JAFMD ISSN 2714-2574 Volume 9 Number 2 June 2026

Journal of Accounting, Finance and Management Discovery

Volume 9 Number 2 June 2026

AUTILIZATION OF QUEUING THEORY AND THE OPERATIONAL PERFORMANCE OF TRANSPORT COMPANIES IN NIGERIA.

THOMAS AYOBAMI BABARINDE
Department of Accounting and Finance, Mountain Top University,
Ogun State, Nigeria
tababarinde@mtu.edu.ng

OLADELE JOHN AKINYOMI
Department of Accounting and Finance, Mountain Top University,
Ogun State, Nigeria
ojakinyomi@mtu.ed.ng

&

JOSHUA ODUTOLA OMOKEHINDE
Department of Accounting and Finance,Mountain Top University,
Ogun State, Nigeria
joomokehinde@mtu.ed.ng

Abstract

The study explored the impact of queuing theory on the operational efficiency of chosen transportation firms in the southern region of Nigeria in response to the persistent queues encountered by travellers in the travel and tourism industry of the economy. A survey design was utilised, with 200 respondents evenly drawn from the staffs of the five major transport companies in Nigeria. The primary data for the study were collected using a validated structured questionnaire. A regression analysis at the 0.05 level of statistical significance was used to test the hypotheses in line with the study's objectives. The result revealed that queuing theory has a significant outcome on the operational performance of transport companies in Nigeria. In view of the findings, the study conclude that the number of servers, how people wait in line, and how long people have to wait have a big effect on the quality of service and operational efficiency of transportation companies. Contrarily, the number of servers, the rules for waiting in line, and the length of time people had to wait had a big effect on operational costs, making them inefficient. In these results, among others, the study recommends transportation enterprises employ a cost-benefit analysis approach to assess the feasibility of utilising queuing theory prior to implementing any requisite measures.

Keywords: *transport, traveller, queuing theory, servers, waiting time, operational performance.*

Introduction

Managing lines is an important part of transportation businesses because it keeps people and goods moving smoothly and quickly. In the transportation industry, lines can form at places like ticket counters, security checkpoints, entrances, and areas where people get their bags. Improper handling of these lines may result in delays, customer dissatisfaction, and safety hazards. Effective line management can enhance productivity, reduce delay periods, and improve client satisfaction for transport enterprises. Thamrin (2020) suggests that businesses can identify periods of heightened demand by analysing consumer travel patterns and allocating resources accordingly. It is suggested that the implementation of multiple security lines or an increase in staffing at ticket booths during peak periods may be beneficial.

Line management systems can be utilised to monitor the movement of individuals or goods. These systems offer up-to-date information on wait times and queue lengths. (Mike, 2021). This can aid enterprises in identifying resource allocation and growth opportunities.

In the context of an epidemic, the implementation of queue management systems can aid transportation companies in upholding social distancing protocols and complying with health and safety regulations. (Alsalem, 2022). The implementation of automatic wait management systems by companies can potentially mitigate the necessity for face-to-face interactions among commuters, minimise traffic congestion, and improve overall transportation safety. Yadav and Sohani (2019) noted that neglecting a short queue could result in its expansion into a longer one, emphasising the necessity of waiting time management. According to Fakokunde, Mustapha, and Aremu (2016), queues emerge as a result of a disparity between the demand and supply of a service.

Consequently, a significant number of patrons perceive queuing as an irksome or objectionable experience. (Mike, 2021). The negative experience of queuing has the potential to adversely affect a consumer's overall impression of a specific organisation. The manner in which managers address the matter of extended queues will have a significant impact on the long-term success of their enterprises. So, it is very important for the financial health of transportation businesses to know how to handle waiting times well. By implementing effective queue management techniques and leveraging technology, businesses have the potential to enhance productivity, reduce wait times, and enhance customer satisfaction, all while prioritising the safety of both customers and staff. Thamrin (2020) asserts that a line control system confers numerous advantages to both service providers and consumers. One potential benefit is the significant improvement of client experience, as well as the potential increase in organisational efficiency and the provision of valuable data for informed decision-making by companies and organisations.

Statement of the Problem

Tourists in Nigeria are often observed to experience extended waiting periods. The issue of extended waiting periods for both departure and entry at the transportation hub has recently become a matter of concern among travellers. These queues have resulted in the squandering of time and resources, adverse health effects for certain travellers, and even fatalities due to fainting and perishing while waiting in line. (Adigun, 2018). Waiting in line can be frustrating and a waste of time for people who use public transportation. Waiting in line for transportation can be difficult and take up a big chunk of a customer's day. During busy times, clients may have to wait longer than usual, which can be frustrating and cause them to miss important appointments or events. Waiting in line can be annoying, especially if the weather is bad or the waiting area is full. When customers feel like they don't have any control over a situation, they may feel helpless and angry. Customers can waste time waiting in line if they have to wait in more than one line or if they don't know where to go. This could lead to longer wait times and make people feel even more frustrated and irritated. It is possible that customers may encounter challenges and discomfort when queuing for transportation.

Research has shown that the use of a single-line and multiple-server system in the financial industry to deal with waiting times has not been completely successful. (Adedoyin, Alawaye, & Taofeek, 2014; Amos, Kenneth, & Onuche, 2015; Wallace, Christian, & Frank, 2015). Thus, transit companies can alleviate these discomforts, enhance productivity, and decrease wait times by furnishing precise and unambiguous information, improving waiting areas, and streamlining the queuing process.

Purpose of the Study

Based on the above problems, the study aimed at evaluating the following objectives:

1. To establish the impact of waiting time on the operational performance of transport companies in Nigeria.
2. To evaluate the influence of queuing discipline on the operational performance of transport companies in Nigeria.
3. To examine the impact of the number of servers on the operational performance of transport companies in Nigeria.

Research Questions

In line with the above specific objectives, the following research questions were posed.

1. What is the impact of waiting time on the operational performance of transport companies in Nigeria?
2. What is the influence of queuing discipline on the operational performance of transport companies in Nigeria?
3. What is the impact of the number of servers on the operational performance of transport companies in Nigeria?

Hypotheses

Concerning the above research questions and goals, the following null hypotheses were tested at the 0.05 statistical significance level.

Ho_1: Waiting time has no substantial effect on the operational performance of transport companies in Nigeria.

Ho_2: Queuing discipline has no favourable impact on the operational performance of transport companies in Nigeria.

Ho_3: The number of servers has no substantial influence on the operational performance of transport companies in Nigeria.

Literature Review

Conceptual Review

Queuing theory

Erlang, a scholar, was interested in the problem of phone lines getting clogged up, so he did research on it in the early 1900s. (Zavanella, Zanoni, Ferretti & Mazzoldi, 2015) The field of queuing theory, which is a relatively new area within the applied theory of probability, has been expanded upon based on this foundational concept. The discovery of queuing theory has proven to be a valuable tool for the progress and enhancement of various practical scientific and social domains. (Abiodun, 2017). The queuing theory was initially employed to address problems related to telephone conversations by categorising them into customers and servers, where the former refers to the telephone calls and the latter to the telephone connection. (Arifin, Probowati, & Hastuti, 2015). The concept was further elucidated in the context of a computing system, wherein the Central Processing Unit (CPU) assumes the role of the server, while the task inputted into the computer is regarded as the client. Queuing theory is currently utilised in diverse computer processes to evaluate performance and sustain competitiveness within the swiftly growing realm of communication services.

Consequently, it exhibits a wide spectrum of potential uses. (Ammar, 2016). The proposal to employ quantitative line models was put forth through the use of queuing theory to address the problem of traffic congestion at intersection points. (Kelathodi, Prosad, & Pratim 2019).

Queueing theory is a quantitative field of study that looks at standing lines and how they work. Boucher and Couture-Piché (2015) say that queuing theory is a way to use analysis to look at lines or lineups that cause delays. The model makes it easier to figure out how different processes, like stopping at a queue, waiting in line, and getting service from a server, work together. (Bishop, Okagbue, Oguntunde, Opanuga, & Odetunmibi, 2018). Queuing theory is a methodology utilised for conducting cost analysis. The majority of companies are unable to operate in a manner that guarantees the absence of queues for their patrons, as such an approach would either be prohibitively expensive or indicative of a limited customer base. (CFI, 2022). In order to establish their business functions, organisations use queuing theory to strike a balance between the cost of client service and the time delay incurred by customers waiting in line. The constituents of a gathering are primarily comprised of the individuals present in the queue and the calibre of the service they anticipate receiving. In scholarly investigations pertaining to the phenomenon of waiting, it is commonly partitioned into the following classifications:

Arrival:

This is the way in which consumers queue or wait in line. According to CFI's (2022) guidelines, factors to consider regarding the presence of individuals at a waiting area encompass variables such as the customary quantity of people who frequent the location during a designated timeframe, such as one hour. Fluctuations in traffic or entries during different times of the day, days of the week, or months are interrelated factors.

The Queue:

This deals with the functionality or structure of the queue. What is the mechanism of motion exhibited by the line? This forms the basis of the argument. The inquiry posed acknowledges that the characteristics of human behaviour are a vital element of queuing theory, as recognised by the CFI (2022). The crux of the matter pertains to evaluating the advantages and disadvantages of adopting a queuing system that funnels customers through a solitary line to four unique cashier stations, as opposed to having four individual lines at each station, in order to provide prompt and efficient customer service. This could potentially impact customer satisfaction regarding the services they receive.

Service:

This is the procedure for giving the client the assistance they are expecting. The typical time it takes to serve each customer or client, the number of workers needed for optimal practical and financial effectiveness, and the regulations regulating the sequence in which customers are given are additional variables that affect the real provision of service. Even though "first-come, first-served" lines are common, some companies should not use this system. (CFI, 2022).

Leaving:

This is the act of departing the queue's place. As a result, companies that provide a drive-through service must take into account how customers exiting the drive-through may affect customers accessing the company's parking area.

Queue Discipline:

Queue discipline pertains to the prioritisation principle governing the provision of service to travellers, specifically the sequence in which items are attended to. Adigun (2018) has identified two primary categories of service for travellers, namely pre-emptive priority and non-pre-emptive priority. Pre-emptive priority involves arranging the items in the queue in such a way that the item with the highest priority in the system is served first, without any displacement of items in service. On the other hand, non-pre-emptive priority occurs when the last item in the system is served first.

Operational Performance

Operational performance goals refer to the specific areas of operational efficiency that a business aims to advance in order to attain its business objectives. (LaMarco, 2019). Upon outlining its business strategy, a business shall identify the relevant practical performance goals and establish the necessary infrastructure to attain its goals. Operational success can be best described as the ability of diverse business groups to collaborate effectively in order to enhance productivity. (Andriiuk, 2021).

In other words, this refers to the phase during which various departments within an organisation collaborate in order to attain specific corporate goals. Consequently, the aim of operational performance management is to facilitate the synchronisation of various departments, ensuring that all personnel collaborate effectively to safeguard the organisation's interests and navigate towards crucial business goals. The term "operational performance" encompasses a wide range of activities undertaken by a company to ensure the efficacy of each department, both independently and in collaboration with other departments. Enhancing organisational efficiency is a primary area of focus for numerous companies globally. It could be argued that this proposition appears to be straightforward. Nevertheless, numerous enterprises encounter difficulties in improving their organisational efficiency. Many businesses tend to limit their focus solely on revenue and expenses, which can impede their ability to enhance organisational performance beyond their expectations. While total and net revenue provide an overview of a company's financial well-being, they do not offer insights into the operational efficiency and effectiveness of its day-to-day business activities.

To summarise, the process of enhancing business efficiency encompasses a broader range of factors. Hence, it is imperative for management to take into account individuals, procedures, and mechanisms to define accurate and feasible performance targets and formulate a technique to attain them. (Andriiuk, 2021). Nevertheless, numerous enterprises encounter difficulties in improving their organisational efficiency beyond their initial expectations. Organisations frequently limit their focus to the financial aspects of revenue and expenditures, thereby complicating the process of enhancing overall performance beyond their initial expectations. While total and net revenue provide an overview of a company's financial well-being, they do not offer insights into the operational efficiency and effectiveness of the business on a day-to-day basis. It is important to write down, keep track of, and evaluate different parts of operational successes to make sure that the right amount of resources are used. Identifying appropriate performance indicators that relate to both internal and external factors impacting an organisation's achievement is a critical aspect of this procedure. (Greasley, 2008). As per Neely's (2008) publication titled "Business Performance Measurement: Unifying Theory and Integrating Practise," the operational performance objectives can be classified into five major categories, namely speed, quality, expense, adaptability, and reliability. Organisations commonly implement a predetermined set of metrics to efficiently evaluate and improve their operational efficiency.

Speed in operations:

The target of measuring speed is to figure out how quickly a business can make its products and estimate how many sales it will make. This objective has to do with things like how long it takes to study and create a new product, as well as how long it takes to make and manage one or more of the enterprise's goods. (LaMarco, 2019). In contemporary times, where time is considered a valuable commodity, swiftness holds a crucial position in determining consumer loyalty and decision-making. The prompt delivery of requested goods or services is positively correlated with customer satisfaction and the likelihood of repeat business. (Andriiuk, 2021). The expeditious dispatch of goods or services is indicative of proficient execution of a company's organisational tactics, thereby implying its commendable performance. The pursuit of speed is a primary objective for corporations in their efforts to develop performance enhancement strategies.

However, on occasion, external factors may present obstacles to achieving this goal.

Quality of Service/Product:

The fundamental aspect of achieving high quality is executing tasks with precision and accuracy. By prioritising quality, a company can maintain a consistent level of customer satisfaction. The visual representation of a product or service is often the primary point of contact for consumers, and as such, it has the potential to significantly impact a company's success or failure. The quality of a service is often evaluated based on the extent to which it adheres to specific requirements. (LaMarco, 2019).

However, it can be argued that there are additional factors to consider in alignment with the topic at hand. (Neely, 200). The product's success is contingent upon several factors, including the attractiveness of its features, its reliability and durability, the ease of maintenance, its efficacy in fulfilling its intended function, and the consumer's perception of its value. All of these indicators are relevant to quality.bThis goal looks at how happy customers are with the value they get for their money and how good the goods or services are that different businesses offer. The very idea of quality has a distinct connotation in every company and sector for the simple reason that you evaluate various things. (Andriiuk, 2021).

For instance, if a business produces goods or products, the calibre of its procedural performance is closely correlated with the standard of the commodities it provides to the final client.

Cost effectiveness:

This goal looks at how much the unit cost of a product changes based on changes in a number of factors, such as the number and types of goods. (LaMarco, 2019). When there are more kinds of products, unit prices tend to go up and sales go down, and vice versa.This will eventually affect how much the product costs to make, how much it sells for, and how much money it could make. One of the final objectives for many companies is to increase their profit margin, and there are two typical methods to do so. (Andriiuk, 2021). In the first situation, companies must make significant efforts to redesign numerous internal procedures that influence business performance. The second choice entails more cost-cutting and less performance development planning. As a result, by reducing the expense of some business processes, companies can boost their profit margins while also decreasing the cost of their final goods and services for consumers, increasing their level of competition.

However, it's equally crucial to take into account how such cost-cutting tactics may impact the quality of the services or products they provide.

Flexibility in operation:

Flexibility in the context of business refers to a company's capacity to adapt to change and shift course as necessary. (Greasley, 2008). This can include expanding production to keep up with an increase in demand or launching new services to adapt to changing client demands. Flexibility as a performance goal may improve reliability, reduce costs, and accelerate reaction times. Flexibility would enable manufacturing enterprises to quickly adjust to a customer's requests. Let's say a company decides there is a place for a new function or a new category of service based on the demands of its target market. (Greasley, 2008). The degree of its operational excellence is shown by its ability to meet those demands. Flexible operations may set up product lines to meet a variety of criteria and can also swiftly adapt these product lines to new requirements. (LaMarco, 2019). The latter is likewise directly connected to the speed goal. A business should be able to manufacture several high-quality product types and modify its processes to accommodate various market circumstances and delivery deadlines.

Dependability of operational performance:

This operational performance goal assesses the organisation's dependability in terms of providing items to clients on time and in line with budgeted expenses and pricing. Another indicator of a product's reliability is how well it performs consistently over a reasonable amount of time. (LaMarco, 2019). Because it has the potential to either improve or diminish the level of confidence your consumers have in you, dependability is a key operational performance target. The degree of dependability demonstrates how likely a company is to keep the promises and commitments it makes to its customers. The degree of dependability of a corporation will be shown by whether or not it follows through on its promises and really fulfils them. Here, a poor operational performance indicator will raise a warning for the client and serve as a reminder to the company that a change is necessary.

Empirical Review

Dragovic and Zrnic did a study in 2011 that looked at how queueing models can be used to measure how well a port works. The research shows that the use of queueing models has made it easier to judge how well a port is doing in many ways. Some of these are faster development, more flexibility, less need for data, and simpler results that are easier to understand and analyse.

The study conducted by Nuhu and Anosike (2014) employed the multi-server technique of modelling to develop a statistical model aimed at tackling the problem of traveller queuing at the Nnamdi Azikiwe International Airport (NAIA), situated in Abuja, the capital city of Nigeria. The present study involved the development and replication of a statistical waiting model utilising data collected from four distinct air transportation companies. The sample included two domestic carriers, namely Arik Airline and Aero Contractor Limited, as well as two foreign airlines. (British Airways and Ethiopian Airlines).

According to the findings, there was an insufficient number of aircraft to effectively cater to the airport's mean of 21,863 domestic and international passengers per month. At a significance level of 5%, the system required a modelling service factor of 0.5 (utilisation factors of 0.4, 0.6, and 0.9). The exercise revealed that, in light of the current carrying capacity of the aircraft, an additional aircraft is required for each foreign carrier to effectively meet the daily customer demand at Nnamdi Azikiwe International Airport in Abuja. The requirement was for an additional five aircraft to be allocated to each local carrier on a daily basis. The study by Umaru (2019) uses the first-come, first-served model, which is a multi-queue, multi-server queuing model with infinite capacity, to solve the problem of congestion in Nigerian ports. The research highlights the potential of queueing theory models in addressing this problem. The aforementioned activity is carried out at the Apapa seaport located in Lagos, Nigeria. The performance indicators of the multi-queue, multi-server waiting model were computed and evaluated. The study involved the computation of performance indicators for the single-queue multi-server model that is currently in use at the general goods container facility located in the Apapa harbour. The findings indicate that the suggested model has the potential to decrease the mean count of vessels in the system (including those in the queue and at berth), the mean length of the queue, the mean waiting duration of vessels in the queue, and the mean waiting duration of vessels in the system by a maximum of 73%, 93%, 78%, and 93%, correspondingly. The findings of the study indicate that the multi-queue, multi-server waiting model is the recommended strategy to mitigate the problem of ship overcrowding at Nigerian ports. This assertion holds particular validity as the proprietors of the harbour perceive its cost-effectiveness as a highly attractive attribute.

Mwangi and Ombuni did a study in 2015 on how long people have to wait at the JKUAT Office's finance department. The study showed that students had to wait a long time for service, which made the unit less efficient. Their claim is that the current competitive business environment is slowly turning modern society into one that is more focused on services. Service operations management grew out of the fact that a company's customer satisfaction and service management skills gave it a competitive edge in the market. Experts in the field of business operations management are interested in waiting because of this.

Chuka, Ezeliora, Okoye, and Obiafudo's study from 2014 looked at how queueing theory could be used in a business setting. FirstBank was at the centre of their investigation. The results of the investigation into the waiting system showed that the business didn't have enough computers to keep up with the demand for the services it offered. It has been said that there is a need for five computers instead of the three servers that are already there. The proposition says that the number of employees needs to go up in order to provide excellent customer service. This implies that the customers experienced a prolonged waiting period before receiving assistance.

According to all of this literature, there hasn't been any current research in the road transport companies to ascertain the impact of queuing theory on the operational performance of these businesses in Nigeria. This research was done based on these premises.

Methodology

This study employed a survey research design as its methodology. A survey research design was used because the study attempted to obtain primary data to investigate queuing theory and the operational performance of selected transport companies in Nigeria. To achieve this goal, two hundred (200) participants were chosen at random from five (5) major road transport companies within southern Nigeria.

Similarly, the study used a validated survey form to obtain data. The reliability of the instrument was ascertained through Cronbach's alpha, and a coefficient of 0.87 was obtained, implying that the instrument is reliable. The obtained data were analysed in line with the research objective using regression analysis, which was performed with the aid of Eviews 10 statistical software. Specifically, the study attempts to establish the impact of the application of queuing theory on the quality of service, speed of operation, and cost effectiveness of the transport firms in Nigeria.

Model Specification

The study used waiting time, the number of servers, and queuing discipline as proxies for the application of queuing theory. On the other hand, quality of service, cost effectiveness, and speed of operation were used as proxies for the operational performance of transport companies. Thus, three different models were used to predict the impact of queuing theory on the operational performance of transport companies in Nigeria.

The model for the study is specified thus:

Operational Performance = $\beta_0 + \beta_1 WT + \beta_2 QD + \beta_3 NS + \mu$

$QS = \beta_0 + \beta_1 WT + \beta_2 QD + \beta_3 NS + \mu$ ……………………………………..(eqn1)

$CE = \beta_0 + \beta_1 WT + \beta_2 QD + \beta_3 NS + \mu$ ……………………………………..(eqn2)

$SO = \beta_0 + \beta_1 WT + \beta_2 QD + \beta_3 NS + \mu$ ……………………………………..(eqn3)

Where: OP = operational performance Dependent variables

QS = quality of service (proxies for operational performance)
CE = cost effectiveness
WT = waiting time
QD = queuing discipline
NS = number of servers
μ = error term

Independent variables
(proxies for queuing theory)

Results
Regression Analysis
Model One: Least Squares

Dependent Variable: QUALITY_OF_SERVICE
Included observations: 200

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
C	3.558652	0.971737	3.662155	0.0003
NUMBER_OF_SERVERS	-0.152924	0.093811	-1.630123	0.1047
QUEUING_DISCIPLINE	0.388748	0.069908	5.560853	0.0000
WAITING_TIME	0.541892	0.078671	6.888119	0.0000

R-squared	0.504336	Mean dependent var	16.42500
Adjusted R-squared	0.496749	S.D. dependent var	2.199674
S.E. of regression	1.560453	Akaike info criterion	3.747627
Sum squared resid	477.2626	Schwarz criterion	3.813593
Log likelihood	-370.7627	Hannan-Quinn criter.	3.774322
F-statistic	66.47635	Durbin-Watson stat	2.368849
Prob(F-statistic)	0.000000		

Model one above predict the impact of queuing theory on the quality of services provided by road transport companies in Nigeria. The table demonstrates that the proxies are important considerations in queuing theory, and as a result, the quality of service variable is evaluated at 3.559. This implies that, when all other parameters are held constant, the quality of services provided by transport firms will significantly improve by 3.559 units due to the characteristics that were taken into account in this study. But the independent variables number of servers, queuing discipline, and waiting time show beta coefficients of -0.1529, 0.3887, and 0.5419, respectively.

Based on this, a change of one unit in the number of servers would cause a small drop in the quality of services offered by transportation companies of -0.1529. Also, a change in how people wait in line (queue discipline) and how long they have to wait would make the quality of services offered by road transport companies better by 0.3887 and 0.5419, respectively. The adjusted r-square of 0.4967 means that changes in the independent variables can explain 49.67% of the changes in the quality of services. Also, the Durbin-

Watson statistic of 2.3688 is within the acceptable range of 2.00, which means that there is no autocorrelation.

Lastly, the F-statistic of 66.47635 and the p-value of 0.001 less than 0.05 alpha show that queuing theory has a big effect on the quality of services provided by road transport companies in Nigeria. So, the null hypothesis, which says that queuing theory doesn't have a big effect on the quality of service given by transportation companies in Nigeria, is not true.

Model Two: Least Squares

Dependent Variable: COST_EFFECTIVENESS

Included observations: 200

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
C	-4.558504	0.793370	-5.745751	0.0000
NUMBER_OF_SERVERS	0.460899	0.076592	6.017617	0.0000
QUEUING_DISCIPLINE	0.400388	0.057076	7.014996	0.0000
WAITING_TIME	0.378051	0.064230	5.885881	0.0000
R-squared	0.804995	Mean dependent var	15.73000	
Adjusted R-squared	0.802011	S.D. dependent var	2.863231	
S.E. of regression	1.274023	Akaike info criterion	3.342034	
Sum squared resid	318.1346	Schwarz criterion	3.408001	
Log likelihood	-330.2034	Hannan-Quinn criter.	3.368730	
F-statistic	269.7013	Durbin-Watson stat	1.978465	
Prob(F-statistic)	0.000000			

The effects of the queuing theory on the cost-effectiveness of road transport companies in Nigeria can be predicted by the second model above. The table shows that the proxies are not important in queuing theory, so the cost effectiveness variable is given a score of -4.5585. This means that if all other factors stay the same, the characteristics that were looked at in this study will cause the cost-effectiveness of transportation companies to drop by 4.5585 units. But the coefficients for the independent variables number of servers, queuing discipline, and waiting time are 0.4609, 0.4004, and 0.3781, respectively.

According to this, if the number of servers, the way people wait in line, or the amount of time they have to wait changed, the operational costs of road transport companies would go up by 0.4609, 0.4004, and 0.3781, respectively. The adjusted r-square of 0.8050 means that changes in the independent variables can explain 80.5% of the changes in operational costs. Also, the Durbin-Watson statistic of 1.978 is within the acceptable range of 2.00, which implies the absence of autocorrelation.

Finally, the F-stat = 269.7013 and p = 0.001 less than 0.05 alpha infer that queuing theory has a significant impact on the operational cost of road transport companies in Nigeria. Therefore, the null hypothesis, which states that queuing theory has no significant impact on the operational costs of road transport companies in Nigeria, is rejected.

Model Three: Least Squares

Dependent Variable: SPEED_IN_OPERATION

Included observations: 200

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
C	1.602972	1.034374	1.549703	0.1228
NUMBER_OF_SERVERS	0.445485	0.099858	4.461179	0.0000
QUEUING_DISCIPLINE	0.019308	0.074414	0.259472	0.7955
WAITING_TIME	0.409500	0.083742	4.890045	0.0000
R-squared	0.612843	Mean dependent var		15.81000
Adjusted R-squared	0.606917	S.D. dependent var		2.649339
S.E. of regression	1.661038	Akaike info criterion		3.872559
Sum squared resid	540.7731	Schwarz criterion		3.938526
Log likelihood	-383.2559	Hannan-Quinn criter.		3.899255
F-statistic	103.4182	Durbin-Watson stat		2.327947
Prob(F-statistic)	0.000000			

Model 3 show how the theory of waiting lines will affect the speed at which road transport companies in Nigeria work. The table shows that proxies are important parts of queuing theory, so the speed operation variable is given a value of 1.6029. This means that, if all other factors stay the same, the factors that were looked at in this study will make transportation companies run much faster by 1.6029 units.

In the same way, the coefficients for the independent variables number of servers, queuing discipline, and waiting time are 0.4454, 0.0193, and 0.4095, respectively. According to this, a change in the number of servers, the way people wait in line, or the amount of time they have to wait would cause the speed of operation of road transport companies to go up by 0.4454, 0.0193, or 0.4095. The adjusted r-square of 0.6069 means that changes in the independent variables can explain 60.6% of the changes in the speed of operation. Also, the Durbin-Watson statistic of 2.3279 is within the acceptable range of 2.00, which means that there is no autocorrelation. Lastly, the F-statistic of 103.4182 and the p-value of 0.001 less than 0.05 alpha show that queuing theory has a big effect on how fast road transport companies in Nigeria work. So, the null hypothesis, which says that queuing theory doesn't have a big effect on how fast road transport companies in Nigeria work, is wrong and must be rejected.

Discussion of Findings

The findings of the analysis indicate that the utilisation of queuing theory has a noteworthy influence on the quality of services rendered by transportation firms. The observed phenomenon can be attributed to the efforts made by the company to minimise customer waiting times in queues, resulting in a noteworthy enhancement of the overall satisfaction levels of passengers towards transportation service providers.

Conversely, it has been determined that the use of queuing theory has led to inefficiencies and elevated operational expenditures for transportation enterprises in Nigeria. The aforementioned phenomenon can be attributed to the efforts of transportation company management to enhance queue management and minimise wait times for customers. The endeavour has led to inefficient expenditures for companies involved in road transportation. The study also found that the speed of operation is significantly influenced by the queue management strategies employed by transportation companies. Transportation companies are able to promptly address customer needs by employing queuing theory. But the current result is in line with what Mwangi and Ombuni (2015) found. They found that service operations management has become more important because it gives companies a competitive edge through customer satisfaction and service operation skills that can be learned by using queuing theory. The aforementioned observation indicates that the application of queuing theory within organisational contexts, such as those found in road transport corporations, possesses the potential to enhance the quality of the products or services they offer.

Conclusion

The present research endeavours to examine the impact of queuing theory on the operational efficiency of transportation firms through empirical analysis. The study identified three distinct independent variables, namely queuing discipline, waiting time, and number of servers, which were then subjected to regression analysis against the dependent variable of operational performance. The primary statistical method employed to assess the impact of the independent variables on the dependent variable was regression analysis. In order to attain the research goal, three models were employed to evaluate three operational performance objectives of firms, namely, service quality, operational speed, and cost efficiency. The results of the study suggest that the number of servers, how people wait in line, and how long people have to wait have a big effect on the quality of service and operational efficiency of transportation companies. On the other hand, the number of servers, the rules for waiting in line, and the length of time people had to wait had a big effect on operational costs, making them inefficient.

Recommendations

Based on the research findings and the resulting conclusion, the following recommendations were proposed:

a) In order to enhance the level of service delivery, it is imperative for road transport enterprises to guarantee adequate server capacity to accommodate client requests, thereby reducing their queue wait time and ensuring their satisfaction. Moreover, this would mitigate the issue of traffic congestion encountered by transportation firms in metropolitan areas where they vie for supremacy over transportation routes.

b) Customers will be loyal to a brand or service if they are happy with the service. Therefore, it is imperative to furnish a comfortable waiting area for travellers during their period of waiting for the arrival of vehicles.

c) In order to enhance customer satisfaction and ensure a pleasant travel experience, it is imperative that personnel receive adequate training to effectively support customers and minimise wait times.

d) In light of the cost ineffectiveness found in this study, it is advisable for transportation enterprises to employ a cost-benefit analysis approach to assess the feasibility of utilising queuing theory prior to implementing any requisite measures.

References

Abiodun, R. O. (2017). Development of Mathematical Models for Predicting Customers Satisfaction in the Banking System with a Queuing Model Using Regression Method, *2(3), 86–91.*

Adigun, A.S. (2018). Application of Queuing Model to Ease Traveler's Flow in Nigerian International Airports. *Journal of Business and Management, 20(8), 17-28*

Alsalem, M. A., Mohammed, R., Albahri, O. S., Zaidan, A. A., Alamoodi, A. H., Dawood, K., Alnoor, A., Albahri, A. S., Zaidan, B. B., Aickelin, U., Alsattar, H., Alazab, M., & Jumaah, F. (2022). Rise of multiattribute decision-making in combating COVID-19: A systematic review of the state-of-the-art literature. *International Journal of Intelligent Systems, 37(6), 3514–3624.*

Ammar, S. I. (2016). Transient solution of an M/M/1 vacation queue with a waiting server and impatient customers. *Journal of the Egyptian Mathematical Society, 25(3), 337–342*

Andriiuk, A. (2021). *7 Steps to Greater Operational Performance When Selling Digital Services.* https://www.forecast.app/blog/operational-performance

Arifin, M. Z., Probowati, B. D., &Hastuti, S. (2015). Applications of Queuing Theory in the Tobacco Supply. *Agriculture and Agricultural Science Procedia, 3, 255–261.*

Bishop, S. A., Okagbue, H. I., Oguntunde, P. E., Opanuga, A. A., & Odetunmibi, O. A. (2018). Survey dataset on analysis of queues in some selected banks in Ogun State, Nigeria. *Data in Brief, 19, 835–841.*

Boucher, J. P., & Couture-Piché, G. (2015). Modeling the number of insureds' cars using queuing theory. *Insurance: Mathematics and Economics, 64, 67–76*.

Corporate Finance Institute CFI (2022). *Queuing Theory.* https://corporatefinanceinstitute.com/resources/accounting/queuing-theory/

Chuka, E. C., Ezeliora, C. D., Okoye, P. U. & Obiafudo, O. J. (2014). Analysis of a Queuing System in an Organization (a case study of First Bank PLC, Nigeria). *American Journal of Engineering Research Vol.3 (2), 63-72*

Dragovic, B. and Zrnic, N.D. (2011).A Queuing Model Study of Port Performance Evolution. ANUL XVIII, NR. 2, ISSN 1453-7397.

Fakokunde, T. O., Mustapha, A.M & Aremu, M. (2016). Understanding the Queuing Theory for Improved Service Delivery: An Entrepreneurial-Mindset Approach. *EJBE Vol. 6(1), 32-46*

Greasley, A. (2008). Operations performance objectives. SAGE Publications Ltd, https://doi.org/10.4135/9781446213025

Kelathodi Kumaran, S., Prosad Dogra, D., & Pratim Roy, P. (2019). Queuing theory guided intelligent traffic scheduling through video analysis using Dirichlet process mixture model. *Expert Systems with Applications, 118, 169–181.*

LaMarco, N. (2019). *Objectives of Operational Performance.* https://smallbusiness.chron.com/objectives-operational-performance-77937.html

Mike, (2021). *The Psychology of waiting in line (queuing if you're British).* https://queue-fair.com/psychology-of-waiting-in-line-queuing

Mwangi, S. K. & Ombuni, T. M. (2015). An Empirical Analysis of Queuing Model and Queuing Behaviour in Relation to Customer Satisfaction at Jkuat Students Finance Office. *American Journal of Theoretical and Applied Statistics, Vol. 4 (4), 233-246.*

Nuhu, A. A. & Anosike, E. N. (2014). Queuing Modelling of Air Transport Passengers of Nnamdi Azikiwe International Airport Abuja, Nigeria Using Multi Server Approach. *Middle-East Journal of Scientific Research, 21(12), 2326-2338,*

Thamrin, D. (2020). *Important factors to consider when choosing a queue management system.* https://www.qmatic.com/blog/important-factors-to-consider-when-choosing-a-queue-management-system

Umaru, M. (2019). Application of queueing theory in tackling the problem of port congestion at Apapa port, Lagos, Nigeria.

Yadav, A. & Sohani, N. (2019). Application of Queuing Theory on a Food Chain. *International Journal of Scientific & Technology Research Vol. 8 (8), 111-116.*

Zavanella, L., Zanoni, S., Ferretti, I., & Mazzoldi, L. (2015). Energy demand in production systems: A Queuing Theory perspective. *International Journal of Production Economics, 170, 393–400.*