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Industrial Engineering Department, UIN Sunan Kalijaga Yogyakarta

DESIGN OF QUEUE SYSTEMS IN TELECOMUNICATION and INFORMATION INDUSTRY USING FLEXIM 6.0 SIMULATION METHOD

Sulton Nur Hakim[1], Andika Julianto Putra[2], Sri Indrawati[3]
[1]Industrial Engineering, Faculty of Industrial Technology, Islamic University of Indonesia
Jl Kaliurang Km 14,5 Yogyakarta, Telp 0274-898444
[2] Industrial Engineering, Faculty of Industrial Technology, Islamic University of Indonesia
Jl Kaliurang Km 14,5 Yogyakarta, Telp 0274-898444
[3] Lecturer at Industrial Engineering, Faculty of Industrial Technology, Islamic University of Indonesia
Jl Kaliurang Km 14,5 Yogyakarta, Telp 0274-898444
Email: 17522019@students.uii.ac.id

Abstract

PT X is an information and communication company as well as a complete telecommunication service and network provider in Indonesia. In serving customer needs related to services, PT X has Plasa spread across 535 outlets throughout Indonesia until 2019.. Plasa is PT X outlet or place of service, which is fully managed by PT X or in cooperation with service partners. According to the explanation given by the Team Leader Plasa has service standards in serving customer needs including the standard customer service time is 10 minutes and the standard number of customers per CSR is 15 customers. But at PT X Yogyakarta the system actually only has one Customer Service to serve 50 customers and the service time sometimes exceeds the predetermined time standard. This resulted in quite long queues and long waiting times. The purpose of this research is to know the appropriate queue simulation model using flexim 6.0 so that waiting time at Plasa can be minimized. The average waiting time required by customers in the queuing system at Plasa is 3248.44 seconds and based on the alternatives that have been made, it can be seen that experiment 1 is the best, this is because the maximum waiting time achieved is better than experiments 2 and 3.

Keyword: Simulation: Flexim 6.0, Experiment, Queue

INTRODUCTION

The service industry is a different sector compared to the manufacturing sector. The manufacturing sector is an industry that processes raw materials into finished materials that can be used by consumers. Meanwhile, the service industry is an industry that produces services as output to consumers who need it. In a service company, service quality is the key to success, because with good service it can foster a positive image in the eyes of the community so that it can provide optimal benefits to the company. One of the problems that need to be considered in business activities is the problem of queues.

Queuing is a phenomenon that arises in human activities. The queues that appear are caused by service activities that are not balanced with the need for services so that service users are not served immediately. According to (Gross, 2008), the queuing system occurs when a customer comes to a service, a customer is waiting to be served, and the customer leaves the service system if it has been served.

PT X is an information and communication company as well as a complete telecommunication service and network provider in Indonesia. In serving customer needs related to services, PT X has Plasa spread across 535 outlets throughout Indonesia until 2019 (Insphira, 2019). Plasa is PT X outlet or place of service, which is fully managed by PT X or in cooperation with service partners.

As a form of cultural application in PT X Core Values (Solid, Speed, Smart), as well as in line with the vision of PT X which is "to become the digital telco of choice for advancing society". Plasa is useful for maintaining good communication between the company and its customers. PT X, which is one of the companies engaged in the service sector, makes Plasa require a service system that is more efficient and effective as well as Plasa service friendliness. It is not uncommon for company services to experience problems, namely long waiting times. Waiting time is the time used by the customer to get service from the beginning of the process to the end of the process. One of the possible causes of the long waiting time is that the number of facilities available in the service is inappropriate and

inaccurate. These causes can be at risk of delayed service, reduce customer satisfaction, reduce service quality and can also cause long queues.

Plasa service system has two servers with different jobdesc. The two servers are Plasa and Payment Counter. The following is the job description for each server in Plasa:

Table 1. Job Description of Server Plasa

No	Server	*Jobdesc*
1	Plasa	New IndiHome Install, IndiHome Complaints, Billing System Straightening, Upgrades and Downgrades.
2	Payment Counter	Monthly payment, and first payment

According to the explanation given by the Team Leader Plasa has service standards in serving customer needs including the standard customer service time is 10 minutes and the standard number of subscribers per CSR is 15 customers. But at PT X Yogyakarta the system actually only has one Customer Service to serve 50 customers and the service time sometimes exceeds the predetermined time standard. This resulted in quite long queues and long waiting times.

Based on the above problems, the purpose of this research is to know the appropriate queue simulation model using flexim 6.0 so that waiting time at Plaza can be minimized. To further examine the Multi-Channel Single Phase queuing system at PT X Yogyakarta using a simulation approach with Flexim 6.0 software. Flexim 6.0 is used to determine service time and number of customers served, as well as waiting time in the queuing system

LITERATURE REVIEW

System

A system consists of parts or components that are integrated for a purpose.Meanwhile, according to Umar in (Sunyoto, 2014) a system is an order that describes a series of various components that have a shared, coordinated relationship that works or runs within a certain period of time and planned. According to (Sutabri, 2012) The system is a group of elements that are closely related to one another, which function together to achieve certain goals.

Queue system

Queuing is a phenomenon that arises in human activities. The queues that appear are caused by service activities that are not balanced with the need for services so that service users are not served immediately. Queuing is a condition when the object goes to an area to be served, but then faces delays due to the service mechanism being busy. Queues arise because of an imbalance between those served and their services (Iqbal, 2011). The queuing system is the arrival of customers to get service, waiting to be served if the service facility (server) is still busy, getting service and then leaving the system after being served (Gross, 2008).

Model

Model is a representation of an object, thing, or ideas in simplified form of natural conditions or phenomena. The model contains information about a phenomenon that is made with the aim of studying the actual system phenomenon. A model can be an imitation of an actual object, system or event which only contains information that is considered important to be studied. (Achmad, 2008). The word "model" is derived from the Latin mold (mold) or pettern (pattern). According to (Achmad, 2008), there are four general forms of models, namely system models, mental models, verbal models, and mathematical models.

Simulation

Simulation according to (Emshoff & A. SImon, 1970) is a system model where the components are presented by computer-run arithmetic and logic processes to estimate the dynamic properties of the system.
Basically, simulation models are grouped into three dimensions, namely (Law, A.M., And Kelton, W.D, 1991)
1. Static Simulation Model with Dynamic Simulation Model.
Static simulation models are used to present a system at a particular moment or a system that is not affected by changes in time. While the dynamic simulation model is used if the system under study is influenced by changes in time.
2. Deterministic Simulation Model with Stochastic Simulation Model.
If the simulation model to be formed does not contain random variables, then the simulation model is said to be a deterministic simulation. In general, the system modeled in the simulation contains several random inputs, so in a system like this the simulation model built is called a stochastic simulation model.
3. Continuous simulation model with Discrete Simulation Model.

To classify a simulation model whether discrete or continuous, it is largely determined by the system being studied. A system is said to be discrete if the system variables that reflect the status of the system change at a certain point in time, while the system is said to be continuous if changes in system variables take place continuously over time.

METHOD

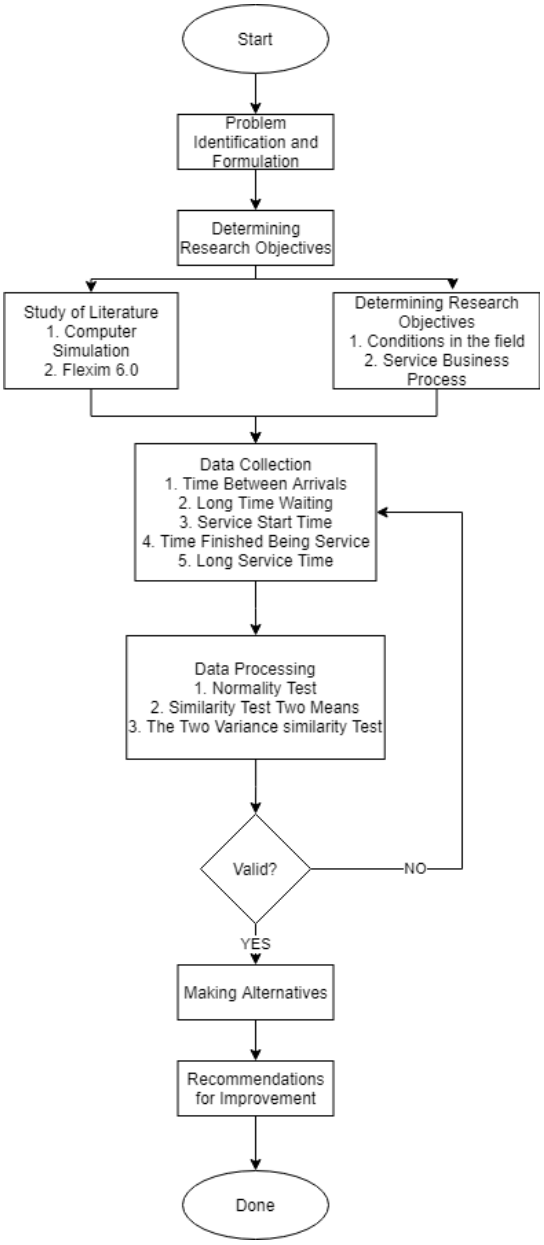
Primary Data

Primary data is data obtained by researchers directly from original sources or first parties. In this study, the method of observation and expert interviews was used in collecting primary data. Primary data taken is the time of arrival of customers, time to start being served, and time to finish being served. With the three data above, it can also be obtained the customer waiting time, the time between customer arrivals, and the speed of service. From these data are used in making models in the Flexim 6.0 software.

Secondary Data

Secondary data is data obtained through intermediary media or indirectly in the form of books, historical reports, journals, as well as materials related to simulations using Flexim 6.0 software.

Research Flow



Picture 1. Research Flow Diagram

The following is an explanation of the research flow diagram:

1. Identification problems
   The research that is being carried out needs continuous improvement. In this study, the analysis was related to the problems that occurred based on the results of observations in the field in the conditions when the researcher was doing the research.
2. Research purpose
   The formulation of the problem relates to the objectives to be achieved and as a basis for drawing research conclusions.
3. Study of literature
   Literature studies are conducted to study theoretical studies from various sources of previous research or books as the basis for the research carried out. The theoretical basis used in this research is computer simulation using Flexim 6.0 software.
4. Observation
   Observations were made so that researchers know how the company's service business processes are the focus of the research.
5. Data collection
   The data used in this study are secondary data and primary data. Primary data is obtained through direct observation.
6. Data processing
   The data that has been obtained will be processed data. Data processing is carried out to determine whether the data that has been collected meets the requirements for conducting research.
7. Alternative making
   After the data collected meets the requirements, the next step is making alternatives. The alternative is made to provide recommendations to the company
8. Results analysis and discussion
   Data that is processed into information will be summarized as a support for making a decision.
9. Recommendation for improvement
   After the data is analyzed, then determine which alternative is the most appropriate for the problems in the company.

RESULT AND DISCUSSION

Data Normality Test of Service Duration

Before creating a simulation model, a normality test is carried out to determine whether the distribution of a data follows or approaches the normal distribution. The following is a Normality Test of Plasa server service duration data:

Table 2. Data Normality Test of Plasa Server Service Duration

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Waktu	.127	30	.200	.947	30	.144

From these data it can be seen that the significant Kolmogorov-Smirnov column (Sig) is 0.200 or a probability of more than 0.05, so H0 is accepted, which means the data is normally distributed.

The following is the Normality Test of the old data for the payment counter server service:

Table 3. Data Normality Test of Payment Counter Server Service Duration

Kolmogorov-Smirnov				Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Waktu	.128	30	.200	.910	30	0.15

From these data it can be seen that the significant Kolmogorov-Smirnov column (Sig) is 0.200 or a probability of more than 0.05, so H0 is accepted, which means the data is normally distributed.

Simulated Initial Conditions

The queue model simulation is carried out with the help of Flexim 6.0 software to describe the work flow that occurs on the Plasa server and payment counters to determine the level of activity that occurs in the system. The following is the initial model at Plasa:

Table 4. Preliminary Simulation Results Summary Report

	Second						
Object	stats_content	stats_contentmax	stats_contentavg	stats_input	stats_output	stats_staytimemax	stats_staytimeavg
Arrival of customers 1	0	0	1	0	44	1153.11	113.32
Arrival of customers 2	0	0	1	0	32	4016.91	251.58
Waiting place	19	20	16.70	76	57	11374,02	3248,44
Plasa Server	1	1	0.97	25	24	1506,37	727,24
Payment counter server	1	1	0.69	32	31	764,73	400,22
End	1	1	0	55	0	0	0

Based on the report above, it can be seen that there are 76 customers who entered the system, and 57 customers who were successfully served until the end. This means that there are still 19 customers who cannot be served. The reason for the large number of customers who do not get the time to be served until the end is because the length of service time is not proportional to the number of customers who come to Plasa. This can cause problems in the system, because unserved customers can have a negative impact on the quality of PT X's service.

Table 5. Preliminary Simulation Results State Report

Object	*Idle* (%)	*Processing* (%)	*Busy* (%)	*Blocked* (%)	*Generatin* (%)	*Empty* (%)	*Collecting* (%)	*Releasing* (%)	*scheduled down* (%)
Arrival of customers 1	0	0	0	28,18	71,82	0	0	0	0
Arrival of customers 2	0	0	0	44,77	55,23	0	0	0	0
Waiting place	0	0	0	0	0	3,45	0	96.55	0
Plasa Server	2,93	97,07	0,00	0,00	0	0	0	0	0
Payment counter server	31,00	69,00	0	0	0	0	0	0	0
End	0	0	0	0	0	0	0	0	0

Based on the report above, it can be seen that the highest% Processing is on the Platform Server and Payment Counter Server. This is because the number of patients who came on that date is not proportional to the number of customer service providers.

Similarity Test of Two Means

The two-mean similarity test is a test to determine whether two populations have the same characteristics. Here is the Waiting Place validation using the two-mean similarity test:

Table 6. Validation Results of The Similarity Test For Two Waiting Points

	Real	Simulation
Mean	3217.333333	2268.640607
SD	1677.261589	1468.749255
N	30	30
Result		
Sp2	240345159.1	
t value	0.3351726	

Based on the results of the above calculations, it can be seen that the t value is in the receiving area, so the hypothesis H0 is accepted. Thus, there is no difference between the total historical output and the total simulation output.

The Two Variance Equality Test

The two-variance similarity test is used to test whether the data distribution is homogeneous or not by comparing the two variances. Here is the Waiting Place validation using the two variance similarity test:

Table 7. Validation Results of The Similarity Test of Two Waiting Variances

Result	
F Value	1,304086

From the results above, it can be seen that the calculated F value is in the acceptance area, so the hypothesis H0 is accepted. Thus the total historical output and the total simulation output have the same or homogeneous variants.

Experiment 1

In experiment 1, the operator added or adjusted the platform server. This is to increase operator idle% and also reduce queuing waiting time. The addition of these three scenarios could have been done because of the large% processing of these operators and also to reduce waiting time. However, for the process of adding CSR, it will go through the recruitment process, causing expenses to increase every month. In terms of service, it will be better so that all customers can be served, so that the level of performance of the Plasa service system will be better.
The following data adjustments are made for the number of operators on the plasa server:

Table 8. Experimental Design

	Variabel	Skenario 1	Skenario 2
Variabel	Nr object in Group 1	1	2

As in the table above, there are 2 scenarios carried out in the experimental design 1. Experiment, namely adding machines or if in the real world, namely increasing the number of servants. In experiment 1, the addition of operators on the platform server will be carried out, the first scenario is in accordance with the initial conditions, namely the number of services in the real system is only 1. The second scenario shows that the researcher wants to try to experiment by adding more servants to 2. The results of experiment 1 are as follows:

Waktu Tunggu Rata-Rata

	Mean (90% Confidence)	Sample Standard Deviation	Min	Max
Scenario 1	2985.11 < 3109.66 < 3234.21	401.52	2126.69	4119.01
Scenario 2	1817.07 < 1996.03 < 2174.99	576.93	873.78	3390.52

Picture 2. Experiment Average Waiting Time 1 (Second)

From the results above, it can be seen that the addition of operators on the plasa server resulted in a decrease in waiting time at the Waiting Place.

Exsperiment 2

In experiment 2 it is almost the same as experiment 1 but the object of adding operators is the payment counter server. The following are the results of experiment 2:

Waktu Tunggu Rata-Rata

	Mean (90% Confidence)	Sample Standard Deviation	Min	Max
Scenario 1	2985.11 < 3109.66 < 3234.21	401.52	2126.69	4119.01
Scenario 2	1938.17 < 2075.81 < 2213.45	443.72	1148.14	2826.74

Picture 3. Experiment Average Waiting Time 2 (Second)

From the results above, it can be seen that the addition of operators on the payment counter server resulted in a decrease in waiting time at the Waiting Place.

Eksperiment 3

In experiment 3, an adjustment was made of the system working hours, where there were customers who were still not served until the working hour was over. This is done to reduce the number of customers who are not served until the working hours are over. In setting working hours, changes are made to the operating hours on the plasa server.

Where initially the operating hours from 08:00 - 13:00 without break time are changed to 08:00 - 15:00 with break times from 12:00 - 13:00. The following is the summary and state report of experiment 3:

Table 9. Summary Report Experiment 3

	Detik						
Object	stats_content	stats_contentmax	stats_contentavg	stats_input	stats_output	stats_staytimemax	stats_staytimeavg
Arrival of customers 1	0	0	1	0	42	380,49	56,24
Arrival of customers 2	0	0	1	0	39	1798,78	108,14
Waiting place	10	20	15.61	81	71	10810,08	3006,95
Plasa Server	1	1	0.99	36	35	4618,19	708,59
Payment counter server	1	1	0.98	35	34	776,40	401,49
End	1	1	0	69	0	0	0

Based on the report above, there was a reduction in unserved customers. Only 10 customers are left in the Waiting Place. This is better in the previous model considering that if the customer cannot be served it will reduce the quality of service.

Table 10. State Report Experiment 3

Object	*Idle* (%)	*Processing* (%)	*Busy* (%)	*Blocked* (%)	*Generatin* (%)	*Empty* (%)	*Collecting* (%)	*Releasing* (%)	*scheduled down* (%)
Arrival of customers 1	0	0	0	33.32	66.68	0	0	0	0
Arrival of customers 2	0	0	0	44.54	55,46	0	0	0	0
Waiting place	0	0	0	0	0	2.76	0	77.24	20
Plasa Server	15.43	84.57	0,00	0,00	0	0	0	0	14.36
Payment counter server	21.07	78.93	0	19.43	0	0	0	0	0
End	0	0	0	0	0	0	80	0	20

Based on the report above, it can be seen that% Processing on the plasa server has decreased by 12.5%. although it is still classified as not significant enough, it is better in terms of operator workload because in the previous model the Plasa server had the highest% processing, namely 97.07%.

EXPERIMENT SELECTION

Based on the discussion of the alternatives above, it can be seen that the best alternative is experiment 1, this is because the average waiting time obtained is the lowest, which is 1996.03 second when compared to experiment 2 and 3, is 2075.81 and 3006.95

CONCLUSION

Based on the results of data processing and discussion above, the conclusions that can be drawn based on this research are:

1. The average waiting time required by customers in the queuing system at Plasa is 3248.44 seconds.
2. Based on the alternatives that have been made, it can be seen that experiment 1 is the best, this is because the maximum waiting time achieved is better than experiments 2 and 3.

REFERENCE

Achmad, M. (2008). Teknik Simulasi dan Pemodelan.
Emshoff & A. SImon. (1970). Rancangan Ulang dan Simulasi. *Social Work jurnal. ISSN: 2339-0042*.
Gross, D. (2008). *Fundamentals of Queuing Theory.* New York: John Willey and Sons.
Insphira, M. (2019). *Laporan Tahunan Final 2019.* Jakarta: PT Telekomunikasi Indonesia Tbk.
Iqbal, M. (2011). *Analisis Kinerja Sistem Pendekatan Teori dan Praktek.* Depok: Gunadarma.
Law,A.M., and Kelton,W.D. (1991). *Simulation Modeling and Analysis.* SIngapore: McGraw-Hill,Inc.
Sunyoto, D. (2014). *Dasar-Dasar Manajemen Pemasaran (Konsep, Strategi, dan kasus).* Yogyakarta: CAPS (Center for Academic Publishing Service).
Sutabri, T. (2012). *Konsep Sistem Informasi.* Yogyakarta: Andi.