Reconstrusting the Amount of Teller through Waiting Time and Salary Consideration at ABC Bank

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Abstract— *Queue is the main problem of a business runs in service field, especially in banking. It comes when the number of server are less than the customers they serve at the same time. In this study, ABC bank company rescedhules the amount of service counters in order to solve queue problem which are totally 5 tellers for 5 counters. Data gained from this study were processed through ARENA simulation software. This study found that the salary of a teller is Rp. 4.300.000,-. The simulation result of teller salary calculation shows that effeciently, ABC bank should have 7 tellers in order to decrease the amount of queue until 90% from the existing condition.*

Keywords— *Service, Queue time, Queue amount, Teller, Teller salary, Bank.*

I. INTRODUCTION

Currently, companies have competition from each field they run for. Some companies are running on manufacturing business while some others are running on service business. Companies which are running on manufacturing business produce tangible product while companies which are running for service business produce intangible products such as banking. A problem in which usually appears from banking company is queue. Queue will happen when the number of server or teller are less than the number of customers coming [1][2]. This condition needs a follow-up from the company itself to do both corrective and preventive action. A corrective action may be done by fixing the existing system run by the company as queue time, the number of queues, service time, or service utility and facility did not run well. While a preventive action may be done by solving a predicted problem such as an exploded customers arrival at the range of time.

Nowadays, queue problem is now being faced by banking industry in Malang city, that is ABC Bank. ABC bank provides deposits, withdrawals, transfers and bill payments. Queue seems to be usually happened at ABC bank especially during break time and certain times.

Queue activity is being started by customer arrival. Then, customer needs to take queue number based on the service that he/she wants to have. Queue process is a process relates to the customer arrival of to a service facility, waiting at the provided-line and leaving just after they have already served [3]. The ABC bank provides two kinds of service counters, they are teller counter and customer service counter. In this case, the researcher focuses on teller counters as the object of the study.

As a customer, certainly, expect to have a good service from the intended service facility. A good service includes hospitality of the servers, excellent service quality and quick service time. Service time will be the object of this study. It is because, the service timing will be directly impacted to customer's satisfaction and service quality [4]. Of course, the customers do not need either a fast or responsive service yet it does not thorough or carefulness. They need something more careful, for example when teller counts money or imputs nominal on computer before giving it to the customers. It needs a very careful action. Thus, it is directly affected to the duration of the service itself. It may also affect to the number of queues waiting for service. The longer the customer waiting, the more they feel uncomfortable. It may cause customer's unsatisfaction. When they feel unsatisfied, they may be canceled their transaction and preferred to choose other banks to provide their needs. This condition will effect to company lost sales.

One of the solution which may be best to be chosen by the company is increasing the number of teller in counters [5]. Yet, it may also appear a new problem faced by the company. Is the policy of adding new tellers economically effective for company's fund comparing with its' previous system? Adding new tellers will economically impact to company's fund for sure. They will increase company's need to pay more for adding new tellers. Thus, it needs new analysis which contains cost element in making decisions.

Currently, ABC bank company is running *Multi Channel Single Phase* [6][7] system which they think it can fulfill their customers' service needs. The advatages of using this system is a customer can be served through a number of available counters by using *first come first served* system. It may decrease the number of queue lists. In this study, the system is rescheduled by researcher. Moreover, the available counters which provide service also be added. Then, the condition will be simulated and analyzed from tellers salary costs perspective.

II. RESEARCH METHOD

This is an action research in which customer queues at ABC Bank Malang will be the object of the study. This study will be conducted on 20 days.

Population of this study is all customer who will conduct a transaction at teller of ABC bank Malang, or it can be said that the population of this study is unlimited. In order to decide the

sample, the researcher uses *Purposive Sampling* technique by considering several criterias such as:

a. Customer who will conduct a transaction at at teller of ABC bank Malang;

b. This study will be done in 20 days (October-December 2018)

c. Data gained during 08.00 – 16.00

Data uses in this study is quantitative, in which the data will be calculated stastistically. The total number of the sample were 40 arrivals. It has statistically been met in term of data adequacy test by using N test. N test showed that proportionally, the sample should be 37 only. The observed data are the time between arrivals and the duration of the teller service time. These data will pass the data adequacy testing and distribution testing process.

In this study, the data were gained from observation method in which the data were gained by directly observing the object of this study. The data gained from the observation can be used as supporting data to analyze as well as make decisions. Data were analyzed using ARENA tool.

III. RESULTS

The result of simulation analysis from queue system of ABC Bank Malang are:

1. Transaction Simulation Program and Actual Transsaction Simulation

TABLE 1. Data of Transaction Simulation

Replication	Program Output	Actual Output
1	832	986
2	818	839
3	820	849
4	834	802
5	817	495

Replication coloumn 1 on table 1 shows that totally there were 832 customers who came out from the teller. On the contrary, the actual coloumn, there were 986 customers who have been served by teller. The two coloumn which has previously been mentioned indicate that replication coloumn 1 – 5 have various value that may be more equal comparing with actual coloumn. The actual output coloumn is vary between 495-986 customers, while simulation ouput coloumn is vary between 817-834 customers.

2. Data Processing Result

Table 2 indicates resource utility level of system run by ABC Bank Malang.

TABLE 2. Resource Utilization Analysis

Resource Utilization	Replication				
	1	2	3	4	5
Teller 1	0.9993	0.9993	1.0000	0.9999	1.0000
Teller 2	0.9974	0.9988	0.9979	0.9990	0.9985
Teller 3	0.9953	0.9973	0.9980	0.9971	0.9966
Teller 4	0.9943	0.9955	0.9972	0.9963	0.9960
Teller 5	0.9956	0.9951	0.9954	0.9950	0.9953

Utilisasi dari jadwal eksisting penugasan 5 teller dengan 5 kali replikasi ditunjukan oleh Tabel 2. Nilai utilisasi masing-masing teller berkisar antara nilai 0,9943-1.

3. The previous analysis result from the existing simulation of queue system run by ABC Bank Malang, we can conclude that the number of existing teller should be added in order to make *Number In, Number Out, WIP (Work In Process), Flow Time, Waitting Time, Number Waitting* dan *Resource Utilization* much more efficient. Thus, the researcher created system scenario in order to fix the raised-problem as follows:

TABLE 3. Planning and Analysis of Scenario Result

Parameter	Baseline (5 *teller*)	Scenario 1 (1 teller added)	Scenario 2 (2 teller added)
Numbber In	860 Customers	866 Customers	863 Customers
Number Out	832 Customers	861 Customers	859 Customers
Work In Process	28 Customers	5 Customers	4 Customers
Flow Time	8.208 minutes	2.988 minutes	2.874 minutes
Waitting Time	5.390 minutes	0.102 minutes	0.006 minutes
Number Waitting	$9.7403 \approx 10$ Customers	$0.1934 \approx 1$ Customers	$0.0149 \approx 1$ Customers

Table 3 shows the result of simulation, using 5 teller as what have been prepared for actual baseline and adding 2 more tellers what have been shown on scenario 1 and 2. Table 3 indicates that the more we add more teller such as 1 teller or 2 tellers, the more we can reduce the *number of work in process, flow time, waiting time,* and *number of waiting*, on the other words the number of teller is contradictive with the parameter. Thus, it may impact to the bigger number in and out. This condition may help queue to be easily unravel and also reduce utility of each teller. The amount of utility will be inversely proportional to the working tellers. It has been clearly shown by table 4 (in number) and Figure 1 (in graphic), where the baseline has 0,9964 of utility performance and has been changed to 0,8639 by adding 1 teller and 0,7354 by adding 2 more tellers.

TABLE 4. Planning and Analysis of Simulation Result of each Teller

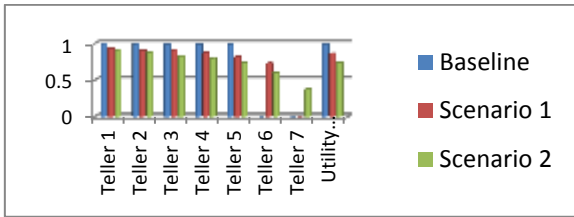| Parameter	Baseline (5 teller)	Scenario 1 (1 teller added)	Scenario 2 (2 teller added)
Resource Utilization			
Teller 1	0.9993	0.9353	0.9155
Teller 2	0.9974	0.9113	0.8848
Teller 3	0.9953	0.9153	0.8318
Teller 4	0.9943	0.8750	0.8031
Teller 5	0.9956	0.8173	0.7326
Teller 6	-	0.7297	0.6052
Teller 7	-	-	0.3754
Utility Average	0.9964 (99,64%)	0.8639 (86,39%)	0.7354 (73,54%)

Figure 1. Teller Performance Analysis

4. Getting result from simulation of baseline, scenario 1, scenario 2 and 6 parameter analysis (number in, number out, work in process, flow time, waiting time, dan number waiting), the very next step after adding 2 more counters is to recalculate the teller salary costs. The tellers' salary costs component will be counted as follows:

TABLE 5. Cost Calculation Analysis

Cost Calculation	Existing	Scenario 1	Scenario 2
Number of tellers	5	6	7
Utility of teller	99,64%	86,39%	73,54%
Pocket Money	Rp. 4.300.000		
Earning/teller=(Utility of teller x Pocket Money)	Rp.4.284.520	Rp.3.714.770	Rp.3.162.220
Difference in cost =(pocket money-earning/teller)	Rp. 15.480	Rp.585.230	Rp.1.137.780
Total Difference in cost =(Number of tellers x Difference in cost)	Rp. 77.400	Rp.3.511.380	Rp.7.964.460
Total Salary=(Number of tellers x Earning/teller)	Rp.21.422.600	Rp.22.288.620	Rp.22.135.540
Difference in Total Salary Costs to Baseline	-	Rp 866.020	Rp. 712.940

The calculation on table 5, we can conclude that every teller in ABC Bank will get salary Rp. 4.300.000,-/month. The total salary cost may be changing, it is based on each tellers' performance. Each tellers' performance can be easily measured by their utility criterion.

IV. DISCUSSION

Here, the researcher will explain the simulation process of research object:

1. There are totally 5 existing tellers at ABC Bank Malang in which they serve around 860 transactions during 3 months

2. *Number In*
Number in shows the number of entity in which will be proceed by the applied-system. The number of entity which has been proceed by the applied-system of ABC bank shows that there are totally 860 customers as what has been shown on table 3. The high number of entity 0,9943 - 1 indicates that the existing tellers (5 tellers on duty) are unable to handle the customers swiftly. It will directly impact to the number of queue list and waiting time. The condition has been previously recorded from simulation which was resulted 10 queues. Customers'

unsatisfaction will potentially appear on the real situation. Here there is a relationship between the customer and the system that is not fulfilled as research conducted by Al-Jumaily et al [8]. By adding cashiers, there were 866 people (scenario 1) and 863 people (scenario 2).

3. *Number Out*
Number Out indicates the number of entities that have left or have finished to be processing from the system. The number of customers leaving the teller from the simulation results is 832 customers. The *number in* and *number out* are out of sync, it means that there is a negative progress such as customer dissatisfaction due to disappointment with the service or the limited time waiting from the customer itself. Corporate management has a role to consider this imbalance. Management must improve comfort in service, because customers are treated equally and efficiently. Thus, it is important to make statistical reports that can be used in the decision making process of the core management [9]. With the addition of the teller assignment, a *number out* increased from the baseline, namely 861 people (scenario 1) and 859 people (scenario 2). This shows that there is a positive progress towards the scenario that is run, which can be seen from the decreasing number of work in process, from the beginning in the baseline condition, there were 28 people, becoming 5 people (scenario 1) and 4 people (scenario 2)

4. *Flow Time*
Flow time is the total time needed for the whole process in the simulation. The total length of time required by the customer in the system is 0.025 hours or equal to 1.5 minutes per customer. The total time spent handling each cutomer is different. But in this study, it was found that the flow time was relatively good where in handling each customer relatively quick. Then, it also shows that there is no significant difference between *number in* and *number out*. Long handling or long flow time can result to customer dissatisfaction [10]. Where, the conclusion is that, there is a long line in the traditional bank teller service, so that the results are contrary to this research. With the addition of the number of tellers, we get a decrease in flow time from 8,208 minutes at baseline conditions, to 2,988 minutes (scenario 1) and 2,874 minutes (scenario 2).

5. *Resource Utilization*
Resource utilization is the level of contribution of a resource both on operator or a machine in a system. This is the level of resource utilities in ABC Bank system. The level of utility resources in the system ranges from 99.43% (teller 1) to 100% (teller 3 and 5). With the addition of tellers, the utility decreased, from the average utility at the baseline ie 99.64% to 86.39% (scenario 1) and 73.54% (scenario 2), as shown in Table 4.

6. The total cost of the teller's salary which is based on the company's obligation baseline is Rp.21,422,600. With the addition of the number of tellers, the total cost of the teller's salary increased by Rp.866,020 to Rp. 22,288,620 for scenario 1, and an increase of Rp.712,940 to Rp.22,135,540. The increasing number of total teller salary costs in scenario 2 is lower than scenario 1. Besides, the scenario 2 also produces better performance compared to scenario 1 and baseline based on the criteria of *Number In, Number Out, WIP (Work In Process), Flow Time, Waitting Time,* and *Number Waitting*. As the Resource Utilization criteria and the total cost of the teller's salary, the baseline has the best performance compared to the two scenarios, but it has a negative impact on the other criteria. So scenario 2, namely the assignment of 7 tellers at 7 different counters is the decision in this study.

V. CONCLUSION

Based on the previous discussions, we can conclude that:

1. Scenario 2 is chosen as a decision, namely the assignment of 7 tellers to reduce queuing time. This decision is supported by the advantages of scenario 2 in the Number In, Number Out, WIP (Work In Process), Flow Time, Waitting Time, and Number Waitting criteria that are better than baseline and scenario 1, and an increase in the total cost of the teller's salary that is lower than scenario 1.
2. Scenario 2 succeeds in reducing waiting time from 5,390 minutes at baseline to 2,874 minutes, or decreases by 46.68%. The condition affected the number of waiting from 10 people in the baseline to 1 person, or decreased by 90%.

REFERENCES

[1]. Taha, Hamdy A. (2003). Operations Reserach : Theory and Application, 3rd Ed. Prentice Hall, India.

[2]. Agyei, Wallace., Christian Asare-Darko., Odilon. Frank., (2015). Modelling and Analysis of Queuing Systems in Banks : (A case study of Ghana Commercial Bank Ltd. Kumasi Main Branch), International Journal of Scientific and Technology Reserach, Vol 4.

[3]. Kakiay, Thomas J. (2004). Dasar Teori Antrian Untuk Kehidupan Nyata (halaman 4-6, 17-18). Penerbit Andi. Yogyakarta.

[4]. Laurent, Felicia., (2016). Pengaruh *E-Service Quality* Terhadap Loyalitas Pelanggan Go-Jek Melalui Kepuasan Pelanggan, AGORA, Vol 4 (2).

[5]. Nafik, Abdul Rauf., Asututi, Yuliani Puji., (2017). Perbandingan Waktu Tunggu Rata-Rata Nasabah Pada Pelayanan Teller Bank Menggunakan Metode FCFS dan SPS, Vol 3 (6).

[6]. Setiawati, Cut I., A. Farah., Budyanna. (2017). Counting Teller Quantity For Better Queue In Financial Institution : Case of Bank Central Asia, Metro Indah Mall Branch Office-Bandung, Jurnal Bisnis dan Manajemen, Vol 18, (2).

[7]. Ramadhan, Jaka Dian., Agus, Fahrul., Astuti, Indah Fitri., (2017). Simulasi Sistem Antrian Dengan Metode *Multiple Channel Single Phase*, Prosiding Seminar Ilmu Komputer dan Teknologi Informasi, Vol 2.

[8]. Al-Jumaily ASA, Al-Jobori HKT. (2011). Automatic Queuing Model for Banking Applications. (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 2, No. 7. Bahrain.

[9]. Ahmed.SZ et al. (2016). Automated Queue Management System. Global Journal of Management and Business Research. Bangladesh.

[10]. Machline C, Serson FM. (2014). A study of queues and customer service in retail bank Agencies. Brazil. POMS International Conferrence 2014, Singapore.