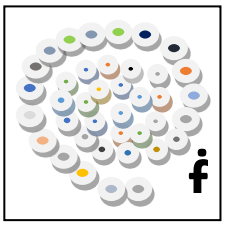

International Journal of Mathematical Analysis and Modelling

(Formerly Journal of the Nigerian Society for Mathematical Biology)

Volume 6, Issue 2 (Oct.-Nov.), 2023

ISSN (Print): 2682 - 5694
ISSN (Online): 2682 - 5708

International Journal of Mathematical Analysis and Modelling
Volume 6, Issue 2, October-November 2023, pages 75 – 82

Analysis of single and multi-teller models using simulation for reducing waiting time: a case study of Access Bank and Eco Bank, Nig Ltd, in Taraba State Nigeria

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Abstract

The essence of any organization is to solve problem and maximize its services and relevance among its subscribers and customers. In an attempt to actualize these, several practices are put in place depending on the type of services rendered and the type of subscribers. The banking sector tends to be one of the most customer oriented establishments in the private sector and thus infers a lot of carefulness in customer services and customer relations. One of the major factors influencing the success of organizations in today's competitive world is to increase customer satisfaction through the improvement of service quality. In this research paper, it was observed that a customer is expected to come into the bank at every 0.72 minutes at Eco bank while at Access bank at every 0.46 minutes a customer comes in. It was also revealed that if it costs ₦ 400 (₦ 200 happiness cost and ₦ 200 service cost) to attend to a customer the expected hourly cost of facility maintenance in Eco Bank is ₦ 33,200 and for Access Bank is ₦52,000 Thus at a single teller access bank spends a minimum cost of ₦ 52, 0000 per hour to attend to 130 customers while at the multi teller, adopting the established average per teller; Eco Bank Spends for 4 tellers, ₦132,000 per hour attending to an average of 83 customers and Access bank spends for 6 tellers, ₦ 312,000 per hour attending to an average of 130 customers. Thus, the cost of facility is dependent on the number of tellers and cost of internet service plus happiness service provided. In addition, the group descriptive statistics, though with varying distribution and sample selection between the banks due to validity of responses collected, there is a mean correlation and deviation in the assessment of empathy and reliability of teller system at both Eco Bank Nigeria and Access Bank Plc. With a related, mean mark above 2.5 and deviation below 0 and significant at 0.125 points to positive autocorrelation. On the other hand, the reliability mean marks are related at 3.148 and 3.528 with a mean deviation of 0.863 and 0.559 respectively. Assurance on its own has a lesser mean mark at 2.815 for Eco bank and 3.111 at Access bank. The deviations are similar at 0.786, which infers no significant difference by mere inspection. Finally, responsiveness as a proxy to measure performance the mean at 2.333 for Eco Bank and Access bank at 2.639 this is quite poor and low thus, we could infer that at both Eco bank and Access bank the responsiveness of the tellers though reliable and assuring is low in responsiveness.

Keywords: empathy; validity; expected; descriptive; customer

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1 Introduction

Banking services is seen and is often a one on one or inter personal relationship due to the confidentiality of financial matters and engagements. In several banks especially at congested or highly populated areas mostly limited in facilities, queuing is common and the major alternative to achieving orderliness and smooth service rendering. In organizations and establishments where services are rendered, it is the paramount desire of the managers to estimate the time and save customers time and maximizes their inflow and opportunities. In the words of [4] as cited in [1], Bank customers have become increasingly demanding, because they require high quality, low priced and immediate service delivery. They want additional improvement of value from their chosen banks. Service delivery in banks is personal, customers are either served immediately or join a queue (waiting line) if the system is busy. A queue occurs where facilities are limited and cannot satisfy demand made against them at a particular period. However, most customers are not comfortable with waiting or queuing. These are common and every day experiences at post offices, ATM, banking halls, fuel stations bet centers and some shops. In the words of [2] as service speeds up, time spent waiting on queue decreases. Service cost however increases as the level of service increases.

The goal of managers is to schedule as few employees as possible while maintaining a minimum customer service level. Managers want queues short enough so that customers do not become dissatisfied and either leaves without transacting their business or transact and never return in the future. However, some waiting can be allowed if the waiting cost is balanced with significant saving in service cost. Thus, it suffices to infer that queuing is a common banking practice which gives the managers especially operations manager concern on how to reduce the queuing or waiting time and increase the quality of service rendered.

In an attempt to solve this conventional challenge and issue, the operations managers have devised means and alternative methods as well as suggested mathematical or statistical operational methods to curb this and maximize customers' service. The provision of the Automated Teller Machine (ATM), is an attempt to render quick and efficient services to customers even outside working hours, internet banking and the use of USSD codes in transactions have been adopted as alternative models to customer service delivery. In the banks, customers form queues and lines to quicken the access to services. The multi teller or single teller model infers a direct human contact between a bank representative or teller and a customer, the multiplicity of this ushers in the multi teller model system. Thus, one could infer that the multi teller system infers the provision of more bank personnel (tellers) who attend to various customers to reduce the queue and the time spent in attending to customers. On the other hand, simulation is a useful technique to analyze complex systems which are expensive to be changed through real experimentation. This approach allows investigation of different service configurations without any physical alteration, leading to the selection of the best solution while spending significantly lower cost.

The banking sector in Nigeria is no exception to this reality and fact. Notable among the banks are the commercial banks that are scattered over the entire 36 states of the federation and Abuja the Capital. In Nigeria there are 21 Commercial banks and each has several departments which one is solely dedicated to customer relations and customer service management. In all attempts banks try as much as possible to satisfy its customers and reduce stress in accessing their services. Each commercial bank is in serious competition with the other considering the open market operation. In all attempt to take charge of market share and maximize shareholders wealth, banks place her customers first and create enabling environment and service accessibilities to

ameliorate the time spent and the stress undertaken in getting served. As the banking activities and services increases, the number of customers increases and each customer desires to be served well, first and possibly treated preferentially. Daily work scheduling is required in many service companies such as Hospitals and Banks. Bad staff-customer scheduling results in long customer waiting times, long queues, and consequently, waiting cost. Bad scheduling can also result in loss of productively of Tellers due to idle times. On the other hand, good scheduling results in low waiting cost, good Teller utilization, customer satisfaction, and more profit. Operations managers are faced with the problem of recognizing the trade-off that must be taken between providing good service and the cost of waiting for such service.

The main aim of this study is to analyze single and multiple teller models or using simulation for reducing waiting time in banks, this will help us ascertain the average waiting time of customers at the various banking halls of the study areas. It will determine the Multi teller effects on the performance of the banks using simulation models and the facility cost of single and multi-teller system and make relevant recommendations as it relates to effective performance and efficient service delivery.

1.2 Scope of the study

The scope of this research is on the analyses of single and multiple teller models or using simulation for reducing waiting time in banks by customers specifically Eco Bank and Access Bank Nigeria Limited. Other inferences are for reference and purpose of emphases and consolidation.

2 Queuing and waiting

Waiting lines are formed whenever the current demand for a service exceeds the current capacity to provide that service [7]. Because of the difficulty in accurately predicting arrival patterns of customers for service and/or how much time is required to provide service to each customer, accurate decision regarding the capacity to be provided is made quite difficult. Excess service capacity involves excessive costs due to underutilization and insufficient capacity to meet peak loads causes waiting lines to become excessively long and customers may even quit the waiting lines. The ultimate goal of banks is to achieve an economic balance between the cost of service (i.e., cost of idle facility and employee) and costs associated with waiting for the service (i.e., social cost and cost of lost customers). Queuing theory does not directly solve this problem, but tries to provide vital information required for taking decisions.

According to [3], a waiting line (length) system or queuing system is defined by two important elements: the population source of its customers and the process or service system. The customer population can be considered as finite or infinite. However, [5] asserted that, the customer population is finite when the number of customers affects potential new customers for the service system already in the system. When the number of customers waiting in line does not significantly affect the rate at which the population generates new customers, the customer population is considered infinite.

According to [3], in his publication on waiting lines and queuing systems, he stated that Waiting in lines may be due to overcrowded, overfilling or due to congestion.

2.1 Single and multiple teller' characteristics

In queuing system, the terms server or teller and channel are used interchangeably (Wang and Tai, 2000). And is used interchangeably with teller system in banking. Queuing systems are either single

server or teller or multiple server or teller s. Single server or teller examples include gas station, food mart with single checkout counter, a theater with a single person selling tickets and controlling admission into the show. Multiple server or teller examples include gas stations with multiple gas pumps, grocery stores with multiple cashiers, and multiple tellers in a bank [8]. The study however looks at both single channel and multiple channels to make comparative judgment.

In a single-phase system, the service is completed all at once, such as a bank transaction or grocery store checkout counter [6]. In a multiphase system, the service is completed in a series of phases, such as at fast-food restaurant with ordering, pay, and pick-up windows.

As indicated by [6], it was also stated by [9] that, Basic single server or teller model assumes customers are arriving at Poisson arrival rate with exponential service times, and first come, first serviced queue discipline, and infinite queue length, and infinite calling population.

By adding additional resources to single server or teller system either service rate can be increased or arrival rate at each server or teller can be decreased with additional cost overhead. In Single server or teller single-phase system, customer is served once completed. Common examples of single server or teller single-phase are a teller counter in bank, a cashier counter in super market, automated ticketing machine at train station. In single server or teller queuing system wait time or performance of system depends on efficiency of serving person or service machine. Single server or teller single-phase queuing system is most commonly automated system found in our regular life. For example many superstores have replaced manual billing counters with automated machines.

[5] Argued that Single server or teller and multiple-phase system incorporates division of work into phases to keep waiting line moving. Common examples of these systems are automatic or manual car wash, drive through restaurants. Waiting line models are important to a business because they directly affect customer service perception and the costs of providing service. [4] also argued that if system average utilization is low, that suggests the waiting line design is inefficient. Poor system design can result in over staffing. Long waits suggest a lack of concern by the organization or can be view as a perception of poor service quality. Queuing analysis has changed the way businesses use to run and has increased efficiency and profitability of businesses.

3 Data analysis and interpretation

3.1 Waiting time interval from arrival to service delivery 8:15am to 9:51am (74 minutes) Single Teller System (Eco Bank)

Table 3.1 Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Arrival Interval	54	2.00	6.00	3.8889	.94503	.893
Valid N (listwise)	54					

3.1.1 Duration for Service Delivery: Single teller System (Eco Bank)

Table 3.2 Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Service Duration	54	2.00	7.00	4.5000	1.17762	1.387
Valid N (listwise)	54					

Waiting time Interval from Arrival to Service Delivery 10:11am - 12:08am (117 minutes)
Single Teller System (Access Bank)

Table 3.3 Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Waiting Time	54	3.00	7.00	4.9074	1.16988	1.369
Valid N (listwise)	54					

3.1.2 Duration for Service Delivery: Single teller System Access Bank
Table 3.4 Descriptive Statistics

	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**	**Variance**
Service Delivery Time	54	1.00	10.00	4.6778	2.50785	6.289
Valid N (listwise)	54					

Results of Customer Satisfaction ratings on banking hall queue and Teller systems as Proxy to performance effect

Table 3.5 Group Statistics

	Bank	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
Empathy	ECO BANK	27	3.0370	.85402	.16436
	ACCESS	36	3.5000	.50709	.08452
Reliability	ECO BANK	27	3.1481	.86397	.16627
	ACCESS	36	3.5278	.55990	.09332
Assurance	ECO BANK	27	2.8148	.78628	.15132
	ACCESS	36	3.1111	.74748	.12458
Responsiveness	ECO BANK	27	2.3333	.78446	.15097
	ACCESS	36	2.6389	.76168	.12695

3.2 Facility Cost of Single and Multi-Teller System

Establishing the assumed cost of service and facility cost.
The Average time spent per customer at the bank per hour
Total customers in 1hour 30 minutes Divided by the number of minutes that is the average customer per minute. (Recall, there is already a mean mark of waiting and service time thus, adopting that per customer)

At the single teller Eco Bank = 4.5 + 3.9 mins is 8 mins 40 seconds.
At the single teller Access Bank = 4.7 + 4.9 mins is 10 minutes,
where, 3.8 is the mean mark achieved in Table 3.1 (Waiting Time Interval, Eco Bank) and
4.5 is the mean mark achieved in table 3.2 (Duration for Service Delivery, Eco Bank).
4.9 is the mean mark achieved in table 3.3 (Waiting Time Interval, Access Bank) 4.7 is the mean mark achieved in table 3.4 (Duration for Service Delivery, Access Bank).

At each time spent by a customer, there is a cost of happiness and lost opportunity to the bank, and each service provided at the individual teller is charged. Assuming that it cost 200 naira to provide comfort to each customer and extra 200 naira to provide data and internet service per minute in service delivery, the possible cost of each teller facility could be calculated thus:

Adopting the Number of arrival time formulae thus as $\frac{Number\ of\ Customers}{Minutes}$.

At Eco Bank $\frac{54\ customers}{74\ minutes}$ **0.72 minutes** (1 hour 14 minutes = 74 minutes).

Thus at Access bank $\frac{54\ customers}{117 minutes}$ = **0.46 minutes** (1 hour 57 minutes as stated earlier = 117 minutes).

From the above, it was observed that a customer is expected to come into the bank at every 0.72 minutes at Eco bank while at Access bank at every 0.46 minutes a customer comes in. thus, in an hour it is expected that about $\frac{60\ minutes}{expected\ minute\ per\ arrival} = \frac{60}{0.72}$ = 83 customers at Eco Bank and $\frac{60\ minutes}{expected\ minute\ per\ arrival} = \frac{60}{0.46}$ = 130 customers at Access Bank.

Thus, if it costs ₦ 400 (₦ 200 happiness cost and ₦ 200 service cost) to attend to a customer, the expected hourly cost of facility maintenance equals

Eco Bank = ₦ 400x 83 = ₦ 33,200,
Access Bank = ₦ 400 x 130 = ₦52,000.

Thus at a single teller access bank spends a minimum cost of ₦ 52, 0000 per hour to attend to 130 customers, while at the multi teller, adopting the established average per teller;
Eco Bank Spends 4 tellers x ₦ 33,200 = ₦132,000 per hour attending to an average of 83 customers.
Access bank spends 6 tellers x ₦ 52,000 = ₦ 312,000 per hour attending to an average of 130 customers.

From the above, the cost of facility is dependent on the number of tellers and cost of internet service plus happiness service provided. The water, snacks and comfort provided at the bank constitute the happiness cost.

4 Discussion and conclusion

In line with the outputs and the analyses interpreted, it becomes pertinent to make the following summary:

1. Commercial banks in contemporary times have adopted the use of multi teller as a means to reduce waiting time and service delivery time though not without extra cost.
2. While it is not uniform in arrival and waiting time among banks and customers, there is an average time which does not exceed certain minutes at teller's points. However, the waiting time of a customer is dependent on the service delivery time of the other customer who

arrived prior to him. That is, from arrival to service delivery of a customer, the time taken by the earlier customer at the teller point is a determinant.

3. In a single teller, the waiting time is more; as many customers are left in the hands of a single teller there by making those who arrived later to wait longer since there is a single queue system.
4. At the multi teller, the maximum waiting time is 15mins with a minimum of 5 mins at the two banks when compared accordingly. More tellers have the likelihood of attending to more customers as seen in the research where Access bank with 6 teller points attended to more customers than Eco bank with 4 teller points.
5. There is an increased cost in the adoption and use of multi teller as more tellers require more service points, human capital, computing items and queue management system. Thus, multi teller adoption and usage requires more cost.
6. Customers were relatively satisfied in the service received in terms of empathy, responsiveness, assurance and reliability in no order. The responses of the customers to the above proxy as a measure of satisfaction were quite similar.

It suffices to conclude from the summary above that; multi teller has the tendency and probability to reduce waiting time in commercial banks thereby improving service delivery but at a cost that is not same with single teller. The waiting times at various commercial banks are dependent on number of teller and the service delivery time from one customer to another. Thus, it suffices to conclude that, while customer satisfaction at the various bank does not differ significantly, the waiting time between a single teller and a multi teller differ. The multi teller experience and waiting time does not differ significantly among commercial banks. The more the teller points, the less the waiting time and better customer service delivery.

It becomes imperative, at this juncture, to make the following recommendations in line with the objective and scope of this study:

1. Commercial banks should improve in their customer service through the adoption of multi teller system.
2. Multi-tellers should be managed to reduce waiting times and improve customer service delivery and in the long run maximize banks corporate objective. Processors at bank tellers should make effort to eliminate biased selection of customers to be attended to as well.
3. Tags and numbers should be given to customers in queues while marks should be made to reduce unfair movement from one teller queue to the other by customers, thereby inculcating equity and fair service delivery as well eliminating dissatisfaction, which is a result of mismanagement of tellers and queue system.
4. The use of First in First Out (FIFO) should be systematically applied and diplomatically adopted in banks to enable customers switch adequately from queue to queue if need be to consolidate waiting time reduction among customers.

Provisions for adequate teller points, ATMs, processors should form part of the banks operational plans and annual operational expenses towards improving customers' satisfaction and service delivery. More computers and service points should be created mostly during periods of festivities and high demand for teller deposit and withdrawal.

As research is contentious, the limitation in scope and objective to this study makes it relevant to recommend the following topics for further studies.

1. A review of Single and Multi-Teller System Management using computerized simulation and manual queuing management System.

2. Alternative to Multi Teller system in a computerized and Robotic era
3. An investigation into the use of ATMs and Human Teller systems for withdrawals and Deposits in a computerized era.
4. Cost Implication and Investigation into the use of ATMs and Human Teller systems for withdrawals and Deposits in a computerized era.
5. The place of banking in the era of Crypto currency.

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