UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Study on the Efficiency of Services Provided by Post Office Using Simulation Modelling

Thesis submitted in accordance with the partial requirements of the Universiti Teknikal Malaysia Melaka for the Bachelor of Manufacturing Engineering (Manufacturing Process) with Honours

By

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Faculty of Manufacturing Engineering
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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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DECLARATION

I hereby declare that this report entitled **"STUDY ON THE EFFICIENCY OF SERVICES PROVIDED BY POST OFFICE USING SIMULATION MODELLING"** is the result of my own research except as cited in the references.

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ABSTRACT

The objectives of the projects are to simulate the system of counter service in post office, measure the efficiency of the counter service, reduce the response time to the customers, and optimise the number of service counter. In order to accomplish this project, a case study was conducted at Ayer Keroh Post Office. The target was set at the four counters which manage the general tasks such as selling stamps and managing express post. This was a one-month case study which started at 22nd of November 2007 and ended at 22nd of December 2007. Data such as arrival time, service starting time, service ending time, give up departure time, queue length and number of counter were taken during the case study. The data taken from the Ayer Keroh Post Office had been analysed and grouped into five categories (Monday-Peak-Season, Monday-Normal-Season, Saturday, Peak-Season, and Normal-Season) and five models were built using ProModel software. Upon completion of models development, the models were verified and validated. The models were run to obtain the analysis data from the simulation. The efficiency of the counter service was evaluated by checking on the system utilisation of the counters. The system was improved by optimising the number of counter, based on the original percentage of system utilisation, through the shift table. The five models were run again and the analysis data showed that system was improved in term of system utilisation. However, the response time did not decline for every model. The response time for Monday-Peak-Season and Monday-Normal-Season decreased; while response time for Saturday, Peak-Season, and Normal-Season had slightly raised up.

ABSTRAK

Tujuan bagi projek ini adalah untuk mensimulasikan sistem kaunter perkhidmatan di pejabat pos, menyukat keefisienan perkhidmatan kaunter, mengurangkan masa menunggu bagi pelanggan dan mengoptimumkan jumlah kaunter di pejabat pos. Untuk menjayakan projek ini, satu kajian kes di pejabat pos Ayer Keroh telah dicadangkan. Sistem yang dikaji adalah empat buah kaunter perkhidmatan yang memberikan perkhidmatan biasa seperti menjual stem dan menguruskan pos ekpres. Kajian ini dijalankan selama sebulan dari 22 hb November 2007 hingga 22 hb Disember 2007. Data seperti masa sampai, masa permulaan perkhidmatan, masa tamat perkhidmatan, masa meninggal tanpa dilayan, panjang barisan dan bilangan kaunter direkod dalam kajian tersebut. Data yang terdapat dari Pejabat Pos Ayer Keroh telah dianalisasikan dan dikumpul lepada lima kumpulan (Monday-Peak-Season, Monday-Normal-Season, Saturday, Peak-Season, dan Normal-Season) dan lima model telah dibuat dengan menggunakan ProModel. Model-model tersebut ditentusahkan selepas habis dibuat. Mereka dijalankan untuk mendapatkan data analisis daripada simulasi. Keefisienan bagi perkhidmatan kaunter ditentukan dengan mengkaji penggunaan kaunter. Sistem ini dibaikkan dengan mengoptimumkan bilangan kaunter berdasarkan peratus penggunaan kaunter yang asal melalui *shift table*. Kelima-lima model tersebut dijalankan lagi dan data analisasi menunjukkan sistem ini telah dibaikkan dari segi penggunaan sistem. Walaubagaimanapun, masa menunggu tidak menurun bagi kesemua model. Masa menunggu bagi *Monday-Peak-Season and Monday-Normal-Season* menurun manakala masa menunggu bagi *Saturday, Peak-Season, and Normal-Season* telah meningkat sedikit.

DEDICATION

For my beloved mother, father and three sisters.

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LIST OF ABBREVIATIONS, SYMBOLS, SPECIALIZED NOMENCLATURE

CPM	-	Critical Path Method
FCFS	-	First Come First Serve
PMB	-	Pos Malaysia Berhad
PDF	-	Probability Density Function
SDESA	-	Simplified Discrete-Event Simulation

LIST OF APPENDICES

CHAPTER 1
INTRODUCTION

1.1 Background

In general, post office is the place where we can buy stamp and post letter. However, post offices in different countries or in different areas may provide various kinds of extra service.

Post offices in Malaysia are under the governance of Pos Malaysia Berhad (PMB). Pos Malaysia encompasses more than 674 Post Offices, over 305 Mini Post Offices and more than 291 independent Postal Agents throughout the nation. Their services are divided into four main categories which are *PosMel, PosLaju, PosNiaga* and *PosLogistik*.

Particular in Malacca, there are 21 post offices. The head quarter of the Malacca state post offices (Malacca General Post Office) is located at Bukit Baru. According to the head of *Posniaga* Department of Malacca branch, the peak season for the counter service starts from around 23rd of a month until around 6th of another month. This is because the pay days of the government and private sectors and the due date for bill-paying also drop within this duration. The peak hour of a day during the peak season starts around 8.30 a.m. and ends around 3.00 p.m.; whereas, during the normal day, the peak hour will usually start from 9.30 a.m. until 2.00 p.m. To ensure the customers able to get response within a short duration, 75% of the counters are always opened. Thus, the servers start work, rest, and end work at time different from each other.

Malacca General Post Office consists of more than 20 counters which responsible on various kinds of service. It uses digital numbering system in its queue system, thus customers need not to physically queue up and a waiting line may not

be seen in front of the counters. After taking a numbering ticket, the customers may sit and wait at the waiting area, or they may go out for a while and come back again.

Malacca General Post Office and another 7 post offices among the 21 post offices in Malacca apply certain system to measure the efficiency of the counter service. The 5 types of data below are taken into consideration to calculate the efficiency of the counter service.

a. the total number of customers in a particular day.
b. the total number of customers who are able to get service within 10 minutes after they take the ticket.
c. the average waiting time.
d. the longest waiting time.
e. percentage of achieved target.

*Data (a) – (d) are taken from the record of the digital-numbering system.
*Result (e) is the ratio of (b) and (a). [(value (b) / value (a)) x 100%]
*The target for Malacca branch post offices is to response to customers within 10 minutes and achieves 90% of the target which means 90% of the customers are desired to be responded within 10 minutes.

Ayer Keroh Post Office, one of the Malacca post offices, runs with 4 general service counters. Different from the Malacca General Post Office, Ayer Keroh Post Office does not use digital numbering system but apply the physically queue up system. A waiting line can be seen in front of the counters. The customers have to stay at the waiting line. If they leave the queue, when they want to come back to the queue, they have to start queuing up from the last position again. Until present stage, Ayer Keroh Post Office is not one of the Malacca post offices which apply the efficiency measuring system.

1.2 Problem Statement

In one day operation, post office may have certain duration which is the peak hour where many customers wait to be responded. Also, within a month, there are peak days in which more customers require for services than the normal day. In these peak hour or peak days, if insufficient counters are opened for services, the waiting line will be too long and cause the dissatisfaction of the customer. On the other hand, if too many counters are opened for the services during the normal hours or normal days, it will cause a waste of man power. As a result, the effectiveness in controlling the number of counter becomes rather important.

Particular in Ayer Keroh Post Office, since it does not apply digital numbering system in its queuing system, the controlling of the number of counter give even more significant effect on the waiting line. When inadequate counters are provided, the customers have to wait for such a long duration in the waiting line; yet they cannot leave the waiting line since they will be treated as new customers and have to queue up from the last position when they come back to the queue. The inefficiency of counter service may cause the customers "balk" from the system which means the customers leave the queue system entirely.

1.3 Objectives

1. To simulate the counter service of post office**.**

2. To measure the efficiency of counter service of post office.

3. To minimise the waiting time of the customers in post office.

4. To optimise the number of counter in post office.

1.4 Scope

1. Only the services of the four counters which manage the general tasks of post office are taken into consideration.

2. Only the customers who queue up in the waiting line are counted in the total number of customers in waiting line, whereas the customers wait outside the line are not taken into account.

3. The data are taken for only one month duration, which is from 22nd November 2007 to 22nd December 2007.

4. The only simulation software used to conduct this case study is ProModel.

5. The factors which are taken into account to optimise the number of service counters and minimise the waiting time of customer are the waiting time in queue and service time at the counters, cost factor is not considered in the task.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

This chapter will discuss the meaning of service system and list down its characteristics. Also, two methods on measuring the service efficiency, provided by Martinich (1997) and Stevenson (2002), will be discussed. Other than that, this chapter will give explanation on queuing theory. To know the distribution type for the data set is essential in simulation, thus this chapter explains a few types of distribution that are usually used in this particular case (post office service system). To manage the queue effectively, a manager needs not only the changing on the physical layout or shift and break time, the psychology of queues can be another important factor in managing queue. Some explanation is given in this chapter on the psychology of queues. Some suggestions for managing queues are also included in this chapter. Furthermore, this chapter will discuss on simulation. Various types of simulation, such as ProModel, Arena, Witness and SDESA are introduced in this chapter. The steps to carry out a simulation have been discussed and the advantages and limitations of simulation are also listed down.

2.2 Service Systems

Chung (2004) defined system as a collection of interacting components that receives input and provides output for some purposes. Desmet, Looy and Dierdonck (1998) defined service as "all those economic activities that are intangible and imply an interaction to be realised between service and consumer". While Harrell, Ghosh and Bowden (2004) stated that service system is a processing system where one or more services are provided to customers where entities (customers, orders, work, etc) are routed through a series of service stations and waiting areas.

2.2.1 Characteristics of Service Systems

Services possess four unique characteristics which distinguish it from manufacturing product. It is said that service is intangible (not a thing) and perishable (cannot be inventoried). Other than that, service provides heterogeneous output (output is vary) and involves simultaneous production and consumption (service is produced and consumed at the same time). A main aspect of service system which makes in different from manufacturing process is that it deals with customer processing and the resource performing the service is human where human have much more complex and unpredictable behaviour than parts and machines.

Since consumption and production of services occur simultaneously, fluctuations in demand for service are hard to cope with. Usually, customers arrive randomly and place immediate orders on the service. The customers have to wait in line if the service capacity is fully utilized at the time he arrives. "Queue" is then formed by these varying arrival rates and service requirements. The perception of waiting is always more important to the customer than the actual waiting time (Fitzsimmons[a] & Fitzsimmons[b], 2001).

2.2.2 Measure of Service Efficiency

Martinich (1997) had provided a method on how to measure the queuing system efficiency. When studying queuing systems, we will differentiate between waiting time of the customers in queue and waiting time in the system. The time in the queue refers to the time a customer spends waiting until he is being served; the time in the system is the time the customer spends in the queue plus the time being served. Similarly, the number of customers in the system is the number in the queue added up with the number being served. There are four primary measures of waiting:

W_q = average time customers spend waiting in the queue

W_s = average time customers spend in the system

L_q = average number of customers waiting in the queue

L_s = average number of customers in the system

All the measures above are long-term average. An individual may experience no waiting in the queue, but the average for all customers may be substantial. Usually, these measures are assumed to be steady-state averages. The queuing system is said to be in steady-state when the rate of departures from the system equals the rate of the arrivals.

The performance measures W_q, W_s, L_q and L_s, are affected by the numerical parameters:

λ = average rate of arrivals in customers / unit time

μ = average rate at which a server can serve customers in customers / unit time

s = number of servers in the system

ρ = utilisation factor (customer arrivals / unit time divided by total service capacity)

P_n = the probability or fraction of time that exactly n customers are in the system

$P_{\geq n}$ = the probability or fraction of time that at least n customers are in the system