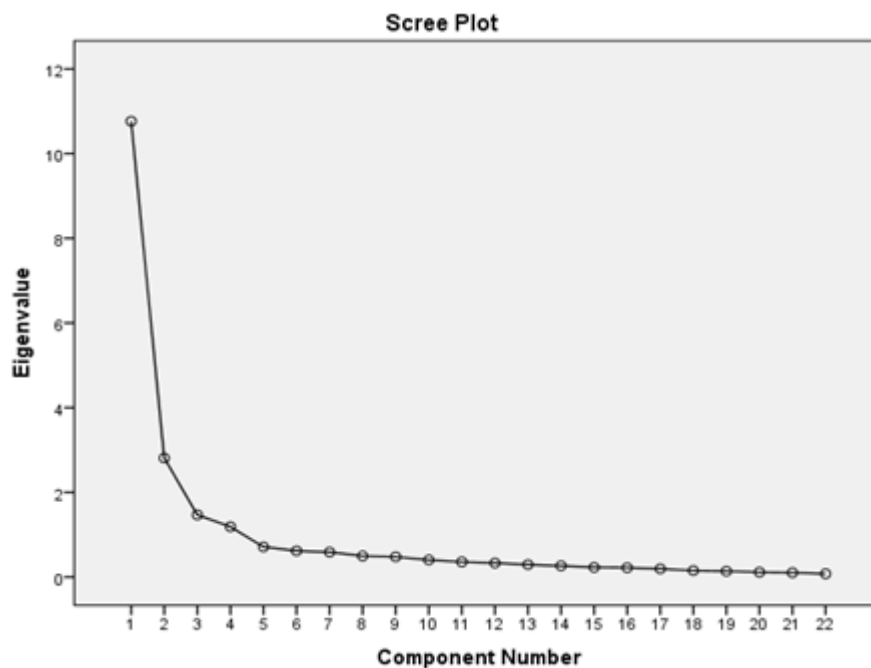


Figure 4. 1 Scree plot

After the aforesaid step which is the KMO and Bartlett's test of Sphericity finalized, the researcher subjected items adopted for service quality into exploratory factor analysis using the principal component extraction method with quartimax rotation with Kaiser Normalization. Kaiser Normalization is performed to obtain stability of solution across samples, in this analysis, all items have equal weight when performing the rotation. Alike, quartimax is selected for orthogonal rotation because it detects overall factors and also maximizes the squared loading so that each item loads most strongly onto a single factor. Likewise, orthogonal rotation analysis assumes all factor are independent or uncorrelated with each other.

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Table 4. 3 Exploratory factor analysis of SERVQUAL dimensions

Construct	Rotated Component Matrix ^a			
	Component			
	1	2	3	4
R ₁	.777			
R ₂	.723			
R ₃	.580			
R ₄	.720			
R ₅	.776			
A ₁	.661			
A ₂	.765			
A ₃	.535			
A ₄	.761			
T ₁		.751		
T ₂		.797		
T ₃		.676		
T ₄		.827		
E ₁	.760			
E ₂	.672			
E ₃	.739			
E ₄	.768			
E ₅	.783			
RE ₁	.839			
RE ₂	.830			
RE ₃	.818			
RE ₄	.800			

Note: Extraction method: principal component analysis

Rotation method: quartimax with Kaiser Normalization

Rotation converged in six iteration

4.2. Fuzzy SERVQUAL Model

The major steps incorporated in the appraisal of bank service quality discussed as follows, the questionnaires' design, distribute survey questionnaires' and gather survey data, analysis of customer expectations and perceptions of service quality, and finally interpretation of fuzzy SERVQUAL analysis.

Step 1. Questionnaire design

This research study adopted questionnaires from previous literature. The SERVQUAL and bank service quality dimensions were interpreted into thoughtfulness under the stirring of previous research studies.

The SERVQUAL model questionnaires addressing customer's perceptions & expectations are weighted using the linguistic variables scale, for instance, the linguistic variables include "strongly disagree", "disagree", "neutral", "agree", "strongly agree".

Table 4. 4 Linguistic variable of perceptions & expectations. Source: [Author](#)

Likert scale	Linguistic variables	Fuzzy membership function
1	Strongly disagree	(1, 1, 3)
2	Disagree	(1, 3, 5)
3	Neutral	(3, 5, 7)
4	Agree	(5, 7, 9)
5	Strongly agree	(7, 9, 9)

Step 2. Distribution of survey questionnaires and collection of survey data

The survey questionnaires were distributed to the customer/respondent online through the personal website "hezrongetahun.blogspot.com" and the collection of survey data was undertaken online, in line with this, the participation was voluntary. The research sample size consists of 228 CBE customers, in line with this customers are required to fill expectation and pereception servey questionnaires.

Step 3. Analysis of customer expectations and perceptions

The main mathematical operations on fuzzy number

The main mathematical operations on the fuzzy number have been discussed in previous literature see for example (Adamo, 1980; Campos & Verdegay, 1989; Dubois & Prade, 1978; Nahmias, 1978).

The main mathematical operations on fuzzy numbers are discussed as follows, let $A_1 = (c_1, a_1, b_1)$ is a triangular fuzzy number and $A_2 = (c_2, a_2, b_2)$ is also a triangular fuzzy number.

1. The triangular fuzzy number $Y = (c, a, b)$ is a special case of a generalized trapezoidal fuzzy number. The ranked average integration representation of the triangular fuzzy number Y will be.

$$P(Y) = \frac{1}{6}(c + 4a + b) \text{ ----- Eq. (1)}$$

2. Addition operation of A_1 and A_2

$$A_1 + A_2 = (c_1 + c_2, a_1 + a_2, b_1 + b_2) \text{ ----- Eq. (2)}$$

Where: $c_1, c_2, a_1, a_2, b_1, b_2$ are real numbers

3. Subtraction operation of A_1 and A_2

$$A_1 - A_2 = (c_1 - c_2, a_1 - a_2, b_1 - b_2) \text{ ----- Eq. (3)}$$

Where: $c_1, c_2, a_1, a_2, b_1, b_2$ are real numbers

4. Division operation of A and any real number r

$$\frac{A}{r} = \left(\frac{c}{r}, \frac{a}{r}, \frac{b}{r} \right) \text{ ----- Eq. (4)}$$

Where: r are real numbers

5. Multiplication operation

$$P(Y_1 * Y_2) = \frac{1}{6}(c_1 + 4a_1 + b_1) * \frac{1}{6}(c_2 + 4a_2 + b_2) \text{ ----- Eq. (5)}$$

The analysis steps are discussed as follows:

1. Let fuzzy number A_{ein} be the service quality expectation from the n^{th} customer under service item i , let fuzzy number A_{pin} be the service quality perceptions from the n^{th} customer under service item i , let fuzzy number TA_{ei} be the sum of service quality expectation from

all customer under service item i , let fuzzy service number TA_{pi} be the sum of service quality perception from all customer under service item i .

$$TA_{ei} = \sum_1^N A_{ein} \text{ ----- Eq. (6)}$$

$$TA_{pi} = \sum_1^N A_{pin} \text{ ----- Eq. (7)}$$

By using equation (2) & (6) we can analyze the sum of service quality expectation from all customers under service item i , alike, by using (2) & (7) we can analyze the sum of service quality perception from all customers under service item i .

2. Let fuzzy number MA_{ei} be the average service quality expectations from all customers under service item i , let fuzzy number MA_{pi} be the average service quality perceptions from all customers under service item i .

$$MA_{ei} = \frac{TA_{ei}}{N} \text{ ----- Eq. (8)}$$

$$MA_{pi} = \frac{TA_{pi}}{N} \text{ ----- Eq. (9)}$$

By using equation (4) & (8) we can analyze the average service quality expectation from all customers under service item i , alike, by using equation (4) & (9) we can analyze the average service quality perception from all customers under service item i .

3. Let fuzzy number Gap_i be the gap within the perception and expectation of service quality from all customers under service item i .

$$Gap_i = MA_{pi} - MA_{ei} \text{ ----- Eq. (10)}$$

By using equation (3) & (10) we can analyze the service quality gap with the expectation and perception from all customers under service item i , likewise, by using equation (1) we can analyze the representation of a fuzzy number.

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Table 4. 5 The analysis of expectations and perceptions

Dimension	Expectation	Perception	Gap	Rank
Reliability	7.726	4.089	-3.637	-3.637^[1]
Item 1	8.154	3.676	-4.478	-4.478 ^[1]
Item 2	7.762	4.546	-3.216	-3.216 ^[8]
Item 3	7.762	4.905	-2.857	-2.857 ^[12]
Item 4	7.065	3.755	-3.310	-3.310 ^[6]
Item 5	7.886	3.562	-4.324	-4.324 ^[2]
Assurance	7.580	5.279	-2.301	-2.301^[4]
Item 6	7.811	5.918	-1.893	-1.893 ^[17]
Item 7	7.539	4.771	-2.768	-2.768 ^[13]
Item 8	7.686	5.680	-2.006	-2.006 ^[16]
Item 9	7.284	4.748	-2.536	-2.536 ^[15]
Tangible	7.597	6.203	-1.394	-1.394^[5]
Item 10	7.977	7.118	-0.859	-0.859 ^[22]
Item 11	7.441	5.739	-1.702	-1.702 ^[19]
Item 12	7.536	6.016	-1.520	-1.520 ^[20]
Item 13	7.435	5.938	-1.497	-1.497 ^[21]
Empathy	7.175	4.388	-2.787	-2.787^[3]
Item 14	7.232	4.013	-3.219	-3.219 ^[7]
Item 15	7.399	5.520	-1.879	-1.879 ^[18]
Item 16	6.814	4.098	-2.716	-2.716 ^[14]
Item 17	7.069	3.957	-3.112	-3.112 ^[9]
Item 18	7.363	4.353	-3.010	-3.010 ^[10]
Responsiveness	7.885	4.485	-3.400	-3.400^[2]
Item 19	7.814	4.323	-3.491	-3.491 ^[5]
Item 20	8.030	4.425	-3.605	-3.605 ^[3]
Item 21	8.124	5.154	-2.970	-2.970 ^[11]
Item 22	7.572	4.039	-3.533	-3.533 ^[4]

Step 4. Interpretation of fuzzy SERVQUAL analysis

Based on the statistics obtained from the table above we can interpret the following analysis result as follows. The researcher asserted that the gap between the service quality expectations and perception is the reference construct which can be used to assess a bank service quality. In line with this, we will see the top ten service quality gap these includes the first variable is reliability which contains, CBE provides the promised service with a given time frame (-4.478); CBE responds for your claim fast and deliver adequate service within the time frame (-4.324); CBE performs the service right the first time (-3.310); whenever you face a problem CBE always a sincere interest in solving it (-3.216).

Alike, the second variable is responsiveness which contains, CBE employees deliver prompt service to you (-3.605); CBE employee never too busy to respond to your request (-3.533); CBE employee inform you exactly when service will be performed (-3.491), the third variable is empathy which contains, CBE give care and individual attention to you (-3.219); CBE gives you the best interest at heart (-3.112), and CBE employee always understand the specific needs of you (-3.010). Consequently, this indicates that the first dimension of reliability has the maximum gap so CBE needs to enhance investment in reliability aspects to improve their service quality and also for the rest of the variables respectively.

4.3. Fuzzy Kano's Model

The main procedure taken in the evaluation of bank service quality in terms of functional and dysfunctional requirement perspective discussed as follows, Kano's model questionnaires' design, distribution of Kano's model questionnaires' and collection of survey data, determine Kano's classification, determine customer satisfaction and self-stated importance and finally determine customer requirement and technical requirement.

Step 1. Kano's model questionnaire design

This research study adopted questionnaires from previous literature. The Kano's model functional and dysfunctional were interpreted into thoughtfulness under the stirring of previous research studies. In line with this customer response is weighted using the linguistic variables, for example, the linguistic variables include "I like it", "I expect it", "I am neutral", "I can tolerate it", "I dislike it".

And the second type of Kano's model questionnaires addressing customer how important a given feature is to them, and customer response is weighted using the linguistic variables scale, for example, the linguistic variables include "Not important", "Some what important", "Important", "Very important", "Extremely important".

Table 4. 6 Linguistic variables of Kano's model. Source: [Author](#)

Self-stated importance scale	Linguistic variable	Fuzzy membership function
1	Not important	(1, 1, 5)
3	Some what important	(1, 5, 7)
5	Important	(5, 7, 11)
7	Very important	(7, 11, 13)
9	Extremely important	(11, 13, 13)

Step 2. Distribution of Kano's model questionnaires and collection of survey data

The survey questionnaires were distributed to the customer/respondent online through the personal website "hezrongetahun.blogspot.com" and the collection of survey data was undertaken online, in line with this, the participation was voluntary. The research sample size 323 CBE customers, in line with this customers are required to fill Kano's model questionnaires.

Step 3. Determine Kano's classification

The Kano classification analysis indicates that the majority of the customer requirement is categorized in one-dimensional, which means the Commercial bank of Ethiopia should note to those features in the design of the service system which implies the more satisfies the customer. See, for example, item 14 with the response of 61 and a percentage of 60.40%, Item 3 response of 57 and percentage 56.44%, item 1 with the response of 53 and percentage of 52.48% which are categorized in one-dimensional. This analysis enables us to determine or to identify customer requirements, which also helps the company to understand the voice of their customer to improve service quality.

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Table 4. 7 Kano classification for Commercial bank of Ethiopia

Customer requirement		A	O	M	I	R	Q	Total	Categories
Item 1	Response	14	53	22	10	1	1	101	O
	Percentage	13.86%	52.48%	21.78%	9.90%	0.99%	0.99%	100%	
Item 2	Response	8	24	42	10	4	13	101	M
	Percentage	7.92%	23.76%	41.58%	9.90%	3.96%	12.87%	100%	
Item 3	Response	21	57	13	6	2	2	101	O
	Percentage	20.79%	56.44%	12.87%	5.94%	1.98%	1.98%	100%	
Item 4	Response	17	28	37	14	2	3	101	M
	Percentage	16.83%	27.72%	36.63%	13.86%	1.98%	2.97%	100%	
Item 5	Response	27	38	13	18	1	4	101	O
	Percentage	26.73%	37.62%	12.87%	17.82%	0.99%	3.96%	100%	
Item 6	Response	14	45	20	20	0	2	101	O
	Percentage	13.86%	44.55%	19.80%	19.80%	0.00%	1.98%	100%	
Item 7	Response	25	29	22	20	1	4	101	O
	Percentage	24.75%	28.71%	21.78%	19.80%	0.99%	3.96%	100%	
Item 8	Response	16	30	23	29	1	2	101	O
	Percentage	15.84%	29.70%	22.77%	28.71%	0.99%	1.98%	100%	
Item 9	Response	12	34	22	28	3	2	101	O
	Percentage	11.88%	33.66%	21.78%	27.72%	2.97%	1.98%	100%	
Item 10	Response	10	33	45	9	1	3	101	M
	Percentage	9.90%	32.67%	44.55%	8.91%	0.99%	2.97%	100%	
Item 11	Response	22	38	13	22	1	5	101	O
	Percentage	21.78%	37.62%	12.87%	21.78%	0.99%	4.95%	100%	
Item 12	Response	30	44	14	7	3	3	101	O
	Percentage	29.70%	43.56%	13.86%	6.93%	2.97%	2.97%	100%	
Item 13	Response	8	42	30	14	4	3	101	O
	Percentage	7.92%	41.58%	29.70%	13.86%	3.96%	2.97%	100%	
Item 14	Response	0	61	36	1	3	0	101	O
	Percentage	0.00%	60.40%	35.64%	0.99%	2.97%	0.00%	100%	
Item 15	Response	13	43	17	10	14	4	101	O
	Percentage	12.87%	42.57%	16.83%	9.90%	13.86%	3.96%	100%	

Step 4. Customer satisfaction coefficient and self-stated importance

The customer satisfaction coefficient shows whether satisfaction can be increased by meeting requirement or, whether fulfilling this service requirement merely prevents the customer from being dissatisfaction. The two equation were used to compute the extent of satisfaction and dissatisfaction as indicate below.

$$\text{Customer satisfaction (better)} = \frac{A+O}{A+O+M+I} \text{----- Eq. (1)}$$

$$\text{Customer dissatisfaction (worst)} = -\frac{O+M}{A+O+M+I} \text{----- Eq. (2)}$$

Table 4. 8 Customer satisfaction coefficient and self-stated importance

Service requirement	$\text{Better} = \frac{A+O}{A+O+M+I}$	$\text{Worst} = -\frac{O+M}{A+O+M+I}$	Self-stated importance
Item 1	0.68	-0.76	10.845
Item 2	0.38	-0.79	10.093
Item 3	0.80	-0.72	11.082
Item 4	0.47	-0.68	10.231
Item 5	0.68	-0.53	9.212
Item 6	0.60	-0.66	9.954
Item 7	0.56	-0.53	9.895
Item 8	0.47	-0.54	9.548
Item 9	0.48	-0.58	9.845
Item 10	0.44	-0.80	10.092
Item 11	0.63	-0.54	9.806
Item 12	0.78	-0.61	9.726
Item 13	0.53	-0.77	10.796
Item 14	0.62	-0.99	10.944
Item 15	0.67	-0.72	10.944

Based on the statistics obtained from the table above we can interpret the following analysis result as follows, the self-stated importance analysis indicate that, having the promised service

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with a given time frame (10.845), fast claims response and get adequate service within the time frame (11.082), employee inform you exactly when the service will be performed (10.796), employee deliver prompt service (10.944). This analysis result is very useful to distinguish features among each other and helps to know which are most relevant to customer therefore in the proceeding step we can determine customer requirement from both fuzzy SERVQUAL and fuzzy Kano's model analysis result.

Step 5. Determine customer requirement and technical requirement

Customer requirements were identified by using fuzzy SERVQUAL and fuzzy Kano's model. Alike, the technical requirement was identified by focused group discussion.

Table 4. 9 List of customer requirement

No.	Customer requirement
1	The bank should provide the promised service with a given time frame
2	The bank should respond to customer clam fast and deliver adequate service with the time frame
3	An employee should deliver prompt service to the customer
4	The employee should never be too busy to respond to customer request
5	The employee should inform customer exactly when service will be performed

Likewise, one of the main reasons for identifying the major customer requirement is to determine which service attributes have a significant effect on customer service perception. In line with this, the bank can trace the gap easily which enables to improve the service quality.

Table 4. 10 List of technical requirement

No.	Technical requirement
1	Collect customer feedback on a continuous basis
2	Identify dissatisfied customer & frequent service failure issues
3	Update service standard & guidelines
4	Conduct adequate training, performance evaluation & rewards
5	Improve internal service quality by concentrating on employee issues and concerns
6	Establish experience sharing conducts

The technical requirement assists the company as a guideline to fulfill the customer requirement with a given service/product specification. Therefore using the above table we can construct a fuzzy analytic network process for further analysis.

4.4. Fuzzy Analytic Network Process

The major steps undertaken in the fuzzy analytic network process is discussed as follows.

Step 1. Establish fuzzy analytic network process pairwise comparison matrices

Following, of identifying the customer requirement from fuzzy SERVQUAL and fuzzy Kano's model analysis the next step is to construct a fuzzy pairwise comparison of customer requirements to analyze the weight of each customer requirement respectively see for instance Appendix A, table (a). In line with this the analytic network process is weighted using the linguistic variables scale, for instance, the linguistic variables include "Equally important", "Weakly important", "Fairly important", "Strongly important", "Absolutely important".

Table 4. 11 Linguistic variables of the Analytic Network Process. Source: [Author](#)

Saaty scale	Linguistic variable	Fuzzy membership function
1	Equally important	(1, 1, 1)
3	Weakly important	(2, 3, 4)
5	Fairly important	(4, 5, 6)
7	Strongly important	(6, 7, 8)
9	Absolutely important	(9, 9, 9)

Step 2. Analyze the local weight of each technical requirement concerning customer requirement

Following, the next step is to determine the fuzzy weight of each customer requirement correspondingly and also analyze the fuzzy weight of each technical requirement by considering customer requirements as a factor. See, for example Appendix A, table (b).

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Table 4. 12 Fuzzy weight of customer requirement

	Fuzzy weight				Weight
CR ₁	0.329042	0.397976	0.472305	0.399774	0.4788824
CR ₂	0.078474	0.085344	0.092577	0.085465	0.10237726
CR ₃	0.056147	0.066162	0.078717	0.067009	0.08026851
CR ₄	0.166245	0.213171	0.264957	0.214791	0.25729409
CR ₅	0.051774	0.066162	0.085367	0.067768	0.08117774
Total				0.834807	1

Step 3. Acquire the weighted supermatrix

In this section, the main task is to construct the weighted supermatrix, having that, the next step is to multiply each column of the technical requirement by fuzzy weight.

Table 4. 13 The weighted supermatrix

	Weight	TR ₁	TR ₂	TR ₃	TR ₄	TR ₅	TR ₆
CR ₁	0.479	0.354697	0.068647	0.255945	0.163718	0.125744	0.031248
CR ₂	0.102	0.241429	0.075028	0.097211	0.097211	0.244401	0.100502
CR ₃	0.080	0.270366	0.046822	0.132208	0.273316	0.054156	0.223131
CR ₄	0.257	0.222068	0.050393	0.102766	0.270215	0.114411	0.240147
CR ₅	0.081	0.12392	0.18745	0.121312	0.182614	0.117983	0.266722

Step 4. Analyze the comprehensive weight

After the aforesaid step is finalized we can construct the relationship matrix between customer requirement and technical requirement which is used for HOQ analysis.

Table 4. 14 Relationship matrix between customer requirement and technical requirement

	TR ₁	TR ₂	TR ₃	TR ₄	TR ₅	TR ₆
CR ₁	0.169858	0.0328738	0.122568	0.078402	0.060216	0.014964
CR ₂	0.024717	0.00768115	0.009952	0.009952	0.025021	0.010289
CR ₃	0.021702	0.00375836	0.010612	0.021939	0.004347	0.01791
CR ₄	0.057137	0.0129658	0.026441	0.069525	0.029437	0.061788
CR ₅	0.01006	0.01521673	0.009848	0.014824	0.009578	0.021652

Besides, the relationship matrix between customer requirement and technical requirement assists the bank in rank customer requirements and how far they are impacted by each technical requirement.

4.5. Integrated fuzzy SERVQUAL, fuzzy Kano's model, fuzzy ANP into QFD

The major approach incorporated in the design of integrated HOQ is discussed as follows. The Importance of “what” is collected from fuzzy SERVQUAL analysis and Kano's categories were assigned based on their fuzzy Kano's model analysis. In line with this, the adjusted importance was computed by multiplying the Kano categories with fuzzy SERVQUAL results (importance of “what” value).

The target was determined from fuzzy SERVQUAL analysis which is the customer expectation of Commercial bank of Ethiopia service attributes. Also inside the body of HOQ is the relationship matrix between customer requirement and the technical requirement which is collected from the fuzzy ANP analysis result. Also, (importance of “how” value) was computed by multiplying the adjusted importance with each technical requirement in the row and sum up the total value each to get total (importance of “how” value).

Likewise, this technique assists the company to determine the minimum set of technical requirements to overcome different issues in line with customer service, which forward to a cost-effective way of improving the service quality. Besides, the application of integrated fuzzy SERVQUAL, fuzzy Kano's model, fuzzy ANP into QFD is presented in the figure below.

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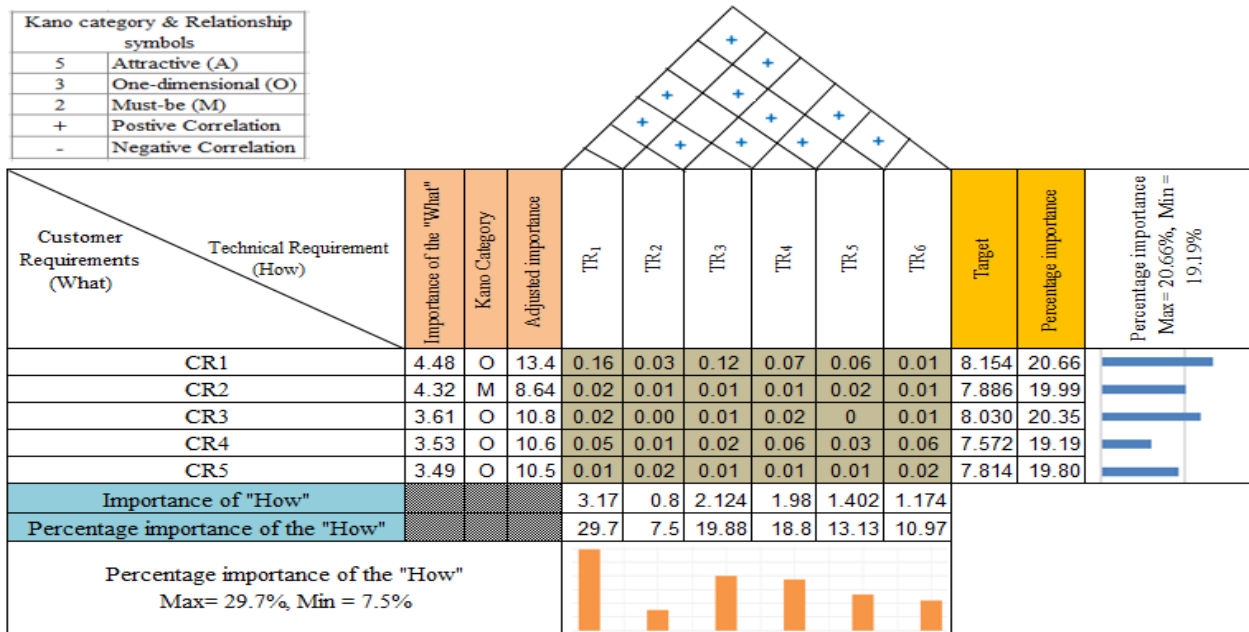


Figure 4. 2 Integrated House of Quality

Alike, from the integrated HOQ analysis prioritize the technical requirement based on their importance see, for example, collecting customer feedback on a continuous basis with the value of (29.7%), update service standard and guidelines (19.88%), conducting adequate training, performance evaluation and reward (18.8%), improve internal service quality by concentrating on employee issues (13.3%), establish experience sharing conducts (10.97) and finally identify the dissatisfied customer and frequent service failure issues (7.5%). Accordingly, the researcher asserted that improving those technical requirements individually can improve the service quality of the bank in turn increases customer satisfaction.

Besides, the analysis also prioritize the customer requirement based on their importance see, for a case, the bank should provide the promised service with a given time frame (20.66%), an employee should deliver prompt service to the customer (20.35%), the bank should respond to customer claim fast and deliver adequate service within the time frame (19.99%), the employee should inform customer exactly when service will be performed (19.80%), and the employee should never be too busy to respond to customer request (19.19%). Therefore, the researcher declared that fulfilling those customer requirements respectively can increase customer satisfaction.

4.6. The bank service performance of the queuing system

Step 1. Data collection and analysis

The data collection was undertaken over a week, and the stopwatch was utilized to record the arrival time and service time for every customer, and the data gathering was directed within a pinnacle period which is when many customers visit the bank. The analysis indicates that the average inter-arrival time follows poison distribution and the service time of each service server follows exponential distribution correspondingly. In the meantime researcher only consider seven servers for analysis.

Step 2. Analyze the performance parameter based on M/M/S

Table 4. 15 Performance analysis based on M/M/S

Result	S ₁	S ₂	S ₃	S ₄	S ₅	S ₆	S ₇
ρ	0.989	0.495	0.327	0.246	0.196	0.164	0.140
L_q	29.127	24.303	15.667	0.457	0.412	0.078	0.095
L_s	29.523	24.698	16.062	0.853	0.561	0.427	0.433
W_q	36.390	30.363	19.574	0.571	0.206	0.038	0.047
W_s	36.885	30.857	20.068	1.066	0.700	0.503	0.542
T_{cw}	NA	NA	NA	NA	NA	NA	NA
T_{cs}	NA	NA	NA	NA	NA	NA	NA

$\lambda = 0.0660$, $\mu = 0.0667$, $S = 7$ & unit of measurement = minute, NA = not available

Step 3. Interpretation of performance or service rate analysis

Based on the statistics obtained from the above table we can interpret the performance or service rate analysis as follows. See for example, utilization rate (ρ) of $S_1 = 98.9\%$, $S_2 = 49.5\%$, $S_3 = 32.7\%$, $S_4 = 24.6\%$, $S_5 = 19.6\%$, $S_6 = 16.4\%$, $S_7 = 14.0\%$, this result indicates a number of server increase the utilization rate decrease which implies most of server is idle, or it can be interpreted as the bank is not utilizing at a maximum effort of the server/tellers efficiency which forward to inadequate service quality. The next is the average number of customer waiting in the queue (L_q) and in the system (L_s) when we go through from $S_1 = 29.127$ to $S_7 = 0.095$, (L_q) and (L_s), $S_1 = 29.523$ to $S_7 = 0.433$ is decreasing, however, most of the time other researchers propose a solution to the bank to increase the number of the server to minimize the average number of customer

waiting in the queue lines and the system, even though increasing the number of the server should not be a solution rather increasing the utilization of the server is the best solution because adding a server into the system will cost the bank.

The average waiting time in the queue (W_q) and the system or the bank (W_s) is shown in the above table is discussed as follows, when we see the value of (W_q) for the first three consecutive servers $S_1 = 36.390$ min or 0.606 hr., $S_2 = 30.363$ min or 0.506 hr., $S_3 = 19.574$ min or 0.326 hr. this result specifies that customer should wait a long time in the queue to get for service or decide to exit from the queuing without getting the service which affects the service quality, but the rest of servers such as $S_4 = 0.571$ min or 0.01 hr., $S_5 = 0.206$ min or 0.003 hr., $S_6 = 0.038$ min or 0.001 hr., and $S_7 = 0.047$ min or 0.001 hr. which indicate that customer should wait minimum time in the queue to get the service. From the average waiting time in the system aspects, $S_1 = 36.885$ min or 0.614 hr., $S_2 = 30.857$ min or 0.514 hr., $S_3 = 20.668$ min or 0.344 hr., $S_4 = 1.066$ min or 0.018 hr., $S_5 = 0.700$ min or 0.011 hr., $S_6 = 0.503$ min or 0.008 hr., $S_7 = 0.542$ min or 0.009 hr., it is fact that customer does not want to waste their time with unnecessary task or process in the system, consequently, the researcher asserted that the bank should allocate the optimal server in the system with an economical manner which leads to increase the server utilization as well as increase the service quality which leads to high customer satisfaction.

4.7. Contribution of the research

This section focuses on presenting research findings, and also try to compare and contrast current research finding with previous research findings which enable us to know the significance of the current research result. Therefore, the discussion is presented as follows.

According to [Shanka \(2012\)](#) finding from regression analysis specify that all SERVQUAL dimensions have a significantly influence on satisfaction of customer, $Z = -0.115 + 0.052X_1 + 0.039 X_2 + 0.166 X_3 + 0.145 X_4 + 0.721 X_5$. The main drawback of this analysis is there is no service quality gap analysis between customer expectation and perception, in the regression analysis the limitation is, to obtain a statistically significant effect on the dependent variable, the correlation between independent variable must be weak, however as we see from the correlation table each independent variables are inter-correlated as a result which reduce the effect on the dependent variable.

Also, [Mulat \(2017\)](#) performed the Pearson Chi-square test to determine the association between the dependent and independent variables, also logistic regression analysis was implemented to analyze the relative importance of each variable. In line with this, the research analysis indicates that employee who gives customer personal attention, providing customers best interest at heart, owning employees who understand customer-specific needs are the variables that have a significant impact on customer satisfaction. Nevertheless, the main drawback of this logistic regression analysis is the assumption of linearity between the dependent variable and the independent variable is unrealistic because the data can be a jumbled mess.

However, current research performed for instance, the gap analysis using fuzzy SERVQUAL model between expectation and perception according to the service quality dimensions, reliability (-3.637); responsiveness (-3.400); empathy (-2.787); assurance (-2.301); and tangible (-1.394). The analysis result indicates that there is a service quality gap between customer perceptions and expectations. In line with this, this research performed fuzzy Kano's model analysis to determine customer requirement or voice of the customer, which helps the bank to trace the gap easily which enables to improve the service quality. Besides, the technical requirement assists the company as a guideline to fulfill the customer requirement with a given service specification. Likewise, fuzzy ANP analysis were performed to determine the relationship matrix between customer requirement and technical requirement which is used for HOQ analysis.

likewise, there is no research that determines the principal factors concerning service quality, and queuing (waiting time) that influence the bank performance, also, there is no research conducted on integrating quality and queuing models. Therefore this research is very essential to understand customer feedback or complain and to improve service delivery.

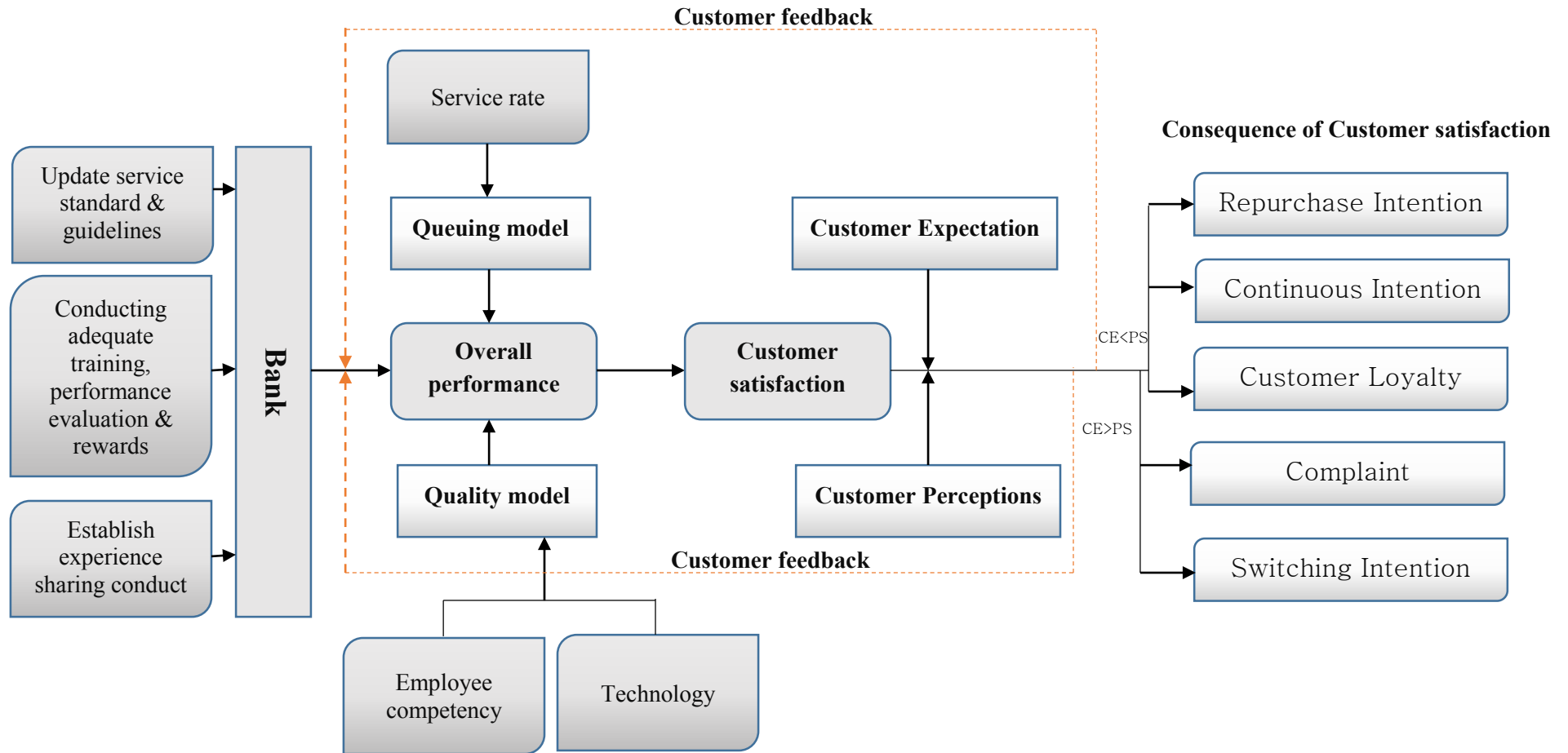


Figure 4. 3 Integrated Quality & Queuing model framework. Source: [Author](#)

The integrated quality and queuing model was developed based on the synergies of literature and empirical findings, this framework can assist to fill both theoretical and practical gaps in the current research areas.

Chapter Five

5. Conclusion, and Recommendation

5.1. Conclusion

The main reason for conducting this thesis is to determine the major features that influence performance and customer satisfaction in line with service quality and queuing (waiting time) in CBE Accordingly, from the research finding the following conclusion is drawn. These include, CBE doesn't provide satisfactory service to its customer. besides, the gap between the customer perceptions and expectation of service quality are listed in descending order see, for instance, the gap between expectation and perception according to the service quality dimensions, reliability (-3.637); responsiveness (-3.400); empathy (-2.787); assurance (-2.301); and tangible (-1.394). The analysis result indicates that there is a service quality gap between customer perceptions and expectations. Consequently, from the analysis result, we can conclude that the Commercial Bank of Ethiopia does not provide satisfactory service to its customer. Besides, it is valuable to mark that the customer always expects to get high service quality, so the service quality gaps which have been negative value is for reason. Further, we can identify the weakest service quality dimension in which the Commercial Bank of Ethiopia should improve, by prioritizing the service quality gap within customer expectation and perception.

Alike, from the integrated HOQ analysis prioritize the technical requirement based on their importance see, for example, collecting customer feedback on a continuous basis with the value of (29.7%), update service standard and guidelines (19.88%), conducting adequate training, performance evaluation and reward (18.8%), improve internal service quality by concentrating on employee issues (13.3%), establish experience sharing conducts (10.97) and finally identify the dissatisfied customer and frequent service failure issues (7.5%). Besides, the analysis also prioritize the customer requirement based on their importance see, for a case, the bank should provide the promised service with a given time frame (20.60%), an employee should deliver prompt service to the customer (20.35%), the bank should respond to customer claim fast and deliver adequate service within the time frame (19.99%), the employee should inform customer exactly when service will be performed (19.80%), and the employee should never be too busy to respond to customer request (19.19%).

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Based on the statistics obtained from the above table we can interpret the performance or service rate analysis as follows. See for example, utilization rate (ρ) of $S_1 = 98.9\%$, $S_2 = 49.5\%$, $S_3 = 32.7\%$, $S_4 = 24.6\%$, $S_5 = 19.6\%$, $S_6 = 16.4\%$, $S_7 = 14.0\%$, this result indicates a number of server increase the utilization rate decrease which implies most of server is idle, or it can be interpreted as the bank is not utilizing at a maximum effort of the server/tellers efficiency which forward to inadequate service quality. The next is the average number of customer waiting in the queue (L_q) and in the system (L_s) when we go through from $S_1 = 29.127$ to $S_7 = 0.095$, (L_q) and (L_s), $S_1 = 29.523$ to $S_7 = 0.433$ is decreasing, however, most of the time other researchers propose a solution to the bank to increase the number of the server to minimize the average number of customer waiting in the queue lines and the system, even though increasing the number of the server should not be a solution rather increasing the utilization of the server is the best solution because adding a server into the system will cost the bank.

The average waiting time in the queue (W_q) and the system or the bank (W_s) is shown in the above table is discussed as follows, when we see the value of (W_q) for the first three consecutive servers $S_1 = 36.390$ min or 0.606 hr., $S_2 = 30.363$ min or 0.506 hr., $S_3 = 19.574$ min or 0.326 hr. this result specifies that customer should wait a long time in the queue to get for service or decide to exit from the queuing without getting the service which affects the service quality, but the rest of servers such as $S_4 = 0.571$ min or 0.01 hr., $S_5 = 0.206$ min or 0.003 hr., $S_6 = 0.038$ min or 0.001 hr., and $S_7 = 0.047$ min or 0.001 hr. which indicate that customer should wait minimum time in the queue to get the service. From the average waiting time in the system aspects, $S_1 = 36.885$ min or 0.614 hr., $S_2 = 30.857$ min or 0.514 hr., $S_3 = 20.668$ min or 0.344 hr., $S_4 = 1.066$ min or 0.018 hr., $S_5 = 0.700$ min or 0.011 hr., $S_6 = 0.503$ min or 0.008 hr., $S_7 = 0.542$ min or 0.009 hr., it is fact that customer does not want to waste their time with unnecessary task or process in the system, consequently, the researcher asserted that the bank should allocate the optimal server in the system with an economical manner which leads to increase the server utilization as well as increase the service quality which leads to high customer satisfaction.

5.2. Recommendation

The finding of the research study indicates that higher service quality leads to higher customer satisfaction. Consequently, the research study recommends the following main points to the case company.

- Collect customer feedback on a continuous basis.
- Update service standard and guidelines.
- Conducting adequate training, performance evaluation, and reward.
- Improve internal service quality by concentrating on employee issues.
- Establish experience sharing conducts. And
- Identify dissatisfied customer and frequent service failure issues.

5.3. Future Research Area

Future research studies could also focus on other service industries and explore customer relationship management based on the influence on companies' profit and success.

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Appendix

Appendix A

Table (a) Fuzzy pairwise comparison of customer requirement

	CR ₁			CR ₂			CR ₃			CR ₄			CR ₅		
CR ₁	1	1	1	1	1	1	6	7	8	9	9	9	4	5	6
CR ₂	1	1	1	1	1	1	4	5	6	0.25	0.2	0.166	0.166	0.142	0.125
CR ₃	0.125	0.142	0.166	0.166	0.2	0.25	1	1	1	0.25	0.2	0.166	6	7	8
CR ₄	0.111	0.111	0.111	4	5	6	4	5	6	1	1	1	4	5	6
CR ₅	0.166	0.2	0.25	6	7	8	0.125	0.142	0.166	0.166	0.2	0.25	1	1	1

Table (b) Fuzzy pairwise comparisons of technical requirement concerning customer requirement

CR ₁	TR ₁			TR ₂			TR ₃			TR ₄			TR ₅			TR ₆		
TR ₁	1	1	1	1	1	1	6	7	8	4	5	6	4	5	6	2	3	4
TR ₂	1	1	1	1	1	1	0.166	0.142	0.125	0.25	0.2	0.166	0.166	0.142	0.125	6	7	8
TR ₃	0.125	0.142	0.25	6	7	8	1	1	1	1	1	1	6	7	8	9	9	9
TR ₄	0.166	0.2	0.25	4	5	6	1	1	1	1	1	1	1	1	1	4	5	6
TR ₅	0.166	0.2	0.25	6	7	8	0.125	0.142	0.166	1	1	1	1	1	1	4	5	6
TR ₆	0.25	0.333	0.5	0.125	0.142	0.166	0.111	0.111	0.111	0.166	0.2	0.25	0.166	0.2	0.25	1	1	1

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CR ₂	TR ₁			TR ₂			TR ₃			TR ₄			TR ₅			TR ₆		
TR ₁	1	1	1	1	1	1	9	9	9	0.5	0.33	0.25	4	5	6	2	3	4
TR ₂	1	1	1	1	1	1	6	7	8	0.25	0.2	0.166	0.166	0.142	0.125	0.25	0.2	0.166
TR ₃	0.111	0.111	0.111	0.125	0.142	0.166	1	1	1	4	5	6	6	7	8	0.5	0.333	0.25
TR ₄	2	3	4	4	5	6	0.166	0.2	0.25	1	1	1	2	3	4	4	5	6
TR ₅	0.166	0.2	0.25	6	7	8	0.125	0.142	0.166	0.25	0.333	0.5	1	1	1	2	3	4
TR ₆	0.25	0.333	0.5	4	5	6	2	3	4	0.166	0.2	0.25	0.25	0.333	0.5	1	1	1

CR ₃	TR ₁			TR ₂			TR ₃			TR ₄			TR ₅			TR ₆		
TR ₁	1	1	1	2	3	4	4	5	6	0.5	0.33	0.25	4	5	6	2	3	4
TR ₂	0.5	0.333	0.25	1	1	1	1	1	1	0.25	0.2	0.166	0.166	0.142	0.125	0.25	0.2	0.166
TR ₃	0.166	0.2	0.25	1	1	1	1	1	1	4	5	6	6	7	8	0.166	0.142	0.125
TR ₄	2	3	4	4	5	6	0.166	0.2	0.25	1	1	1	4	5	6	4	5	6
TR ₅	0.166	0.2	0.25	6	7	8	0.125	0.142	0.166	0.166	0.2	0.25	1	1	1	0.111	0.111	0.111
TR ₆	0.25	0.333	0.5	4	5	6	6	7	8	0.166	0.2	0.25	9	9	9	1	1	1

CR ₄	TR ₁			TR ₂			TR ₃			TR ₄			TR ₅			TR ₆		
TR ₁	1	1	1	2	3	4	4	5	6	0.5	0.33	0.25	1	1	1	2	3	4
TR ₂	0.5	0.333	0.25	1	1	1	1	1	1	0.25	0.2	0.166	0.166	0.142	0.125	0.25	0.2	0.166
TR ₃	0.166	0.2	0.25	1	1	1	1	1	1	4	5	6	1	1	1	0.166	0.142	0.125
TR ₄	2	3	4	4	5	6	0.166	0.2	0.25	1	1	1	2	3	4	4	5	6
TR ₅	1	1	1	6	7	8	1	1	1	0.25	0.333	0.5	1	1	1	0.111	0.111	0.111
TR ₆	0.25	0.333	0.5	4	5	6	6	7	8	0.166	0.2	0.25	9	9	9	1	1	1

CR ₅	TR ₁			TR ₂			TR ₃			TR ₄			TR ₅			TR ₆		
TR ₁	1	1	1	0.166	0.2	0.25	4	5	96	0.5	0.33	0.25	0.25	0.2	0.166	2	3	4
TR ₂	1	1	1	1	1	1	6	7	8	2	3	4	0.166	0.142	0.125	0.25	0.2	0.166
TR ₃	0.166	0.2	0.25	0.125	0.142	0.166	1	1	1	4	5	6	6	7	8	0.166	0.142	0.125
TR ₄	2	3	4	0.25	0.333	0.5	0.125	0.142	0.166	1	1	1	2	3	4	4	5	6
TR ₅	4	5	6	6	7	8	0.125	0.142	0.166	0.25	0.333	0.5	1	1	1	0.111	0.111	0.111
TR ₆	0.25	0.333	0.5	4	5	6	2	3	4	0.25	0.2	0.166	9	9	9	1	1	1

Table (c) Fuzzy weight of technical requirement with respect to customer requirement

CR ₁	Fuzzy weight			Weight	
TR ₁	0.269718	0.357729	0.454326	0.360591	0.35469741
TR ₂	0.066118	0.069638	0.073606	0.069788	0.06864692
TR ₃	0.2081	0.251238	0.321257	0.260198	0.25594547
TR ₄	0.132238	0.164699	0.202381	0.166439	0.16371848
TR ₅	0.100044	0.125949	0.157506	0.127833	0.12574368
TR ₆	0.024048	0.030746	0.040507	0.031767	0.03124803
Total				1.016617	1
CR ₂	Fuzzy weight			Weight	
TR ₁	0.215273	0.242959	0.273069	0.243767	0.241429
TR ₂	0.215273	0.242959	0.273069	0.243767	0.241429
TR ₃	0.07463	0.075338	0.077295	0.075754	0.075028
TR ₄	0.087885	0.09726	0.109313	0.098152	0.097211
TR ₅	0.17577	0.242967	0.321566	0.246768	0.244401
TR ₆	0.074631	0.098517	0.131278	0.101475	0.100502
Total				1.009684	1

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CR ₃	Fuzzy weight				Weight
TR ₁	0.211088	0.26455	0.321564	0.265734	0.270366
TR ₂	0.049323	0.045357	0.04338	0.04602	0.046822
TR ₃	0.110727	0.128826	0.150276	0.129943	0.132208
TR ₄	0.197295	0.264559	0.344048	0.268634	0.273316
TR ₅	0.043088	0.052236	0.064362	0.053228	0.054156
TR ₆	0.170866	0.213985	0.273075	0.219309	0.223131
Total				0.982868	1
CR ₄	Fuzzy weight				Weight
TR ₁	0.167541	0.202308	0.238548	0.202799	0.222068
TR ₂	0.049323	0.045357	0.04338	0.04602	0.050393
TR ₃	0.082141	0.093144	0.106261	0.093849	0.102766
TR ₄	0.17577	0.242967	0.321566	0.246768	0.270215
TR ₅	0.087884	0.10287	0.122698	0.104484	0.114411
TR ₆	0.170866	0.213985	0.273075	0.219309	0.240147
Total				0.913228	1
CR ₅	Fuzzy weight				Weight
TR ₁	0.087885	0.098515	0.119274	0.101891	0.12392
TR ₂	0.142273	0.154712	0.165399	0.154128	0.18745
TR ₃	0.08377	0.098517	0.116955	0.099747	0.121312
TR ₄	0.105544	0.146278	0.198635	0.150152	0.182614
TR ₅	0.078296	0.093709	0.119025	0.09701	0.117983
TR ₆	0.170866	0.213985	0.273075	0.219309	0.266722
Total				0.822237	1

Appendix B

Survey Questionnaires

Dear Respondent:

My Name is Getahun Mekuria, I am currently researching a thesis as partial fulfillment of the requirement for the degree of Master of Science in Industrial Engineering, School of Mechanical and Industrial Engineering at Addis Ababa Institute of Technology. The research is carrying out on develop an integrated service quality and queuing model for performance analysis: a case of the Commercial Bank of Ethiopia. And you have been nominated to participate in this research, due to the importance of your information in the research. Also, the information you provide will be used only for this research, and your information will be kept strictly confidential.

If you have any queries, concern please do not hesitate to contact me, and I am available at, Mobile number, +251923388799; Email address, getahunmekuria3@gmail.com.

Thank you for your valuable time.

2020
Addis Ababa, Ethiopia

SERVQUAL Questionnaire

Part 1. Customer Service Expectation Questionnaire

Direction: - please indicate the extent to which the service provided by the Commercial Bank of Ethiopia should have the features described by each statement. Please mark (√) or (X) in the provided space.

No.	Questionnaire	Likert scale				
		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
		1	2	3	4	5
Reliability						
1	The bank should provide the promised service with a given time frame					
2	Whenever a customer has a problem bank should always sincere interest in solving it					
3	The bank should maintain less error working process					
4	The bank should perform the service right the first time					
5	The bank should respond for customer claim fast and deliver adequate service within the time frame					
Assurance						
6	Employee should have adequate knowledge to answer customer request					
7	The behavior of employee should instill confidence in customer					
8	Customer should feel safe in transaction of the bank					

9	Employee should be consistently courteous with customer					
Tangible						
10	The bank should have all the necessary modern equipment (ATM, POS, computer, security camera, banknote counter or bill counter etc.)					
11	The physical facilities of the bank should be visually appealing					
12	Employees should have neat appearing					
13	Material associated with the service such as (money deposit, withdraw, transfer invoice etc.) should be visually appealing					
Empathy						
14	The bank should give care & individual attention to customer					
15	The bank should have operating hours convenient to all their customer					
16	Employee should give customer personal attention					
17	The bank should give customer's best interest at heart					
18	The employees should always understand the specific needs of their customers					
Responsiveness						
19	Employees should inform customer exactly when service will be performed					
20	Employees should deliver prompt service to customer					
21	Employees should always be willing to help customers					
22	Employees should never be too busy to respond to customers request					

Part 2. Customer Service perception Questionnaire

Direction: - please indicate the extent to which the service provided by the Commercial Bank of Ethiopia should has the features and benefits described by each statement. Please mark (√) or (X) in the provided space.

No.	Questionnaire	Likert scale				
		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
		1	2	3	4	5
Reliability						
1	CBE provide the promised service with a given time frame					
2	Whenever you face a problem CBE always sincere interest in solving it					
3	CBE maintain less error working process					
4	CBE perform the service right the first time					
5	CBE respond for your claim fast and deliver adequate service within the time frame					
Assurance						
6	CBE employee have adequate knowledge to answer your request					
7	The behavior of CBE employee instill confidence in you					
8	You feel safe in transaction of CBE					
9	CBE employee consistently courteous with you					
Tangible						

10	CBE has all the necessary modern equipment (ATM, POS, computer, security camera, banknote counter or bill counter etc.)					
11	The physical facilities of CBE is visually appealing					
12	CBE employees has neat appearing					
13	Material associated with the service such as (money deposit, withdraw, transfer invoice etc.) is visually appealing					
Empathy						
14	CBE give care & individual attention to you					
15	CBE has operating hours convenient to you					
16	CBE employees give personal attention for you					
17	CBE gives you the best interest at heart					
18	CBE employees always understand the specific needs of you					
Responsiveness						
19	CBE employees inform you exactly when service will be performed					
20	CBE employees deliver prompt service to you					
21	CBE employees always willing to help you					
22	CBE employees never be too busy to respond to your request					

Kano's Model Questionnaire

Direction: - The questions have two categories first, it asks you, how you would feel, if you have the feature (functional) and have not the feature (dysfunctional). Please mark (✓) or (X) in the provided space.

No.	Questionnaire	Attribute
1a	If the bank perform the promised service with a given time frame, how do you feel?	☐ . I like it
		☐ . I expect it
		☐ . I'm neutral
		☐ . I can tolerate it
		☐ . I dislike it
1b	How do you feel, if the bank do not perform the promised service with a given time frame?	☐ . I like it
		☐ . I expect it
		☐ . I'm neutral
		☐ . I can tolerate it
		☐ . I dislike it
2a	If the bank maintain less error working process, how do you feel?	☐ . I like it
		☐ . I expect it
		☐ . I'm neutral
		☐ . I can tolerate it
		☐ . I dislike it
2b	How do you feel, if the bank do not maintain less error working process?	☐ . I like it
		☐ . I expect it
		☐ . I'm neutral
		☐ . I can tolerate it
		☐ . I dislike it
3a	If the bank respond for your claim fast & deliver adequate service within the time frame, how do you feel?	☐ . I like it
		☐ . I expect it
		☐ . I'm neutral
		☐ . I can tolerate it
		☐ . I dislike it
3b	How do you feel, if the bank do not respond for your claim fast & deliver adequate service within the time frame?	☐ . I like it
		☐ . I expect it
		☐ . I'm neutral
		☐ . I can tolerate it
		☐ . I dislike it
4a	If employee have adequate knowledge to answer your request, how do you feel?	☐ . I like it
		☐ . I expect it
		☐ . I'm neutral
		☐ . I can tolerate it
		☐ . I dislike it

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4b	How do you feel, if employee do not have adequate knowledge to answer your request?	☐ . I like it ☐ . I expect it ☐ . I'm neutral ☐ . I can tolerate it ☐ . I dislike it
5a	If employee consistently courteous with you, how do you feel?	☐ . I like it ☐ . I expect it ☐ . I'm neutral ☐ . I can tolerate it ☐ . I dislike it
5b	How do you feel, if employee do not consistently courteous with you?	☐ . I like it ☐ . I expect it ☐ . I'm neutral ☐ . I can tolerate it ☐ . I dislike it
6a	If the bank have all the necessary modern equipment (ATM, POS, computer, security camera, and banknote counter or bill counter etc.), how do you feel?	☐ . I like it ☐ . I expect it ☐ . I'm neutral ☐ . I can tolerate it ☐ . I dislike it
6b	How do you feel, if the bank do not have all the necessary modern equipment (ATM, POS, computer, security camera, and banknote counter or bill counter etc.), how do you feel?	☐ . I like it ☐ . I expect it ☐ . I'm neutral ☐ . I can tolerate it ☐ . I dislike it
7a	If the physical facilities of the bank is visually appealing, how do you feel?	☐ . I like it ☐ . I expect it ☐ . I'm neutral ☐ . I can tolerate it ☐ . I dislike it
7b	How do you feel, if the physical facilities of the bank is not visually appealing?	☐ . I like it ☐ . I expect it ☐ . I'm neutral ☐ . I can tolerate it ☐ . I dislike it
8a	If the employee have neat appearing, how do you feel?	☐ . I like it ☐ . I expect it ☐ . I'm neutral ☐ . I can tolerate it ☐ . I dislike it
8b	How do you feel, if the employee do not have neat appearing?	☐ . I like it ☐ . I expect it ☐ . I'm neutral ☐ . I can tolerate it

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		☐ . I dislike it
9a	If the material associated with the service such as (money deposit, withdraw, transfer invoice etc.) is visually appealing, how do you feel?	☐ . I like it
		☐ . I expect it
		☐ . I'm neutral
		☐ . I can tolerate it
		☐ . I dislike it
9b	How do you feel, if the material associated with the service such as (money deposit, withdraw, transfer invoice etc.) is not visually appealing	☐ . I like it
		☐ . I expect it
		☐ . I'm neutral
		☐ . I can tolerate it
		☐ . I dislike it
10a	If the bank have operating hours convenient to you, how do you feel?	☐ . I like it
		☐ . I expect it
		☐ . I'm neutral
		☐ . I can tolerate it
		☐ . I dislike it
10b	How do you feel, if the bank do not have operating hours convenient to you?	☐ . I like it
		☐ . I expect it
		☐ . I'm neutral
		☐ . I can tolerate it
		☐ . I dislike it
11a	If employee give you a personal attention, how do you feel?	☐ . I like it
		☐ . I expect it
		☐ . I'm neutral
		☐ . I can tolerate it
		☐ . I dislike it
11b	How do you feel, if employee do not give you a personal attention?	☐ . I like it
		☐ . I expect it
		☐ . I'm neutral
		☐ . I can tolerate it
		☐ . I dislike it
12a	If employee always understand the specific needs of you, how do you feel?	☐ . I like it
		☐ . I expect it
		☐ . I'm neutral
		☐ . I can tolerate it
		☐ . I dislike it
12b	How do you feel, if employee do not understand the specific needs of you?	☐ . I like it
		☐ . I expect it
		☐ . I'm neutral
		☐ . I can tolerate it
		☐ . I dislike it

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13a	If employee inform you exactly when service will be performed, how do you feel?	☐ . I like it ☐ . I expect it ☐ . I'm neutral ☐ . I can tolerate it ☐ . I dislike it
13b	How do you feel, if employee do not inform you exactly when service will be performed?	☐ . I like it ☐ . I expect it ☐ . I'm neutral ☐ . I can tolerate it ☐ . I dislike it
14a	If employee always willing to help you, how do you feel?	☐ . I like it ☐ . I expect it ☐ . I'm neutral ☐ . I can tolerate it ☐ . I dislike it
14b	How do you feel, if employee are not always willing to help you?	☐ . I like it ☐ . I expect it ☐ . I'm neutral ☐ . I can tolerate it ☐ . I dislike it
15a	If employee deliver prompt service to you, how do you feel?	☐ . I like it ☐ . I expect it ☐ . I'm neutral ☐ . I can tolerate it ☐ . I dislike it
15b	How do you feel, if employee do not deliver prompt service to you?	☐ . I like it ☐ . I expect it ☐ . I'm neutral ☐ . I can tolerate it ☐ . I dislike it

Part 2. Kano's Model importance type questionnaires

Direction: - The questions below ask you, how you would feel about the importance of each feature described in the bank service. Please mark (√) or (X) in the provided space.

No.	Questionnaire	Self-stated importance scale				
		Not important	Somewhat important	Important	Very important	Extremely important
		1	3	5	7	9
1	How important is having the promised service with a given time frame					
2	How important is that having a less error working process					
3	How important is that having fast claims response and get adequate service within the time frame					
4	How important is that employee has adequate knowledge and competency to answer your request					
5	How important is that employee consistently courteous with you					
6	How important is that the bank use modern equipment (ATM, POS, computer, security camera, and banknote counter or bill counter, etc)					
7	How important is that the physical facilities of the bank are visually appealing					
8	How important is that employee have net appearing					
9	How important is that the material associated with the service such as (money deposit, withdraw, transfer invoice, etc) is visually appealing					
10	How important is that having convenient working hour					
11	How important is that employee give you personal attention					

12	How important is that employee understand the specific need of you					
13	How important is that employee inform you exactly when the service will be performed					
14	How important is that employee willing to help you					
15	How important is that employee deliver prompt service to you					

Service delivery time variation of Commerical Bank of Ethiopia

STANDARD DELIVERY TIME RECORD							
Measured on 10/04/2019 and 12/04/2019 at an average							
S.No	Service Type	Details	Average Service Delivery Time In Minutes			Actual	Variation
			waiting	processing	total time		
1	Acc Opening	Saving	5	10	15	18	-3
		Current	5	13	18	20	-2
		CBE BIRR	4	4	8	8	0
2	Collection	Saving	2	5	7	7	0
		Current	2	8	10	11	-1
		LMTS	2	5	7	10.3	-3.3
		CPO	3	7	10	12.6	-2.6
		FROM CBE BIRR	4	7	11	10	1
3	Payment	Saving	2	4	6	6.1	-0.1
		Current	2	5	7	17.3	-10.3
		LMTS PAYMENT	2	5	7	6	1
		CPO	2	5	7	5.9	1.1
		FCY Purchase Payment	2	3	5	5.2	-0.2

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		FROM CBE BIRR	4	7	11	15	-4
4	Foreign transfer	Payment From Mto At Branch	3	7	10	14.2	-4.2
		Payment Processed From Center	3	17	20	50	-30
5	Online banking	Mobile Banking	2	6	8	8	0
		Internet Banking	2	8	10		10
6	ATM Cards	Registration On System	2	3	5	5	0
		Card Delivery To Customers		15 days	16 days		0
7	CBE Birr	Registration For Personal	2	5	7	6.7	0.3
		Registration For Agent & Merchant	2	8	10		10
8	POS Deployment	Deployment After Collecting POS		5days	5days		not observed
9	Authentication	Authentication For Acc Opened		15days	15days	1day	14days
		Legal & Power Of Attorney City		2days	2days	1day	1day
		Legal & Power Of Attorney Outline		5days	5days	more than 20 days	less by 15 days
10	Excess Cash	Excesses Cash		1day	1day	1day	safe
11	Reconciliation	ATM		24hrs	24hrs	19 days & still more	less by more than 19 days
		POS		3days	3days	1day	no gap
		CBE Birr		1day	1day	1day	no gap
		Inventory		at least 1 quarter	at least 1 quarter	not observed	not observed
		System Suspense Accounts		1day	1day	1DAY	no gap