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USE THE QUEUE THEORY TO ASSESS THE QUALITY STANDARDS OF SERVICE SYSTEMS TO ACHIEVE THE CUSTOMER'S DESIRE

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Abstract:

Control of the impact of quality on the performance of organizations is one of the most important things in today's business environment. For growth and development, quality and achieving customer satisfaction have become an obsession for service institutions as customer satisfaction has become the main focus of their interests, so this approach is considered one of its primary goals that must be achieved, which is necessary It must pool its efforts towards achieving these goals, in order to provide a quality service that meets the needs of customers and achieves their satisfaction.
The issue of measuring the quality of service systems is seen through the specific dimensions of that, which depend on the method of accountability in some of them, such as the behavior of employees in these service centers, as well as the quantitative method in others as the length of service and waiting. The latter adopts dynamic models in which the element of time plays an important role, especially in queue models.
The most important finding of the study is that increasing the shop’s employees also leads to reducing the total costs of the shop from losing customers who cannot find a place to wait, but through careful studies that do not lead to increasing the total costs.

Keywords: Queuing theory, Quality of service, Service quality standards, Client's desire, Dynamic models.

INTRODUCTION

The issue of measuring the quality of service is seen through the dimensions that can be measured. For some dimensions, descriptive methods that mainly depend on the most appropriate accountability are the behavior of employees in the service centers, while there are dimensions that prefer to follow the quantitative methods to measure them, and ISO 9004 specifications have provided quantitative dimensions that can Measured, which is the duration of service delivery and delivery, and the customer's waiting times for obtaining the service. These dimensions have clear significance and significance in dynamic quantitative models, specifically in the queue models, which are the previous dimensions of the basic indicators that the model seeks to measure.
The implementation of quality is costly and needs to invest a lot of money, which makes companies think twice before making such a decision, at a time when many of these companies are trying to reduce costs, so the design of a performance improvement program that mainly depends on the measurement and measurement required a daily and basic activity in this program, Usually, measurement is done before and after application to find the difference in performance, and this is done using various tools such as standards, indicators, specifications, work rules and procedures, guidelines, work instructions ... etc., and process research methods are used closely during the various work stages to stand In the competition market.
The problem of the study revolves around the following question: Does the application of waiting line models lead to a reduction in waiting times and thus achieving customer satisfaction?
The importance of this research is evident through the detailed presentation of the various aspects of the look-up of the waiting lines and the quality of banking service.
While this study aims to apply queue models to a banking exchange based on the quality standards of service systems to achieve the customer's desire.

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PREVIOUS STUDIES

1- A study (Asaad Al-Asadi, 2011) entitled (Theory of waiting rows and their applications on Iraqi commercial ports): This study aimed to measure the speed of movement of freight and unloading and the amount of waiting time spent by commercial ships during shipping or unloading operations, and strive to reduce that time, whether During charging, discharging, or waiting operations. The study concluded the most important results:

A- The times that the commercial ports spent in charging, unloading or waiting for the location after a long time are not commensurate with the economic situation in the country, as these times are relatively long if compared to the commercial ports of countries neighboring Iraq, and this means the failure of Iraqi commercial ports

B - Some commercial ports recorded fewer times, whether in shipping, unloading, or waiting times, and this does not mean that they are good or fast ports in the completion of work, but rather this causes the number of merchant ships to visit or the low freight or cargo.

2 - A study (Shatt Mbark, 2018) entitled (Applications of queuing theory models on some commercial banks in the Ubari region) This study aimed to apply the queues of low-profile models to some commercial banks in the Ubari region - South Arab Libya, by assessing the reality and working to reduce the waiting time Clients and ending their transactions in a satisfactory process through the results. The study recommends improving and developing the quality of customer service in commercial banks. Through the issuance of electronic debit cards and the approval and use of the mobile inquiry service.

QUALITY OF SERVICE

Since the mid-1980s, there has been strong and continuous research interest in identifying and measuring quality of service. Most of the outputs were from Parasuraman, Zeithaml and Berry (1985) and their theory, SERVQUAL. This theory is based on the idea that quality of service is essentially a comparison of customer expectations and perceptions of service.

In their amazing works, they concluded that the basic assumption of the quality of service model is the simple formal relationship between three variables:

Quality of service = perceptions - service expectations (whyte, 2018,8)

The common element of all quality definitions is that the quality of the product or service indicates the awareness of the degree to which the product or service meets the customer's expectations. Quality of service is the first concept that must be considered for any organization that seeks to implement the Service Management System (SMS). (Kunas, 2012,16)

Salman defines the quality of service as the contrast between the expectation and the perception of the service received or received by customers. As the judgment on the quality of service is a reflection of the degree and direction of the discrepancy between consumer perception and expectations. By providing good quality service, organizations can achieve customer satisfaction and loyalty, and the intention to repurchase. (Salman, 2017, p5,7)

QUALITY OF SERVICE DIMENSION (Rai, 2013,191)

1. Reliability: includes consistency of performance and reliability.
2. Response: relates to the willingness or willingness of employees to provide the service.
3. Efficiency: means having the skills and knowledge required to perform the service.
4. Access: is about acceptance and ease of contact.
5. Courtesy: It includes providing manners, respect and cordiality in dealing with the customer.
6. Communication: It means keeping clients familiar with a language they can understand and listen to.
7. Credibility: implies trust and credibility.
8. Understanding / knowing the customer: It involves making an effort to understand the customer's needs.

QUEUE THEORY (Bhat, 2015,1,4,5)

The ranks of the waiting lines theory dates back more than 100 years. Johannsen's "Waiting Times and Number of Calls" (an article published in 1907 and reprinted in the Journal of Electrical Engineers at the Post Office, London, October 1910) appears to be the first paper on this topic. But the method used in this paper was not mathematically accurate, and therefore, from a more accurate viewpoint, the paper of greatest historical importance is A. K. Erlang "Probability theory and phone conversations". It should be noted that in the works of Erlang, as well as the work done by others in the 1920s and 1930s, the primary impulse was the practical problem of congestion. Queue theory has proven over time that it is a fertile field for researchers who wanted to conduct basic research on random processes involving mathematical models.

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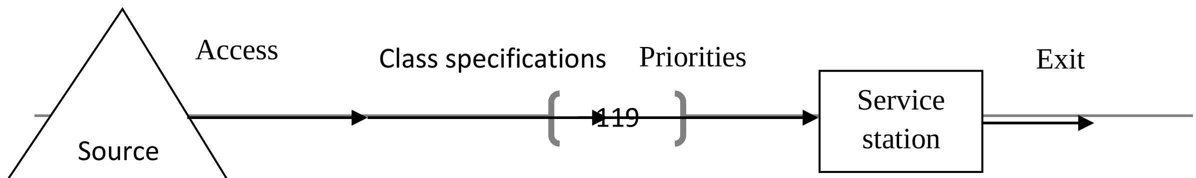
Waiting lists (or wait lines) help establishments or companies provide the service in an organized manner. Forming a queue being a social phenomenon, is beneficial to society if it can be managed so that the unit that is waiting and the unit that serves gets the most benefit. For example, there was a time when passengers at flight stations formed separate lines in front of check-in counters. But now we always see only one line feeding on several meters. This is the result of the realization that the one-line policy better serves travelers and airlines. This conclusion came from an analysis of the situation in which a queue is created and the service provided.
Here are some examples:
(A) In telecommunication systems, the voice or data transmission queue for transit lines is important. A simple example is the phone exchange.
(B) In a manufacturing system with multiple workstations, finished units work in one station pending access to the next.
(C) The means of transportation (cars) that require the service waiting for its role in the garage.
(D) The patients arrive at the doctor's office for treatment.

THE MAIN AXES IN THE APPLICATION OF WAITING THEORY TO MEASURE THE QUALITY OF SERVICE SYSTEMS

1- Defining quality in service systems in general and in banking services in particular
(Standard for the degree to which the actual performance of the service matches the expectations of customers for this service, or it is the difference between customers 'expectations for this service and their perceptions of its actual performance.) (Nuri and Jumaa, 2015, 29)
The quality of the banking service is defined as: "To satisfy the requirements of customers, study the bank's ability to determine these requirements and the ability to meet them, and the bank has adopted a process of providing high-quality services through which it seeks to outperform the requirements of customers." (Al-Halabi, 2017, 51)
2- Keeping quality of service on hold (Fathi, 2009, 74)
A. Determine the excess time and use it to provide other services
Administrative procedures represent every employee or head of a channel to end transactions. The transaction takes a period of time for each employee. In order for the transaction to pass from more than one employee, this requires a number of channels.
B. Evaluating the performance of services (service intensity) to develop the quality of service to suit the demand for it
Quality of service in the queues can be assessed by calculating the intensity of the demand for the service (the number of applicants), and how quickly the service is performed, by calculating the number of beneficiaries of the service in (hour / day / week)
C. The customer's mental image of the quality of service in the queues
It is the sum of the thoughts, feelings, and beliefs that an individual has towards something or the public's perception of the organization's behaviors, activities, and accomplishments (Abu Akr 2016, 26).
It represents how the customer perceives the quality of the service by comparing the actual performance of the work of the service centers with the customer's expectations such as immediate, responsiveness and accuracy in providing the service, and for this it necessitated the service units to carry out studies in order to reach the customer's satisfaction.
The customer holds different expectations about the service:

A. Desired service: It is the level that the customer hopes to obtain.
B. Appropriate service: It is the level of service that the customer is ready to accept.

Endurance Zone: Between these two levels, there is a middle area called the Endurance Zone, which represents the minimum level of service that the customer finds acceptable and satisfactory. If the level of service performance is below the endurance area, the customer will feel frustrated and dissatisfied, while if the actual performance is above the endurance area, the customer will feel satisfied. (Al ashari, 2001, 33)
3- Applying queues for measuring service quality
The waiting phenomenon can be described as a flow of the different units on the service center, line up in rows (the row may be moral or real) or several rows, the length of which varies according to the degree of arrival and length of service, each unit receives the necessary service when its role comes, and then the unit leaves a system Waiting rows.
This phenomenon can be expressed in the form (1) as follows:



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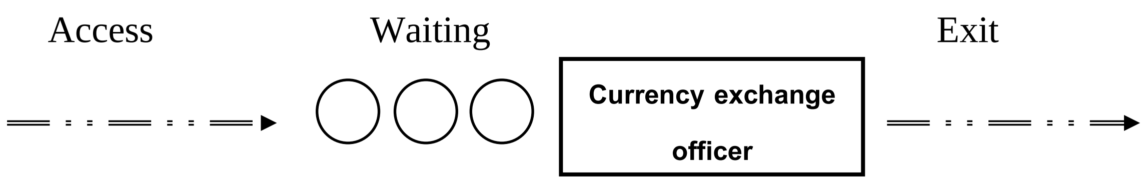
Rijjal Al Saadi and Bolodan, success of "Implementing Queue Models to Measure the Quality of Banking Service," the Sixth National Forum Skikda, Deposit and Deposit Services at the Local Development Bank - Jijel Agency -, 2009,6.

THE PRACTICAL SIDE

A banking exchange near the Central Bank of Iraq is working to replace the local currency, the Iraqi dinar, with the foreign currency, the dollar. The employee serves one customer every 20 minutes, as it requires counting and testing the currency before the transformation process. To the banking exchange, it is fixed, which is 12 minutes, that the shop currently has one employee to serve customers and has the ability to hire others in the event the shop needs employees and the store contains 10 seats for the purpose of resting customers and waiting for service, while the worker receives a fee of $ 4 an hour And that of the shop suggests the idea of giving a discount of $ 5 $ per hour customer in the case of waiting and delay in receiving the service, at the time that customers who do not find a place in the shop will leave and there will be a loss of $ 20 at least for each Treacherous customer.
The process can be represented as (2) as follows:



The first customer arrives at the exchange office at the beginning of the opening of the store, that is, at 8:00 am Minutes, he gets his service 8.20 and ends at 8.32. During this period, a third customer will arrive at the shop at 8.24 o'clock. He will be in the queue and the matter will continue in this way as the number of customers increases and the queue increases more with the passage of time as indicated in the table below:

Table (2)

status	customer number	Incident	time		status	customer number	Incident	time

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Customer 12 serves	11	leaving	11.40		Customer 1 serves	1	Arrival	8.00
Waiting	20	Arrival	11.48		Waiting	2	Arrival	8.12
Customer 13 serves	12	leaving	12:00		Customer 2 serves	1	leaving	8.20
Waiting	21	Arrival	12:00		Waiting	3	Arrival	8.24
Waiting	22	Arrival	12.12		Waiting	4	Arrival	8.36
Customer 14 serves	13	leaving	12.20		Customer 3 serves	2	leaving	8.40
Waiting	23	Arrival	12.24		Waiting	5	Arrival	8.48
Waiting	24	Arrival	12.36		Customer 4 serves	3	leaving	9.00
Customer 15 serves	14	leaving	12.40		Waiting	6	Arrival	9.00
Waiting	25	Arrival	12.48		Waiting	7	Arrival	9.12
Customer 16 serves	15	leaving	1.00		Customer 5 serves	4	leaving	9.20
Waiting	26	Arrival	1.00		Waiting	8	Arrival	9.24
Waiting	27	Arrival	1.12		Waiting	9	Arrival	9.36
Customer 17 serves	16	leaving	1.20		Customer 6 serves	5	leaving	9.40
Waiting	28	Arrival	1.24		Waiting	10	Arrival	9.48
Waiting	29	Arrival	1.36		Customer 7 serves	6	leaving	10.00
Customer 18 serves	17	leaving	1.40		Waiting	11	Arrival	10.00
Waiting	30	Arrival	1.48		Waiting	12	Arrival	10.12
Customer 19 serves	18	leaving	2.00		Customer 8 serves	7	leaving	10.20
Waiting	31	Arrival	2.00		Waiting	13	Arrival	10.24
Waiting	32	Arrival	2.12		Waiting	14	Arrival	10.36
Customer 20 serves	19	leaving	2.20		Customer 9 serves	8	leaving	10.40
Waiting	33	Arrival	2.24		Waiting	15	Arrival	10.48
Waiting	34	Arrival	2.36		Customer 10 serves	9	leaving	11.00
Customer 21 serves	20	leaving	2.40		Waiting	16	Arrival	11.00
Waiting	35	Arrival	2.48		Waiting	17	Arrival	11.12
Customer	21	leaving	3.00		Customer 11	10	leaving	11.20

22 serves				serves			
Waiting	36	Arrival	3.00	Waiting	18	Arrival	11.24
				Waiting	19	Arrival	11.36

For the purpose of pending Quality of service implementation, the shop issue in the WinQSB application program will be implemented as (3) as follows:

Data Description	ENTRY
Number of servers	1
Service rate (per server per h)	3
Customer arrival rate (per h)	5
Queue capacity (maximum waiting space)	10
Customer population	M
Busy server cost per h	4
Idle server cost per h	4
Customer waiting cost h	5
Customer being served cost per h	5
Cost of customer being balked	20
Unit queue capacity cost	

Then we obtain the results in Table (3) as follows:

	Performance Measure	Result
1	System: M/M/1/11	From Formula
2	Customer arrival rate (lambda) per h =	5.0000
3	Service rate per server (mu) per h =	3.0000
4	Overall system effective arrival rate per h =	2.9956
5	Overall system effective service rate per h =	2.9956
6	Overall system utilization =	99.8546 %
7	Average number of customers in the system (L) =	9.5262
8	Average number of customers in the queue (Lq) =	8.5276
9	Average number of customers in the queue for a busy system (Lb) =	8.5401
10	Average time customer spends in the system (W) =	3.1800 hs
11	Average time customer spends in the queue (Wq) =	2.8467 hs
12	Average time customer spends in the queue for a busy system (Wb) =	2.8508 hs
13	The probability that all servers are idle (Po) =	0.1454 %
14	The probability an arriving customer waits (Pw or Pb) =	99.8546 %
15	Average number of customers being balked per h =	2.0044
16	Total cost of busy server per h =	$3.9942
17	Total cost of idle server per h =	$0.0058
18	Total cost of customer waiting per h =	$42.6382
19	Total cost of customer being served per h =	$4.9927
20	Total cost of customer being balked per h =	$40.0873
21	Total queue space cost per h =	$0
22	Total system cost per h =	$91.7182

The above table shows that the quality of the parking queue is M / M / 1, meaning that the distribution of arrivals is Poisson and the departure departure is Poisson. The number of service centers is one center, i.e. only one employee, and also shows the percentage of the total benefit of the optimally exploited system, which is 99.85% meaning that The employee performs his duties without there being wasted time.
The average number of arrivals in the system is 9.52 per hour, while the average number of arrivals in the parking queue is 8.52 per hour, and the average number of arrivals in the time of congestion is 8.54 per hour.

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The average time the customer spends in the system (queue + service) is 3.18 hours, while the average time that the customer spends in the queue is 2.84 hours, and the average time that the customer spends in the queue in times of congestion to obtain service is 2.85 hours.
The cost of the shop every hour in the event that the service is busy is 3.99 $, and the cost of the shop every hour because the service is idle is 0.0058 $, while the total cost of waiting for the customer every hour is 42.63$, and the total cost of the hourly customer service is 4.99 $, and the total cost of not getting the customer On hourly service is 40.08 $, and the total cost per hour is 91.71 $.
If the shop owner hires a second employee for the purpose of customer service, as in Table (4) the following:

	Performance Measure	Result
1	System: M/M/2/12	From Formula
2	Customer arrival rate (lambda) per h =	5.0000
3	Service rate per server (mu) per h =	3.0000
4	Overall system effective arrival rate per h =	4.8865
5	Overall system effective service rate per h =	4.8865
6	Overall system utilization =	81.4411 %
7	Average number of customers in the system (L) =	4.0302
8	Average number of customers in the queue (Lq) =	2.4014
9	Average number of customers in the queue for a busy system (Lb) =	3.2893
10	Average time customer spends in the system (W) =	0.8248 hs
11	Average time customer spends in the queue (Wq) =	0.4914 hs
12	Average time customer spends in the queue for a busy system (Wb) =	0.6731 hs
13	The probability that all servers are idle (Po) =	10.1231 %
14	The probability an arriving customer waits (Pw or Pb) =	73.0052 %
15	Average number of customers being balked per h =	0.1135
16	Total cost of busy server per h =	$6.5153
17	Total cost of idle server per h =	$1.4847
18	Total cost of customer waiting per h =	$12.0068
19	Total cost of customer being served per h =	$8.1441
20	Total cost of customer being balked per h =	$2.2707
21	Total queue space cost per h =	$0
22	Total system cost per h =	$30.4216

The above table shows that the quality of the parking queue became M / M / 2, that is, the number of service centers is two, so the percentage of the total benefit of the optimally exploited system has become 81.44%, meaning that there is wasted time among the employees and the exploitation of the system has decreased.
The average time the customer spends in the system (queue + service) is 0.8248 hours, while the average time that the customer spends on the queue is 0.4914 hours, and the average time that the customer spends on the queue in busy times to obtain service is 0.6731 hours.
And the cost of the shop every hour in the event that the service is busy is 6.51 $, and the cost of the shop every hour because the service is idle is 1.48 $, while the total cost of waiting for the customer every hour is 12 $, the total cost of the hourly customer service is 8.14 $, and the total cost of not getting the customer Per hour service is 2.27 $, and the total cost per hour system is 30.42 $.
But if the shop owner hires a third employee for the purpose of customer service, as in Table (5) the following:

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	Performance Measure	Result
1	System: M/M/3/13	From Formula
2	Customer arrival rate (lambda) per h =	5.0000
3	Service rate per server (mu) per h =	3.0000
4	Overall system effective arrival rate per h =	4.9981
5	Overall system effective service rate per h =	4.9981
6	Overall system utilization =	55.5348 %
7	Average number of customers in the system (L) =	2.0352
8	Average number of customers in the queue (Lq) =	0.3692
9	Average number of customers in the queue for a busy system (Lb) =	1.2329
10	Average time customer spends in the system (W) =	0.4072 hs
11	Average time customer spends in the queue (Wq) =	0.0739 hs
12	Average time customer spends in the queue for a busy system (Wb) =	0.2467 hs
13	The probability that all servers are idle (Po) =	17.2742 %
14	The probability an arriving customer waits (Pw or Pb) =	29.9433 %
15	Average number of customers being balked per h =	0.0019
16	Total cost of busy server per h =	$6.6642
17	Total cost of idle server per h =	$5.3358
18	Total cost of customer waiting per h =	$1.8458
19	Total cost of customer being served per h =	$8.3302
20	Total cost of customer being balked per h =	$0.0373
21	Total queue space cost per h =	$0
22	Total system cost per h =	$22.2133

The quality of the parking queue becomes M / M / 3, i.e. the number of service centers is three, so the percentage of the total benefit of the fully exploited system has become 55.53%, meaning there is more lost time for employees and less exploitation of the system than before.
The average time the customer spends in the system (queue + service) is 0.4072 hours, while the average time that the customer spends on the queue is 0.0739 hours, and the average time that the customer spends in the queue in busy times to obtain service is 0.2467 hours.
The cost of the shop every hour in the event that the service is busy is 6.66 $, and the cost of the shop every hour because the service is idle is 5.33 $, while the total cost of waiting for the customer every hour is 1.84 $, and the total cost of the hourly customer service is 8.33 $, and the total cost of not getting the customer On hourly service is 0.03 $, and the total cost per hour is 22.21 $.
But if the shop owner hires a fourth employee for the purpose of customer service, as in Table (6) the following:

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	Performance Measure	Result
1	System: M/M/4/14	From Formula
2	Customer arrival rate (lambda) per h =	5.0000
3	Service rate per server (mu) per h =	3.0000
4	Overall system effective arrival rate per h =	5.0000
5	Overall system effective service rate per h =	5.0000
6	Overall system utilization =	41.6663 %
7	Average number of customers in the system (L) =	1.7398
8	Average number of customers in the queue (Lq) =	0.0731
9	Average number of customers in the queue for a busy system (Lb) =	0.7136
10	Average time customer spends in the system (W) =	0.3480 hs
11	Average time customer spends in the queue (Wq) =	0.0146 hs
12	Average time customer spends in the queue for a busy system (Wb) =	0.1427 hs
13	The probability that all servers are idle (Po) =	18.5933 %
14	The probability an arriving customer waits (Pw or Pb) =	10.2470 %
15	Average number of customers being balked per h =	0.0000
16	Total cost of busy server per h =	$6.6666
17	Total cost of idle server per h =	$9.3334
18	Total cost of customer waiting per h =	$0.3656
19	Total cost of customer being served per h =	$8.3333
20	Total cost of customer being balked per h =	$0.0009
21	Total queue space cost per h =	$0
22	Total system cost per h =	$24.6998

The quality of the waiting queue becomes M / M / 4, meaning that the number of service centers is four, so the percentage of the total benefit of the fully exploited system has become 41.66%, meaning there is more lost time for employees and less exploitation of the system than it was in the case of three employees.
The average time that a customer spends in the system (queue + service) is 0.348 hours, while the average time that a customer spends on the queue is 0.0146 hours, and the average time that a customer spends on the queue in busy times to obtain service is 0.1427 hours.
The cost of the shop every hour in the event that the service is busy is 6.66 $, and the cost of the shop every hour because the service is idle is 9.33 $, while the total cost of waiting for the customer every hour is 0.36 $, and the total cost of the hourly customer service is 8.33 $, and the total cost of not getting the customer On hourly service is 0.0009 $, and the total cost per hour per system is 24.69 $.
From the above analyzes, it becomes clear to us that by increasing the number of employees to three, he gave the best time for customer service and reduced waiting time, as well as reducing the cost of waiting, as customers were waiting 3.18 hours in the queue while the time became 0.4 hours in the queue, and this was what the customer was waiting for a little time To provide the service to him, and also that the increase in employees led to the reduction of customers that the store loses, and consequently, the service has improved the store's future image.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

1. The current reality of the banking exchange operates with one service window (one employee), which we suggest the store owner to add two other employees to become three service windows to improve the quality of the service provided to customers by reducing the time spent waiting.
2. The increase in the shop employees also leads to a decrease in the total costs of the shop from the loss of customers who cannot find a place to wait, but this increase is considered and not arbitrary through the applications of the queues.

Recommendations

1. Application of waiting-line models in ministries and government institutions for the purpose of competing with private institutions whose number and quality are increasing due to the openness that is taking place in our country
2. Urging attention to quality of service with quantitative dimensions and its application because of its importance in real life

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