QUEUING THEORY APPLICATION AND CUSTOMERS' TIME MANAGEMENT IN DEPOSIT MONEY BANKS IN NIGERIA

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ABSTRACT

The study examined queuing theory, application and customers time management in deposit money banks in Nigeria.. A comparative analysis between Access Bank PLC branch in Ajilosun and First Bank PLC, Oke Isa, Ado Ekiti, Ekiti State were used as a case study. Data for the study were gathered through observation of the arrival time, time spent waiting in the queue, service time and time of departure customers from the banking hall. The observation time at Access Bank started by 2.30pm and ended 3.44pm which has been previously observed to be the peak period of the bank while the observation time of the First Bank PLC started 3.00pm and ended 4.57pm on different days. Data sourced were fitted into the single and multiple channel models and the results computed and analyzed manually. It was revealed that the mean service rate, the mean time spent in the queue by a customer, and aggregate service rate in the system by a customer at Access bank plc are substantially reduced compared to that of the first bank plc while the waiting line is short most especially for the multiple channels with the real time data processing enhancing the service delivery. It was concluded that despite these differences, queuing system and application of it in the banking industry, especially in the sampled banks is effective in achieving quality service delivery and this is also enhanced by the application of real time data processing adopted by the banks. Therefore, the study recommended that queue management should be employed by banks as it will enhance the quality of service delivery and time management for both banks and the customers. In addition, a single channel for banks that have high traffic intensity rate should be discouraged while a multiple channel should be encouraged as it reduces the waiting time of bank customers in the system. Lastly, idle time of the servers need to be checked as this could lead to more waiting time for customers.

Keywords: Queuing, real time system, quality service, single channel, multiple channels

INTRODUCTION

Queuing theory is the mathematical application of a statistical model to client flow management (Odewale, 2016). Bereket (2016) also considers the queue to be a

general phenomenon in the daily experience of human effort and also a common experience in virtually every economic life. Tian and Tong (2011) presented it as a waiting line, identified two key elements: the client's population source from which to draw and the service system. There is almost no economic activity where wait times are not essential.

Customers wait on line to get attention of the cashiers in the banks and attendants at the filling stations, barber shops, salon, shops, bus-stops, supermarkets, telephone booths, toll gates, food canteens. According to Odewole (2016), waiting is a value-added activity, so people don't like waiting situations. It is always the desire of every customer to get an efficient and timely service delivery of a service system through efficient time management by money deposit banks.

Time management refers to managing time effectively so that right time is allocated to the right activities to prevent bank customers waiting for many hours for service or sometimes requested to come back the next day. According to Ogunnaike and Ogbari (2008) as cited by Farabiyi, (2016), Poor time management leads to customers delay and frustration and, as he said, most banks exhibit similar character of poor time management which can spoil bank-customer's relationship.

Deposit money banks acting as intermediaries between the surplus and deficit sectors of the economy have always been the center of attraction to many customers that want to carry out one transaction or other through the services provided by these banks. An efficient deposit money bank must pay adequate attention to rules that govern arrivals, service times and the order in which arriving customers are served in order to boost patronage and increase the quality of bank services (Farayibi, 2016). These desires are most times not met in servicing a system which calls for proper management of queues for optimum quality bank service delivery.

Quality bank service is an integral part of the development process of most of the banks who clamours for success and survival in the present day competitive environment (Okoe, Adjei & Osareukhoe, 2013). This implies that, in the banking industry today, only a bank that carve a niche for itself, by offering selfless and quality bank service to their customers, will be able to scale through. The reason being that, bank customers of nowadays know the importance of quality service and they tend to switch such banks that are not service oriented to banks that are ready to offer them good and prompt service.

As a result of banks offering quality service to their customers and to have a high customer's patronage and loyalty, adoption of real time processing was introduced in

the early 2000's (Ovia, 2002; Joseph & Stone, 2003: Salawu & Salawu, 2007). Real time processing system is a computer application which helps to process data within a shortest period of time. Meaning, as the data is inputted, the output is produced. A good example of a real time processing system in Nigeria banking system is computer on-line system, Automated teller machine, mobile banking application, web application, point of sales services application, e wallet application, e-transact application to mention but a few. Adoption of these have not only added value to bank service delivery to their customers, but it has helped the banks in processing bank customer transactions speedily, reduce paperwork, ensure accuracy of records and makes banking business extend beyond banking hours (Salawu & Salawu,2007; Harriet, Ogunaike, Adegbuyi & Dada, 2017).

Many works have been carried out on the queuing system and customers time management in banking industry: Kasum (2006) worked on queue efficiency in Nigeria, Pei-chun and Ann 2006 assessed service efficiency with application of queuing theory in Taiwan, while Toshiba, Sanjay & Anil (2013) and Anichebe (2013) worked on application of queuing theory for the improvement in queuing problem of banking industry, also Williams, Ogege &Ideji (2014) worked on effective customer service on bank profitability using queuing approach, Obinwanne & Odunukwe (2015) and Ugawa, Okonkwo & Okonkwo (2015) appraised queuing theory effectiveness in the management of customers time in Nigeria banking system, Bereket (2016) used queuing modelling for comparative study of banking system in Ethiopia and Odewale (2016) investigated waiting lines, banks effective delivery and technology driven services in Nigeria.

In spite of several works on queuing model and customer time management in the banking industry, considerable attention has not been given to types of queuing as it affects customers' time management in money deposit bank in Nigeria. Furthermore little research work has been done in comparing queuing system in old generation banks to new generation banks. Service delivery in most Deposit Money Banks in Nigeria is still inadequate. Long queue can still be seen at the banking halls and at the ATM service points, customers complain of waiting too long in banking halls with absolute no rest of mind because of insecurity in the country and other service failures such as non-functioning of ATMs, ATM debit without pay, non-availability of staff at service points, unprofessional conduct or rude behaviours by the staff of the banks, poor standard of records or improper information, failed promises among others (Idowu, Aliu & Adagunodo, 2002 ; Farabiyi, 2016).

Again, the modem day computerization, such as Online Real Time processing,

Automated Teller Machine (ATM), etc., by banks an attempt to minimize waiting line problem has not yielded the much wanted result due to contimuous breakdown of such computerization and networking arrangements. Hence, long queue persisted in all Deposit Money, Banks in Nigeria.

Therefore, the main objective of this study is to examine the queuing theory, application and customer time management in deposit money banks in Nigeria while specific objectives are:

1. Assessing the effect of single queuing and single or multiple server system of queuing in Nigerian money deposit banks

2. Evaluating the effect of queuing theory on customer time management in old and new generation banks in Nigeria.

This study will surely add to the existing literature on queuing theory approach from Nigeria by looking into a single line with a single server and single queue with multiple servers. Also the queuing methods in old and new generation banks in Nigeria will also be evaluated an attempt to see their differences.

LITERATURE REVIEW

Concept of queuing system

Queue according to Ayodeji and Olutoye (2014), is the total number of items/ persons awaiting a service function in a system which does not include the item or person currently being served. It is mostly experienced in a system when a server or service provider is attending to a customer and before the server could finish with the customer within his average service rate, several other customers have arrived awaiting service. They categorized queue into four classes such as a single queue with a single server, single queue with multiple server or service point, multiple queue with a single server or service point and multiple queue with multiple server/service point.

According to Ugwa, et al, (2015), the major purpose of the queue is to achieve an economic balance between the cost of rendering services and the cost associated with the waiting time. When the waiting time of arrival is too long, it may lead to the customer leaving the queue to another line that has no long queue and it may lead to the customer leaving the banking hall totally because of too long time used in servicing a customer. The length of wait time in the queue was attributed to the service provider's inefficiency in reaching the benchmark for client time. He further

says that, “waiting line or queue arise whenever the demand for customer service cannot perfectly be matched by a set of well-defined service facilities”

Obviously, there are specific costs associated with client wait times and unused service facilities. Taha (1982) argues that these two categories of costs evolve in opposite directions. For instance, by adding more service facilities, we reduce the cost of customers waiting, but we increase the cost of unused facilities. On the other hand, by reducing the number of service, facilities, we increase the cost of waiting, but we reduce the cost of inactive facilities. This raises the question of how to manage these costs for the efficiency and effectiveness of Nigeria's banking system.

Types of Queues

According to Egbo (2001), there are three main varieties of queuing situations commonly found in many places and circumstances around us. These include;

1. Single queue with single service print.
2. Single Queue with several service points:
3. Multiple queues with multiple service point.

Single queue with a single service point: In this type of queue, only one line is formed and only one facility gives service. Single queue with multiple points of service: In this type, queue items may go to any available point of service and receive service. It is the newly adopted and operational queue system in the savings and current accounts of most banks. It is also found at most petrol stations in this age of fuel shortages. Several lines with several service points: in this case, according to Egbo, there are several lines and several service facilities. This queue type reduces the average time a customer or element in a queue spends.

Items in a queuing.

The items that make up a queue are:

a) Arrivals
b) Queue
c) Service
d) Exit/Departure.

Arrivals: This represents the people or jobs coming into the system to receive service. The arrival pattern of these objects affects the way of ordering queues. The arrival may be systematic or it may be random or systematic random. The entry rate is a

measure of how long an object takes to reach a queue.

Queue: This represents the actual time spent in waiting, for service as the objects arrival there is the likelihood that they will wait or queue for their turn.

Service: This represents receiving attention. The objective of the system is to receive the service. The service rate describes the time spent on the effective reception of the attentive service. As with the arrival rate, the service rate can be random or systematic, or both.

Output/Depart: Upon receipt of the service, the object will leave the system. Leaving the system is also called departing. This start rounds off the cycle.

Queue or wait line issue.

In general, a queue problem arises when the customer service demand cannot be perfectly satisfied by a set of well-defined service facilities. The perfect match cannot be achieved because, in many situations, neither the arrival times or arrival rate of customers, nor the service times or service rate of service facilities can be accurately predicted. Therefore, either clients have to wait for services (in this case the queue emerges), or service facilities have to wait (in this case, service facilities remain inactive). Obviously, there are specific costs associated with client wait times and unused service facilities. Taha (1982) argues that these two categories of costs evolve in opposite directions. For instance, by adding more service facilities, we reduce the cost of customers waiting, but we increase the cost of unused facilities. Conversely, by reducing the number of services, facilities, we raise the cost of waiting, but we reduce the cost of unused facilities. Consequently, the challenge is how to manage these costs for the effectiveness and efficiency of the organization.

One major recurring problem with Nigerian Banks is the overcrowded banking halls and this had led to the movement of customers from one bank to the other, where they can obtain banking services without much delay. Failure of service facilities such as machinery (network failure), limited staff and inefficient use of resources usually occur. These situations give rise to the formation of long queues and When customers wait in queue, there is the danger that waiting time will become excessive leading to the loss of some customers to competitors (Kotler,1999).

Another issue is the failure of banks to adapt their service facilities to the needs of customers without much delay. The current experience in Nigeria is that most banks

do not have the facilities and capabilities to serve the number of customers without much delay the part of customers. The problem in this regard had been that though bank customers, for instance, have always been desirous of spending the least possible time banking transactions, this age-long desire is yet to be met by the banks. Furthermore, banks want to attract, retain customers and the same time maximizes profits.

However, with much observation and inquiry, despite the fact that most of the banks are real time 24/7, waiting time of customers in the banking hall for deposit or withdrawals has been so discouraging and too long.

Quality Service and Real Time System

Quality service is the critical factors that influence the competitiveness of banks. Quality service and live system. Quality of service is one of the most important factors affecting the competitiveness of banks. Banks can set themselves apart from their competitors by offering high-quality service. In the same vein, Hernon and Whitman (2001) described it as the gap analysis or the gap of the customer expected service and the real service provided by the banks. De Caruana (2002) is the result of comparing clients' expectations of a service and their perceptions of how the service was performed. In the same vein, Hernon and Whitman (2001) described it as the gap analysis or the gap between the service expected by the client and the actual service provided by the banks. From these definitions, it can be summarized that the quality of service is relative in terms of customer perception from one bank to the next.

The quality of banking service can be improved through the use of a real-time system which can be explained by information and communication technologies (Osabuohien, 2008). It explains how customer expectations differ from the actual service provided by banks. The quality of banking service can be improved by means of a real-time system which can be explained by information and communication technologies (Osabuohien, 2008). According to Irechukwu (2000), computerization of information through the use of ICT in the banking operations such as account opening, transaction processing, recording, transferring information, checking balances and account mandate processing have not only added value to banking operations but it has also enhanced the service delivery of banks to their different customers through the use of different electronic gadgets such as Automated Teller Machine, Smart Cards, Telephone Banking, Electronic Funds

Transfer, Electronic Data Interchange, Electronic Home and Office Banking etc. These have provided self-service facilities from where prospective customers can complete their account opening documents direct online, validate their account numbers, receive instruction on when and how to receive their cheque books, credit and debit cards, account balance etc

Theoretical framework

The theoretical frame used for this study is the theory of queuing. This theory is based on A.K Erlang in 1905, (Ugwa, Okonkwo & Okonkwo, 2015) when he created the models to describe the Copenhagen telephone exchange. Since then, ideas have seen applications such as telecommunications, traffic engineering, information technology and especially the banking system. In the banking system, the application of the queue system improves the provision of bank services to their clients when each client observes the queues to be served. It is efficient, faster and cheaper than when customers refused to hold a queue. Most importantly, it makes the job easier for their waiters/cashiers. Based on this theory, there are assumptions that guide the use of the simple queuing system. Based on Ayodeji and Olutoye (2014), these hypotheses are:

- We only have one line.
- No balking. This assumption assumes that incoming clients continue to join the queue.
- The length of the line is not restricted.
- The ability of the system is limitless.
- You don't go back. This hypothesis implies that arriving customers stay in the queue until they are served. (patient customers)
- No one leaves the system unattended.
- The first-come, first-served approach is in effect.
- Server maintenance time follows an exponential distribution sequence.
- •The service rate is in excess of the arrival rate.

Empirical Framework

Williams, Ogege and Ideji (2014) looked at the profitability of the Nigerian bank using the queue and regression approach. Primary data were sourced from 5 sampled banks, which are First Bank of Nigeria, Zenith bank, Access Bank Plc, Guarantee Bank

and Union Bank Plc through observation of bank customers, taking into consideration the time a customer spends in the queue and the time the bank cashier spends attending to the customer. It was revealed that the average time a bank client spends waiting in the queue to complete a banking operation has a linear relationship to the bank's profitability. Furthermore, it has also been found that poor customer service management at banks can reduce the profitability of banks and thus cause financial difficulties. Therefore, the study concluded that there is an inverse relationship between bank customer services and profitability in Nigeria banks

Obinwanne and Odunukwe (2015) examined the application of queuing models to customer management in banking system in Nigeria. The primary data was obtained by observing the bank's clients and she used the queue model for the birth and death process as an analytical technique. It was found that there were savings in the expected cost of the expectation and the actual cost of the expectation, which means that the average cost of the expectation is reduced. It was noted that adding one more server will help reduce the time spent in the queue, which may improve client satisfaction. Consequently, the bank queue system improves the efficiency and effectiveness of banking transactions.

Ugwa, et al. (2015), evaluated the application of queuing theory in the effective management of time in money deposit banks using Zenith bank PLC in Enugu metropolis as a case study. The information was obtained from the bank's client by observing the queue system of the selected bank sampled. It was found that the application of queuing theory can be used in the contest a cost optimization model, which has to do with the cost of offering the service and the cost of waiting

Odewole (2016) investigated waiting lines, banks' effective delivery systems and technology driven services in Nigeria. The study was conducted at one of the business banks located at Obafemi Awolowo University, Ile ife. The primary data comes from observing customers in the queues to be served. It was found that the arrival of customers and the service time rate of servers follow a poisson exponential probability distribution and the mean service rate, the mean time spent in the queue by a customer, and aggregate service rate in the system by a customer are substantially reduced. It was also revealed that the adoption of technology at Nigerian banks has reduced the queue and waits time for bank clients, which improves the efficient delivery of services at that bank.

METHOD OF STUDY

A survey design was used in the study. Primary data were employed and were extracted from the daily activities of the selected banks, taking into consideration the

time a customer spent on the queue and the time the bank cashiers spent in attending to each customer. Access Bank Plc and First Bank Plc were purposive selected for the study because the former is one of the fastest growing new generation banks that meet up the lists of the 10 customer oriented banks in Nigeria, same with First Bank Plc which represent one of the orthodox bank and customer oriented banks in Nigeria (KPMG, 2014). The State of Ekiti was chosen to represent the country since we have these two banks in the whole country that have the same methods of operation. Banks in Nigeria have a slogan which is called TECHO, meaning, turnaround time, error free processing, customer service, helpfulness and Ambiance. The bank expected that the client's withdrawal would be processed within 5minutes and the deposits would be processed within 3minutes. However, this type of methods follows M/M/1 simple queue model and multiple channels where servers' serve jobs that arrive according to a Poisson process and exponentially distributed service requirements. The study used queue theory, analysis methods as a method of estimation.

Model Formulation: The single channel model was extracted from Ayodeji and Olutoye (2014), while ratings for multiple channels were consistent with Ugwa et al (2015). As a result, the ratings used in single and multiple channels are indicated below.

Single channel:

$$\rho = \frac{\text{Average service completion time } 1/\mu}{\text{Average inter-Arrival time } 1/\lambda} = \frac{\lambda}{\mu}$$

Multiple Channels:

$$po = \frac{m!(1-\ell)}{(\ell c)c + m!(1-\ell)}$$

n = number of customers in the system (waiting and in service)

μ= mean Average (expected) service rate or average number of customers served per unit time at the place of service

λ=Average (expected) customers' arrival rate or average number of arrivals per unit of time in the queuing system

Server utilization factor (SUF or Traffic intensity (TI) = $\lambda/\mu*100$

Ls=Mean (Average) number of customers in the system = $\lambda/\ \mu-\lambda$

Ws=Mean (Average) waiting time in the system = 1/μ-λ
Lq=Mean (Average) number of customers in queue = λ2 / μ(μ-λ)
Wq= Mean (Average) waiting time in the queue = λ/μ(μ-λ)
Pn=Probability of n customers in the system = (λ/μ)n(1-λ/μ)

DATA ANALYSIS

Access Bank Data Analysis:

Single channel

1. From the table 1 below, it is observed that it takes server 2 minutes to attend to a customer and the arrival time rate of customers into the system is 3minutes. Therefore, μ= ½=0.5 while λ=1/3=0.33
2. The traffic intensity is calculated as λ/μ*100 = 0.33/0.50*100 = 0.66
3. Ls=Mean (Average) number of customers in the system = λ/ μ-λ. The average number of customers in the system is 0.33/0.50-0.33 =1.94 customers
4. Ws=Mean (Average) waiting time in the system = 1/μ-λ. Waiting time in the queue is 1/0.50-0.33= 5.88 minutes
5. Wq= Mean (Average) waiting time in the queue = λ/μ(μ-λ). This is the average number of time units that a customer stays in the queue = 0.33/ 0.5(0.50-0.33) = 0.33/0.085 = 3.88 minutes
6. Probability of service, unit in the system is idle = 1-λ/μ =1- 0.33/0.5= 0.34
7. Probability that at least 3 object is in the system = (λ/μ)n(1-λ/μ) = (0.33/0.5)3 *(1-0.66= 0 .2874*0.34= 0.09

Multiple Channels

In a multichannel with a single queue, the following calculations were performed. m=number of open channels,?= average time of arrival, μ= average service price per channel. Therefore, from the observation, it takes servers 1hr to attend to 40 customer's i.e λ, the service rate i.e μ is 20, and it is derived by dividing the service rate per hour with the number of customers attended to per hour. From access bank benchmark for turnaround time, the study assumes that each server used 3 minutes for each transaction, then service rate is 60/3=20 while the number of channels is 3

The traffic intensity is calculated thus

ℓ = λ/Cμ = 40/3*20= 0.66

The probability that there are zero people or units in the system. To calculate Po, the formula below is used

$$po = \frac{m!(1-\ell)}{(\ell c)c + m!(1-\ell)} = \frac{3!(1-0.66)}{(0.66*3)3 + 3!(1-0.66)} = 0.208$$

The average number of people or units in the system

$$Ls = \frac{\lambda\mu(\lambda/\mu)^m}{(m-1)!(m\mu-\lambda)^2} P_o + \frac{\lambda}{\mu} = \frac{40*20(40/20)^3}{(3-1)!\,(3*20-40)^2} 0.208 + \frac{40}{20} = 3.66$$

The average time a unit spends in the waiting line and being served(namely, in the system) is

$$Ws = \frac{\mu(\lambda/\mu)^m}{(m-1)!\,(m\mu-\lambda)^2} Po + \frac{1}{\mu} = \frac{Ls}{\lambda} = \frac{3.66}{40} = 0.00915*60=5.49$$

The average number of people or unit in line waiting for service is

$$Lq = Ls - \frac{\lambda}{\mu} = 3.66 - 40/20 = 3.66-2= 1.66$$

The average time a person or units spends in the queue waiting for service is

$$Wq = Ws - \frac{1}{\mu} = \frac{Lq}{\lambda} = \frac{1.66}{40} = 0.0415*60= 2.49$$

Proportion of time the server is idle =1-p = 1-0.66= 0.34

First Bank Plc Data Analysis:

Single channel

1. From the table 1 below, it is observed that it takes server 2 minutes to attend to a customer and the average arrival time rate of customers into the system is 5minutes. Therefore, μ= ½=0.5 while λ=1/5=0.2
2. The traffic intensity is calculated as λ/μ*100 = 0.20/0.50*100 = 0.40
3. Ls=Mean (Average) number of customers in the system = λ/ μ-λ. The average number of customer in the system is 0.2/0.50-0.20 =0.66 customers

4. Ws=Mean (Average) waiting time in the system = 1/μ-λ. Waiting time in the queue is 1/0.50-0.20= 3.33 minutes
5. Wq= Mean (Average) waiting time in the queue = λ/μ(μ-λ). This is the average number of time units that a customer stays in the queue = 0.20/ 0.5(0.50-0.20) =0.20/0.15= 1.33 minutes
6. Probability of service, unit in the system is idle = 1-λ/μ =1- 0.2/0.5= 1-0.40= 0.60
7. Probability that at least 3 object is in the system = (λ/μ)n(1-λ/μ) = (0.20/0.5)3 *(1-0.60= 0 .064*0.60= 0.0384

Multiple channels

In a multichannel with a single queue, the following calculations were performed. m=number of open channels, ?= average time of arrival, μ= average service price per channel. Therefore, from the observation, it takes servers 1hr to attend to 35 customers i.e λ, the service rate i.e μ is 12, and it is derived by dividing the service rate per hour with the number of customers attended to per hour. From the observation from First Bank, the turnaround time average of 5minutes for each customer by the serves, then service rate is 60/5=12 while the number of channels is 5.

The traffic intensity is calculated thus

ℓ = λ/Cμ = 35/5*12= 0.58

The probability that there are zero people or units in the system. To calculate Po, the formula below is used

$$po = \frac{m!(1-\ell)}{(\ell c)c + m!(1-\ell)} = \frac{5!(1-0.58)}{(0.58*5)5 + 5!(1-0.58)} = 0.4666$$

The average number of people or units in the system

$$Ls = \frac{\lambda\mu(\lambda/\mu)m}{(m-1)!(m\mu-\lambda)2} Po + \frac{\lambda}{\mu} = \frac{35*12(35/12)535}{(5-1)!\,(5*12-35)212} 0.4666 + \frac{}{} = 5.70$$

The average time a unit spends in the waiting line and being served(namely, in the system) is

$$Ws = \frac{\mu(\lambda/\mu)m}{(m-1)!\,(m\mu-\lambda)2} Po + \frac{1}{\mu} = \frac{Ls}{\lambda} = \frac{17.66}{40} = 0.1628*60=9.852$$

The average number of people or unit in line waiting for service is

$$Lq = Ls - \frac{\lambda}{\mu} = 5.70 - 35/12 = 5.70-2.91= 2.79$$

The average time a person or units spends in the queue waiting for service is

$$Wq = Ws - \frac{1}{\mu} = \frac{Lq}{\lambda} = \frac{2.79}{35} = 0.07*60= 4.78\text{minutes}$$

Proportion of time the server is idle = 1-Po.= 1-0.46= 0.54

DISCUSSION OF FINDINGS

Table 1 provides a summary of the queue management system findings from the sample banks. The data sourced in table 3 and 4 were used to calculate the arrival rate, the service rate, effective of the service channel, probability of the idle service and busy service points in the bank so as to make conclusion whether the queuing system in the bank enhances service delivery and time management which is one of the means to achieve customer patronage, loyalty and satisfaction. Comparing the two banks, the traffic intensity of a single channel of the two banks was found to be 0.66 and 0.40. It shows how the average arrival rate relates to the service rate. The average number of outstanding applications from both banks is 1.94 and 0.66. This means that the queue is still getting clients and adding to the queue. The median wait time in the system for a single channel is 5.88 minutes and 3.33 minutes. This explains the length of period spent by a customer in the system passing through the queue before receiving service. The results indicate that access bank clients stay longer in the queue prior to receiving service. This may also be seen from the average wait time spent in the queue that is 3.88 minutes to 1.33 minutes. The likelihood of the POC being inactive is 0.34 and 0.60. This indicates that service outlets were busy for 0.66 for the first and 0.40 for the second, respectively. Finally, the probability for n clients to be in the queue is 0.09 and 0.038. The probabilities shown are less than 1 for both banks, meaning that, as customers join the queue, servers responded by responding quickly to customers.

Table 1: Summary of the Queuing System in the Sampled Bank

Banks	Access Bank Plc	First Bank Plc
Notations	Single channel	Single Channel
Traffic intensity	0.66	0.40
Average no of customers in the system	1.94	0.66
Average waiting time in the system	5.88	3.33
Average waiting time in the queue	3.88	1.33
Probability that service point is idle	0.34	0.60
Probability that at least 3 object is in the system	0.09	0.0384

Table 2 presents the summary of the results, as above, in the multi-channel system of the sampled banks. Comparing the two banks, the channel traffic intensity for the two banks was found to be 0.66 and 0.58. It indicates the ratio of the average arrival rate to the service rate. This means that the entry rate is higher in the access bank than in the first bank. The mean number of clients in the network is 3.66 and 5.70. This indicates that more clients are located on the bank premises of the first bank than Access Bank. However, these customers would have to wait for 5.49 minutes and 9.852 minutes before joining the queue and after joining the queue, they would have to wait for 2.49 minutes and 4.78 minutes before being serviced. The probability that the service points are idle are 34% and 54% This indicates that, service points in first bank are more idle than access bank and lastly, the probability that n customers are in the queue is 0.2 and 0.46 which shows more customers are in the queue in first bank than in access bank due to the number of service points that is idle or servers wasting much time attending to customers Although, this may be attributed to the fact that, customers are joining the queue continuously.

Table 1: Summary of the Queuing System in the Sampled Bank

Banks	**Access Bank Plc**	**First Bank Plc**
Notations	Multiple Channel	Multiple channel
Traffic intensity	0.66	0.58
Average no of customers in the system	3.66	5.70
Average waiting time in the system	5.49	9.85
Average waiting time in the queue	2.49	4.78
Probability that service point is idle	0.34	0.54
Probability that at least 3 object is in the system	0.20	0.46

CONCLUSION

Based on the findings of this research work, the study concluded that, queuing system and application in the banking industry, especially in the sampled banks are effective in achieving quality service delivery and this is also enhanced by the application of real time data processing adopted by the bank. This was supported by Obinwanne, & Odunukwe, (2015) Ugwa, Okonkwo, & Okonkwo, (2015) Odewale, (2016). The results obtained explicitly revealed that, the sampled banks leave up to what they pronounce, by ensuring that the turnaround time for customers are not more than 3 minutes and 5 minutes for withdrawals and deposits as the case may be. The reason for this is that, the bank always wants to satisfy their customers, help them, and deliver a quality and prompt service to them so as to buy their loyalty and their patronage as these also have positive effects on the bank profitability and going concern. This is confirmed by KPMG (2014) who said these banks are the top 10 customer-focused banks in Nigeria. However, the study's analysis showed that, despite the number of service channels in the first bank, a greater number of customers remain in the system and in the queue. Additionally, server downtime should be reviewed as it allows clients to wait longer than necessary. However, queuing system and real time processing in banks have contributed immensely to the customer satisfaction in Nigeria banks.

The study recommended that banks use queuing to improve service delivery and time management for banks and customers. In addition, a single channel for banks that have high traffic intensity rate should be discouraged while a multiple channel should be encouraged as it helps in reducing the waiting time of bank customers. Lastly, it is recommended that, additional server or service point to the existing one should be initiated without looking at the cost implication because this will help in reducing the waiting time of customers and decongest the banking hall.

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