USING A QUEUING MODEL TO ANALYZE AND RECOMMEND CHANGES IN THE NEWS COMING SERVICE PERFORMANCE OF A NATIONAL MEDIA

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Abstract

The culture of media business service in Albania is being shaped day by day by giving up the old tradition of orientating itself toward the in-out flow rather than considering the out-in flow, meaning the greater importance of reader service that makes changes happen from outside, having them into focus. This empirical study focuses on solving a critical service problem in the news from the specific media we must concentrate on. In our case, it concerns measuring the performance of a queue service for the news coming service. It is the queue theory that helps us understand the problem modeling. Thus, performance analysis reaches out by testing the actual waiting time to improve the news manipulating time service, therefore business costs. The methodology used here is based on the Little Law, which relates the average arrival rate with the average waiting time (Poisson distribution) and item number in the queue, combined with the formula that calculates the total economic cost. The model is applied to our specific queue dataset. The data are obtained from one-month observations of news arrival time in a business organization that is focused on the media sector products. The results show that the business must employ another service channel (journalist).

Keywords: *news, queue theory, performance analysis, little law*

INTRODUCTION

Delays and problems with queues are present in everyday life in different places such as hospitals, post offices, bus stations, etc.

Our study deals with queues but from a business perspective. The purpose of this empirical study is formulated as follows: describe the actual media business situation, analyze if there are spaces for modifications, and quantify these modifications in economic terms. We shall formulate an abstract problem in queue model terms to accomplish the objectives. According to Hillier and Lieberman (2003) [1], a queue, or generally a queue system, is used to demonstrate a set of one or more waiting for lines along with a server or more than one server that gives the service to those waiting lines.

The paper analyzes factual data gathered in the business organization environment, which is the media. The problem for the media is the lack of coordination between the local correspondents and the journalist that makes the news resume because of a high number of news coming from those different sources. Thus, the news cannot be analyzed as it should be, and some news may not be transmitted in live streams. This brings economic loss and is a real problem for the media. We analyze in this paper the possibility of adding another journalist to have a better performance in news reporting. The data relates to the time of news coming and are confined only to the arrival process. They are processed using the "Little" formulas for queues.

MATERIALS AND METHODS

The father of queue theory, A.K. Erlang developed the fundamentals during the 1909-1929 period. However, the first-time dependent solutions are made by Baily and Bat (1969) [2], using the generating functions of Lederman and Reuter using the spectral theory. In later times the queue concept developed, and its practical value has a better impact on everyday life.

The literature listed here concerns different ways of analyzing a queue performance and beginning with Pan and Prkhbar (2005) [3], which used the SHRINK method (Small scale Hi-fidelity Reproduction of

Network Kinetics). The technique consists of taking a web traffic data choice and making an appropriate system version that extrapolates the system performance in place of the original one. The SHRINK method is used in simulating large webs. The same work there gives some other examples. Here is mentioned one example related to the TCP arrivals as Poisson distribution. Fernando et al. (2003) [4] refer that the latter modeling is an admirable internet approach. The examples have time as an important indicator, but not the only one.

Our study will analyze time and cost as important indicators from the business perspective. In this point of view, the problem is treated by Velimerovic et al. (2011) [5], who was given the importance of the leading performance indicators in management.

However, one method might not be satisfactory. In another study in the production control field, we have a queueing model for job-shop scheduling JIT, Sheikh et al. (2005) [6]. It is a study in which the system performance is measured through simulation, but the new approach stands in hybridizing two methods ATC (arrival time control) and GA (genetic control). The first method controls the arrival time, transforming the scheduling problem into a controlling problem with continuous variables, eliminating the combinatory complexity. But ATC alone does not guarantee optimality. Therefore there, are used genetic algorithms. GA tries to optimize these smaller pieces if ATC shares the population in groups.

In our study, the arrival time distribution is supposed to be Poisson, and then we will try to verify it. The Little law is used as in Little's (1961) [7] formulas and the total cost formula to measure the system performance and find the better position of the queue model and, therefore, the minimal cost model.

The A.I. Martyshkin et al. (2019) [10] study will be a future hint for analyzing the chosen business's hardware and software performance analyses. Queue mathematical modeling and computer performance remains a nonexplorable field in the specific business area.

The research method used in this study is a quantitative research approach. The data gathered were the daily record of the queuing system over 38 days in which the data were collected regarding the news' arrival at the media newsrooms. They were processed manually in an excel spreadsheet at the moment they happened.

Then the 1578 data was grouped in one-hour intervals to show the news arrival distribution during the day clearly.

According to Hillier and Lieberman's theory (2001), arrival times have a specific distribution. In our case, we must prove the kind of distribution to make possible the existence of the premises for building the queue model. The chi-square is the statistical test that will prove the solid or weak correlation between data to have a precise probability distribution model.

After the hypothesis is proved, there is space to determine the queue-specific model as the above theory predicted.

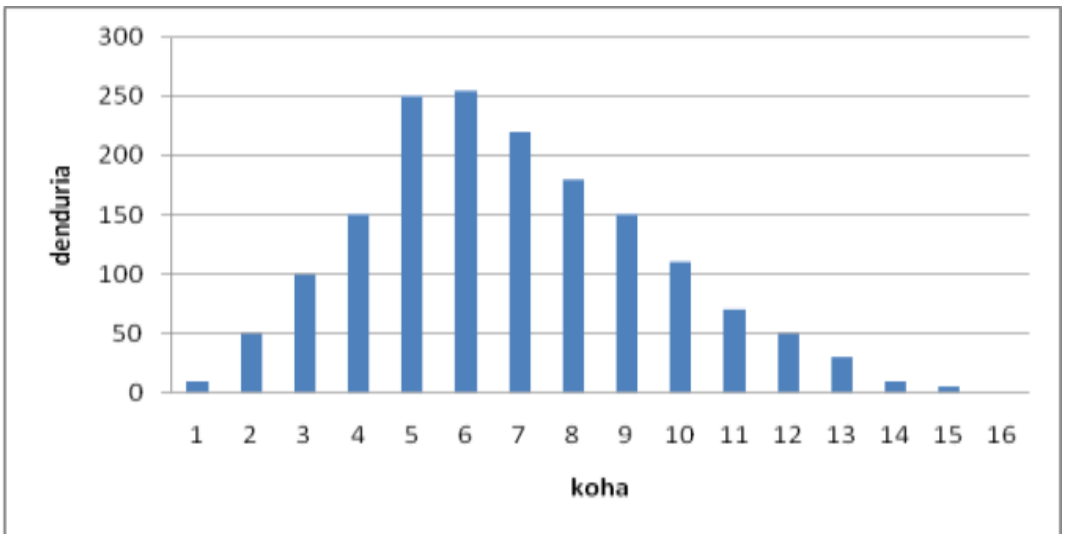
If the arrival time distribution is Poissonian, then we can deduce, as in the theorem of Hillier and Lieberman (2001), that the interarrival time distribution is exponential.

The interracial time distribution is considered degenerated because of data lack. The server number is one, but according to performance measuring and economic costs, the optimal server number will be determined.

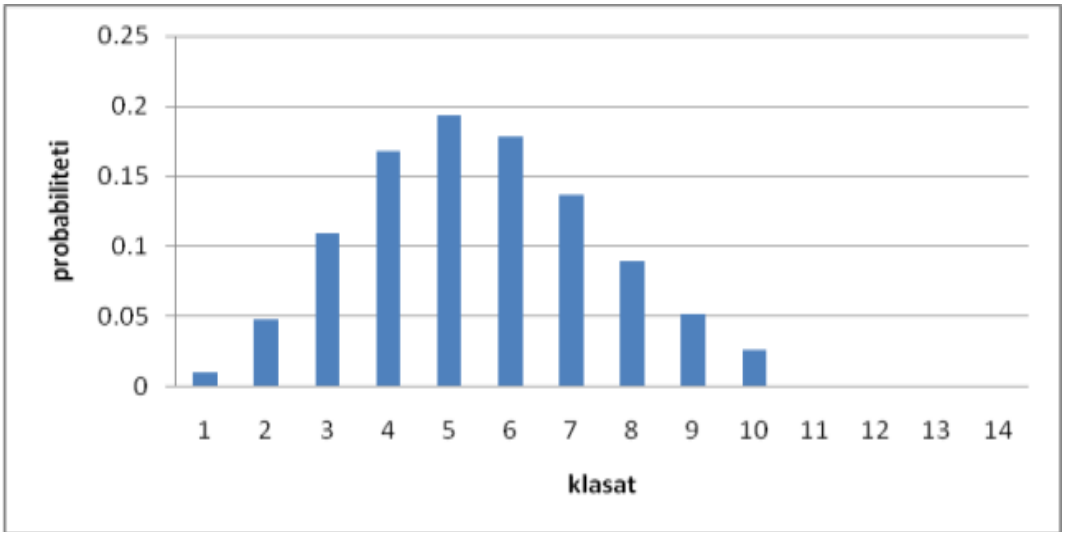
The Little and economic cost formulas will help us calculate the performance and show the need for our queue model to improve.

RESULTS AND DISCUSSION

According to Hillier and Lieberman (2001), there cannot be a queue system if there is no proven time distribution.



Graphic 1. Time distribution (koha=Time and Denduria=Frequency)



Graphic 2. Poisson probability (klasat=Classes and probabiliti-Probability)

The above graphics suggest that the Poisson distribution might be implied, but it must be proved.

So, to show that the arrival time distributions have a Poissonian distribution, we build the zero hypothesis and use the chi-square test to prove it.

H0= The arrival time distribution is Poissonian

Ha=The arrival time distribution is not Poissonian

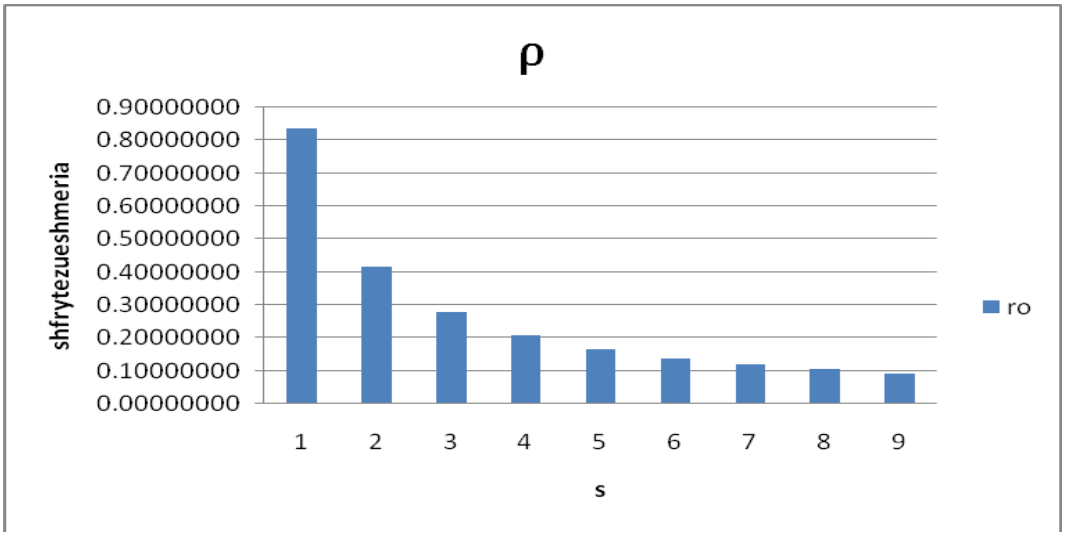
The freedom scale number is calculated as k-p-1, where k is the number of groups, and p is the number of variables. In our case, the classification is made in nine classes. So, the freedom scale number is 7. For this value, the critic chi-square is 14.2. After our valuations, the observed chi-square is 12.4, and the significance scale is p=0.06>0.05. So, we can say that the H0 stands. So, the news arrival time has a Poisson distribution. According to the theorem we mentioned above that connects the arrival times, and interarrival times there can be simulated the exponential distribution λ=4.6

We must state the final objective of the study, the performance analysis of our queue. The necessary data have been calculated and showed that λ= 4.6 client/hour and μ=5.5. We have taken an average service cost of about Cs=2.5 $/hour and waiting for the cost of about Cw=3$/hour:1

s	P	p0	p1	Lq	L	Wq	W	Cost/Hour
1	0.83636	0.16363	0.13685	4.27474	5.111111	0.92929	1.11111	17.833333
2	0.41818	0.41025	0.34312	0.17725	1.013621	0.0385	0.22035	8.0408653
3	0.27878	0.50721	0.42421	0.02650	0.862871	0.0057	0.18758	10.088613
4	0.20909	0.53701	0.44914	0.00366	0.840023	0.0007	0.18261	12.520069
5	0.16727	0.54334	0.45443	0.00044	0.83681	9.72E-05	0.18191	15.010431
6	0.13939	0.54439	0.45530	4.87E-05	0.83641	1.06E-05	0.18182	17.509237
7	0.11948	0.54453	0.45542	4.77E-06	0.83636	1.04E-06	0.18181	20.009105
8	0.10454	0.54455	0.45544	4.22E-07	0.83636	9.17E-08	0.18181	22.509092
9	0.09292	0.54455	0.45544	3.39E-08	0.83636	7.38E-09	0.18181	25.009091

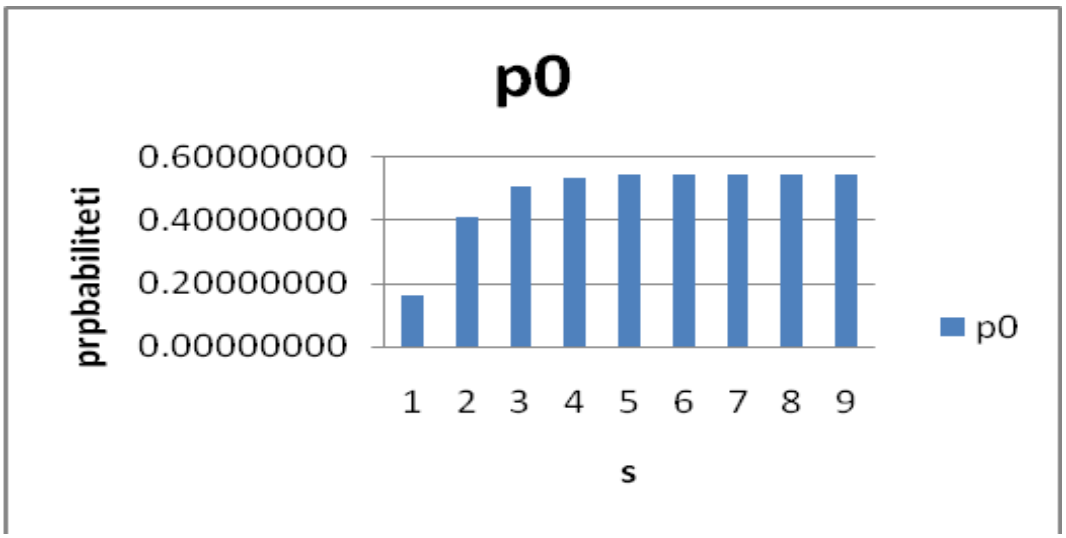
Table 1. A data summary for analyzing performance

The above results give us a broad point of view which is analyzed as follows.



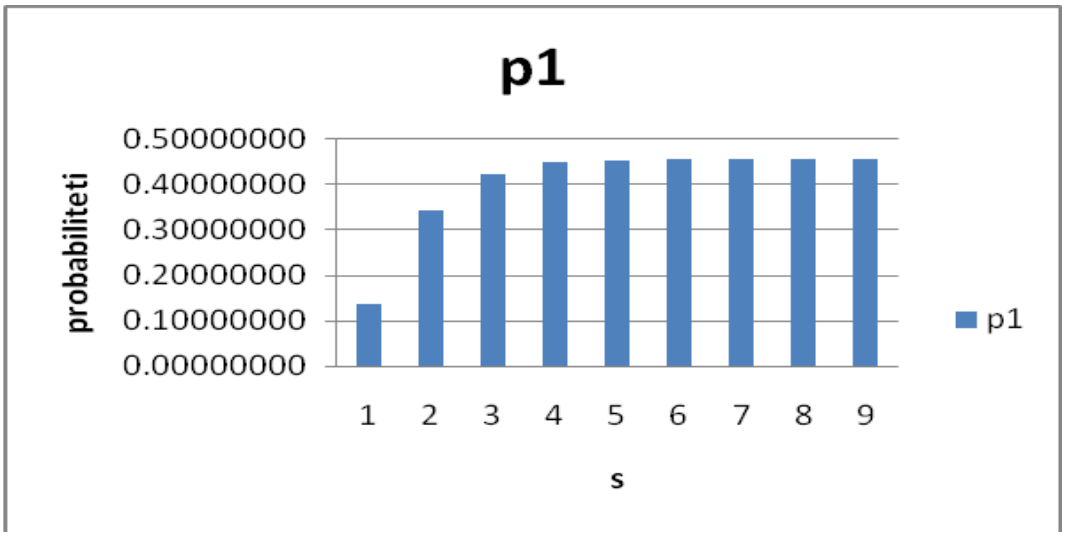
Graphic 3. Usage norm/servers (s=servers and shfrytezushmeria= usability)

[1] Calculated taking an average payment of the persons serving and opportune cost of the person waiting

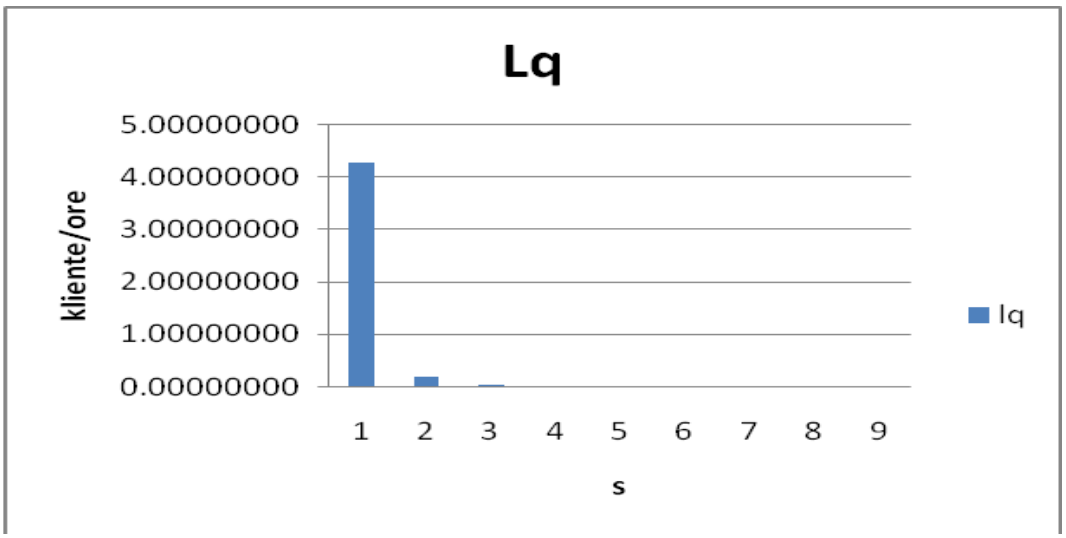


Graphic 4. Probability to have 0 news/servers (s=servers and probabiliteti-Probability)

The queue system usage depending on the servers' number, is declining. The marginal law of utility justifies this trend. If the number of servers is bigger than one, the queue gets a specific 'relief.' The increase in the probability of having 0 news shows that there is more 'space' when there is a more significant number of servers/journalists. The usage norms and P0 differ significantly when we scroll from the first to the second server compared to others.

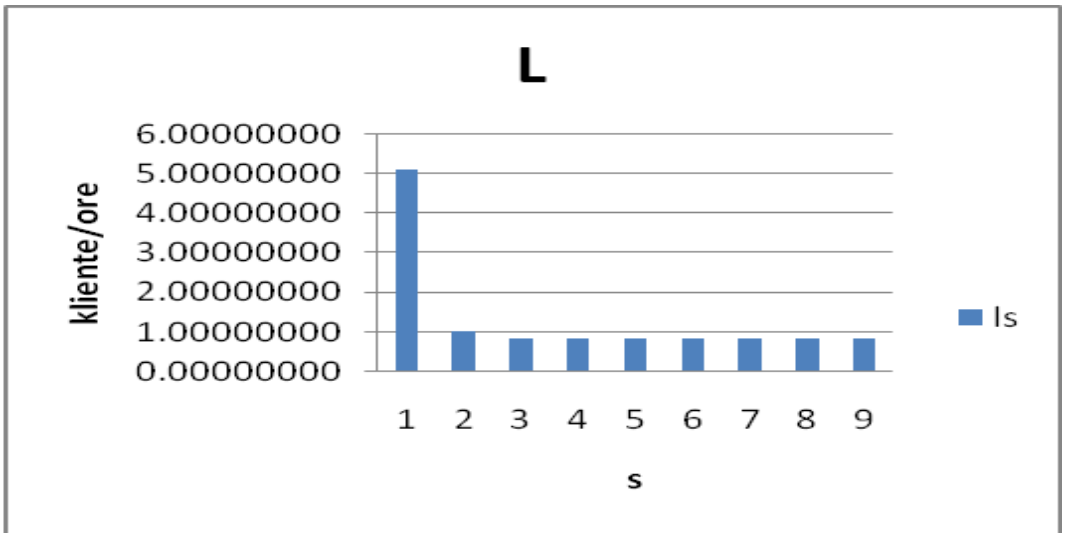


Graphic 5. Probability to have one news (s=servers, and probabiliteti-Probability)



Graphic 6. The number of news waiting per hour in the queue (s=servers and kliente/ore=clients/hour)

We see in graphic 5 that the number of servers increases until we reach the fourth server. While in graphic 6, the number of clients waiting per hour decreases sharply at the second server. So, there is an efficiency gain process at server no 2.

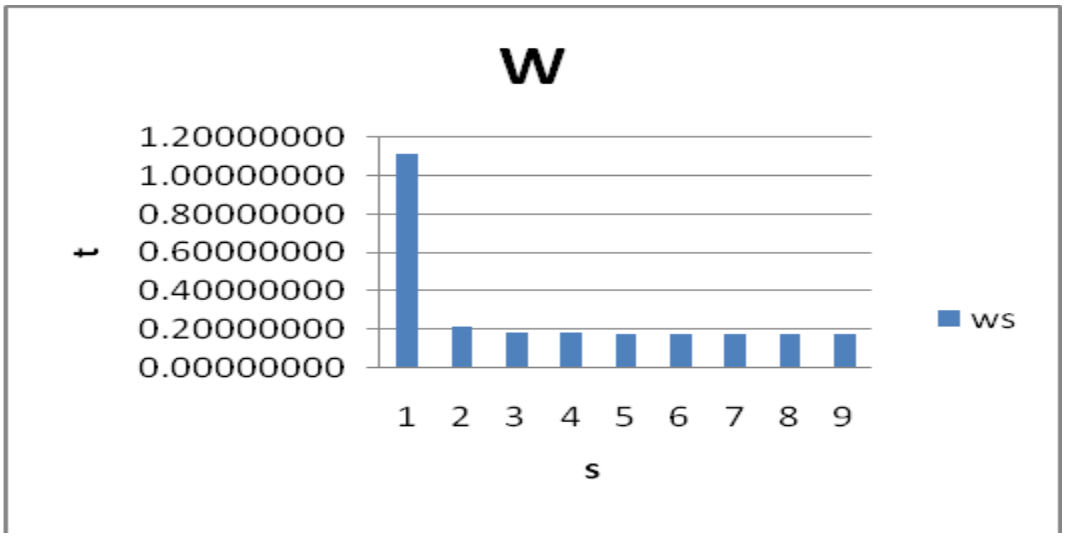


Graphic 7. The number of news waiting in the system (s=servers and kliente/ore=clients/hour)

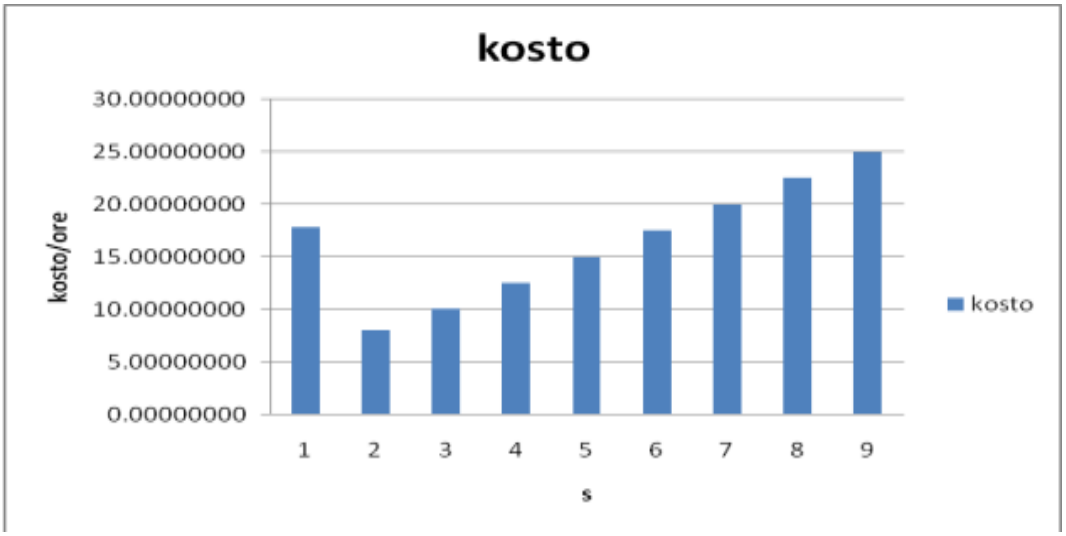


Graphic 8. Waiting time per news (sherbyes=servers and kliente=clients)

With the declining trend, having the number 2 server as a breakdown point stresses the necessity to have another server/journalist besides the unique one. In graphic 8, there is the waiting time in a queue per client. We see again how it drastically decreases at number 2.



Graphic 9. Waiting system time per client/news (s=servers and t=time)



Graphic 10. Total cost per server/journalist (kosto=cost, s=sherbyes and kosto/ore=cost/hour)

As shown above, another server/journalist needs to make the system work better. The cost graphic shows that the cost has the lowest point at the number 2 server/journalist, thus the better performance.

CONCLUSIONS

Our study aimed to analyze the news processing performance level. Literature offered us different ways to view a queue. We could examine it in various aspects. In our case, the queue theory was a real help for the media business organization. The analysis of queue performance is very important for the news service, thus for business profits, especially those concerned in the media service sector.

There is an urgent need to add another server/journalist point so the costs will be lowered and the public will be satisfied.

There exist some limitations regarding data gathered only for the arrival time, not for the service time, so it implies limited suggestions for waiting for cost and service cost, and it could be the object of further studies. Also, as a part of the doctoral studies in Artificial Intelligence (AI) methods, this study's method will be used further in combination with other AI methods, especially in analyzing processor efficiencies in parallel processing data.

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