Simulation Analysis of Queueing Customers at Baloy's Eatery

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Abstract **-Enhancing the level of service provided by the eatery system is essential for ensuring consumer happiness and satisfaction especially during this pandemic. The workers are worried about how long it takes for customers to receive their service especially when it is peak hours. Decision-makers must consistently raise the quality of their services as assessed by appropriate performance indicators in order to remain competitive. We concentrate on simulating eatery systems in our work. The study is divided into three phases: (i) identifying the most useful performance measures that affect customer happiness and service quality; (ii) simulating the unique performance of eatery systems in relation to selling performance; and (iii) evaluating and enhancing system service quality. An example case study is provided to demonstrate the usefulness of the suggested simulation approach.**

Keywords - **Simulation modeling, queuing system, eatery, quality of service, selling performance, excel simulation**

I. INTRODUCTION

An increase in the public's demand for fast food might present its own challenges for the industry. The community's queuing system is the issue that can be looked upon as a result of the increasing interest. People in the Philippines are less fond of waiting in lines for things. This is a problem that Baloy's Eatery also has. Long lines are a result of the large number of fast food enthusiasts. The fast food restaurant's production suffers as a result of this condition.

In order to decrease the number of queues and the idle time of each counter, it is important to create enhancements to optimize the queue system. Finding what kind of arrival time distribution and the duration of service is the first step in queuing system repair. By modeling the ideal queuing system with Simio software, we can identify the model that best fits the types of arrival time distribution and length of service. Simulation is a technique that emulates system processes with the help of computer systems. A system's conformity to actual systems in the real world is assessed through simulation. Simulation is a method for gathering data and for making predictions about future events. In the effective simulation application reported in this study, simulation was used to model, assess, and optimize the operational processes and staffing levels of a restaurant—unusually, a restaurant that offers only take-out services and has no "dine-in" capacity. The simulation analysis demonstrated the most efficient procedure for addressing limited capacity and distressingly long waiting times. More specifically, (Brann and Kulick) discuss the simulation of restaurant operations, and (Curin et al.) describe how simulation was successfully used to shorten wait times at a crowded fast-food restaurant on a university campus. The restaurant that served take-away meals but no dine-in services was the subject of investigation in the current study as well.

II. CASE STUDY BACKGROUND

The term "entity" refers to any object that enters a system, moves through a number of processes, and then exits the system. Our population at Baloy's Eatery is made up of whole entities. Customers who entered Baloy's eatery served as our study's data source. The selected case study works from 11:00 am to 1:00 pm which is usually the peak hours of the store . However, having discussed with the employees and consumers revealed that in the process waiting time takes over 10 mins if the customers are at peak of 10-20 customers on the queue and it also depends on how famous the food or product that has been sold; with this experiences the longest waiting time, which may lead to customer dissatisfaction.We collected 30 data from different persons we recorded the time they spent in ordering waiting and getting the food. Currently, there is a single cashier for it to process the payments.The part of their process is composed of three phases first is the window where the customer will order/choose the food, second is the cashier where the customer will pay the food and lastly the window where the customer will get the food.They provide service for these customers on a first-in-first-out (FIFO) basis. Simio Software was used in the system's design to minimize queues and idle time for each counter. Distribution testing and creating a queue system simulation are the steps of system design. Distribution testing is performed on the old service data and the time interval of arrival that has been collected during the observation.We use MMS Queuing model to calculate the performance of the service. We use randomness in the simulator to calculate the validation which corresponds with the observed data. We verify and validate it which is somehow correct according to the results.

III. EXCEL-BASED SIMULATION METHODOLOGY

A. MMS QUEUING MODEL

The excel-based simulation approach proposed in this study uses the M/M/s queuing model. The model can be used to analyze queuing systems in service systems, particularly in restaurants and eateries. The basic model parameters are defined as in the following notation:

Notation
λ Arrival rate: the number of customer arrivals per hour
s The number of servers available to serve customers
μ Service rate; number of customers served per hour
N Calling population
P0 Probability of no customers in the system
Pn Probability of n customers in the system
W Average customer waiting time in queue and in service
Wq The waiting time of the customer in the queue
L The number of customers in the queue and in service
Lq The number of customers in the queue

The following performance measures are adopted from queuing theory, specifically the M/M/s model (Hillier and Lieberman, 2010) [12]. Thus, for a multiple server system, with $s > 1$, if $\rho = l/(s\mu) < 1$, then,

MMS Queuing Model

M/M/s Queueing Model
operating hours 11am -1:00pm(2hrs)

	Collection of data for 30 persons	
Service Duration (mins)	Frequency (f)	f.D
1	0	0
2	1	2
3	15	45
4	14	56
	Σf = 30	Σf.D = 103

Table 1: The frequency data collected from different persons

As shown in table 1 we collected data from 30 different persons. Which cites that half of the population of 30 have a customer service rate of 3 mins.

Time Unit	mins	
Arrival Rate (λ)	1.5	customers/min
Service Rate per server (mu)	8.74	customers/min
Number of servers (s)	3	servers
Calculations		
Ave time between arrivals	0.666667	mins
Ave service time per server	0.114444	mins
Combined service rate (s*mu)	26.21359	customers/min
Performance Measures		
Rho (Average server Utilization)	0.057222	
P0 (probability the system is empty)	0.84225	
L (average number in system)	0.171712	customers
Lq (average number waiting in the q	4.57E-05	customers
W (average time in system)	0.114475	hour
Wq (average time in the queue)	3.05E-05	hour

Probability of a specific no of customers in the system

no	Probablility
0	0.842250153
1	0.144586276
2	0.012410322
3	0.000710146
4	1.01596-05
5	5.81323E-07
6	3.32646E-08
7	1.90347E-09
8	1.08921E-10
9	6.2327E-12
10	3.56649E-13
11	2.04082E-14
12	1.1678E-15
13	6.68244E-17
14	3.82384E-18
15	2.18809E-19
16	1.25207E-20
17	7.16463E-22
18	4.09976E-23
19	2.34597E-24
20	1.34242E-25

Table 2: Calculations for the performance measure

As shown in table 2 we calculate the data to get the performance measure.

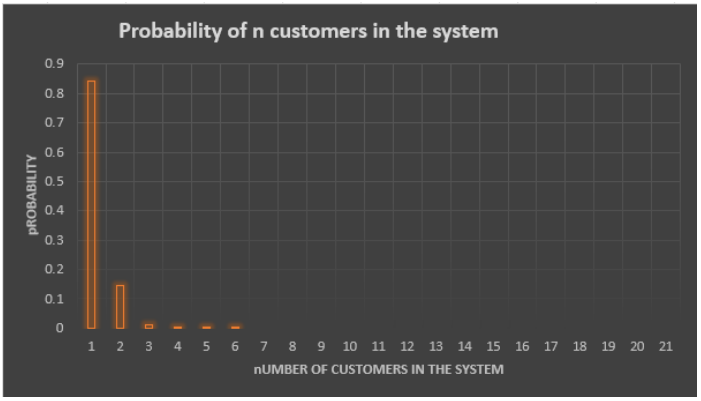

Figure 1 : Graph of the probability of n customers in the system

In terms of the probability of waiting for a given time t. The output measures in the model are W, Wq, Lq, L, and Pn. Correspondingly, a set of output measures are presented alongside the input parameter values.

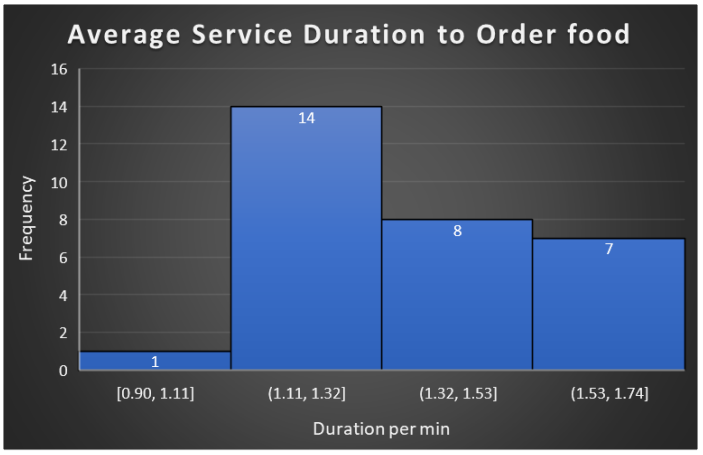

Figure 2 : Graph of the average Service Duration to order food.

As shown in Figure 2 we calculate the average duration of service to order a food which average is between 1.11 to 1.32 mins

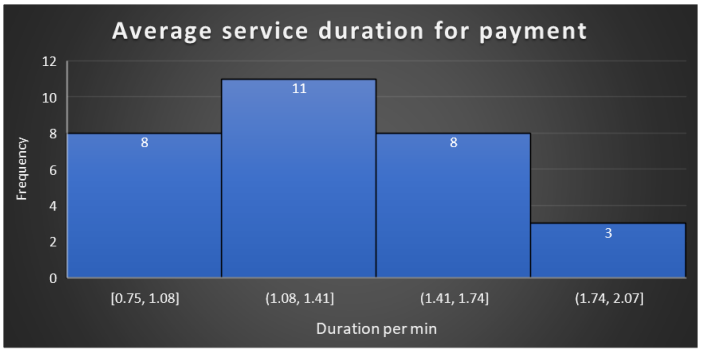

Figure 3 : Graph of the average Service Duration to pay for the food.

As shown in Figure 3 we calculate the average duration of service to pay for the food which averages between 1.08 to 1.41 mins.

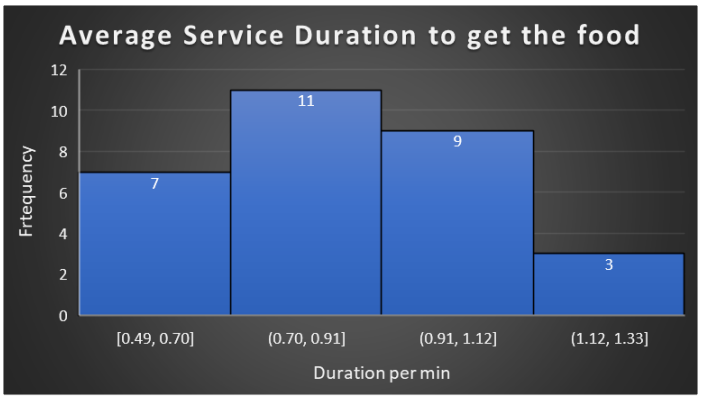

Figure 4 : Graph of the average Service Duration to get the food.

As shown in Figure 4 we calculate the average duration of service to get the food which averages between 0.70 to 0.90 secs.

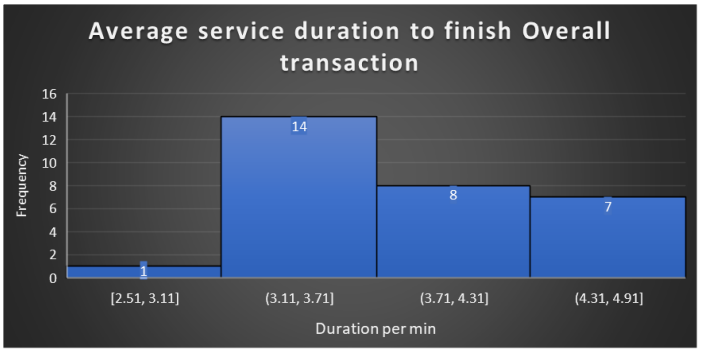

Figure 5 : Graph of the average Service Duration to finish the overall transaction.

As shown in Figure 5 we calculate the average duration of service to finish the overall transaction which averages between 3.11 to 3.71 mins.

B. BASE CASE STUDY

On average, the arrival rate of customers at the peak hours of the eatery system was λ =1.5 customers/ mins . All customers then wait in a single queue for service after the first customer finishes the transaction. The mean staff service time for all transactions is μ = 8.74 minutes, as recorded in Table 2. Fig. 2 presents the simulation results and the current performance of the system. With three tellers in the system, the average waiting time for customers is Wq =3.04791, and the average number of customers in the system is L = 3. The behavioral performance was validated against the observed performance of the actual system. The next stage of the simulation approach is concerned with re-design of the process in order to improve its performance.

C. REDESIGN AND IMPROVEMENT

In process redesign, .We present the case of the whole transaction in process in this section.

1) Process Mapping: A customer will buy 2-4 different kinds of dishes with different quantities at the time when the staff checks if there is still stock of that specific dish , while the customer waits.
2) Provide a checklist on proper customer service.

3) Queue Management: For improved queue management we proposed to have 2 cashiers for 1 which will focus on elderly, pregnant and disabled persons for them not to be with other persons. Create a queue for customers that will only pick up their orders. For short separation of queues are suggested.

IV. CONCLUSION

This simulation project's analysis gave the restaurateur helpful guidance and assurances. The restaurant owner was persuaded that the operations were most definitely not overstaffed because of the inclusion of numerous scenarios, many of which had purposefully lower staffing numbers than the existing situation. This contributed to the credibility the model and its analysis attained.

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BIOGRAPHY

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