Simulation of Queuing System for Customer Service Improvement: A Case Study

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Abstract. This paper describes the queuing system for buying tickets in a cinema. Queues can be interpreted as a long line of customers who need service from one or more service facilities. Queues occur because of an imbalance between those served and their services. Some cinema consumers are annoyed because of the long queue to buy tickets and sometimes cancel them. One cinema that does not escape the length of the queue waiting time is the XYZ cinema. The purpose of this study is to optimize the queue system in buying tickets in the cinema to avoid long queues. The queuing system is optimized with a simulation approach using discrete event simulation. Simulation results show the best value obtained in the proposed scenario simulation model is to add a queue path to the queuing system. The results obtained are by increasing the queue path from 1 to 2 so that the length of the queue decreases from 91.2068 people per hour to 54.1520 and 50.8887 people per hour. Service time at counter 1 is 4.2201 minutes with an average number of 58.5861 people per hour. Service time at counter 2 is 3.9701 minutes with an average number of 51.1310 people per hour.

1. Introduction
The development of the world film industry is developing rapidly in the digital age and producing quality films. Indonesia is known as one of the countries that has a large number of citizens [1]. This certainly provides enormous potential in the human resources sector which can have massive effects on various industries in Indonesia, one of which is cinema. The number of cinema viewers experiencing high growth makes the number of cinemas increase each year [2]. The number of cinemas in Indonesia in 2019 is 2000 cinemas [3]. Comparison of the number of cinemas and the large audience still makes a long queue in several theaters. Queues can be interpreted as a long line of customers who need service from one or more service facilities [4]. Queues occur because of an imbalance between those served and their services [5]. Based on the results of interviews conducted with several cinema managers, many viewers were annoyed with the long queues when buying tickets and made some viewers cancel to watch. The cancellation made the cinema revenue reduced because customers chose to go to other theaters in the hope that the queue for more ticket purchases a little. One of the famous cinemas in Medan is the XYZ cinema, this cinema experiences a long queue in purchasing tickets, especially holidays. From interviews with cinema managers, analysis and simulation approaches are needed to illustrate and optimize the ticket purchase queue system so that it can determine the number of lines to be made in ticket purchases. The purpose of this study is to optimize the queue system in buying tickets at the XYZ cinema to avoid long queues. The basic process components of the queue are:

a. Arrival
Every queue problem involves arrival, for example cars, people, phone calls to be served, and others. This element is often called the input process. The input process includes the source of arrival or commonly called the calling population, and the manner of arrival which is generally a random variable. A random variable is a variable whose value can be anything as a result of a random experiment. Random variables can be either discrete or continuous. If a random variable is only possible to have a few values, it is a discrete random variable. Conversely, if the value is possible to vary over a certain range, it is known as a continuous random variable.

b. Service
A service or service mechanism can consist of one or more servants, or one or more service facilities. Each service facility is sometimes referred to as a channel. For example, a toll road can have several toll booths. The service mechanism can only consist of one service in one service facility found at a ticket window such as ticket sales at a movie theatre.

c. The queue
The essence of queuing analysis is the queue itself. The emergence of the queue depends on the nature of the coming and the service process. If there is no queue, it means that the servants are unemployed or have excess service facilities [2]. In this case, we request a simulation to solve the queue problem. Simulation model is one model that asks anyone involved in this strategy to consider themselves as other people who support to learn how others do it and feel [3][14]. The software used is Arena Software. Arena Software is software developed and systems developed by System Modeling. This software is able to build experimental models using modules that state processes or logic. Furthermore, this software has a connecting line that is used to declare the relationship between modules and or express the flow of entities.

2. Research Methodology
In conducting research, there are several stages that are used, namely the stage of data collection, initial identification of problems, setting goals, processing data, then conclusions.

2.1. Data Collection
At this stage the data obtained from direct observation to the field. Data needed is data between arrivals [4], length of service.

2.2. Distribution Testing
Distribution testing for a long time to service [5] is done with Easyfit Software. From the distribution, the distribution parameters taken to be included in the Arena Software are the distribution of time between arrivals and the distribution of service time.

2.3. Initial System Identification
In the initial identification the problem will be sought in the XYZ Cinema queuing system.

2.4. Analysis of the Arena Initial Model
At this stage the simulation is made in the form of modules using Software arena.

2.5. Arena Proposed Model
At this stage the proposal is made in the form of module simulations using the Arena Software. Alternative queuing system solutions are proposed to reduce queue length at XYZ Cinema consumers. Several previous studies using different methods that the authors used as a reference [7] such as the PLN payment counter queue [8]; simulation of vehicle movement in two-dimensional space [9]; queue at the supermarket cashier [10]; optimization of production processes in fish canning companies [11]; queues at pharmacies [12]; XYZ skin care consumer queues [13].
3. Result and Discussion

3.1. Data Collection
At this stage the data is obtained from direct observation to the field, on Saturday, October 26, 2019 for 8 hours, starting at 14.00-22.00 WIB. The data needed is data between arrivals, length of service. Data obtained during observation can be seen in the Appendix.

3.2. Distribution Testing
The following is a distribution test carried out on the data between arrival time and service length that has been collected during the observation using Easyfit Software which can be seen in Figure 1 and Figure 2.

**Figure 1.** Testing the Distribution Of Time Between Arrivals
Based on Figure 1. The distribution of time between arrivals is Exponential Distribution with $\alpha = 0.46618$.

**Figure 2.** Testing the Long Service Distribution
Based on Figure 1. The distribution of time between arrivals is Exponential Distribution with $\alpha = 0.46618$. 
3.3. Initial System Identification
The system in the object of observation consists of 4 stages, namely the arrival of consumers, queues, services and consumers out. The queuing system in XYZ Cinema has several problems namely the time consumers wait very long because there is only 1 queue line even though there are 2 counters. Therefore, it is necessary to improve the XYZ Cinema queue system.

3.4. Analysis of the Arena Initial Model
At this stage the simulation is made in the form of modules using Software arena. Following is a module in activity simulation at XYZ Cinema which can be seen in Figure 3.

![Figure 3. The initial model simulation arena](image)

Based on Figure 3. The initial model explain than when the customer get in to XYZ Cinema, They get into the queue without choosing the queue, because there is only 1 line, After finished queueing, they pick the counter that are available to be served then the costumers leave.
Figure 4. Results of Initial Model Arena Simulation

Based on Figure 4, it is obtained that the average queue time of simulation is 3.3962 minutes with an average number of 91.2068 people per hour. Service time at counter 1 is 4.3553 minutes with an average number of 59.3596 per hour. The service time at counter 2 is 4.3280 minutes with an average amount of 57.2442 per hour.

3.5. Arena Proposed Model

At this stage the proposal is made in the form of module simulations using the Arena Software. An alternative queuing system solution is proposed to reduce the queue length for XYZ Cinema consumers, namely to increase the queue path in the XYZ Cinema queue system. Following is an alternative module offered solution which can be seen in Figure 5.
Figure 5. Results of Initial Model Arena Simulation

Based on Figure 5, the proposed arena simulation model explain that when the customer get into XYZ Cinema, They get into the queue and they choos the queue and they will wait. After finished queueing, they headed to the counter in front of their queue, after being served, the customer left.
Figure 6. Simulation Results of the Proposed Model Arena

Based on Figure 6, it is obtained that the average queue time of simulation is 3.9007 minutes and 3.9513 minutes with an average number of 54.1520 people per hour on line 1 and 50.8877 people per hour. Service time at counter 1 is 4.2201 minutes with an average number of 58.5861 per hour. The service time at counter 2 is 3.9701 minutes with an average amount of 51.1310 per hour.

4. Conclusion
The simulation results show that the best value is obtained in the arena simulation of the proposed scenario model, namely by adding a queue path to the XYZ Cinema queuing system. Based on the simulation of the proposed model arena, it was obtained that the average queuing time of the simulation was 3.9007 minutes and 3.9513 minutes with an average number of 54,1520 people per hour and 50.8877 people per hour. Service time at counter 1 is 4.2201 minutes with an average amount of 58.5861 per hour. Service time at counter 2 is 3.9701 minutes with an average amount of 51.1310 per hour the length of the queue is reduced, and it will reduce invalidation and will increase the turnover of XYZ Cinema.

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