

fe: AN APPROACH FOR OPERATIONS EFFECTIVENESS AMONGST PETROL FILLING STATIONS IN PORT HARCOURT RIVERS STATE, NIGERIA

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ABSTRACT

The study empirically determines the correlation that existed between single channel and queuing model and operational effectiveness of petrol filling stations in Obio Akpo and Port Harcourt local areas in Rivers State. The study was necessitated by the increasing queues in the service station leading to a high rate of calling customers waiting time and frequent repair of service facilities. The study adopted a correlation design with the use of questionnaire with a samples size was 87 respondents. Spearman and regression statistical tool was used in testing the hypotheses stated, Findings revealed moderate positive significant correlation among variables studied, and causality was tested using regression analysis, whose beta value ranged from -0.21 to -0.32. The conclusion was instructive at the level of optimality derived in the adoption of queuing model on operations maximization and optimum matrix among studied petrol filling stations in Rivers State. Amongst recommendations was the proactiveness in the prediction of calling customers pick time and the ready to optimize service stations utile by calling customers.

INTRODUCTION

Rendering of service is an aspect of organizational activity that is offered virtually in every day of neither in an exchange of goods or service for money or by passing on information by the service rendering organization to her customers. Most especially, Spafuni, & Koko, (2023) asserted that, sectors of our economy where their enjoyment a high level of monopoly of product where its substitute are rarely found or harness for consumption or commercial purposes and her teeming customers are increasing on a daily basis such as in the case of a petroleum and banking sectors. Often times, Jaimul, & Adebayo, (2023) noted that, service officers of these sector most importantly the petrol filling stations are in the press to optimally satisfy their customer given the time of their arrival to the service station, and as well ensure that their waiting time on the queue is maximally reduced. In our global system, according to Maabea, & Barinie, (2022), also in the work of Ak_celik, (2021), the concept of providing and receiving service are inherent in today's specialized and interdependent world where service organizations are operating at a high level of competition with an objective function geared towards attaining market dominance. Thus, opportunity abound for service rendering organization in ensuring that time required for a customer to wait in the queues before he is served is minimized, reduction in cost metric, and as well idle time associated with service facilities are curbed given a single channel model (Cruz, & MacGregor, 2022). However, queuing theory, which is often known as waiting line theory, was first propounded by A. K. Erlang in 1903 to solve the problem of decongesting telephone traffic (Erol, et al., 2023). In his quest to resolve congestions, he encountered more difficulty most especially during busy periods, where telephone operators were unable to handle the calls the moment they were made, resulting in delayed calls (Keshi, & Patonu, 2023). A. K. Erland directed his first efforts at finding the delay for one operator and later on the results were extended to find the delays of several operators. The field of telephone traffic was further developed by Molins in 1927 and Thornton D-Fry in 1928. Then after World War II, it was now extended to other general problems (Richwell, 2021).

2. Problem of the Study

Operations among the petrol filling station in Port Harcourt has been grossly influenced as a result of increase in the use of petroleum product for the purposes of domestic, commercial and industrial use. Apparently, increase in demand for the product has increased service capacity and at the same time placed pressure on service facilities leading to frequent repair, and cost burden in the industry. Hence, the high rate of queue experienced among major petrol filling stations in Port Harcourt was as a result of few service facilities with standard regulatory measure and when there is low demand and service facilities are sub-optimally utilized (idle) over a period of time. It was contingent on these problems for the system would require a scheduled arrival time and evaluate service facilities that would optimally serve in order to bring a balance between cost reduction and customer's satisfaction

3. Conceptual Framework

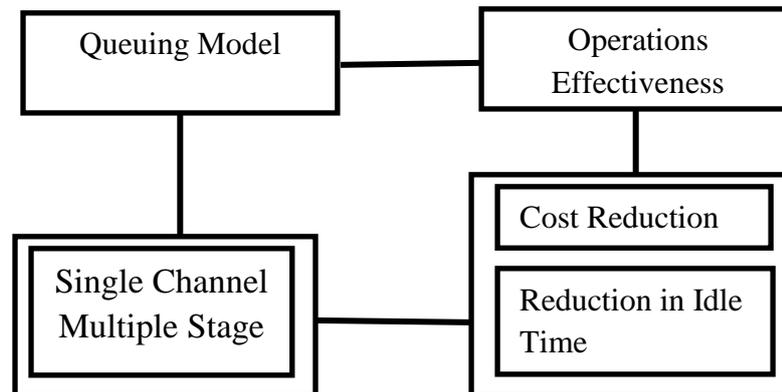


Figure 1. Researchers Conceptualization (2024)

4. Aim and Objectives of the Study

1. To determine the relationship that exist between single channel and cost reduction among filling stations in Port Harcourt, Rivers State
2. To determine the relationship that between single channel and reduction in idle time among filling stations in Port Harcourt, Rivers State.

5. Research Questions

1. What is the relationship between single channel and cost reduction among filling stations in Port Harcourt, Rivers State?
2. What is the relationship between single channel and reduction in idle time cost reduction among filling stations in Port Harcourt, Rivers State?

6. Statement of Hypotheses

1. There is no significant relationship between single channel and cost reduction among filling stations in Port Harcourt, Rivers State
2. There is no significant relationship between single channel and reduction in idle time cost reduction among filling stations in Port Harcourt, Rivers State

7. Scope of the Study

Content Scope: the study was basically centered on the variables and dimension identified, which includes queuing, operations effectiveness, single channel, cost and idle time reduction.

Geographical Scope: this consisted of major petro filling station with the minimum of six (6) service facility points located with Obio Akpor and Port Harcourt in Rivers State.

Unit of analyses: this study was purely at organizational level, where only managers were considered; hence it was a macro study.

8. Conceptual Review

One of the functional objections of operations manager is to ensure that operational activities are optimal, service facilities are effective devoid of sudden break down and interruption that would contribute to man hour loss (downtime). For an organization or individual to optimize satisfaction and achieve her daily activities, Torlu, & Fashola, (2022) avowed that, there exist the likelihood for us to find ourselves in queues, even at the market space, banking hall, shops and mulls, hospitals and care giver centers, driving on the roads (traffic), fast food centers and restaurants, petrol filling stations and gas refilling stations, to mention a few. Also, Davidson (2021) reiterated that, for industrial sectors where heavy equipment and machines are often characterized with sudden break down, wait for repair, telecommunication and telephone exchanges where data and incoming calls wait for service organizations to answer, at traffic lights, etc. Karibi & Ukiavo (2023) pointed out that, we also have queues; even in the education sector most especially public schools and institutions, lecturers and students find themselves in queues as a result of inadequate facilities.

The queuing system of a service organization is often organized in a single service multiple channel as asserted by Abane, (2021), where calling customers form a single line down to the service officer in order to be served. Often cases, as pointed by Cox, (2021), the service station may have a number of service channels, organized in a lateral or matrix form where customers position themselves to be served. In case of horizontal channels, several customers may be served at the same time (Boel & Mihaylova 2023). Also, Hongler & Filliger (2022) opined that, in a situation where the serial form is arranged, it enables calling customer to pass or walk through different service channels from the first down to the last. This system is found during conferences where delegates are required to carry out manual registration from one desk to the other unto the last desk in order to complete their registration process (Marshall, 2021).

In a collaborative view, Sojie, & Waripri (2022), and Jain & MacGregor (2021) posited that, queuing system is often characterized with waiting cost and idle cost, hence it is important for the system to be arranged in a way that would effectively optimize service facilities that would stimulate and reduce these cost. Cruz et al., (2023) alluded that, waiting cost is associated with the time or point of arrival of a customer to a service station and the period or duration he is served or exits the service station. Whereas, Adler et al., (2022) observed that, idle cost is associated with the time or period for which service facilities are not used or put to use. This could be as a result on low calling customers or sudden break down.

9. Theoretical Framework

Stimulation model was found supportive to this study. It was first introduced by John von Neumann, Stanislaw Ulam and Nicholas Metropolis while they were working on the atomic bomb in the 1940s (De Palma & Marcha 2023). Kwekwebe & Ololo, (2023) stated that, Monte Carlo simulation is a problem-solving technique that is used to represent the probability of certain outcomes by running a number of trial runs (called simulations) and using random variables. It is a representation of real-life situations. Terriella & Amakovie (2022) argued that, it is a method in which a replica of a real-world process or system is developed over a period of time. The simulated model acts in the same manner as the selected physical or abstract process or system behaves in reality, and it would require iteration process till the expected number of simulation runs has been generated (Cetin et al., 2023).

The system theory of operations management was also found supportive to this study. The theory was propounded in 1950s by Ludwig von Bertalanffy. The concept for which the theory was based broke out from classical management theory of Fredrick Taylor who viewed organizations as machines and moved toward a more holistic view that sees them as networks of people, procedures and activities (De Schutteret al., 2022). The systems theory of organization is a theory that organizations are composed of many subsystems that aren't necessarily related to one another and yet work together to form the whole. Memeze & Sopriye (2022) posited that, this theory is helpful for understanding things like organizational behavior, organizational change and development of organization in relateness to connectivity of units or components towards optimum maximization of corporate objective.

10. Empirical Review

Akarelu & Edafe (2023) carried out a study on optimizing operational efficiency with the application of multiple - multiple channel of queuing model in Edo state. The objective was to control traffic of calling customers among government hospitals in Benin City. The study adopted a correlation approach with the use of multiple regression statistical tool. A total number of 624 instruments were collected from respondents which consisted of patience at simple random and front desk officers of the respective hospitals. Findings revealed that operational efficiency was increased at 0.34b, 0.45b and 0.26b > 0.00p. Thus, waiting cost and idle time were negatively affected at -0.41 and -0.27.

Makinde, et al., (2023) conducted a study on queuing model: a just application for smoothing operation among shopping malls in Abuja, Nigeria. The aim was to find the relationship that existed between queuing and operations effectiveness 37 shopping malls in the federal capital. The problem was to optimize service facilities as against waiting cost, with a sample size of 74 respondents which were one (1) service attendant and one (1) service supervisor. Spearman statistical tool was adopted, and finding revealed that there was a significant position correlation that existed between dimensions measured at the sign of 0.45, 0.53, 0.42 > 0.00p. The paper concluded that, waiting cost and idle time are index for evaluating efficiency if adequately monitored.

Waribo & White (2023), in their work carried out in Delhi on traffic control among gas station in the city. The study adopted multiple channel – multiple service approach of queuing model among 81 stations in the city. Macro study of unit on analyses was adopted which consisted of 81 service managers as respondents. The correlation approach with the use of regression analyses was adopted. Findings showed that gas station maximized operations efficiency between variables measured at the sign $0.00 \leq 0.65, 0.61, \text{ and } 0.68$ respectively. This indicated a strong positive correlation amongst variables measured; hence the approach optimizes operations utile among gas stations studied.

11. Methodology

The study adopted a correlation design of the quasi experimental research with the use of primary source of date. A total number of 83 managers were sampled as respondents with the use of stratified sampling technique from 83 petro filling stations with both Obio Akpor and Port Harcourt local area. A judgmental approach was adopted in selecting studied petro filing stations; hence it was a census study. The instrument was considered valid at the measure 0.75, while Spearman Rank statistical tool was adopted in combination with regression analyses to determine causality.

12. Correlation Matrix of Bivariate Analyses and Discussion of Findings

A cross dimensional analyses of all variables, using predictor dimensions as against criteria dimensions

Table 1. Bivariate Analyses of Single Channel and Dimensions of Operations Effectiveness

	Cost Reduction	Idle Time Reduction
p - Value	0.31	0.43
2-tailed	0.05	0.05
N	83	83

Source: SPSS 25.00 Output. Field Survey, (2024)

Table 1 clearly indicated and showed the degree of correlation between paired variables. It revealed that single channel multiple stage correlates with cost reduction, idle time reduction at the measure of $0.31 \text{ and } 0.43 \geq 0.05p$. Thus, variables measured are positively significant at a moderate degree.

13. Correlation Matrix of Multivariate Analyses and Discussion of Findings

Analyses of all variables and dimensions across organizations studied.

Table 2. Multivariate Analyses of both variables and Dimensions

	Queuing	Operations Effectiveness	Single Channel	Cost Reduction	Idle Time Reduction
p - Value	0.44	0.36	0.38	0.31	0.43
2-tailed	0.05	0.05	0.05	0.05	0.05
N	83	83	83	83	83

Source: SPSS 25.00 Output. Field Survey, (2024)

Table 2 predicted a positive significant correlation among all variables measured. It depicted positive significant correlation at the measure of 0.44(queuing model); 0.36 (operations effectiveness), 0.38 (single channel multiple stage), 0.31 (cost reduction), and 0.43 (idle time reduction) $\geq 0.05p$. it further revealed the degree of measure for all variables measured at moderate. This inferred that variables measures are all positively significant related for effective operations of petrol filling station studied

Table 3 Linear Regression on all Dependent Variables

Model	B	Beta	t	Sig.
(Constant)	0.31		2.53	0.51
Single Channel	-0.42	-0.34	5.53	0

Source: SPSS 25.00 Output. Field Survey, (2024)

a. Dependent Variable: Cost Reduction

Table 4 Linear Regression on all Dependent Variables

Model	B	Beta	t	Sig.
(Constant)	0.44		0.22	0.47
Single Channel	-0.32	-0.29	6.43	0

Source: SPSS 25.00 Output. Field Survey, (2024)

a. Dependent Variable: Reduction in Idle time

Table 4 showed how the predictor variables influenced the criteria variable in the study. Thus, the regression values both had negative significant value. Thus, at a unit of - 0.42 reductions in single channel multiple stages would affect cost reduction, hence leading to operations ineffectiveness; at the reduction of input of single channel multiple stages to the rate of -0.31 would negatively idle time cost respectively. Menenuba, & Egba, (2022) also elaborated on the use adoption of a single channel multiple stage, how it effective operation would be indicative if its measured margin slops down into negativity. This further proved

that operations effectiveness is minimally optimized at the degrees measured as against suboptimal operations, which is in collaboration with the work of Dallery, & Gershwin, (2022).

14. Conclusion

Queuing model is a very practical approach for optimizing operation effectiveness. Most importantly, it considers or all-inclusive in the determination of variables that plays in ensuring that service station optimizes calling customer's time and satisfaction. From the findings, it was clear that service stations are effective in full capacity utilization of service facilities considering the rate of calling customers and the multiple stage distribution points. Thus, single channel multiple stage approach of queuing model is one best means for determining operations optimality and viability of work operation, considering the organization as in the case of these organizations or sector studied.

15. Recommendation

1. Single channel, multiple stage of would require functional service facilities with a guarantee for low interruptions.
2. The application of queuing is so what complex, given the pace at which calling customers arrives, inter-arrivals and exits the service station
3. Service stations manager would require information that would predict pick hours in order to determine effective strategy to control customer's behavior within the period of service in the service station.

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