Simulation of Service Industry: An Effective Approach to Improve Service quality under Dynamic Demand Scenario

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ABSTRACT

In today's world of global competition, customer satisfaction has become a major concern in service industry settings like banks, hospitals, call centers, etc. Service organizations, in general, are characterized by high variability in demand. Under changing demand scenario, if the workforce is constant, customer's waiting time may increase drastically which may result in heavy loss to business. Customer's efficient staff scheduling which takes into account varying demand levels. This paper investigates the various processes of bank at a branch of a nationalized bank in India. It also suggests a methodological framework that can be implemented in this service industry. This investigation reduces waiting time, processing time and finds a way for proper utilization of resources.

Keywords: System simulation, Service industry, waiting time

INTRODUCTION

Simulation means imitation of reality. Simulation techniques are widely used in industry for the purpose of capacity & resource planning. Based on the well developed statistical theories, simulation effectively deals with the unforeseen uncertainties in any business. When used proficiently, it enables to determine the fluctuations in many business parameters (like, demand, service time, waiting time, downtime, repair time, etc.,) to desired level of accuracy with specified degree of confidence level.

With the advent of many simulation software, simulation is gaining ever increasing importance in industry to plan & control the processes effectively .Service industries are different than manufacturing industries in the sense that the former works with more flexibility in the processes. Standardized processes may vary from time to time depending the customer's requirement. Service industries, in general, employ comparatively less automation, which is one of the causes for the variations. Hence, it would be interesting to study the process deviations under changing customer's requirement and to develop master plan that could compensate for the expected deviation without hampering the resource availability.

METHODOLOGY

DISCRETE –EVENT SYSTEM SIMULATION

Discrete-event system simulation is the modeling of system in which the state variable changes only at discrete set of point in time. The simulation models are analyzed by numerical method rather than by analytical method. Analytical methods employ the deductive reasoning of mathematics to solve the model. Numerical methods employ computational procedure to solve mathematical models. System can be categorized as discrete or continuous. Few systems in practice are wholly discrete or continuous, but one type change predominates for most system, it will usually be possible classify a system as discrete or continuous system. The bank is an example of a discrete system, the state variable that is the number of customers in the bank, changes only when a customer arrives or when the service provided to a customer is completed.

There are various software packages available for discrete event simulation. Few of them are ARENA, AUTOMAD, EXTEND, FLEXSIM, MICRO SAINT, PROMODEL, QUEST, SIMUL8. This project makes use of highly effective and user friendly software package ARENA.

ARENA

Arena software enables to bring the power of modeling and simulation to business. It is designed for analyzing the impact of changes involving significant and complex redesigns associated with supply chain, manufacturing, processes, logistics, distribution and warehousing, and service systems. Arena software provides the maximum flexibility and breadth of application coverage to model any desired level of detail and complexity.

In addition to the Arena Professional Edition, Rockwell Software offers a full suite of products to provide enterprise-wide simulation, optimization, and 3D model animation.

Arena is an advanced simulation system that provides an interactive environment for building, graphically animating, verifying, and analyzing simulation models. With Arena, one can design a unique Arena template that is specific to particular project, company, or industry. Within Arena's template-building area, one can create complete simulation building blocks.

SYSTEM DESCRIPTION AND DATA COLLECTION

The service industry selected for simulation was a bank. The bank was suffering from some problem like ineffective utilization of various resources, long waiting line of customer, completion of some transaction taking more time than the standard time for these transaction, etc. A simulation study was needed in this bank to improve various processes of the bank. A simulation model of this service industry will help in analyzing various problems and finding proper solutions of these problems. The bank considered for study opens at 10:30 am every morning and remains open up to 4 pm evening. Sunday is holiday and on Saturday it remains open up to 1 pm. The bank mainly deals with transaction like saving fund account open, Current fund account open, fixed fund account open, Draft issue, Income tax challan, Cash saving, Cash withdrawal, loans, pension etc. The bank has five various counters for various transactions. Customers come randomly for various transaction and form queue in these counters. Various data regarding to the customer arrival, their waiting time, their service start time, service end time are recorded. These observations were done from 02.02.2010 to 27.03.2010 for a period of 51 days. These data were analyzed and tested for various probability distribution functions. They were made ready for used as input to the simulation model.

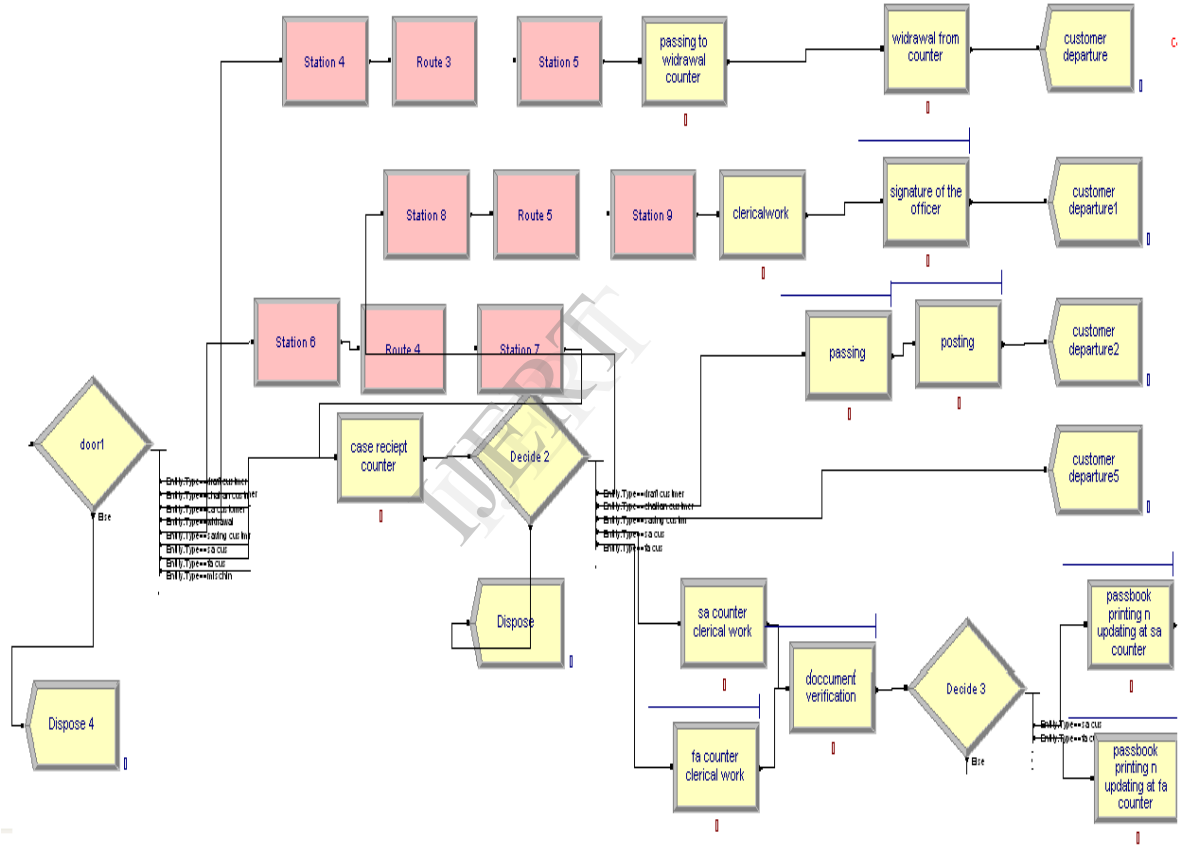
Table-1 Data Collection at saving counter on a particular day

arrival time	service start	service end	service time	waiting time	purpose	inter arrival time
10.3	10.34	10.37	4	4	cash saving	0
10.3	10.37	10.39	2	7	challan customer	0
10.3	1.39	10.43	4	9	ca opening cus	0
10.3	10.43	10.45	2	13	cash saving	0
10.31	10.45	10.47	2	14	challan customer	1
10.32	10.47	10.5	3	15	draft customer	1
10.34	10.5	10.51	1	16	cash saving	2
10.35	10.51	10.53	2	16	cash saving	1
10.39	10.53	10.56	3	14	fa opening cus	4
10.4	10.56	10.57	1	16	draft customer	1
10.42	10.57	11.01	4	15	sa opening cus	2
10.48	11.01	11.02	1	13	cash saving	6
10.5	11.02	11.02	0	12	challan customer	2
10.59	11.02	11.07	5	3	cash saving	9
11	11.07	11.11	4	7	draft customer	1
11.01	11.11	11.12	1	10	ca opening cus	1
11.02	11.12	11.14	2	10	cash saving	1
11.04	11.14	11.18	4	10	miscellaneous	2
11.07	11.18	11.21	3	11	cash saving	3
11.08	11.21	11.29	8	13	cash saving	1
11.09	11.29	11.31	2	20	draft customer	1
11.13	11.31	11.32	1	18	cash saving	4
11.13	11.32	11.35	3	19	cash saving	0
11.19	11.35	11.39	4	16	cash saving	6
11.19	11.39	11.45	3	20	challan customer	0
11.22	11.45	11.47	2	23	cash saving	3
11.25	11.47	11.48	1	22	miscleneous	8
11.35	11.48	11.51	3	13	draft customer	5
11.38	11.51	11.52	3	13	cash saving	3
11.4	11.52	11.55	3	12	fa opening cus	2
11.43	11.55	11.57	2	12	cash saving	3
11.44	11.57	11.59	4	13	cash saving	1
11.49	11.59	12.02	3	10	miscleneous	5
11.55	12.02	12.05	3	7	challan customer	6
11.59	12.05	12.07	2	6	cash saving	4
11.59	12.07	12.13	6	8	cash saving	0
12.01	12.13	12.14	1	12	miscleneous	0
12.01	12.14	12.16	2	13	cash saving	2
12.04	12.16	12.21	5	12	challan customer	3
12.09	12.21	12.24	3	12	cash saving	5
12.13	12.24	12.26	2	11	miscleneous	4
12.16	12.26	12.26	0	10	draft customer	3
12.16	12.26	12.29	3	10	draft customer	0
12.27	12.29	12.32	3	2	cash saving	9
12.27	12.32	12.36	4	5	cash saving	0

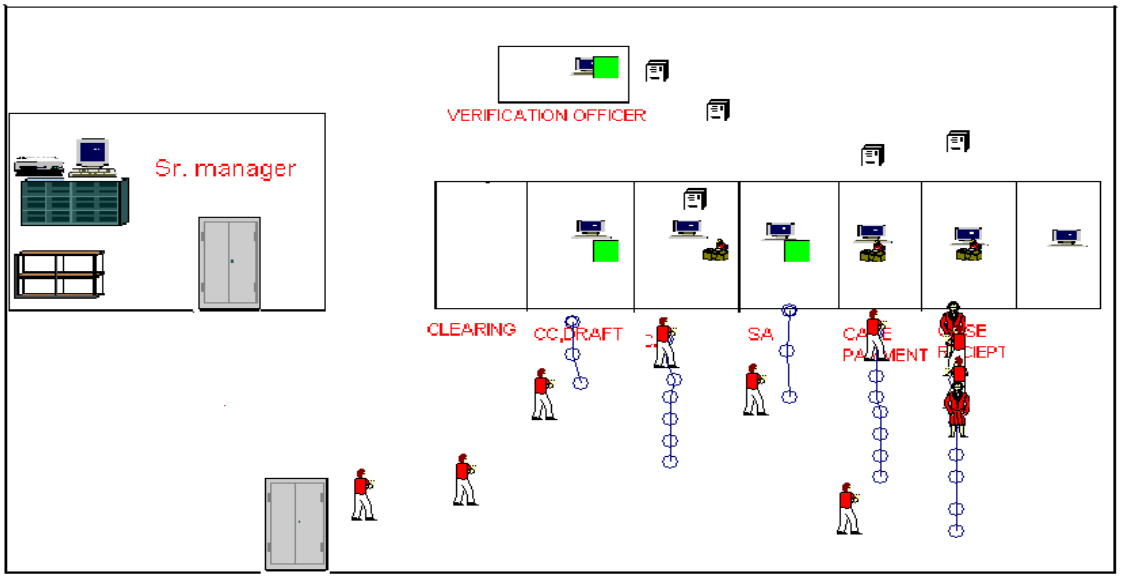
MODEL BUILDING AND VERIFICATION

A simulation model is prepared using the analyzed data with the help of ARENA software. The model is prepared for total replication time of 10350 minute. Various modules of ARENA software are used for preparing the model logic. After preparing the model data were collected again for a period of fifteen days. The model was verified after comparing the actual data collected in this period of time to the result predicted by the simulated model

Model logic (SCREEN SHOT OF ARENA)



SIMULATION RUNS (screen shot of ARENA)



The model was simulated for total replication time of 10350 minute

RESULTS AND DISCUSION

The simulation modal of the bank help us in determining some major aspect of the bank mainly about their resource utilization, actual time taken in their various process, service rate and waiting time of customer at various counter. This model can also estimate or predict the number of customers coming for various transactions. Some major aspect or results obtained from this model are discussed bellow

1) **Resource utilization(SCREEN SHOT OF ARENA)**

Resources

simulation model

Replication 1

Resource Detail Summary

Usage

	Inst Util	Num Busy
ca clerk	0.91	0.91
cash saving	0.76	0.76
cash withdraw	0.93	0.93
casier	0.00	0.00
draft clerk	0.41	0.41
officer	0.48	0.48
sa clerk	0.34	0.34

2) **The model can predict arrival of various customers in future for various transactions**

3) Actual time required for various transaction in the bank(SCREEN SHOT OF ARENA)

Replication 1 Start Time: 0.00 Stop Time: 10,350.00 Time Units: Minutes

Entity

Time

VA Time	Average	Minimum	Maximum
ca customer	18.9284	14.5089	23.2578
challan custmer	10.5946	7.5721	13.4937
draft custmer	15.0224	12.2627	17.5507
fa cus	13.5553	11.3800	15.3060
sa cus	13.4315	11.3729	15.7284
saving custmr	3.0030	2.0051	3.9962
widrawal	6.5169	5.5695	7.4820

4) Opening of current account takes more time than standard time: The simulation model helps us in finding the cause for this and also helps in finding the way to reduce this time.

As opening of current account takes a time of 14.50 to 23.35 minute. This is much higher than the standard time 10 to 15 minute. So Opening of current account customers wait more time in the queue as compare to fixed or saving account opening customer.

This happen because the CA Clerk remains busy in other transaction. CA clerk remains busy for 91% of time where as SA clerk remains busy for only 34% of time. So processing of some transaction should be shifted from CA counter to SA counter. It will reduce the waiting time in the ca counter. For example passing of a challan process can be shifted from CA to SA counter.

Processing time of various transactions after shifting passing process from CA counter to SA counter (SCREEN SHOT OF ARENA)

Time

VA Time	Average	Minimum	Maximum
ca customer	18.1551	14.4200	21.9441
challan custmer	10.9230	7.5689	13.9110
draft custmer	15.4237	12.4581	18.7806
fa cus	13.9386	11.4467	16.7430
mischln	2.2473	1.5004	2.9984
sa cus	14.0335	11.5565	16.4866
saving custmr	3.5390	2.0006	4.9979
widrawal	6.5106	5.5063	7.4510

CONCLUSIONS

The simulated model gives some important result for improvement of the processes and reduced waiting time. It reduces current account opening time by 9%. After changing the layout of the bank it will reduce further. Proper resource utilization is possible. The model can also predict no of customer in future. It will help for future planning of the bank

FUTURE SCOPE

In this model all observation are done in minute time unit. If possible observation should be done in second time unit using stop watch or by other means. Then more accurate results can be expected. In future the simulation model can be used for comparing various activities of other branches of the bank with this branch of the bank. One can observe or study the various processes of the bank by this model, he does not need to come to the bank or direct observation is not necessary

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