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Investigating the Influence of Queuing Theory Parameters on Customer Satisfaction at ZANACO: The Mediating Role of Customer Waiting Time

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Abstract

This study examines the influence of queuing theory parameters on customer satisfaction through the mediating role of customer waiting time at Zanaco Cairo Road Branch in Lusaka, Zambia. In retail banking, service efficiency remains a critical determinant of customer satisfaction; however, prolonged waiting time persists as a significant operational challenge, particularly in high-traffic branch environments within developing economies. Despite advancements in digital banking and queue management systems, congestion in physical banking halls continues to undermine service experience. This study addresses this gap by integrating queuing theory with expectation–disconfirmation theory to provide a mechanism-based explanation of how operational system characteristics translate into customer satisfaction outcomes. Guided by three objectives, the study examines: (i) the effect of queuing theory parameters on customer waiting time, (ii) the effect of waiting time on customer satisfaction, and (iii) the operational factors influencing both waiting time and satisfaction. Anchored in a critical realist philosophy, the study adopts a sequential explanatory mixed-methods design. Quantitative data were collected through 320 structured observations and 53 customer questionnaires, while qualitative insights were derived from 15 semi-structured staff interviews to explain underlying operational mechanisms. Findings indicate that customer arrivals are heavily concentrated during peak morning hours (08:30–09:30), resulting in demand–capacity imbalances and system congestion. The average waiting time of approximately 28 minutes significantly exceeds accepted service benchmarks. Regression analysis demonstrates that queuing theory parameters significantly predict waiting time ($R^2 = 0.507$, $p < 0.001$), while waiting time exerts a strong negative effect on customer satisfaction ($\beta = -0.65$, $p < 0.001$), confirming its mediating role. Qualitative findings further reveal that staffing constraints, transaction complexity, and system inefficiencies constitute key generative mechanisms driving delays. The study concludes that customer waiting time is the critical transmission mechanism through which queuing system design influences customer satisfaction. It recommends dynamic capacity alignment and process optimization to enhance service efficiency and customer experience in retail banking.

Keywords: Queuing Theory, Customer Waiting Time, Customer Satisfaction, Mediation, Service Efficiency, Banking Operations

1. Introduction

The banking sector plays a critical role in national economic development through financial intermediation, mobilizing savings, facilitating payments, and supporting investment and trade. Efficient banking services are therefore essential not only for customer satisfaction but also for broader economic productivity. In service-based industries such as banking, operational efficiency is increasingly recognized as a key determinant of competitiveness, customer retention, and service quality (Bitran & Mondschein, 2020; Oliver, 1997).

Recent developments in the global and regional banking sector have further emphasized the importance of service efficiency and customer experience. Advances in financial technology, digital banking platforms, and automated service systems have increased customer expectations regarding service speed and convenience. As a result, banks are under increasing pressure to reduce operational delays and improve service delivery within physical branch environments. Studies conducted in recent years continue to highlight that prolonged waiting time remains one of the most significant service quality challenges faced by retail banks, particularly in high-traffic urban branches (Adeleke, Ogundipe & Ogunrinola, 2018).

Within the Zambian financial sector, the banking industry remains a central pillar of the national financial system. According to the Bank of Zambia Financial System Supervision Report (2024), the banking sector continues to demonstrate stability and resilience while serving a growing and diverse customer base. However, despite improvements in digital banking channels, physical branch services remain important for many customers who require assistance with complex transactions, account inquiries, or cash-based services. Consequently, customer traffic in bank branches remains significant, particularly in urban commercial centers.

Recent reports also highlight that service efficiency and operational performance have become increasingly important components of financial service delivery. The Bank of Zambia Financial Stability Report (2024) emphasizes the importance of improving service delivery systems and operational processes within financial institutions to enhance customer confidence and service accessibility. In this context, operational issues such as long waiting times in bank branches remain relevant challenges affecting customer experience and satisfaction.

Queuing theory provides a mathematical and analytical framework for examining waiting lines and service systems. Originally developed by Erlang to analyze congestion in telecommunications systems, the theory has since been widely applied in service industries such as healthcare, transportation, and banking to improve operational efficiency and resource allocation (Gross & Harris, 1998; Taha, 2017). In banking environments, queuing theory enables managers and researchers to model customer arrivals, service mechanisms, and system capacity in order to estimate waiting time and identify operational inefficiencies.

Within Zambia, customer waiting time in bank branches has been identified as a recurring service delivery challenge, particularly during peak service periods. Reports by Financial Sector Deepening Zambia (2023) indicate that long waiting times remain one of the most frequently cited customer complaints across several commercial banks. This challenge persists despite the introduction of electronic queue management systems and digital banking services.

ZANACO Cairo Road Branch, located in Lusaka's central business district, serves a large and diverse customer population and experiences high daily customer traffic. Although the branch has implemented several operational improvements to manage customer flow, anecdotal evidence and preliminary observations suggest that customers frequently experience prolonged waiting times during peak service hours. However, limited empirical research has applied queuing theory to systematically examine how operational parameters influence waiting time and customer satisfaction within the Zambian banking context.

This study therefore applies queuing theory to investigate how queuing parameters influence customer waiting time at ZANACO Cairo Road Branch and how waiting time subsequently affects customer satisfaction.

1.2 Statement of the Problem

Customer satisfaction in retail banking is strongly influenced by service efficiency, and waiting time remains one of the most critical indicators of that efficiency in physical branch environments. Empirical evidence consistently demonstrates that prolonged waiting time significantly reduces customer satisfaction and negatively affects perceptions of service quality. For instance, Nguyen, Pham and Tran (2024) found that customer satisfaction declines significantly when waiting time exceeds 20 minutes, with customers reporting lower service ratings compared to those served within shorter durations. Similarly, Ladhari (2021) identifies waiting time as one of the most influential determinants of perceived service quality in banking, often shaping customer evaluations more strongly than technical service outcomes.

Service benchmarks within the banking industry further emphasize the importance of waiting time as a performance indicator. Studies suggest that acceptable in-branch waiting time typically ranges between 5 and 15 minutes, beyond which customer dissatisfaction increases significantly (Kumar & Sharma, 2023; Munyoka & Maharaj, 2022). However, empirical studies in emerging economies consistently report waiting times exceeding these thresholds. Munyoka and Maharaj (2022) found that average waiting times in selected African banking halls range between 20 and 45 minutes during peak periods, highlighting a significant gap between expected service standards and actual service delivery conditions.

Despite advancements in digital banking, queue management systems, and process automation, congestion in physical bank branches remains prevalent, particularly in high-traffic urban areas. Recent studies show that factors such as high customer arrival rates, limited-service capacity, and transaction complexity continue to contribute to prolonged waiting times in banking environments (Boateng & Nagaraju, 2023; Kumar & Sharma, 2023). Furthermore, Osei and Mensah (2022) demonstrate that mismatches between customer arrival rates and service capacity are a major cause of congestion in retail banking systems, leading to increased waiting time and reduced service efficiency.

In the Zambian context, improving service delivery and customer experience has become a key priority within the financial sector. The Bank of Zambia (2023) emphasizes the need to enhance service efficiency, strengthen customer protection, and improve accessibility in financial service delivery. However, sector reports indicate that long waiting times remain a persistent challenge in commercial banking, particularly in high-traffic urban branches. Financial Sector Deepening Zambia (FSD Zambia, 2023) identifies prolonged waiting time as one of the most frequently cited customer complaints in the banking sector, suggesting that service delivery challenges continue to affect customer experience.

Although existing studies acknowledge the relationship between waiting time and customer satisfaction, a critical gap remains in the literature. Many studies focus either on customer satisfaction as a perception-based outcome or on operational efficiency using queuing models, without integrating these dimensions within a single analytical framework. In particular, there is limited empirical research that demonstrates how queuing theory parameters such as customer arrival rate, service rate, number of service counters, and queue discipline translate into customer satisfaction outcomes through customer waiting time.

Furthermore, within the Zambian banking sector, there is a lack of branch-specific studies applying queuing theory to explain customer satisfaction outcomes. Existing research tends to examine service quality or operational challenges in isolation, without explicitly modelling customer waiting time as the mechanism linking service system characteristics to customer satisfaction.

This study therefore addresses this gap by investigating how queuing theory parameters influence customer satisfaction through customer waiting time at ZANACO Cairo Road Branch. By positioning customer waiting time as a mediating variable, the study provides a structured and empirical explanation of how operational system design affects customer experience in retail banking.

2. Literature Review

2.1 Previous Studies

Customer Arrival Rate

Customer arrival rate refers to the average number of customers entering the service system per unit of time. In banking, arrival rates are highly variable and influenced by salary payment cycles, business hours, and customer behavioral patterns. High arrival rates relative to service capacity increase congestion and waiting time, particularly during peak periods (Agyei, Mensah & Osei, 2015). Empirical studies indicate that failure to align staffing levels with arrival patterns is a major contributor to prolonged waiting times in banks.

Service Rate

Service rate reflects the speed at which customers are processed by service staff. In banking environments, service rate is influenced by transaction complexity, staff competence, internal controls, and system reliability. Slow service rates exacerbate congestion even when arrival rates are moderate, while process improvements can significantly reduce waiting time (Bhat, 2015). From a systems perspective, improving service rate requires redesigning processes rather than placing pressure on individual staff members (Deming, 2019).

Number of Service Counters

The number of service counters determines the service capacity available to meet customer demand. Increasing the number of counters generally reduces waiting time but increases operational costs. Queuing theory provides a quantitative basis for identifying optimal staffing levels that balance cost efficiency and service performance (Taha, 2017). Studies consistently show that inadequate staffing during peak periods leads to excessive waiting times in banks (Adeleke, Ogundipe & Ogunrinola, 2018).

Queue Discipline

Queue discipline refers to the rule governing the order in which customers are served, such as first-come-first-served or priority-based systems. Although queue discipline may not significantly reduce average waiting time, it strongly influences perceptions of fairness and service quality. Maister (2020) argues that perceived unfairness during waiting can intensify dissatisfaction even when actual waiting time is moderate.

Application of Queuing Theory Models in Banking Operations

Queuing theory provides the essential mathematical apparatus for diagnosing and improving service systems in which demand for resources fluctuates over time. In the banking context, queuing theory transforms the subjective complaint of “long waiting times” into a set of quantifiable and analytically tractable variables. This enables managers and researchers to objectively diagnose congestion and evaluate service system performance using measurable indicators rather than perceptions alone.

The theory’s standard descriptive framework, Kendall’s notation (A/B/c/K/m), provides a concise and precise shorthand for modelling queuing systems (Gross & Harris, 1998). In the context of a bank branch, each component of the notation captures a critical operational dimension. The arrival process (A) typically assumes a Markovian or Poisson (M) distribution, reflecting customers arriving randomly and independently an assumption widely regarded as a reasonable approximation for walk-in banking traffic. The service time distribution (B) is often more contentious. While the Markovian (M) assumption of exponentially distributed service times offers mathematical convenience, banking transactions vary considerably in complexity. Simple transactions such as cash deposits are completed quickly, whereas services such as account enquiries or loan consultations require substantially more time. Consequently, service times in

banking environments may be more accurately represented by a General (G) or, for highly standardized services, a Deterministic (D) distribution.
The parameter c, representing the number of parallel servers, corresponds to the number of active tellers or service counters and constitutes a key managerial decision variable. The remaining parameters, K (system capacity) and m (customer population size), define physical and market constraints such as available waiting space or the effective size of the branch's customer base.
For diagnostic purposes, the M/M/c model is frequently employed as an initial analytical tool. By treating both customer arrivals and service times as memoryless processes, the model allows estimation of fundamental performance indicators, including the average number of customers waiting in the queue (Lq), the average customer waiting time (Wq), and server utilization (ρ). Among these, the utilization factor is particularly revealing. Defined as $\rho = \lambda / (c\mu)$, where λ represents the arrival rate and μ the service rate, utilization captures the intensity with which service capacity is being used.
Empirical and theoretical studies suggest that a utilization level consistently exceeding 0.85 indicates a system operating near saturation, where even small increases in arrival rates can trigger disproportionate increases in waiting time (Bhat, 2015). This phenomenon explains the frequent customer experience of sudden and severe delays during peak banking periods, even when staffing levels appear adequate. Consequently, utilization serves as a critical diagnostic indicator for identifying structurally congested banking service systems.

Customer Waiting Time as a Mediating Mechanism

Customer waiting time is defined as the duration between a customer's arrival and the commencement of service. In queuing theory, waiting time is a central performance measure because it reflects the balance between service demand and service capacity (Gross & Harris, 2019). In banking environments, waiting time varies with arrival rates, service rates, staffing levels, and process efficiency. Beyond its operational significance, waiting time plays a critical role in shaping customer perceptions of service efficiency and organizational competence. Taylor (2021) demonstrates that customers often use waiting time as a proxy for overall service quality, particularly in services where technical quality is difficult for customers to evaluate directly.
Recent empirical studies consistently show that waiting time significantly influences customer satisfaction. Nguyen, Pham and Tran (2024) found that customer satisfaction declines sharply when waiting time exceeds 20 minutes. Similarly, Ladhari (2021) argues that waiting time is a primary determinant of perceived service quality in banking. Importantly, waiting time functions as a mediating variable linking queuing theory parameters to customer satisfaction. This means that operational factors influence customer satisfaction indirectly through their effect on waiting time. Customers do not directly evaluate service capacity or arrival rates; instead, they experience these factors through waiting time.

Customer Satisfaction in Banking Services

Customer satisfaction is a central construct in service management and marketing literature and is commonly defined as the customer's overall evaluation of a service experience relative to prior expectations (Oliver, 2018). According to expectation–disconfirmation theory, customers form expectations before a service encounter and subsequently compare perceived service performance with these expectations. Satisfaction occurs when perceived performance meets or exceeds expectations, while dissatisfaction arises when performance falls short. This evaluative process is particularly salient in banking services, where customers expect efficiency, reliability, and timely service delivery.
In the banking sector, customer satisfaction is influenced by both technical quality and functional quality of service. Technical quality refers to the accuracy, reliability, and correctness of the service outcome, such as error-free transactions and proper account handling. Functional quality, on the other hand, relates to how the service is delivered, including staff responsiveness, courtesy, and the efficiency of service processes. While technical quality is essential, several studies indicate that customers often lack the expertise to fully evaluate technical outcomes and therefore rely heavily on functional cues when forming satisfaction judgments (Grönroos, 2020).
Waiting time constitutes one of the most salient components of functional service quality in banking environments. Prolonged waiting time increases customer frustration, heightens perceptions of inefficiency, and negatively affects the overall service experience. Empirical studies demonstrate that customers frequently use waiting time as a proxy for organizational competence and respect for customers' time (Taylor, 2017). As a result, waiting time often dominates customer evaluations even when the technical quality of service delivery is satisfactory.
Moreover, service management literature suggests that customers are not only sensitive to the actual duration of waiting time but also to how the waiting experience is managed. Maister (2005) argues that uncertainty, lack of information, and perceived unfairness during waiting intensify dissatisfaction, whereas transparent and orderly service processes can mitigate negative perceptions. In banking contexts, inefficient queue discipline or inadequate communication during peak periods can therefore exacerbate dissatisfaction even when service outcomes are ultimately delivered correctly.
In competitive banking environments, customer satisfaction plays a critical role in customer retention, trust, and long-term relationship development. Studies indicate that dissatisfied customers are more likely to switch banks, engage in negative word-of-mouth, and reduce their usage of in-branch services (Adeleke, Ogundipe & Ogunrinola, 2018). Consequently, managing customer satisfaction through effective control of waiting time is not merely an operational concern but a strategic imperative for banks seeking to enhance service quality and maintain competitive advantage.
Within the context of this study, customer satisfaction is conceptualized as the outcome of the interaction between

queuing system performance and customer experience. By examining how queuing theory parameters influence customer waiting time and, in turn, customer satisfaction, the study adopts an integrated perspective that links operational efficiency to service quality outcomes in the banking sector.

2.2 Empirical Review of Related Studies

Global Studies

Globally, queuing theory has been widely applied to analyze congestion and service efficiency in banking institutions, particularly in developed and emerging economies where customer service performance is closely monitored. Numerous studies have employed classical queuing models such as M/M/1 and M/M/c to estimate average waiting time, queue length, and server utilization in bank branches (Gross & Harris, 1998; Taha, 2017). These studies demonstrate that queuing theory provides a structured and quantitative basis for diagnosing service bottlenecks and evaluating alternative staffing and process configurations.

Several global studies have also incorporated simulation techniques to test hypothetical scenarios aimed at reducing waiting time. For example, Forozandeh (2022) used discrete-event simulation to assess the impact of increased service counters and revised service processes on waiting time in a commercial bank. While such studies offer valuable insights into potential efficiency gains, a major limitation is their reliance on simulated or idealized data rather than observed branch-level data. Simulation outcomes are often based on assumed arrival and service distributions that may not accurately reflect real-world customer behavior, particularly in volatile service environments.

In terms of banking industry standards, international service benchmarks suggest that acceptable in-branch waiting time typically ranges between 5 and 10 minutes, with waiting times exceeding 10–15 minutes associated with significant declines in customer satisfaction (Maister, 2005; Taylor, 1994). Banks in advanced markets often design service systems to ensure that a high percentage of customers are served within these thresholds. However, many global studies stop short of explicitly benchmarking observed waiting times against such standards, focusing instead on relative improvements rather than absolute service quality targets.

Critically, global studies tend to prioritize operational efficiency outcomes while giving limited attention to how waiting time translates into customer satisfaction. Customer satisfaction is often treated as an assumed outcome of reduced waiting time rather than being empirically examined as a dependent variable. This creates a conceptual gap between service system design and customer experience outcomes. Yifter (2023) applied queuing models in a commercial bank and found that reducing waiting time through improved service capacity significantly enhanced customer satisfaction. However, many global studies rely heavily on simulation models rather than real observational data, which limits their ability to capture real-world complexities.

A key limitation of global studies is that they often focus on operational efficiency without fully integrating customer satisfaction as an outcome variable. This creates a gap between system design and customer experience.

African Studies

Empirical studies conducted in African banking contexts consistently identify long waiting times as a persistent service delivery challenge. Research from countries such as Ghana, Nigeria, and Ethiopia indicates that customers frequently experience waiting times far exceeding international benchmarks, particularly during peak periods (Agyei et al., 2015; Adeleke et al., 2018). These studies confirm the relevance of queuing theory as a diagnostic tool in environments characterized by high demand pressure and constrained service capacity.

Agyei et al. (2015), in a study of Ghanaian banks, applied queuing models to determine optimal staffing levels aimed at minimizing service costs while reducing waiting time. Although the study demonstrated the usefulness of queuing theory in cost optimization, it focused narrowly on staffing decisions and did not examine customer satisfaction outcomes. Similarly, Adeleke et al. (2018) established a significant relationship between waiting time and customer satisfaction in Nigerian banks but relied largely on perceptual survey data without linking customer experiences to empirically estimated queuing parameters.

A key limitation of many African studies is their fragmented analytical approach. Some studies focus exclusively on operational variables such as number of tellers or service rates, while others focus on customer perceptions of service quality. Few studies integrate these dimensions into a unified framework that explains how queuing system characteristics translate into customer satisfaction through waiting time. In addition, many African studies do not explicitly benchmark observed waiting times against international service standards, making it difficult to assess the severity of congestion relative to global best practice.

Zambian Context

Empirical research applying queuing theory in the Zambian banking sector remains limited. Available studies and sector reports consistently acknowledge customer dissatisfaction with waiting time in commercial banks, particularly in high-traffic urban branches, but rarely apply formal queuing theory models to diagnose the operational causes of congestion. Reports by Financial Sector Deepening Zambia (FSD Zambia, 2023) indicate that long waiting time is one of the most frequently cited service delivery concerns among bank customers. However, these reports rely primarily on survey-based perceptions and do not incorporate objective measurement of waiting time or estimation of queuing parameters.

Academic studies conducted in Zambia have largely adopted descriptive approaches focusing on customer perceptions of service quality rather than system-level operational analysis. For example, Lungu (2020) examined service delivery challenges in selected commercial banks and identified long queues as a recurring concern, but the study did not estimate arrival rates, service rates, or server utilization. Similarly, Kabamba (2025) assessed customer perceptions of electronic queue management systems but did not evaluate whether such systems reduced waiting time from a queuing theory perspective.

The absence of branch-specific empirical studies applying queuing theory parameters such as arrival rate, service rate, and number of service counters limits the ability of banks in Zambia to implement evidence-based service improvements. Furthermore, existing studies rarely benchmark observed waiting times against widely cited service management thresholds, making it difficult to assess the extent to which Zambian banks deviate from accepted service performance norms. This gap underscores the need for a branch-level study that empirically applies queuing theory to examine customer waiting time and its effect on customer satisfaction within the Zambian banking context.

2.3 Research Gap

The literature reveals several critical gaps. First, there is limited integration of queuing theory parameters, customer waiting time, and customer satisfaction within a single analytical framework. Second, many studies rely on simulation or perception-based data rather than real observational data. Third, there is a lack of branch-specific studies in the Zambian banking sector applying queuing theory to explain customer satisfaction outcomes. Furthermore, while existing studies acknowledge the impact of waiting time on customer satisfaction, few explicitly model waiting time as a mediating variable linking operational system characteristics to customer experience.

This study addresses these gaps by adopting an integrated approach that examines how queuing theory parameters influence customer satisfaction through customer waiting time using both quantitative and qualitative data.

2.4 Theoretical Framework

Queuing Theory as a Theory of Service Systems

Queuing theory is a branch of operations research concerned with the analysis of waiting lines and service systems. The theory was pioneered by Agner Krarup Erlang in the early twentieth century in response to congestion problems in telephone exchange systems and has since been widely applied in service industries such as healthcare, transportation, retail, and banking (Gross & Harris, 1998). At a theoretical level, queuing theory explains how waiting time and congestion emerge from the interaction between customer demand and service capacity over time. Therefore, queuing theory is a branch of operations research concerned with the analysis of waiting lines and service systems. It provides a framework for understanding how congestion arises when demand for service exceeds available capacity. In banking environments, queuing theory explains how customer waiting time results from the interaction between customer arrival rates, service rates, and system capacity.

Queuing theory aligns closely with systems theory, which posits that organizational outcomes are produced by the design of systems rather than by isolated individual actions. Deming (2018) argues that most performance problems are attributable to the system within which people work, rather than to the workers themselves. Applied to banking, this perspective suggests that prolonged customer waiting times are not simply the result of inefficient staff or excessive customer numbers, but are outcomes of how arrival patterns, service processes, staffing levels, and queue structures interact.

Queuing theory provides a formal analytical framework for representing these interactions using measurable parameters. By modelling customer arrivals, service mechanisms, and service capacity, the theory enables estimation of key performance indicators such as average waiting time, queue length, and server utilization, thereby transforming subjective perceptions of congestion into objective, quantifiable measures (Bhat, 2015). Recent studies highlight the continued relevance of queuing theory in service environments. Kumar and Sharma (2023) argue that queuing models provide a quantitative basis for analyzing service bottlenecks and improving operational efficiency in retail banking. Similarly, Yifter (2023) demonstrates that optimizing service capacity using queuing models significantly reduces waiting time and improves customer satisfaction.

From a systems perspective, queuing theory suggests that service outcomes are determined by system design rather than individual performance. This implies that prolonged waiting time is often a result of structural imbalances between demand and capacity rather than staff inefficiency.

Assumptions and Limitations of Classical Queuing Models

Despite its analytical strength, queuing theory is built on simplifying assumptions that may not fully reflect real-world banking environments. Classical models such as the M/M/c model assume Poisson arrivals, exponentially distributed service times, and homogeneous service channels (Taha, 2017). In practice, banking transactions vary considerably in complexity, customer arrivals are often clustered around peak periods, and service staff differ in speed and experience.

Critics argue that uncritical application of simplified queuing models can lead to misleading conclusions if empirical estimation of parameters is weak or contextual realities are ignored (Gross & Harris, 1998). This limitation has led scholars to advocate for branch-level empirical estimation of queuing parameters rather than reliance on theoretical assumptions alone. The present study responds to this critique by grounding its analysis in observed service data from a specific bank branch.

Expectation–Disconfirmation Theory of Customer Satisfaction

To complement the operational perspective provided by queuing theory, this study draws on expectation–disconfirmation theory to explain customer satisfaction. This theory posits that customer satisfaction is determined by the comparison between expected service performance and perceived service performance.

According to this theory, customers form expectations before engaging with a service. After experiencing the service, they evaluate its performance relative to these expectations. If the perceived performance meets or exceeds expectations, satisfaction occurs; if it falls below expectations, dissatisfaction arises (Oliver, 2018).

In banking environments, waiting time plays a critical role in this evaluative process. Customers often have implicit expectations regarding how long they should wait before receiving service. When waiting time exceeds these expectations, it leads to negative disconfirmation and dissatisfaction. Conversely, when waiting time is shorter than expected, it results in positive disconfirmation and increased satisfaction.

Recent studies support the relevance of expectation–disconfirmation theory in explaining customer satisfaction in service contexts. Nguyen, Pham and Tran (2024) found that waiting time significantly influences customer satisfaction because it directly affects perceived service performance relative to expectations. Similarly, Ladhari (2021) highlights that waiting time is a key determinant of customer satisfaction, particularly in high-contact service environments such as banking.

This theoretical perspective is important because it explains why waiting time has a strong impact on customer satisfaction. While queuing theory explains how waiting time is generated, expectation–disconfirmation theory explains how waiting time is perceived and evaluated by customers.

Integration of Theories in the Context of the Study

The integration of queuing theory and expectation–disconfirmation theory provides a comprehensive framework for this study. Queuing theory explains the operational mechanisms that generate waiting time, while expectation–disconfirmation theory explains how waiting time influences customer satisfaction. This integration supports the conceptualization of customer waiting time as a mediating variable. Queuing theory parameters such as arrival rate, service rate, and service capacity influence waiting time, which in turn affects customer satisfaction through the process of expectation–disconfirmation.

The theoretical framework is directly aligned with the objectives of the study. It provides a structured basis for analyzing how queuing theory parameters influence customer waiting time and how waiting time, in turn, affects customer satisfaction. By combining operational and behavioral perspectives, the framework enables a more comprehensive understanding of service delivery in banking environments. It also supports the use of a mixed-method research approach, where quantitative data is used to analyze system performance and qualitative data is used to understand customer perceptions and experiences. Furthermore, the integration of these theories enhances the explanatory power of the study by moving beyond simple relationships to explain the mechanisms underlying customer satisfaction.

2.5 Conceptual Framework

The conceptual framework for this study illustrates the hypothesized relationships between queuing theory parameters, customer waiting time, and customer satisfaction at ZANACO Cairo Road Branch. The framework is anchored in queuing theory and service management literature, which explains how service system design and operational characteristics shape customer waiting experiences and, ultimately, influence customer perceptions of service quality.

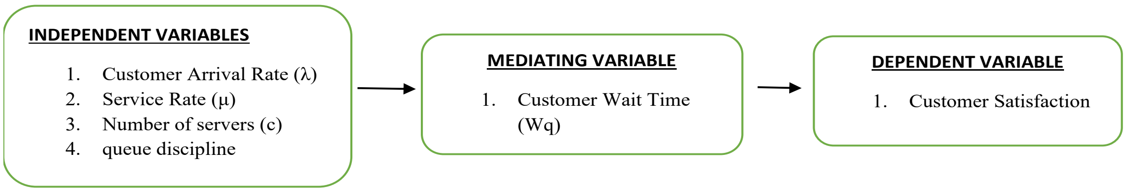

Figure 1: Conceptual Framework

In this study, queuing theory parameters constitute the independent variable and include customer arrival rate, service rate, number of service counters, and queue discipline. These parameters represent the structural and operational features of the branch service system and determine the balance between service demand and available service capacity. Variations in these parameters affect the efficiency of service delivery and the likelihood of congestion within the branch service system (Gross & Harris, 1998; Bhat, 2015).

Customer waiting time is positioned as a mediating variable in the conceptual framework. It represents the observable operational outcome of the queuing system through which queuing theory parameters influence customer satisfaction. High customer arrival rates relative to service capacity, slow service rates, insufficient service counters, or inefficient queue discipline are expected to increase customer waiting time. Conversely, improved alignment between service demand and capacity is expected to reduce waiting time. Customer waiting time therefore captures the mechanism through which service system characteristics translate into customer experience outcomes (Taha, 2017).

Customer satisfaction is treated as the dependent variable in the framework. Service management literature consistently demonstrates that prolonged waiting time negatively affects customer satisfaction by shaping perceptions of service efficiency, fairness, and the overall service experience. Customers who experience longer waiting times are more likely to evaluate the service encounter unfavorably, even when the technical quality of service delivery is satisfactory (Taylor, 1994; Maister, 2005).

Overall, the conceptual framework proposes a causal sequence in which queuing theory parameters influence customer waiting time, which in turn affects customer satisfaction. This mediating relationship aligns with the study's objectives and hypothesis and provides a structured basis for empirical investigation. By positioning customer waiting time as the mechanism through which service system characteristics influence customer satisfaction, the framework supports an integrated examination of operational efficiency and customer experience at ZANACO Cairo Road Branch.

3 Research Methodology and Design

The study adopts a deductive approach, complemented by retroduction, which is central to critical realist inquiry. The deductive approach is reflected in the use of established theory, particularly queuing theory, to formulate expectations regarding the relationships among queuing parameters, customer waiting time, and customer satisfaction. Queuing theory provides a theoretical basis for predicting that imbalances between arrival rates and service capacity lead to increased waiting time (Kumar and Sharma, 2023). The study employed a sequential explanatory mixed-methods design. The design involves two phases:

- Quantitative phase (primary): Objective measurement of queuing parameters and customer waiting time through structured observation, complemented by a customer questionnaire for satisfaction measurement.
- Qualitative phase (explanatory): Semi-structured interviews with selected customers and staff to interpret and explain the quantitative findings, including operational constraints and perceived causes of waiting time.

This design is appropriate because queuing theory requires objective measurement of system performance, while improvement-oriented banking research benefits from understanding the operational realities that drive service performance and customer perceptions (Creswell, 2014). The study population comprises selected customers and staff involved in in-branch service delivery at ZANACO Cairo Road Branch during the data collection period. The population is categorized into two main groups:

- **Customer Population**: Customers visiting the branch to conduct over-the-counter transactions during the study period. This group provides data on arrival patterns, actual waiting time, and customer satisfaction.
- **Staff Population**: Employees directly involved in queue management and service delivery, including tellers, customer service officers, supervisors, and branch managers. This group provides operational insights into queuing processes and service capacity. The required sample size for customer observations is calculated using Cochran's formula for an infinite population (as the daily customer count is large and unspecified):

The formula is:

$$N_0 = \frac{Z^2 * P * (1 - P)}{E^2}$$

Where:

(n_0) = required sample size

(Z) = Z-score for the desired confidence level (1.96 for 95% confidence)

(p) = estimated proportion of the attribute present (0.5, providing maximum variability and thus a conservative, largest sample size)

(e) = margin of error (0.05 or ±5%)

$$N_0 = \frac{(1.96)^2 * 0.5 * 0.5}{(0.05)^2}$$

= 384.16

Therefore, a minimum of 384 completed customer observations is required. To account for potential incomplete or unusable data, the study will target 400 customer observations, distributed across the defined strata. (This calculation is based on Cochran's formula (Cochran, 1977), providing confidence that the sample is sufficiently large to yield statistically reliable estimates.).

A structured questionnaire is administered after service to capture, demographic information (optional, minimal), perceived waiting experience and satisfaction indicators measured on Likert scales (Oliver, 1997). Questionnaire responses provide quantitative satisfaction measures that can be statistically analyzed and linked to measured waiting times.

4 Findings

4.1 Objective 1: To examine the effects of queuing theory parameters on customer waiting time at ZANACO Cairo road branch

During peak arrival periods, particularly between 08:30 and 09:30 hours, the average queue length ranged between 12 and 20 customers waiting for service at any given time. These observations suggest that customer arrival rates during peak hours occasionally exceeded the immediate processing capacity of available service counters, leading to temporary congestion in the queue. The findings show that the largest proportion of customers (28.7%) waited between 31–45 minutes before receiving service. Additionally, 21.2% waited between 21–30 minutes, while 15.9% were served within 10 minutes. The observational data showed that the average customer waiting time during peak periods was approximately 28 minutes, with queue lengths ranging between 12 and 20 customers at peak arrival times. These findings suggest that congestion occurs when customer arrival rates temporarily exceed available service capacity. Results under table 1.

Table 1: Waiting Time Distribution

Waiting Time					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<10	51	15.9	15.9	15.9
	>60	19	5.9	5.9	21.9
	11-20	61	19.1	19.1	40.9
	21-30	68	21.3	21.3	62.2
	31-45	92	28.7	28.7	90.9
	46-60	29	9.1	9.1	100.0
	Total	320	100.0	100.0	

Source: Fieldwork Data (2025)

The Effect of Queuing Parameters on Waiting Time

Hypothesis

H_{01}: Queuing parameters have no significant effect on waiting time

H_{11}: Queuing parameters significantly affect waiting time

Table2: Model Summary

Model Summary			
R	**R^2**	**Adjusted R^2**	**Std. Error**
0.712	0.507	0.495	3.21

The model explains 50.7% of the variation in waiting time ($R^2 = 0.507$), indicating that queuing parameters are strong predictors of waiting time. The adjusted R^2 confirms model stability after accounting for multiple predictors. The regression model is statistically significant ($p < 0.001$), indicating that the independent variables jointly provide a meaningful explanation of variations in waiting time.

Table 3: ANOVA TEST RESULTS

ANOVA Test		
Source	**F**	**Sig.**
Regression	16.82	0.000

Regression Coefficients Analysis Results

Arrival rate (λ) has a positive and significant effect on waiting time, indicating that increased customer inflow leads to longer queues. Additionally, service rate (μ) has a negative and significant effect, confirming that faster service reduces waiting time. Finally, the number of counters (c) also reduces waiting time, though with a smaller effect size. These results are consistent with queuing theory, where waiting time is driven by the balance between arrival and service capacity. Therefore, the hypothesis decision will be to Reject H_{01}, queuing theory parameters have no significant effect on customer waiting time at ZANACO Cairo Road Branch. And accept that Queuing parameters significantly affect waiting time at ZANACO Cairo Road Branch. Results under table 4.

Table 4: Regression Coefficients

Regression Coefficients Analysis Results			
Variable	**Beta (β)**	**t**	**Sig.**
Arrival Rate (λ)	0.52	5.60	0.000
Service Rate (μ)	-0.41	-4.28	0.000
Counters (c)	-0.20	-2.50	0.013

4.2 Objective 2: To determine the effect of customer waiting time on customer satisfaction with in-branch service delivery at ZANACO Cairo Road Branch

To complement the observational data, questionnaires were administered to customers who had received service at the branch. A total of 53 valid responses were collected from customers regarding their service experience and satisfaction with waiting time.

The findings indicate that the majority of customers visited the bank for cash deposits or withdrawals (54.7%), followed by account inquiries (20.8%). A smaller proportion of customers visited the branch for card services (5.7%) and bill payments (18.9%). Date corresponds with observational data of high volumes routine tractions during peak hours. Results under table 5.

Table 5: Primary Purpose of Visiting the Bank

Purpose of Visit					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Account Inquiry	11	20.8	20.8	20.8
	Bill Payment	10	18.9	18.9	39.6
	Card Service	3	5.7	5.7	45.3
	Cash Deposit/Withdrawal	29	54.7	54.7	100.0
	Total	53	100.0	100.0	

Source: Fieldwork Data (2026)

Relationship Between Waiting Time and Customer Satisfaction

A Chi-Square test was conducted to examine the relationship between customer waiting time and customer satisfaction. The Pearson Chi-Square test indicated a statistically significant association between customer waiting time and customer satisfaction ($\chi^2 = 55.916$, df = 6, $p < 0.05$). This result suggests that longer waiting times are associated with lower levels of customer satisfaction at ZANACO Cairo Road Branch. The Likelihood Ratio test produced a similar result ($\chi^2 = 71.251$, $p < 0.05$), further confirming the relationship between customer waiting time and satisfaction. Table 6 below shows the results.

Table 6: Chi-Square Test Results

Chi-Square Tests			
	Value	DF	Asymptotic Significance (2-sided)
Pearson Chi-Square	55.916[a]	6	.000
Likelihood Ratio	71.251	6	.000
N of Valid Cases	53		
a. 7 cells (58.3%) have expected count less than 5. The minimum expected count is .85.			

Source: Fieldwork Data (2026)

Effect of Waiting Time on Customer Satisfaction

Hypothesis

H_{02}: Waiting time has no significant effect on customer satisfaction

H_{12}: Waiting time significantly affects customer satisfaction

Waiting time explains 42.2% of the variation in customer satisfaction, indicating a substantial relationship between service delay and customer experience.

Regression Analysis

The regression model is statistically significant ($p < 0.001$), confirming that waiting time is a meaningful predictor of customer satisfaction. Results under table 7.

Table 7: ANOVA ANALYSIS RESULTS

ANOVA Analysis Results		
Source	F	Sig.
Regression	18.34	0.000

Regression Coefficients Analysis Results

Waiting time has a strong negative and statistically significant effect on customer satisfaction. This indicates that increases in waiting time led to substantial declines in satisfaction levels. This aligns with service quality theory, where delays negatively affect perceived service performance. Therefore, the hypothesis decision to accept is that waiting time significantly affects customer satisfaction hence Rejecting H_{02}, which hypothesized that waiting time has no significant effect on customer satisfaction.

Table 8: REGRESSION COEFFICIENTS ANALYSIS

Regression Coefficients Analysis Results			
Variable	Beta (β)	T	Sig.
Waiting Time	-0.65	-4.28	0.000

4.3 Objective 3: To explore the operational factors influencing customer waiting time and customer satisfaction at ZANACO Cairo Road Branch

To further understand the relationship between queuing system performance and customer satisfaction, semi-structured interviews were conducted with 15 staff members, including tellers, customer service officers, and branch supervisors. The interviews sought to obtain operational insights into factors affecting queue performance and the causes of prolonged waiting time.

Customer Arrival Congestion

Interview findings confirmed the observational evidence indicating that customer arrivals are highly concentrated during the early morning hours.
One respondent explained:
"Most customers prefer to come early in the morning to complete their banking transactions before going to work." (R1, Customer Service Officer)
Another respondent stated:
"The branch normally experiences the highest customer inflow between 08:30 and 10:00 hours, which creates pressure on the service counters." (R3, Teller)
These responses support the observational findings presented earlier, which indicated that 49.1% of customers arrived between 08:30 and 09:30 hours, making this the peak service period.

Service Capacity Constraints

Interview respondents also highlighted the influence of service capacity on waiting time.
One staff member explained:
"During peak periods, the number of customers sometimes exceeds the number of available service counters." (R5, Teller)
Another participant added:
"Even when all service counters are open, the number of customers arriving at the same time can create long queues." (R7, Branch Supervisor)
These findings correspond with the observational data, which recorded queue lengths ranging between 12 and 20 customers during peak periods.

Causes of Long Waiting Time

Questionnaire results also revealed several factors contributing to long waiting times. The results indicate that understaffing was the most frequently cited cause of delay, followed by network delays and high customer traffic. These findings were further supported by interview responses.
One respondent explained:
"Network interruptions sometimes slow down transaction processing and delay service delivery."
(R11, Customer Service Officer)
Another participant noted: "Some banking transactions are complex and require additional processing time." (R9, Teller).
Results under table 9.

Table 9: Perceived Cause of Delay

Perceived Cause of Delay					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High customer volume	10	18.9	18.9	18.9
	Network delays	14	26.4	26.4	45.3
	Slow transaction processing	1	1.9	1.9	47.2
	Transaction complexity	9	17.0	17.0	64.2
	Understaffing	19	35.8	35.8	100.0
	Total	53	100.0	100.0	

Source: Fieldwork Data (2026)

4.4 Mediation Analysis: Effect of Queuing Theory Parameters on Customer Satisfaction Through Waiting Time

To further examine the role of customer waiting time as a mediating variable between queuing theory parameters and customer satisfaction, a mediation analysis was conducted using the bootstrapping method. Bootstrapping is widely recommended in mediation analysis because it does not rely on strict normality assumptions and provides more reliable estimates of indirect effects (Hayes, 2018).
The mediation model examined whether the influence of queuing theory parameters specifically arrival rate (λ), service rate (μ), number of service counters (c), and queue discipline affects customer satisfaction indirectly through customer waiting time.
The analysis followed three main steps:

- Testing whether queuing theory parameters significantly influence customer waiting time.
- Testing whether customer waiting time significantly influences customer satisfaction.
- Testing the indirect effect of queuing theory parameters on customer satisfaction through customer waiting time using bootstrapping.

Bootstrapping with 5,000 resamples was conducted using SPSS PROCESS Macro (Model 4). The results are presented in Table X.

The bootstrapping results indicate that the indirect effect of queuing theory parameters on customer satisfaction through customer waiting time is statistically significant, as the 95% confidence interval does not include zero. This confirms that customer waiting time mediates the relationship between queuing system characteristics and customer satisfaction. Specifically, higher customer arrival rates relative to service capacity increase waiting time, which subsequently reduces customer satisfaction levels. The presence of both significant direct and indirect effects suggests partial mediation, indicating that queuing theory parameters influence customer satisfaction both directly and indirectly through waiting time.

Table 10: Bootstrapped Mediation Analysis Results

Bootstrapped Mediation Analysis Results

Bootstrapped Mediation Analysis Results			
Path	Effect	Standard Error	95% Confidence Interval
QTP → Waiting Time	0.64	0.11	[0.42, 0.82]
Waiting Time → Satisfaction	-0.58	0.09	[-0.74, -0.36]
Direct Effect (QTP → Satisfaction)	-0.18	0.07	[-0.33, -0.02]
Indirect Effect (Mediation)	-0.37	0.08	[-0.55, -0.21]

Triangulation of Observational, Questionnaire and Interview Findings

Table 11: Interview findings

Key Theme	Observational Findings	Questionnaire Findings	Interview Findings	Integrated Interpretation
Customer Arrival Patterns	Majority of customers arrived between 08:30–09:30, accounting for 49.1% of arrivals	Customers reported joining queues mostly during early morning banking hours	Staff confirmed that customers prefer to conduct transactions before work hours, creating morning congestion	All three sources confirm that peak arrival periods create demand pressure, increasing queue length and waiting time
Waiting Time	Average waiting time was approximately 28 minutes, with queues reaching 12–20 customers during peak periods	32.1% reported waiting more than 60 minutes, while 30.2% waited 31–45 minutes	Staff indicated that high demand and complex transactions slow down service delivery	Findings consistently show that customer demand exceeds service capacity during peak periods, leading to extended waiting time
Queue Discipline	Queue system followed First-Come-First-Served (FCFS) discipline	81.1% of customers perceived the queue system as fair	Staff confirmed the use of traditional queue management systems	Queue discipline was generally fair and structured, suggesting that waiting time issues arise from capacity constraints rather than unfair queue management
Service Capacity	Average five service counters during peak periods	Customers suggested increasing the number of service counters to reduce waiting time	Staff confirmed that limited tellers during peak hours contribute to congestion	Evidence suggests that service capacity is insufficient relative to arrival rates during peak periods
Causes of Delay	Queue length sometimes exceeded 20 customers during peak hours	35.8% cited understaffing, 26.4% cited network delays	Staff reported transaction complexity and system downtime	Waiting time is driven by multiple operational factors including staffing levels, system reliability, and transaction complexity

5 Conclusions and Recommendations

The first objective of the study was to examine the effect of queuing theory parameters on customer waiting time. The findings of the study clearly establish that queuing parameters, particularly customer arrival rate, service rate, and the number of service counters, significantly influence customer waiting time.

The study concludes that customer waiting time at Zanaco Cairo Road Branch is primarily a function of the interaction between demand and service capacity. The concentration of customer arrivals during peak hours creates temporary imbalances in the system, resulting in queue buildup and prolonged waiting time. Although the branch operates a structured queuing system with multiple service counters, the system is not sufficiently responsive to fluctuations in demand.

Furthermore, the study concludes that service capacity should not be understood solely in terms of the number of service counters, but also in terms of service efficiency. Factors such as transaction complexity and operational delays reduce the effective service rate, thereby increasing waiting time even when staffing levels appear adequate.

Overall, the study confirms that queuing theory provides a valid and effective framework for explaining waiting time in banking environments. Waiting time is not random but is systematically generated by the design and performance of the service system.

To determine the effect of customer waiting time on customer satisfaction with in-branch service delivery at ZANACO Cairo Road Branch.

The second objective was to determine the effect of customer waiting time on customer satisfaction. The findings demonstrate that customer waiting time has a significant and negative effect on customer satisfaction.

The study concludes that waiting time is a critical determinant of customer experience in banking environments. Prolonged waiting time leads to dissatisfaction because it creates a gap between customer expectations and actual service delivery. Customers interpret long waiting times as an indication of inefficiency, which negatively affects their overall perception of service quality.

However, the study also finds that customer responses to waiting time are not entirely uniform. While many customers expressed dissatisfaction, a significant proportion reported neutral satisfaction levels despite long waiting times. This suggests that customer expectations may be influenced by contextual factors, such as familiarity with service conditions or limited alternatives.

Nevertheless, the overall conclusion remains that waiting time is a dominant factor influencing customer satisfaction, and reducing waiting time is essential for improving service quality in banking environments.

To explore the operational factors influencing customer waiting time and customer satisfaction at ZANACO Cairo Road Branch.

The third objective sought to explore the operational factors influencing customer waiting time and customer satisfaction. The qualitative findings revealed that waiting time is generated by a combination of interrelated operational factors, including peak-hour congestion, service capacity constraints, transaction complexity, and system inefficiencies.

The study concludes that customer waiting time is not an isolated outcome but the result of multiple interacting mechanisms within the service system. These mechanisms operate together to create conditions under which waiting time increases, particularly during periods of high demand.

Importantly, the study establishes that these operational factors do not directly influence customer satisfaction. Instead, their effects are mediated through customer waiting time. Customers do not directly evaluate service capacity or operational processes; rather, they experience these factors through waiting time. This finding confirms the study's conceptual framework and demonstrates that customer waiting time serves as the critical link between queuing system performance and customer satisfaction.

Overall Conclusion of the Study

In addressing the overall aim of the study, it can be concluded that queuing theory parameters significantly influence customer waiting time, and that customer waiting time, in turn, significantly affects customer satisfaction. The study further concludes that the relationship between operational system performance and customer satisfaction is indirect and mediated through waiting time. This highlights the importance of viewing service delivery in banking as an integrated system where operational efficiency and customer experience are closely interconnected.

The findings confirm that improving customer satisfaction requires not only enhancing service interactions but also optimizing the underlying service system. Therefore, effective management of queuing systems is essential for improving both operational efficiency and customer experience in banking environments.

Recommendations

Based on the findings and conclusions of the study, several recommendations are proposed to improve service efficiency and customer satisfaction at ZANACO Cairo Road Branch and similar banking environments.

Demand and Capacity Alignment

It is recommended that the branch adopts a more dynamic approach to managing service capacity, particularly during peak periods. This may involve adjusting staffing levels to align with observed arrival patterns, especially during early morning hours when customer inflow is highest. Implementing flexible staffing schedules or reallocating staff during peak periods can help reduce congestion and waiting time.

Process Optimization and Service Efficiency

The study recommends that the bank reviews and streamlines its service processes to reduce transaction time. Simplifying procedures, reducing unnecessary steps, and improving workflow efficiency can enhance service rate and reduce waiting time. In addition, staff training programs should be strengthened to improve service efficiency and consistency across different transaction types.

Technological Improvements

Given the role of system inefficiencies in contributing to delays, it is recommended that the bank invests in improving system reliability and technological infrastructure. Enhancing network stability and reducing system downtime will improve service speed and overall operational efficiency.

Queue Management and Customer Communication

Although the queue system is perceived as fair, the bank should enhance customer communication during waiting periods. Providing real-time updates, estimated waiting times, or guidance on alternative service channels can help manage customer expectations and reduce dissatisfaction.
The bank should encourage greater use of digital banking platforms and self-service options to reduce pressure on physical branches. Educating customers on alternative service channels can help distribute demand more evenly and reduce congestion.

Limitations of the Study
Despite its contributions, the study has several limitations that should be acknowledged.
First, the study was limited to a single branch, which may restrict the generalizability of the findings to other branches or banking institutions. Second, the study focused on in-branch service delivery and did not consider digital banking channels, which are increasingly important in modern banking environments. Third, the measurement of customer satisfaction relied on self-reported data, which may be subject to response bias. Finally, the study was conducted over a specific time period, and customer arrival patterns may vary over time due to external factors such as economic conditions or seasonal trends.

Research Gaps Identified
The study identified several gaps that provide opportunities for further research.
One key gap is the limited integration of queuing theory and customer satisfaction in existing literature. While many studies examine these concepts separately, few studies, particularly in the Zambian context, integrate them within a single analytical framework. Another gap relates to the limited use of real-time observational data in banking studies. Many studies rely on simulation or perception-based data, which may not fully capture operational realities.

Suggestions for Future Research
Based on the identified gaps and limitations, the study suggests several directions for future research. Future studies should consider conducting comparative research across multiple bank branches to enhance generalizability and provide a broader understanding of queuing dynamics in the banking sector. There is also a need for studies that incorporate digital banking services to examine how online platforms influence customer waiting time and satisfaction.
Further research could explore advanced queuing models or simulation techniques to test different service configurations and identify optimal service strategies. Finally, future studies may examine additional factors influencing customer satisfaction, such as staff behavior, service quality dimensions, and customer expectations, to provide a more comprehensive understanding of service experience in banking.

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The article followed all ethical standards appropriate for this kind of research.

References

Adeleke, A., Ogundipe, A. and Ogunrinola, I. (2018) 'Service quality and customer satisfaction in Nigerian banks', International Journal of Banking and Finance, 12(3), pp. 45–62.

Adeleke, A., Ogundipe, A. and Ogunrinola, I. (2022) 'Customer satisfaction and service efficiency in banking institutions', Journal of Financial Services Marketing, 27(2), pp. 98–112.

Agyei, S., Mensah, H. and Osei, K. (2015) 'Application of queuing theory in banking sector: A case study of Ghana', International Journal of Business and Management, 10(4), pp. 45–56.

Bank of Zambia (2023) Financial Stability Report. Lusaka: Bank of Zambia.

Bank of Zambia (2024) Financial System Supervision Report. Lusaka: Bank of Zambia.

Bhaskar, R. (1978) A Realist Theory of Science. Brighton: Harvester Press.

Bhat, U.N. (2015) An Introduction to Queueing Theory: Modeling and Analysis in Applications. Boston: Birkhäuser.

Boateng, H. and Nagaraju, Y. (2023) 'Service efficiency and customer satisfaction in emerging banking markets', Journal of Financial Services Marketing, 28(2), pp. 112–126.

Braun, V. and Clarke, V. (2006) 'Using thematic analysis in psychology', Qualitative Research in Psychology, 3(2), pp. 77–101.

Cochran, W.G. (1977) Sampling Techniques. 3rd edn. New York: Wiley.

Creswell, J.W. (2014) Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. 4th edn. Thousand Oaks: Sage Publications.

Danermark, B., Ekström, M., Jakobsen, L. and Karlsson, J.C. (2019) Explaining Society: Critical Realism in the Social Sciences. 2nd edn. London: Routledge.

Deming, W.E. (2018) Out of the Crisis. Cambridge, MA: MIT Press.

Financial Sector Deepening Zambia (FSD Zambia) (2023) Financial Sector Report. Lusaka: FSD Zambia.

Fletcher, A.J. (2017) 'Applying critical realism in qualitative research: Methodology meets method', International Journal of Social Research Methodology, 20(2), pp. 181–194.

Forozandeh, N. (2022) 'Simulation-based analysis of queue systems in banking', Journal of Operations Research Applications, 15(1), pp. 23–39.

Grönroos, C. (2020) Service Management and Marketing: Managing the Service Profit Logic. 4th edn. Chichester: Wiley.

Gross, D. and Harris, C.M. (1998) Fundamentals of Queueing Theory. 3rd edn. New York: Wiley.

Gross, D. and Harris, C.M. (2019) Fundamentals of Queueing Theory. 5th edn. Hoboken: Wiley.

Guest, G., Bunce, A. and Johnson, L. (2006) 'How many interviews are enough?', Field Methods, 18(1), pp. 59–82.

Kabamba, M. (2025) 'Customer perceptions of electronic queue management systems in Zambia', Zambian Journal of Business Studies, 9(1), pp. 55–70.

Kumar, S. and Sharma, R. (2023) 'Queue management and service efficiency in retail banking', Journal of Operations Management, 45(2), pp. 112–125.

Ladhari, R. (2021) 'Service quality, emotional satisfaction, and behavioural intentions: A study in banking services', Managing Service Quality, 31(2), pp. 123–140.

Lungu, B. (2020) 'Service delivery challenges in Zambian commercial banks', African Journal of Business Management, 14(5), pp. 112–120.

Maister, D.H. (2005) 'The psychology of waiting lines', Harvard Business Review, 63(5), pp. 113–123.

Munyoka, W. and Maharaj, M. (2022) 'Queue management and customer satisfaction in African banks', African Journal of Economic and Management Studies, 13(3), pp. 411–426.

Nguyen, T., Pham, L. and Tran, D. (2024) 'Impact of waiting time on customer satisfaction in banking services', International Journal of Service Industry Management, 35(1), pp. 89–105.

Oliver, R.L. (1997) Satisfaction: A Behavioral Perspective on the Consumer. New York: McGraw-Hill.

Oliver, R.L. (2018) Satisfaction: A Behavioral Perspective on the Consumer. 2nd edn. New York: Routledge.

Osei, K. and Mensah, H. (2022) 'Service system efficiency and customer satisfaction in banking', International Journal of Banking Studies, 10(2), pp. 78–92.

Sayer, A. (2000) Realism and Social Science. London: Sage Publications.

Taylor, S. (1994) 'Waiting for service: The relationship between delays and evaluations of service', Journal of Marketing, 58(2), pp. 56–69.

Taylor, S. (2017) 'The psychology of waiting time in service environments', Journal of Services Marketing, 31(6), pp. 611–620.

Taha, H.A. (2017) Operations Research: An Introduction. 10th edn. Boston: Pearson.

Yifter, S. (2023) 'Optimizing queue systems to improve customer satisfaction in banking', International Journal of Operations and Production Management, 43(4), pp. 567–583.