

**Queuing Models: A Tool For Assessing The Profitability Of Barbing Salon
Business In Agbor Town Of Delta State, Nigeria.**

¹*Ehiwario, J.C. And* ²*Okafor P.N.*

¹Department of Mathematics
College Of Education, Agbor, Delta State, Nigeria

²Department of Mathematics And Statistics
Institute of Ecumenical Education
In Affiliation With Enugu State University of Technology,
Onitsha Study Centre.

Abstract

The study considered small scale business as an option in reducing the unemployment rate in our society. The study uses queuing models to assess the profitability of barbing salon business in Agbor town of Delta State. The result of the study indicates that the distribution of inter-arrival times, service times, and waiting times are invariant with respect to the time of the day. It was observed that the barbers are idle for 40 percent of the total time. The customer was expected to spend 30 minutes in the system with waiting time and service time of 18 minutes and 12 minutes respectively. The shop opens for 12 hours daily for business with 36 and 10,368 customers demanding for services daily and annually respectively. The business made an annual net profit of N837, 881 with opening capital of N15,100. This indicates 555% rate of return on the capital employed. It was concluded that the business is very profitable and has a solvency/liquidity ratio of 7:1. It was therefore recommended that unemployed youths should avail themselves of the opportunity of low capital requirement to get something doing.

Keywords: queuing model, arrival time, service time, unemployment, barbing salon queuing behaviour, profitability, customer.

Introduction

The rate of restiveness occasioned by high rate of unemployment in our society is alarming. The universities and other higher institutions in Nigeria have designed curricular to meet mainly the manpower needs of government; regarded erroneously as the greatest employer of labour. These designs failed because government at all levels have failed to meet the employment requirements of the teeming youths. The private sectors in various capacities have helped to alleviate the problem. Unfortunately, their capacity to carry the burden is limited by their inability to produce at full capacity as a result of numerous impediments. Most youths are consequently left in a quagmire of being unemployed [1]

The resultant effect of the increasing unemployment rate is social vices and criminality. [2] has the conviction that the federal government is confronted with a lot of problems that have to do with mass unemployment particularly of young school leavers, shelter, insecurity and other social vices that are associated with human trafficking to other countries in search of gainful employment, obtaining by trick otherwise known as the Advance Fee Fraud (419) and so on. He fronted that the problem of unemployment and its attendant effects can only be combated through entrepreneurship development. Sad enough, the government at all levels is not doing anything towards that direction.

Corresponding author: *Ehiwario, J.C.*, E-mail: -, Tel.: +2348034664577

Since the government of Nigeria has failed in providing jobs for her teeming youths, it is imperative to consider and model a small scale business process with low capital requirement that can engage these youths. Rung a Barbing salon is a type of small scale business that does not require a huge sum of money to establish. The first barbing salon was established on a commercial scale in Agbor in 1995 and the number has increased to 227, a rate of 13 per annum. With this growth rate, it is needful to carry out feasibility studies on the business in order to ascertain its profitability.

Purpose of the Study

The general aim of the study is to use the customer flow characteristics to assess the profitability of barbing salon business in Agbor, town of Delta State. While the particular objectives are:

- (i) to determine the distribution and mean rate of arrival of customer per hour and the daily inflow of customers to the shop
- (ii) to ascertain the average number of customers served per hour and the total time spent by a customer at the shop.
- (iii) to estimate the annual income and profit of the business.

Queuing Modeling

The main problem of nearly every waiting line situation in a trade-off-decision. The decision makers must weigh the added cost of producing more rapid services against the inherent costs of customers waiting. In assessing the profitability of barbing salon, it is expedient to also consider customers' satisfaction, and the time spent at the shop [3-6]. The trade-off-decision is straight forward. The decision could simply be reduced to money terms and then the choice is easily made.

There are two types of costs associated with waiting line models-opportunity and frustration costs. The former results when a potential customer having arrived at the facility, found that the queue was too long for him to join and then decided to have his services elsewhere. Consequently, this cost usually leads to lost of revenue on the part of management. On the other hand, frustration cost, is incurred when a potential customer returned after he had left the queue because of long queue. Here, the management does not lose anything but the entire economic system does.

Assumptions of the Model

The number of customers arriving at the salon is assumed to be Poisson distributed. This implies that the arrival occurs one at a time from a finite source and there was no fixed schedule for customer arrivals, so customers flow is random. Consequently, the inter-arrival times will be exponentially distributed. The further implication is that M/G/I queuing model is considered ideal in this study, where M and G represent exponential inter-arrival times and general non-exponential service times respectively. While 1 stands for one server.

Source and Method of Data Collection

Two data sets were collected for the study. The first set was the waiting line data which include the average number of customers that patronized fifty barbing salons, randomly selected from the area for a period of four weeks, excluding Sundays. The shops open between 8am and 8pm daily. Tally cards marked according to the time of the day were issued to customer once service is completed and paid for. The essence of the cards is to ensure easy and accuracy in the collection of data.

The second data set, include type of services rendered, charges per service estimated cost of equipment and materials used for the services and the overhead cost. The charges per service were obtained from their official price list since they have a unified union that regulates the prices charged.

To obtain the above information, a well structure questionnaires were randomly administered to 60 barbing salon owners in the area. Out of these, 50 were correctly completed and returned. This gives 83% response. The first data set were averaged and the result presented in Table 1.

Analysis of Data and Result

Table 1: Average Daily number of customers that received services from the salons in Agbor, town.

	Mon	Tue	Wed	Thur	Fri	Sat	T_i	
Morning	36	49	43	37	20	70	255	45.5
Afternoon	25	30	52	63	27	40	237	39.5
Evening	35	48	25	32	70	40	250	41.7
Total	96	127	120	132	117	150	T = 742	$\bar{X} = 41.2$

Model

The fixed effects model is considered appropriate since the treatment do not constitute a random sample. The data can be modelled as:

$$X_{ij} = \mu + \alpha_i + \ell_{ij}, \ell_{ij} \sim N(0, \sigma^2) \dots\dots\dots (i) \quad i = 1,2,3 \text{ and } j = 1,2,3 \dots 6.$$

Where μ is the general mean, X_{ij} is the j th observation (days of the week) from the i th treatment (time of the day), α_i is the mean effect of the i th treatment (time of the day) and ℓ_{ij} is the error associated with X_{ij}

Hypothesis (H₀): The population distributions of the variables are the same for all the days of the week and for each period of the day.

Test of Hypothesis:

We can use one-way analysis of variance (ANOVA) to test the hypothesis at 0.05 level of significance with reference to **Table 1**. The ANOVA procedures are as follows:

$$(i) \quad SS\mu = \frac{T^2}{pq} = C \dots\dots\dots (ii) \\ = 30586.89$$

$$(ii) \quad SS\alpha_i = C_i - C \dots\dots\dots (iii) \\ = 28.78$$

$$SS \ell_{ij} = C_{ij} - C_i, \dots\dots\dots (iv) \\ = 3804.33$$

Where T is the grand total of the row and column effect (see Table 1) p and q are the number of rows and columns respectively,

$$C = \frac{T^2}{pq} = \text{correction factor.}$$

$SS\mu$, $SS\alpha_i$ and $SS \ell_{ij}$ are the sum of squares of the general of the general mean, treatment (Days/period) and errors respectively.

$$C_i = \sum_i^p T_i^2 / q \text{ and } C_{ij} = \sum_{ij} x_{ij}^2$$

The result of the test of the hypothesis can be summarized in an ANOVA table (see Table 2).

Table 2: ANOVA table

Source of variation	Sum of squares (SS)	Degree of freedom (df)	Mean Squares (MS)	F-ratio
Constant		1		
Treatment (Days/period)	28.78	2	14.38	0.038
Error	3804.33	10	380.43	

Note: F- ratio is obtained as:

$$F\text{-ratio} = \frac{MS_{\alpha i}}{MS_{\ell ij}} \dots\dots\dots (v)$$

Equation (v) is then referred to as the F-calculated. While F-tabulated is obtained from a statistical table called F-table. Therefore from the F-table, the F-tabulated is

$$F_{(2,10)}^{(0.05)} = 4.10$$

Where 0.05 is the level of significance and (2,10) are the respective degrees of freedom for the treatment and error.

Decision Rule: We reject the hypothesis (H_0) if the F-calculate exceeds the F-tabulated.

Comparing the value F-calculated in table 2 and that of F-tabulated, we discovered that the F-calculated is less than F-tabulated. Hence we accept the hypothesis (H_0) and conclude that the entire system data on customer flow is the same with respect to the days of the week and time of the day.

Queuing Behaviour Analysis

Let μ be the mean number of customers served per hour. Hence, the mean service time then becomes $\frac{1}{\mu}$ per hour and let λ be the mean number of customers that arrived to the service facility, so that the mean arrival time is $\frac{1}{\lambda}$ per hour.

According to [7], for the theory of M/G/I queue to hold, given a suitable queuing behaviour, the traffic intensity $P = \frac{\lambda}{\mu} < 1$. From our application (Table 1), $\lambda = \frac{742}{288} = 2.58 \cong 3 \therefore \lambda = 3$ customers per hour.

Let the mean number of customers served per hour be 5 (see table 1)

$\therefore \mu = \frac{3}{5} = 0.6$ customers per hour.

When we substitute values λ and μ into equation (iv) and solve we have:

- (i) The average number of customers on queue (L_q) at any given time is:

$L_q = \frac{\lambda}{\mu(\mu-\lambda)}$ (vi)

$\therefore L_q = \frac{3}{5(5-3)} = 0.3$

$\cong 1$ person on queue at any point in time.

- (ii) The average number of customers in the system (L_s) is given by

$L_s = \frac{\lambda}{\mu-\lambda}$ (vii)

$\therefore L_s = \frac{3}{5-3} = 1.5 \cong 2$ customers in the system.

- (iii) The waiting time on queue (W_q) is given as:

$W_q = \frac{\lambda}{\mu(\mu-\lambda)}$ (viii)

$\therefore W_q = \frac{3}{5(5-3)} = 0.3$ hours or 18minutes

- (iv) The waiting time in the system (W_s) is given as:

$W_s = \frac{1}{\mu-\lambda}$ (ix)

$\therefore W_s = \frac{1}{5-3} = 0.5$ hours or 30minutes

- (v) The probability that the server is idle is given as:

$P(N = 0) = 1-p$ (x)

$\therefore P(N = 0) = 1-0.6 = 0.4$

This implies that the server is idle for 40% of the total time.

Demand for Services

As mentioned earlier, the shops open between 8am and 8pm, implying that each day the barbing shop is opened to customer for 12 hours for 6 days. Since the arrival rate is 3 customers per hour, it implies that the daily expected number of customers calling for service is 36. Weekly expected number of customers is 216 while the expected annual customers flow is 10368.

Table 3 shows the distribution of customers by type of services and their respective percentage of patronage.

Table 3: Distribution of Customers by type of service

Type of service	No of customers	Prob. Factor	Expected No of customers for the year	% of customers by service for the year
Hair cut	638	0.8598	8927	86.10
Dandruff treatment	20	0.0270	276	2.69
Sporting wave	10	0.0135	138	1.33
Blow-out	7	0.0094	96	0.93
Dyeing	12	0.0162	166	1.60
Hair washing	5	0.0067	69	0.67
Shaving	50	0.0674	696	6.71
Total	742	1.0000	10,368	100

Of all the various types of services rendered in the barbershop, hair cut received the highest patronage. This accounted for 86% of the total expected number of customer for the year. Hair washing on the other hand, received the least and it accounted for 0.67% of the expected number of customers for the year.

Sales (Revenue)

Sales in accounting means the selling of goods originally purchased by the firm with the intention of resale. In our study however, we can take sales to mean the total estimated revenue accruing to the business.

The expected number of customers in a year demanding for each service, multiply by the corresponding charges per customer gives us the yearly contributions of each service to the total estimated revenue of the business. The estimated sales of our barbing salon shop are summarized in the Table 4.

Table 4: Estimated Sales

Type of service	Charges per customers	Expected yearly No of customer	Estimated revenue in Naira	% Contribution of services on the estimated revenue
Hair cut	100	8927	892,700	89.72
Dandruff treatment	100	276	27,600	2.77
Sporting wave	120	138	16,560	1.66
Blow-out	120	96	11,520	1.16
Hair washing	50	69	34,800	3.50
Shaving	50	696	8,300	0.83
Total		10,368	N994,930	100

From Table 4 above, we observed that the haircut contributed about 90% to the total estimated revenue for the year while shaving contributed 0.83 percent to the total annual revenue.

Cost of Sales

The cost of sales include the cost of direct raw materials like sterilizers, lubricants, dyes, and other chemicals use for treatment, in addition to the cost of transporting these items (i.e. carriage inwards).

The difference between the cost of sales and sales is known as the gross profit. In this study, the cost of sales is summed up to N6,050.

Overhead Costs

These include all the administrative expenses. That is all the expenses incurred in the day to day running of the business. These are presented in Table 5.

Table 5: Estimated Overhead cost for the year

Items	Expenses per month in Naira	Estimated Exp. For the year in Naira
Rent	1500	18,000
Electric bill	200	2,400
Fuel/lighting	3,000	36,000
Repairs	-	1,500
Salaries/wages	3000	36,000
Business premises permit	-	1000
Others	1000	12,000
Total	8,700	106,900

Profit and Loss Account (PLA)

This account measures the profitability of the business. It reveals whether the firm is operating at a lost or not. The PLA of the barbing salon business is presented in Table 6.

Table 6: Profit and Loss Account for the year ended 31st Dec. 2010

Sales (Revenue)	N994,930
Less cost of sales	N6,050
Gross profit	N988,880
Less overhead cost	N106,900
Net profit before tax	N881,980
Less income tax on profit (5% of 881.980)	N44,099
Net profit after tax	N837,881

Balance Sheet (BS): This shows the firm’s equity and obligations. It is a statement that shows the financial position of the business enterprise at any point in time [8-9]

To prepare this statement, we need the current asserts (cash at hand and at the bank), fixed asserts and opening capital. The balance sheet for our barbing salon is summarized below.

Table 7: Balance sheet as at the year ended 31st Dec. 2010

	N		N	N
Owners Equity		Fixed Assets:		
Capital employed	15,100	Equipment	7000	
Add Net Profit for the year	<u>837,881</u>	Fixtures & fittings	12,000	
Equity	<u>852,981</u>	Generator	<u>11,030</u>	
		Total fixed Assets		30,030
		Current Assets:		
		Debtors	1,700	
		Cash in Bank		50,000
		Cash in hand		<u>10,000</u>
		Total Current Assets		<u>61,700</u>
		Total Assets		<u>91,730</u>
Current Liabilities				
Creditor	1000			
Deferred rent	3000			
Deferred tax	<u>5,000</u>			
Total current liabilities	<u>9,000</u>			

Note: Total Assets = fixed assets + current Assess (xi)
 = 30,030 + 61,700 = N91,730

Working Capital = Current Assets – Current Liability (xii)
 = 61700 – 9000 = **N52,700**

Assessment of the Profitability of the Barbing Salon Business through Financial Ratios

Basically, financial ratios are used by statisticians and decision makers to assess whether a business is doing well or not. These ratios include:

(i) **Returns on capital employed:** This is the percentage of profit earned on the total capital employed. It is calculated as:

$$\text{Return on capital} = \frac{\text{Net Profit after tax}}{\text{capital employed}} \times 100 \dots\dots\dots (\text{xiii})$$

$$\therefore \text{Return on capital employed} = \frac{837,881}{15,100} \times 100 = 554.9\%$$

(ii) **After tax profit margin:** This is computed as:

$$\text{After tax profit margin} = \frac{\text{Net Profit after tax}}{\text{sales(estimated revenue)}} \times 100 \dots\dots\dots (\text{xiv})$$

$$\therefore \text{After tax profit margin} = \frac{837,881}{994,930} \times 100 = 84.22\%$$

This shows the percentage of the revenue (sales) that the profit is made up of.

(iii) **Current Ratio (working capital ratio):** This is the excess of current assets over current liabilities. It shows the ability of the business to meet its short term liabilities as they fall due, out of its short term assets. It determines the solvency of a business.

It is expressed as:

$$\text{Current ratio} = \frac{\text{Current Assets}}{\text{Current liabilities}} \dots\dots\dots (\text{xv})$$

$$\therefore \text{Current ratio} = \frac{61,700}{9,000} = 7:1$$

A ratio of 2:1 is considered ideal. [7and 8].

From our study, the ratio 7:1 means that our barbing salon business can repay its short term liabilities easily. This indicates that the solvency rate is very high.

Discussion of Result

The result of our analysis in tables 1 and 2 shows that the entire system data on customers flow is the same with respect to the days of the week and time of the day. This indicates that the distributions of the inter-arrival times, service times, queuing times and waiting times are also invariant with respect to time of the day.

From the queuing behaviour analysis, it was observed that about 2 customers are expected to be in the system at any point in time, with about 1 person on the queue waiting to be attended to. A customer is expected be on the queue for about 18 minutes before he can be attended to and 30 minutes on the whole to complete the service. This implies that the mean service time is 12 minutes. On the average, the barber are only idle for 40 percent of the total time.

The shop opens for business for 12 hours a day with the daily inflow of customers amounting to 36 while the expected annual customer inflow is 10,368.

The annual net profit of N837,881 with an opening capital and total assets of N15,100 and N91,730 respectively. Thus, having 554.9 percent rate of rate of return on the capital employed. The business has a solvency ratio of 7:1 with an after tax profit margin of about 84 percent. These results show that the baring salon business in Agbor town is lucrative and has high solvency rate.

Conclusion

Based on the above result, it is therefore concluded that barber shop business is a business venture that requires low capital to establish with a very high rate of return. It has the ability to curb or reduce the rate of unemployment and its attendant problem in the society.

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