Queue Management: Improvement in the Call Handling Process in the I.T. Sector in an Eletric Power Company

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Abstract

Currently, organizations seek a differential in the quality of service provided, aiming at customer satisfaction. One of the problems faced by establishments that have flows is the capacity of service, when the customer is not met according to their expectations, due to the excess of demand, generating queues. In this way, this article exposes the importance of the active management of queues by the service managers because it persuades the user about the quality of service. In order to do so, the generation of queues is analyzed, and certain techniques are reported to mitigate the waiting time by the user in the queue, reducing their negative impacts. For the development of the work in question, statistical tools were used to aid the analysis of the processes.

Keywords:*Queue theory, Attendance, Service center.*

I. INTRODUCTION

The supply of services since 1950s has shown its relevance in the world economy sector. Given this, some changes in paradigms are perceived mainly by the successive increase of competition, but also due to technological and social factors. The first, thanks to the technological evolution, allows new approaches as a form of shelter and production management, and the second, through the transformation of the perception of values by the clients, where they become more demanding and informed.

In the face of the current competition of service providers, their management is an important tool to achieve success, aiming at quality, customer satisfaction, among others. [1]

According to [2], the fact that services are supplied and consumed together, managers present difficulties regarding service capacity especially since their demand has high versatility.

The present work has the objective of exposing queuing theory and its guidelines for the control in the generation of queues, which are caused by the high flow of users, highlighting the relevance of this management to customer satisfaction. For a better understanding of queuing management, a renowned electric power company in the *Zona da Mata mineira*was used as the object of study, conducting a case study in the customer registration process. To analyse the normality of the collected samples, Minitab 10 software was used, generating a control graph and a sample calculation to prove into Poisson distribution formulas to calculate the waiting time of each process in the queue.

II. LITERATURE REVISION

A. Queuing theory

Accordingo to [3], queue theory is conceptualized as a study used to solve impasses that correlate with the waiting time of customers requesting a service. Waiting time is defined by the intermittence between the time the user arrives to be served, the length of the service an his/her avoidance of the place.

According to [4], the queuing process is determined by the arrival regime, service regime and queuing discipline. Since the arrival regime covers the classification of clients, finite of infinite, the arrangement of the probability of the interval of time between arrivals, since, this arrangement can be stationary or variable in time. The service regime is related to the availability of the service, the effectiveness of the system, that is, the number of customers served at the same time and the length of time of service of each user, with probability distribution stationary or not, of the size of the queue.

B. Methodology for services in I.T.

According to [5], the methodology used to a certain service is usually predetermined by the time required by an attendant to serve a user. This time can be set and fixed or it can be a random variable whose probability distribution is presumably known. It is also necessary to know if the user is serviced by only one attendant or if it is necessary to distribute tasks to two or more attendants.

In order for the service to be more efficient, it is necessary to use the system dynamics methodology, also known as OSI (Open System Interconnection) model.

Aiming at the best customer service, it is important that there is a form of organization to service certain types of service. For this, one of the most used

models is the OSI, which according to [7], Open Systems Interconnection is the communication standard for networked computers, based on the layer system, established by ISO in 1974, in order to ensure compatibility between different operating systems.

C. Model M/M/1

According to [8] the M/M/1 model is characterized as a system that has a single queue being serviced by a server that has no capacity limit, classified as FIFO type, according to [9], is the type of queue in which the first one that arrives in the queue will always be the first one to be attended to. The number of processes arriving in the queue per minute is detailed by a Poisson distribution of parameter λ, defined by the average process arrival rate per unit of time and μ, determined by the average attendance rate per unit time.

D. Model M/M/s

According to [10], this model is used in queuing systems with more than one attendant, the arrivals and the service times are processed by Poisson distribution and Exponential Negative, in which formulas are used to calculate from the average rate, by the average attendance rate and by the number of attendants.

III. METHODOLOGY

For the development of this article were carried out bibliographical research, through books, scientific articles, magazines and academic sites, having as object of study a company of distribution of electric energy.

It was followed up by calls that were attended by I.T. from February 2017 to February 2018, in which some information of the process, such as the duration of service and whether it was met within the pre-established period of each type of call.

In order to help the process of analysis of the collected samples and to guarantee the reliability of the study of the queues, a control chart was constructed during the research, which, according to [11], so that a certain number of samples for analysis, it is necessary to identify and measure the variations in the process through the control charts, which are tools used to evaluate the data collected in order to be in statistical control. This is done to determine if the variations that occur are due to notable causes or random causes.

It should be noted that the control graph used was of type $\bar{x}$-S because, according to [12], it is used when the sample size is greater than ten or twelve and when this size is variable.

Since this graph was generated in the statistical software Minitab 16, which, according to the [13], has intuitive capabilities, as it allows to obtain descriptive statistics, simulations and distributions, elementary statistical inference, analysis of variance, analysis of categorical data, non-parametric methods among others.

To simulate the waiting time of each call to be attended and the average time of attendance of the same, was used Excel 10 software. According to [14], it is a spreadsheet program of the Microsoft Office system. It can be used to compile and edit workbooks to check data and choose the best business decisions. Strictly, it can be used to analyze data, generate formulas to calculate them, organize them in various ways and display them in different types of graphs.

Each type of open call has its Service Level Agreement (SLA), which according to [15] is an agreement between a service provider and a customer that ensures specific performance and reliability levels for a particular service under certain conditions and can specify the maximum time for any type of request.

IV.RESULTS AND DISCUSSION

The aim of this study, in order to reach the objectives described, was to analyze, in the Information Technology sector, an electric energy company in Zona da Mata Mineira, the attendance of calls received by the company employees for software, where there is the largest amount of service orders.

For the same, it was observed that the method used was M/M/1, where 19,283 calls were solved and 380 calls were answered after the deadline, totaling 3,800 hours not counted in the billing of the service center, since SLA is 10 hours long, as shown in Tables 1 and 2.

PROCESS	RESPONS	ORDER OF SERVICE		
		WITHIN THE TIME LIMIT	OUT OF TIME LIMIT	TOTAL
CONFIGURATION ACCOUNT	Analistas	1.719	38	1.662
ACCOUNT AMENDMENT	Analistas	557	13	535
PASSWORD RESET	Analistas	596	13	506
SOFTWARE	Ana/Tec	19.283	380	17.961
INSTALLATION WORK STATION	Técnicos	2.366	1	2.049
REPAIR STATION WORK	Técnicos	4.122	3	3.806
PERIPHERAL	Técnicos	5.096	4	4.668
PDA	Técnicos	3.198	6	2.939
RECOVERY OF FILES	Analistas	238	3	220
EXCLUSION OF ACCOUNT	Analistas	9	-	9
TOTAL		37.184	461	34.355

Table 1: Summary by processes of open calls from Feb/2017 to Feb/2018

SOFTWARE			
MONTH	WITHIN THE TIME LIMIT	OUT OF TIME LIMIT	TOTAL
fev/17	1.182	40	1.222
mar/17	1.467	19	1.486
abr/17	1.450	23	1.473
mai/17	1.855	34	1.889
jun/17	1.748	19	1.767
jul/17	1.459	18	1.477
ago/17	1.561	26	1.587
set/17	1.336	11	1.347
out/17	1.334	19	1.353
nov/17	1.385	19	1.404
dez/17	1.223	37	1.260
jan/18	1.644	59	1.703
fev/18	1.639	56	1.695
TOTAL	19.283	380	19.663

Table 2: Monthly summary of attended software calls

In order to verify if the obtained results reached the ideal reliability, we used the sample calculation for simple random sampling, which according to Viera (2011) are all the collected results that have the same probability of being selected. It was verified that for a population of 19,283 calls 377 samples are required, representing around one week worked, considering a confidence level of 95%.

After obtaining these data they were inserted into Minitab 16 software to assess if they were under control. For a better visualization of these data, a Control Chart of the type $\bar{x}$ -S was done, as shown in figure 1.

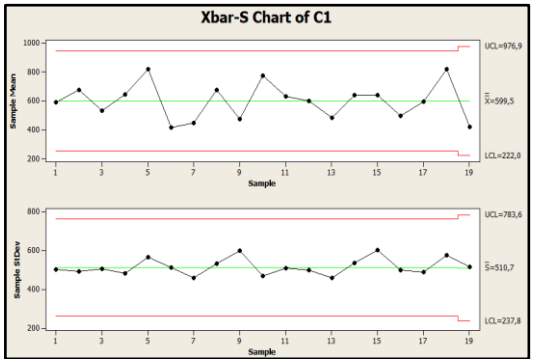

Fig. 1: Control Chart $\bar{x}$-S of the samples of duration time of calls

From the confirmation of the normality of the samples, the observed data were inserted into a formula for modeling the queue types, being M/M/1 and M/M/s.

It was verified that the average waiting time had a reduction with the M/M/s method around 0,0031 hours per call, totaling around 70 minutes of gains per week, being able to attend them with greater agility, not losing the service quality.

The company analyzed has a service center, where customers are the employees of energy distributors throughout the country, where the calls are answered by a tool and the time worked for each employee is calculated for the calculation of the billing, which was defined by ANEEL the amount of R $ 102.35 per hour worked.

With this reduction in call waiting time, it was possible to reduce the 61 hours of the 3,800 delays, where R $ 6,243.35 were increased in the turnover of the exchange during the analyzed months.

V.CONCLUSIONS

In this study, an approach was presented on the Theory of Queues and their methods, emphasizing the model that the company object of study uses.

It was verified that the average time of waiting is variable, according to the model approached, being able to be greater or smaller. In this study, it was analyzed that the smallest TME was obtained by the M / M / s method, achieving a reduction around 61 (sixty-one) hours in thirteen months, which used in the call handling process will generate an increase of R $ 6,243.35 in long-term central revenue.

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