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Procedia Environmental Sciences 10 (2011) 640 – 646
Procedia Environmental Sciences

2011 3rd International Conference on Environmental Science and Information Application Technology (ESIAT 2011)

Study on Queuing System Optimization of Bank Based on BPR

Tian Hao[a]a*,Tong Yifei[b]

[a]Nanjing University of Science and Technology, School of Mechanical Engineering 402, 210094 Nanjing, People's Republic of China
[b]Nanjing University of Science and Technology, School of Mechanical Engineering 402, 210094 Nanjing, People's Republic of China

Abstract

This paper focuses on improving the queuing system of bank based on BPR. Firstly, the bottleneck problems of bank queuing is analyzed as well as the concept, classification and methodologies of BPR (business process reengineering). Secondly, the bank businesses are investigated and analyzed. Thirdly, the queuing system of certain bank is optimized based on BPR by enterprise dynamic simulation. Finally, the simulated results are discussed and the optimized result is concluded.

Keywords: BPR;Queuing system; Enterprise Dynamic; bank management

1. Introduction

The problem of bank queuing has existed for long time wherever our country or other countries whose population density is high. However, this problem can't be solved completely in short time. It is not practical for the banks to increase the number of branch bank and servers in the banks merely. Wrong decision of location selecting as well as redundant building of banks will of course bring huge loss to the bank. Meanwhile, waste of related resources will lead to tremendous environmental problems. According to the analysis, there are four main reasons leading to the existence of problem of bank queuing [1]: Deficiency of power from the commercial banks. Because of the low interests of small service and the

* Corresponding author. Tel.: 86-15850548693; fax: 02584315831.
E-mail address: airtianhao@sina.cn

doi:10.1016/j.proenv.2011.09.103

80/20 rule, the commercial banks lack of power for eliminating this problem. The existence of Switching Cost Effect also makes the problem paid little attention. The level of management of our country's banks is low. Lacking of outside competition leads to improper classification of customers, lopsided business process, improper staffing, etc. The custom of paying needs time to be changed completely. Return on investment of ATM is relatively low. Therefore, we should not anchor our hope on the increasing of branch bank, change of custom of paying, popularization of electronic bank to solve the problem of bank queuing. Thus, we must focus on improving the queuing system of bank.

BPR is a thorough rebuilding of business process. BPR focus on improving on many aspects like cost, quality, service, speed, etc. [2] According to the difference of range of process and characteristic of reengineering, BPR can be divided into three parts---BPR within the function, BPR among the functions and the BPR among organizations [3]. We need scientific method and tools to study on the reengineering of process. Based on the results of former research, methods of BPR can be divided into four categories: method based on analysis of results, method based on analysis of technique, method based on eliminating of activities, method based on agent standard. This study mainly focus on the application of BPR in the bank queuing system, discovery of bottleneck and optimization based on simulation.

2. Application of BPR in the bank queuing system

This study researches on the application of BPR in the bank queuing system based on Xiao Ling Wei Branch of Industrial and Commercial Bank Nanjing Branch. Resulting from the huge traffic, the problem of queuing system is especially severe in this branch bank. The number of staff in this branch bank is about 40.The business hall has 9 servers and 1 server for VIP. Hours saving business 9 00-5:00 Monday to Sunday Corporate business 9-11:30and 1:30-5:00 Monday to Friday

2.1Analysis of business process

Analysis of business process is divided into external part and internal part. The external part is the process of customers' queuing.

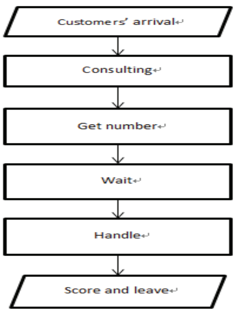

Fig.1. External Part

2.2Investigation and analysis of current situation of queuing

2.2.1Statistics of basic business

There is a great variation of the number of customers' arrival in different time period. Meanwhile, different business has different handling time. Aiming at this situation, here's the mean of the two-day' statistics (Tuesday, Friday).We divide the serving time into four parts. In each part, we divide the business into three categories: Saving business, corporate business and VIP business. Statistics is listed in table1.

Table 1.Statistics of basic business

Time	Type	Number Of Servers	Times	Average Duration Of service	Average people in queue	Average Duration Of queuing	Number Of Leaver
9:30	Corporate	5	24	12.1	11	14	13
---	Saving		75	5 39			
11:30	VIP	1	1	23	0	0	0
11:30	Corporate	2	28	5.05	2	4	0
---	VIP	1	1	19	0	0	0
1:30							
13:30	Corporate	5	17	12.1	7	11	3
---	Saving		67	5.51			
15:30	VIP	1	2	18	0	0	0
15:30	Corporate	7	20	11.2	19	25	18
---	saving		64	6.0			
17:00	VIP	1	2	21	0	0	0

2.2.2 Existing problem of current services

By investigating and analyzing both the internal part and external part, we conclude the problems as the following aspects

(1)The overall queue time is relatively long level of customers' satisfaction is comparatively low.
(2)Usage ratio of VIP is low.
(3)The number of open servers is fixed rather than flexible. The division of working time is uneven.
(4)In the period of 3:30-5:00, many old people who spend a lot of time depositing and withdrawing are in the queue.
(5)The time of corporate business is long especially for the business of taxes.
(6)Speed of serving business of depositing is low(5.9minutes) compared to other commercial banks.

3. Reengineering of bank queuing process

3.1 Determination of the key factor

According to the theory of queuing [4],for the M/M/C/ /m model like the bank queuing system with C servers:

The probability that the system is idle: $$P_0 = \frac{1}{\sum_{k=0}^{C-1} \frac{1}{k!}\left(\frac{\lambda}{\mu}\right)^k + \frac{1}{C!} \cdot \frac{1}{1-\rho} \cdot \left(\frac{\lambda}{\mu}\right)^C} \quad (1)$$

Average number of customers per hour : $$L_S = L_q + \frac{\lambda}{\mu} \quad (2)$$

Average number of waiting customers per hour : $L_q = \frac{(c\rho)^c \rho}{c!(1-\rho)^2} P_0$ (3)

Average waiting time per person : $W_s = \frac{L_s}{\lambda}$ (4)

Average serving time per person $W_q = \frac{L_q}{\lambda}$ (5)

Number of customers' arrival in each hour

μ 1/Average serving time

The probability that the system is busy $\rho = \frac{\lambda}{c\mu}$

According to the study, the statistics got from investigation meet the formula. Based on the flow chart and formula above, the key points of solving the problem are determining the number of open servers and average serving time. However, due to the difficulty of improving the skills of the staff notably in short time as well as the complexity of the internal process, this study focuses on determining the open servers to optimize the queuing system.

3.2Determination of open servers based on Enterprise Dynamic

Regardless of cost, more servers mean the better situation. But, considering the current situation---recruitment is becoming more and more difficult, low profits of small service, it is obviously not practical to open so many servers. According to the situation of the branch bank, we consider determining the number of servers from two aspects: 1The number should be as little as possible in the context that customer satisfaction is improved and the time of waiting is reduced. The number of servers should be limited below 7. 2. For improving the efficiency of VIP server, we plan to open the VIP server to saving business considering that most of the saving business is handled less than 7 minutes. In this plan, VIP will get NO.1 in the queue when he arrives. Due to the impossibility and inconvenience to determine the appropriate number by change the number of servers in reality; this study will use Enterprise Dynamic to determine the number of the servers and whether to use the VIP server for saving business.

3.2.1Simulation process

1 Collect the data related to the structure and process of production system based on investigation.

2 Build model in to determine the layout. Describe the relation between each part.

3 Input the related parameters and build the model which could be identified by the computers in Enterprise Dynamic Enterprise Dynamics uses 4DScript .

4 Make sure that the model is correct and run the model . Then determine the ending time.

5 Repeat the simulation for several times .Analyze the results and find the bottlenecks.

6 Optimize the model and adjust the parameters.

3.2.2Simulation of queuing system

In order to verify that the simulation meets the statistics and real situation, we simulate the situation of 5 servers firstly. Then we will simulate the situation of 6&7 servers.

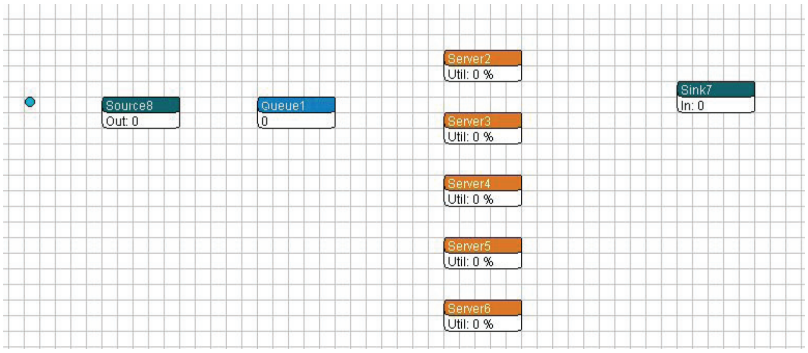

Fig. 2. Model of simulation

In the simulation of the interval between 9:30 and11:30, working time of server is 430S.Due to the huge variation of interval between two arrivals, we combine the mean value and the observational data by using the function Max (0, Normal (72, 60)). The mean result of 5simulation is listed in Table 2.

Table 2.Simulation of basic business of5 servers

	content		throughput		Stay time
Name	**current**	**average**	**input**	**output**	**average**
N of server=5	0	0.000	0	0	0.000
Source	0	0.000	100	100	0.000
Queue	15	10.295	100	85	770.575
Server	1	0.960	17	16	430.000
Server	1	0.982	17	16	430.000
Server	1	0.995	17	16	430.000
Server	1	0.958	17	16	430.000
Server	1	0.999	17	16	430.000
sink	0	0.000	80	0	0.000

The result of simulation of the average number in queue which is 10.295 is close to the measured data 11.Simulated waiting time770s is close to the measured data 840s. Therefore, this model for simulating can get result which is close to the actual results. This study then simulated the situation of 6 and 7 servers .The mean result of simulations is listed in Table 3.

Table3. Simulation of basic business of6 and 7servers

	Content		throughput		Stay time
Name	**Current**	**average**	**input**	**output**	**average**
N of server=6	0	0.000	0	0	0.000
Source	0	0.000	107	107	0.000
Queue	10	5.249	107	97	336.619
Server	1	0.922	16	15	430.000
Server	1	0.955	16	15	430.000
Server	1	0.955	16	15	430.000
Server	1	0.941	16	15	430.000
Server	1	0.902	16	15	430.000

Server	1	0.967	17	16	430.000
Sink	0	0.000	91	0	0.000
Sink	0	0.000	91	0	0.000
N of server=7	0	0.000	0	0	0.000
Source	0	0.000	106	106	0.000
Queue	0	1.782	106	106	121.062
Server	1	0.871	15	14	430.000
server	1	0.843	15	14	430.000
server	1	0.860	15	14	430.000
server	1	0.896	15	14	430.000
server	1	0.876	15	14	430.000
server	0	0.896	15	15	430.000
server	1	0.903	16	15	430.000
Sink4	0	0.000	100	0	0.000

3.2.3 Analysis of the statistics of the simulation

In the situation of 6 and 7 servers, due to the possible situation that will be changed by the modification, we adjust the parameters and get the function Max (0, Normal (65, 60)) with working time remained. We can see from the result that the average number of people in queue is 5.29 when there are 6 servers. The waiting time is 339s. When there are 7servers, the average number of people in queue is 1.782 and the waiting time is 121s. Obviously, there are least people in queue when number is 7. But, considering the whole situation, we suggest the optimized number of servers is 6.

3.2.4 BPR of bank queuing system

According to former analysis, determining the number of servers is the key to solving queuing problem. However, the traditional method which determines the fixed number according to statistics of a relatively long period (Usually 6 months) is not flexible. If the bank use simulating method to determine the number of open servers by refer to dynamic statistics, it will improve much in flexibility and make full use of the current resources. On the other hand, according to the result, the modification of VIP server will improve its low efficiency.

4. Conclusion

The problem of queuing which is related to many aspects like the customer satisfaction is one of the most serious problems needing improved. This study uses simulation to determine the appropriate number of servers in certain period and improves the key point of the queuing system. Finally, this study proposes reasonable method of optimize the bank queuing system by using BPR.

Acknowledgements

This work was financially supported by Undergraduate Research Training Project of Nanjing University of Science and Technology. The supports are gratefully acknowledged. The authors would also acknowledge the anonymous reviewers.

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