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Optimization of Bank Teller (Bank Cashier) Services Through Analysis of the Queue System at Bank BPD Bali (Renon Branch Office)

DesakAyu Melina Pangastuti[1], PutuYudi Setiawan[2]
Faculty of Economics and Business, Udayana University (Unud), Bali, Indonesia

ABSTRACT : A queue is a line of people or goods waiting to be served and then exiting the line when it is finished. Queues are in the manufacturing and service sectors. The purpose of this study is to analyze the queuing system that is applied to provide better service to customers. By calculating the total average number of customer arrivals and the average total number of people served and optimizing the number of tellers operating. The results show that the queue type model used by BPD Bali, Renon Branch Offices is a Multi Channel - Single Phase queue type. The arrival pattern of customers has a Poisson distribution with a value of 0.924 and the service pattern is not exponential with a value of 0.000. The total number of customer arrivals per unit time (λ) is 11 customers / hour and the total value of the average number of people served per unit time (μ) is 24 customers / hour. From the research results it can be found that the teller performance of Bank BPD Bali, Renon Branch Office is not optimal.

Keywords: *queue, poisson, exponential*

I. INTRODUCTION

Companies in the service and manufacturing sector must be able to provide fast and best service in accordance with the wishes of the customer to meet their needs given the large population(Li et al., 2020). Services are a fast growing economic sector and services are the largest economic sector in developed societies. One of the many service sectors is banking institutions, services provided by banks to customers such as the ease of taking money and saving money, transferring between accounts, shopping, or paying electricity and telephone bills are facilities that can be accepted by customers (Brastama & Yadnya, 2020). With fast, easy and satisfying service, it will make customers feel satisfied because this service makes customers loyal so they will come back again(Aminy, 2020). In general, every customer expects to immediately get teller service without having to wait long. The basic process of queuing is the presence of a customer or customer or product coming either at a fixed rate or not from an input source that requires server service, if they cannot enter the service facility, the customer must wait to form a queue(Sivakami Sundari & Palaniammal, 2019). A queuing process is a process associated with the arrival of a customer at a service facility, then waiting in a line (queue) if all the servants are busy, and finally leaving the facility. When it comes to providing services to customers at the bank, the phenomenon of queuing can no longer be avoided and this problem must be found a solution immediately, it is clear that many customers are waiting to be served(Iberahim et al., 2016). The length and length of the lines make customers feel uncomfortable, thinking that their time is wasted when they queue before being served(Supriyadi et al., 2019).

Regional Development Bank (BPD-*Bank Pembangunan Daerah* in Bahasa Indonesia) as one of the banks in the national banking system has a significant function and role in the context of regional economic development because it is able to open service networks in areas where it is economically impossible for private banks to do so(Prayuda & Purnawati, 2020). Therefore, the Regional Development Bank has become a bank that is in great demand by the people of Bali, therefore queuing is something that cannot be avoided anymore(Putri & Wiksuana, 2021). Bank BPD Bali has made innovations in accordance with the times, namely the launch of internet banking which can be downloaded via the play store and app store(Perbawa & Pratiwi, 2020). This is done to reduce the queue of customers who want to make transactions and can use their personal devices to make transactions, but this is not effective because many customers are elderly and cannot use internet banking and some customers are worried about the security of internet banking. Therefore, customers finally choose to come directly to the bank to make transactions, queuing can no longer be avoided.

Queuing is the main problem faced by Bank BPD Bali, this queue is caused by a lack of tellers who are not enough to serve customers who want to make transactions at Bank BPD Bali, Renon Branch Office.

According to some consumers, the queue of Bank BPD Bali and Renon Branch Offices was long enough so that many customers felt that the waiting time could be accelerated. The length of the queue is a problem faced by the BPD Bali Bank, Renon Branch Office and a solution must be found. Looking at the queuing process, it can be said that customers want to get service at a service facility. Therefore, the Bank BPD Bali, Renon Branch Office had to make a decision so that the queue was not very long. If the time spent waiting in line is very long, customers eventually get out of the queue system. To find out the proper queuing system at Bank BPD Bali, Renon Branch Office, an in-depth study is needed. This research was conducted by analyzing to optimize the service work of tellers at Bank BPD Bali, Renon Branch Office with the aim of optimizing the queue system model.

There are four queuing system theories, namely, 1) Single Channel - Single Phase means that there is only one line entering the service system or there is one service facility. Single Phase means there is only one service(Titin & Ghofur, 2020); 2) Single Channel - Multi Phase, the term Multi Phase indicates that there are two or more services that are carried out sequentially (Purwanda, 2019); 3) Multi Channel - Single Phase occurs whenever there are two or more service facilities flowing by a single queue, for example this model is a queue at a bank teller, and 4) Multi Channel queuing system - Multi Phase occurs anytime where there are two more than one queue (Bahar et al., 2018). The assumption of the queuing model is that customers who come are patient people. Patient customers are those who are willing to wait in line and not get out or move from the line. Customers participate by forming a queue patiently for service. An impatient customer is a customer who deliberately leaves the line before it is served. In order to follow up on this problem, the bank concerned must pay attention to customer time which is wasted for free while customers are waiting. If the number of services is added, the consumer's waiting time will decrease, while when the number of services is insufficient there will be a waiting fee by the consumer. Several research results show that using the Multi Channel-Single Phase queuing method has reduced the number of queues when customers transact by adding tellers, this is evident from Mayangsari & Prastiwi (2016)and in this study to know how many tellers are available to achieve optimization.

According to Sari et al. (2017), the arrival of customers gets to tellers with a Poisson distribution. According to Fadlilah et al. (2017), service data and customer arrivals have a Poisson distribution. According to Nadya & Permana (2019)Saragih et al. (2018)Andika et al. (2018)stated that testing the compatibility of the number of arrivals with a Poisson distribution. Based on the above research, it can be concluded that in this study the following hypotheses are obtained:

H1: The pattern of customer arrival to the teller has a Poisson distribution

According to Febrianti (2020), customer service patterns are exponentially distributed. According to Andika et al. (2018), the service pattern at Bank X has an exponential distribution. According to Sismetha et al. (2017), Reski et al. (2019) stated that testing the compatibility of customer service speed distribution is an exponential distribution. Based on the above research, it can be concluded that in this study the following hypotheses are obtained:

H2: The pattern of customer service by tellers has an exponential distribution

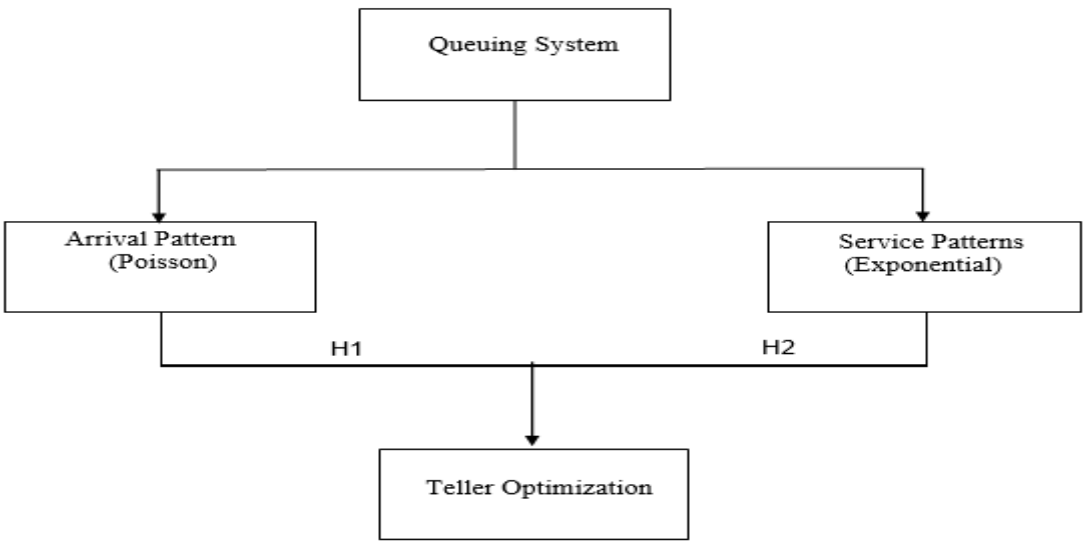

Figure 1. Conceptual Frame

II. METHODS

This research is a descriptive research with a quantitative approach. This study seeks to describe how many tellers are provided for queuing optimization and to explain the stages of optimizing the queuing system. The variables contained in this study are the average time consumers come; Customer arrival interval time; Waiting time (from queuing to getting service) and service time

The population in this study were all customers who made transactions at the teller of Bank BPD Bali Renon Branch Office in a period of 25 working days a month. The sampling technique used is incidental sampling, which is a sample determination technique based on chance, that is, consumers who accidentally meet the researcher can be used as samples, if it is considered that the person who happened to be met is suitable as a data source. Data was collected on weekdays, namely 10: 00-15: 00 WITA by paying attention to busy and off-peak hours. Data collection techniques used in this study were observation and interview. Data analysis of customer arrival at the teller is processed with a frequency interval of 30 minutes to find the number of people per time (λ). Customer service data is poured into the frequency distribution in order to find the number of service frequencies, namely the average number of people served per time (μ). The formula used is:

$$\mu = \frac{Number\ \ of\ \ visitors}{number\ \ of\ \ observations} \ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

$$\lambda = \frac{total\ \ arrivals}{observation\ \ \ time} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

POM - QM Calculations With Software for Windows Version 3.0

POM / QM software for Windows is a software designed to perform the calculations required by management to make decisions in production and marketing. After the results of looking for the number of arrivals of people per unit time (λ) and the average number of people served per time (μ), it is known that the data is processed using POM / QM software for Windows waiting line version 3.0.

Optimization of Multi Channel-Single Phase Method

For now, Bank BPD Bali Renon Branch Office has used a Multichannel-Single Phase queuing system model with a total of 3 tellers, but queues are still quite long. This requires adding tellers and comparisons in order to optimize the previous tellers.

Operational Variables

1) **The average time a consumer arrives** is how long it takes from one customer to arrive until another customer arrives(Gumus et al., 2017). The form of the combination of the arrival process with service is generally known as a universal standard, namely:
   (a / b / c) :(d / e / f)……..(3)
   a: Arrival distribution.
   b: Service time distribution (service time distribution).
   c: Number of servants.
   d: Queuing discipline, such as FCFS, LCFS, SIRO or PRI.
   e: The maximum number of subscribers allowed in the system
   f: Source of arrival
2) **The time of arrival interval** is the distance of arrival from one customer to the next in units of time(Som, 2016).
3) **Waiting time** is how long a consumer spends before being given service(Karunakaran & Maragathasundari, 2019).
   Lq = Ls - λ / μ……...(4)
   Lq: Average number of units in the queue (average queue length)
   Ls: Average number of units in the system
   λ: Average arrival speed (number of arrivals per unit time)
   μ: Average service speed (number of units served per unit time when service is busy)
4) **Service time** is the time that shows how long the customer is served when making transactions(Liang, 2017).

III. RESULTS AND DISCUSSION

Service and Arrival Data Analysis

Table 1. Data Analysis on Arrival and Service

	N	Minimum	Maximum	Mean
Time Between Arrivals	162	,00	12,00	2,4815

Duration of Service	162	,00	63,00	5,7222
Valid N (listwise)	162			

Source: Processed Data, 2020

Based on the table 1, it can be seen that the average arrival time between visitors of Bank BPD Bali Renon Branch is 2.4815 minutes and the length of service per customer is 5.72 minutes. The longest service time a customer receives is 63 minutes or the equivalent of 1 hour and 3 minutes. So that the average level of service time is 24 customers / hour, as well as for the customer arrival rate of 11 customers / hour

Goodness Of Fit Test

Table 2.Analysis of Goodness Of Fit Customer Service Duration

N		162
Exponential parameter Mean		6,2161
Most Extreme Differences	Absolute	,209
	Positive	,077
	Negative	-,209
Kolmogorov-Smirnov Z		2,663
Asymp. Sig. (2-tailed)		,000

Source: Processed Data, 2020

Based on table 2, it can be seen that the P value (sig) of the Kolmogorov-Smirnov test results is 0,000 where this value is smaller than the critical value (α), which is 0.05 so the length of service time does not have an exponential distribution.

Table 3. Goodness of Fit Test Analyst, Customer Arrival

N		21
Poissonparameter Mean		12,3333
Most Extreme Differences	Absolute	,116
	Positive	,116
	Negative	-,116
Kolmogorov-Smirnov Z		,532
Asymp. Sig. (2-tailed)		,940

Source: Processed Data, 2020

Based on table 3, it is known that the P value (sig) from the Kolmogorov-Smirnov test results is 0.940 where this value is greater than the critical value (α), which is 0.05 so that the number of visitors who come has a Poisson distribution

Table 4. Goodness of Fit Test Analysis, Number of Customers

N		21
Poissonparameter Mean		11,2857
Most Extreme Differences	Absolute	,120
	Positive	,109
	Negative	-,120
Kolmogorov-Smirnov Z		,549
Asymp. Sig. (2-tailed)		,924

Source: Processed Data, 2020

Based on table 4, it is known that the P value (sig) from the Kolmogorov-Smirnov test results is 0.924, where this value is greater than the critical value (α), which is 0.05, meaning that the number of visitors served is a Poisson distribution.

Table 5. Queue Calculation Results using POM-QM

Parameter	Value	Parameter	Value	Minutes	Seconds
M/M/s		Average server utilization	0.80		
Arrivalrate(lambda)	24	Average number in thequeue(Lq)	2.59		
Service rate(mu)	11	Average number in thesystem(L)	4.99		
Number of servers	3	Average time in thequeue(Wq)	0.11	6.47	388.31
		Average time in thesystem(W)	0.21	12.47	748.31

Source: Processed Data, 2020

With 3 servers, the level of server activity is quite high as indicated by the utilization value of 0.8, this utilization value is more than 0.5, which indicates that the server has a high level of activity, with the average customer waiting time (Wq) of 6.47 minutes. / customer and the average customer served time (W) was 12.47 minutes / customer. This shows that the teller queue system at Bank BPD Bali, Renon Branch Offices with 3 servers is still not optimal because the service time and customer waiting time are still quite high.

Table 6. Optimization Results of the Multi Channel-Single Phase Method

Parameter	Total Server				
	3	4	5	6	7
Average server utilization	0.8	0.6	0.48	0.4	0.31
Average number in the queue(Lq)	2.59	0.43	0.1	0.03	0.01
Average number in the system(L)	4.99	2.83	2.5	2.43	2.41
Average time in the queue(Wq)	0.11	0.02	0.0	0	0
Average time in the system(W)	0.21	0.12	0.1	0.1	0.1

Source: Processed Data, 2020

Table 6 shows the comparison of the number of servers with the level of service, if the number of servers is 3, the level of server activity is still high, which is 0.8 with the average time per customer (wq) of 0.11 hours or equivalent to 12.47 minutes. If the server number is 4, the server utilization level is still high, namely 0.6. However, if it becomes 5 servers, the server utilization rate is optimal with a utility value of 0.48 and the average customer service time (W) is faster, which is 0.12 hours, equivalent to 7.2 minutes and waiting time per customer (Wq) 0.02 or about 1.2 minutes. If there are 6 or 7 servers, the server utility can also be said to be optimal with an average customer service time of 0.1 hour or the equivalent of 6 minutes without any waiting time per customer.When the server (teller) becomes 5-7, the server's busyness (utilization) is optimal. The addition of this server can be tailored to the needs of the Bank.

H1 in this study is the pattern of customer arrival to the teller with a Poisson distribution. The test results from the table above show the results of the Asymp significance value. Sig has a P value (sig) of 0.924> $\alpha = 0.05$. This value states that the pattern of customer arrival to the teller has a Poisson distribution. So it can be concluded that **H1 is accepted.**H2 in this study is a customer service pattern by tellers with an exponential distribution. The test results in table 4.2 show that the significance value of asymp.sig has a P value (sig) of 0.000 $<\alpha = 0.05$. This value states that the pattern of customer service by tellers does not have an exponential distribution. So it can be concluded that the **H2 is rejected**. The results of this study are in line with Bahar et al. (2018)which also states that the arrival of customers to the teller does not have an exponential distribution. These results indicate that the service pattern is not in accordance with the expected time. The results obtained are that the pattern of customer arrivals is not exponential, which means that service time and service waiting time are still quite high. So that the service pattern, namely the teller on duty was added to 5-7 tellers the average waiting time to 7.2 minutes, which was originally 12.47 minutes.

In this study it can be concluded that the optimal teller is 5 to 7. This can be seen from the results of the analysis using POM-QM software because with the number of tellers 5 levels of server activity is optimal. The addition of servers can be tailored to the needs of the bank. The results of this study are able to provide empirical evidence, namely that the number of tellers affects the level of service. With an optimal teller, it can improve the servants who are influenced by customer satisfaction in getting service and don't have to wait long to get service. It can be seen from the research above that when server 3 the average time for customers to be served is 12.47 minutes / customer, while when servers are 5 to 7 the average time for customers is served is 7.2 - 6 minutes / customer. The addition of servers can be tailored to the needs of the bank, because the servers needed are different every day.The results of this study indicate that there is a significant influence between open servers and the speed at which customers are served. So with this research it can be used as a reference to find out how many servers can be opened so that customers get fast and easy service and also a consideration that can be used at Bank BPD Bali, Renon branch offices to be able to speed up service.

IV. CONCLUSION

Based on data analysis using POM-QM conducted at Bank BPD Bali, Renon Branch Offices, it is concluded that the tellers available at Bank BPD Bali, Renon Branch Offices are still not optimal and there are long queues. The optimization carried out by Bank BPD Bali, Renon Branch Office is still not optimal, it can be seen from the calculation using the queuing system analysis using POM-QM that the server has a high level of activity, with an average waiting time of 6.47 minutes / customer and an average average service time served is 12.47 minutes / customer. This shows that the teller queue system at Bank BPD Bali, Renon Branch Office with

3 servers is still not optimal.Optimization of the queues by Bank BPD Bali Renon branch offices have not run optimally, so there must be attention to the tellers available so there is no accumulation.**For further research**, in this study the sample used only used customers who made transactions at the teller section and not in other parts where the other part also had a queue, and in this study only general research was carried out and did not examine the total costs incurred. used every day.

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