

Queue management system (QMS) as a recent trend in improving service's quality

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Abstract :

Improving service quality has become one of the most important elements for creating and developing competitive advantages in the markets to either maintain or develop the enterprise's market share. Queue management is considered now as a very important aspect of the integrated system of service quality especially in this actual health situation characterized by the huge outbreak of the coronavirus pandemic. So this is what made any company strive to have the shortest and effective waiting line aiming to increase the consumer satisfaction level and enhancing the service's quality. To uncover the relationship between queue Management System and quality of service, this article draws on several previous studies and multiple theoretical approaches. This research revealed that the queue management system contributes to and effectively impacts the quality of service.

Keywords: Queue management system, queues, Service's quality, waiting line management..

JEL classification codes: M100, L800

الملخص:

يعتبر نظام تحسين جودة الخدمة أحد أهم العناصر لخلق وتطوير المزايا التنافسية في الأسواق إما للحفاظ على الحصة السوقية للمؤسسة أو تطويرها. وتعتبر إدارة صفوف الانتظار الآن منهجا ومدخلا مهماً للغاية في النظام المتكامل لجودة الخدمة خاصة في هذا الوضع الصحي الحالي الذي يتميز بالتفشي الكبير للجائحة فيروس كورونا، وهذا ما جعل أي شركة تسعى جاهدة للحصول على أقصر خط انتظار وأكثره فاعلية بهدف زيادة مستوى رضا المستهلك وتحسين جودة الخدمة. وللكشف عن العلاقة بين نظام إدارة صفوف الانتظار وجودة الخدمة، اعتمدت هذه المقالة على العديد من الدراسات السابقة والأساليب النظرية المتعددة.

وقد أظهرت نتائج هذا البحث أن نظام إدارة صفوف الانتظار يساهم بشكل جلي وفعال في تطوير جودة الخدمة.

الكلمات المفتاح: نظام إدارة صفوف الانتظار؛ الطوابير؛ جودة الخدمة؛ إدارة خطوط الانتظار.

تصنيف JEL: M100 L800

I-Introduction:

The competitive conflict has become one of the most important features that distinguish the contemporary economic situation, this is what put institutions in front of an imperative to distinguish from competitors by relying on various modern marketing approaches.

One of the most beneficial marketing methods that allow any company to face competition and obtain sustainable competitive advantages is the approach or the method to improving service quality, making the consumer more satisfied and more loyal to the company.

Thus, the queue management system considered one the most important and crucial approach in improving the service quality by minimizing the length and the time of each waiting line, which lead the company to have more competitive advantages by solving the problems relating to the waiting lines.

Due to the actual health situation that is characterized by a significant outbreak of the Coronavirus pandemic, social distancing has become an inevitable and decisive factor among all companies around the world, which has obligated these companies more and more to install and develop adequate and effective waiting line management as possible.

I.1- Research questions:

Through this paper, the critical question we seek to answer will be as follows:

What is the main impact of implementing an adequate queue management system on service' quality?

This key question elicits from three other sub-questions:

- 1- What does the phenomenon of waiting mean?
- 2- What is the impact of the waiting phenomenon on the quality of service?
- 3- What does the whole meaning of the queue management system?

I.2- Study hypotheses:

The following main hypothesis can be adopted to give a straightforward answer to the previous questions:

The queue management system contributes to an effective way of improving the service quality.

I.3- The study importance:

The current trend of the queue management system has a clear and obvious impact on the quality of service, as this innovative model of the queue management system has developed many recent inventions and innovations that have directly and effectively contributed to improving the quality of service. It is therefore essential and necessary to explain the primary function and effect of the queue management system on the quality of service to increase the level of the customers' satisfaction, especially in this current situation characterized by a large outbreak of Coronavirus disease, where each company must establish an appropriate system for managing the queues that ensure the smooth flow of customers in addition to ensuring Social distancing.

I.4- Study methodology:

In order to adequately explain the study problematic and the main hypotheses, we divided this article into three critical parts:

The first part will focus on the phenomenon of waiting and its impact on the quality of service.

In the second section, we will try to concentrate on the idea of the queue management system by concentrating on its definition, characteristics, and types.

Finally, by the third part, we will focus on how to improve the service quality by implementing an adequate queue management system.

I.5- Previous studies:

The queue management system and its impact on the service quality is a new approach used by so many companies whether industrial companies or services companies especially in our contemporary economy.

But the important observation that we have noticed is that this new approach is not used undoubtedly in our companies in Algeria, unlike other companies in European, Asian, and American countries.

Therefore, the previous studies we are going to present are mainly from European, American, and Asian nations.

a- Automated queue management system: an article written by Md. Nasir Uddin, Mm Rashid, Mg Mostafa, Belayet H, Sm Salam, Na Nithe & SZ Ahmed, and published in *Global Journal of Management and Business Research: A Administration and Management*, Volume 16 Issue 1 Version 1.0 Year 2016, USA.

The purpose of this research was to develop an Automated Queue Management System to coordinate a queuing system that could examine the status of the queue and determine which customer to serve first. This study concentrated mostly on the queuing mechanism for banks, various queuing algorithm methods used in banks to identify customer needs, and the average response time (Md. Nasir Uddin February 2016).

b- Droid Queue Management System DQMS: Counter Service For Queue Management System: a dissertation written by Nasiratul Safiah Binti Mohammad Rushdi on September 2012, university of technology Petronas, Perak in Malaysia.

This study focused on the main role of the Droid queue management system (DQMS is an android software available in the company to manage the waiting list) as a modern approach and its role in improving service delivery effectively and efficiently (Rushdi 2012).

c- Hospital Service Queue Management System with Wireless Approach: a research paper written by Manoon Ngorsed and Poonphon Suesaowaluk, Springer Science+Business Media Singapore 2016.

This research introduced a suggested alternative queuing management method which might minimize public discomfort by replacing the traditional system by the new one based on high technology over wireless. This process's commitment not only represents the citizens seeking the system of Hospital care, but they still use their time doing other tasks (Suesaowaluk 2016).

d- Integrated queue management system: a thesis written by Gonçalo António Rendeiro da Silva, tecnico institute, university of Lisboa, Portugal, November 2016.

This study proposed a new queue management system called the SIGA system, developed and introduced to provide both customers and workers with more details while maintaining records of all service-related activities. It can be adapted to other situations and can interact with other current frameworks, such as CRM for customer relationship management. A server-based solution is suggested after the specifications are obtained, documenting all service operations (Silva, Integrated queue management system 2016).

e- Queue Management Optimization with Short Message System SMS Notification: a research paper presented by R Kanesaraj Ramasamy, and Fang-Fang Chua in the International Conference on Economics, Business Innovation IPEDR vol.38 (2012) IACSIT Press, Singapore.

In this paper, the authors focused on increasing the customers' satisfaction by reducing the waiting time in queues, hence they developed a new approach or framework configured with a simple application that is widely obtainable with smartphones for SMS notification queue management, particularly for phone users (R Kanesaraj Ramasamy 2012).

f- Perception of Waiting Time in Queues and Effects on Service Quality Perception and Satisfaction: A Research on Airline Check-in Services: a research paper by Ozlem Atalik and Emircan Ozdemir presented in the international LCBR European Marketing Conference organized by Lupcon Center for Business Research.

This paper achieved an important result that waiting time should be kept to a minimum to prevent a negative impact on customer perceptions of service quality (Ozlem Atalik 2016).

g- Service quality, customer satisfaction, and customer value: A holistic perspective: an article written by Haemoon Oh, where he focused on the integrative approach among Service quality, customer satisfaction, and customer value (Oh, Service quality, customer satisfaction, and customer value: A holistic perspective 1999).

h- Queuing Theory and Customer Satisfaction: A Review of Terminology, Trends, and Applications to Pharmacy Practice: an article published by Ronald Anthony Nosek. Jr and James P. Wilson. This article showed the relationship between the queuing theory and customer satisfaction in the field of pharmacy (Ronald Anthony Nosek, Queuing Theory and Customer Satisfaction: A Review of Terminology, Trends, and Applications to Pharmacy Practice 2001).

i- Queuing Theory and Customer Satisfaction: A Review of Performance, Trends and Application in Banking Practice (A Study of First Bank Plc Gwagwalada, Abuja Branch): This article provided an overview of queuing theory, its effectiveness, and its contribution to customer satisfaction in the banking industry (N. B. Munirat Olafemi Yusuf 2015).

m- Capacity Design and Service Quality Control in a queuing System: a research paper written by S.D. DESHMUKH and SURESH JAIN. This paper highlighted how to improve and control the quality of service using capacity design and focus on it (JAIN 1977).

II- The relationship between the phenomenon of waiting and the quality of service:

The phenomenon of waiting has become one of the most distinctive features of our daily life, as many consumers have to spend a long time in queues to obtain their service's needs, for example in supermarkets, hospitals, administration departments ... etc.

In this context, there are several questions can be asked, and one of these questions:

is there any relationship between the phenomenon of waiting and the service's quality, or in another meaning is the phenomenon of waiting has an impact on the service's quality or not?

Maister (1985) published eight principles that influence customer perception of actual wait times (Karu 2013, 7):

1. Unoccupied waits seem longer than busy waits.
2. Pre-process waits tend to be longer than in-process waits.
3. Anxiety makes waits seem longer.
4. The uncertain wait appears to be longer than the expectation of a known duration.
5. Unexplained waits appear longer than the waits which have been clarified.
6. Unjust waits appear longer than fair waits.
7. The more the service is important, the longer customers would be willing to wait.
8. Waiting alone seems longer than waiting for a party.

Although Maister's model is generally accepted due to its clear face validity, there are also studies that show that the shift in perceived waiting does not improve the customer's perception of waiting. (Karu 2013, 7)

Despite this bad and black picture of waiting, the majority of great service institutions find themselves forced to face waiting's problems to provide their services. The consumer might get forced to stand up in a long line of waiting in the supermarket, train station, airport, and other places in waiting to get the service. (Fatima 2011, 76)

Although the consumers find themselves sometimes forced to stand up in a long line of waiting, but most of consumers expect to get the service at the short time as possible. Therefore the companies strive to minimise the length of their lines in order to improve the service quality by improving the customer satisfaction.

In this context the customer satisfaction Customer satisfaction was defined as the difference between the Perceptions of the client and his or her expectations, which Many times, it is based on previous experiences (Ronald Anthony Nosek, *Queuing Theory and Customer Satisfaction: A Review of Terminology, Trends, and Applications to Pharmacy Practice 2001, 277*).

Although it is possible to manage and decrease actual waiting time and to some extent to manage customer expectations about customer satisfaction managing the customer's perception of the queuing experience can be the vital element in satisfaction with the service interaction. (Ronald Anthony Nosek, *Queuing Theory and Customer Satisfaction: A Review of Terminology, Trends, and Applications to Pharmacy Practice 2001, 277*)

The relationship between the waiting time and the customer satisfaction is generally inverse in nature, which means when the waiting time decreases the level of the customer satisfaction increase and so on. (Ronald Anthony Nosek, *Queuing Theory and Customer Satisfaction: A Review of Terminology, Trends, and Applications to Pharmacy Practice 2001, 277*)

Upgrading the level of service considering the waiting time has become an important issue in recent years with an increasing emphasis on quality especially in the field of operations.

In general way companies are capable to reduce the waiting time and guarantee broader services through expending their service's ability, which usually means adding again others number of service's providers, Such as the rise in the number of sellers in the main shopping centers or expanding the number of bank workers for purposes of withdrawal and deposit...ect, but expending the capacity of service in this regard has a monetary cost related to the basic on waiting for line analysis that links between the cost of service's improving and waiting for the cost for the unit (Mousaoui 2008, 285-286).

For the prior concepts, the approval of the production or service sector enterprise requires the following (EL FADAL 2008, 313):

- Preparation of unique places from which a particular system is coordinated to sell these goods to the final customer or intermediary.
- Preparing stations or sites through which the service is marketed, such as service delivery platforms in banks or fuel pumps.
- Preparing the place or site through which customers are regular in waiting lines to obtain the service with the required quality specifications.

According to all what have mentioned above it is clear that there is an obvious relation between the phenomenon of waiting and the service quality, therefore most companies endeavor to control the waiting lines in the perfect way to ensure their service quality.

III- Queue management system concept:

In this section we will try to highlight on the queue management system by focusing on three main points:

1. Queue management definition.
2. Queue management characteristics.
3. Types of queue management.

III-1- Queue management definition:

When we talk about queues, the words that often spring to our mind are “annoyance”, “lots of people”, “boredom” and “waste of time”...etc

So let's go over the several definitions and meaning of the queue management system, but before this, it is desirable to highlight some terms related to this concept (Silva, Integrated Queue Management System 2016, 8):

1. Queue:

A queue is a line of people awaiting services or products. In economic terms, it's even simpler a queue is a textbook case of demands exceeding supply. When more people are queuing up than the clerks or assistants ready to service and satisfy them, we get queues.

An acronym for common customer problems used to track customers. In the academic sense, a graduate can need to apply for an "A-Certificate Issuance" or continue late with "B-Fee Payments." In a hospital sense, one may consider the options for "A-Scheduled Review" or "B-Urgency" at reception. The word queue does not apply to a fitness queue. It's more of a virtual queue. A way to separate the customers into the different problems that they want to tackle will arrange the queue itself as the staff wishes.

2. Desk:

The word desk is used here as a generic place where the client is called to address his problem. The idea is that this method should be used in the multiple cashier model mentioned above, such that each "cashier" that can essentially be a cashier, counter, or basic reception desk is commonly referred to as a desk, preceded by an identification (e.g. Desk 1) and associated with its current staff member (e.g. Alice). It is necessary to have the desk identifier so that a customer knows which Desk to address when it is called by that Desk operator. Important note: a desk is not the equivalent of a desk operator: if Alice, initially in Desk 1, exits the program, every desk-unassigned operator is free to select Desk 1.

3. Ticket:

A specific numbered ticket per service session, created for a customer, corresponding to a queue and service, should provide information about the name of the queue and operation, with a short queue and unique number.

Customers can be identified by ticket dispensers with the card reader. The client can receive a message about waiting time by entering the phone number, so it can be alerted when its turn comes up.

4. Service session:

Service session Period before the ticket loses its validity, by default coinciding with the open-hours of the office. Tickets taken during the previous session will not be valid for a current or future session. Can be extended by the Service Administrator or set as normal.

Therefore we can have different definitions and meaning of the queue management system or waiting lines system, where the most common of it can be summarized as follows:

a- “ A queue management system is the organization of queues of people within a retail or public sector department. It can be either reactive through a system that can organize the existing queue or proactive through queue management statistics gathering system, so that the trends can be identified and anticipated” (Md. Nasir Uddin February 2016, 52).

b- From another point of view, the queue management system considers as a mathematical models for the operations research and this prototype aims to visualize the objective reality of a particular situation and summarize its dimensions to study and analyze it and then take the right decision (Djenabi 2010, 259).

c- The queue management theory depends on units arrival such as clients, machines...etc to the service stations, where the arrival operation can be with a fixed rate in a known period of time, or with a randomly (Houcine Yacine Taama 2009).

d- Queuing theory is the systematic analysis of standing in line and is a whole field of operations management discipline. The theory of queuing uses statistical models and performance metrics to analyze and ideally enhance customer flow through a queuing framework (N. B. Munirat Olafemi Yusuf 2015, 90). Essentially, a queuing mechanism or waiting line phenomenon consists of six main components (N. B. Munirat Olafemi Yusuf 2015, 92):

- The population, the arrival,
- Queues itself queue discipline,
- Service mechanism,
- Departure or exit.

It should be noted that there are two types of queues which are structured and unstructured queues. So we try to highlight each concept as follow:

1. Structured queue:

A structured queue is a fixed type queue and included individuals who are in a predetermined position. We can see this in paying counter supermarkets and certain other retail outlets including banks and post offices. This type of queue system is also set up to handle the ranking of tickets for a service with identification and thus allow for stress-free waiting. Some of this device is intended for reception by pointing or remotely rank allocation on smartphones or via SMS, expanding the various possibilities (Md. Nasir Uddin February 2016, 52).

2. Unstructured queue:

The unstructured queue is where people form a line in uncertain and diverse locations and directions. That is also the case in certain types of shopping, taxi lines, ATMs, and in other cases at times of high demand. Any of the latest approaches is allocating ranks for service, pages, or RFID badges or simply reading the customer's card. Besides, to be efficient it is hard to enforce a way to organize those queues. The reason is that one cannot easily calculate the behavior of man (Md. Nasir Uddin February 2016, 52).

Finally, we can consider the queue management system as a customer relationship management CRM or at least a sort of king of it. Reaching a queue is one of the first parts of the relation between the customer and the company. Through taking care of this connection, the queue management takes steps into the customer service field.

III-2 Characteristic of the queue management system:

Queue processes are described by six basic characteristics, which provide adequate representation of the queue system.

So we will try to highlight these six characteristics as follows:

1. Arrival pattern of customers:

The arrival pattern of customers means the time spent between a customer's arrival and another to a service location, this time may be fixed or random variable, and it is the most common, that means a known random distribution. The arrival pattern of customers may be individually or in groups. Models of waiting lines include an arrival rate and a service rate. The rate of arrival determines the average number of clients per period. For example, one system may have ten customers arriving every hour on average. The service rate determines the total number of clients that can be serviced over a period of time. The service rate is service system efficiency. If the number of customers you can serve per period is fewer than the total number of incoming customers, the waiting line would expand infinitely (California State University, Sacramento s.d., 9).

So the managers in the company should make sure the arrival rate and service rate are for the same time, that is, the number of customers per hour, or per day, or per week (California State University, Sacramento s.d., 9).

2. Service delivery pattern:

It is the rule by which the clients are chosen in the line to be served, and the most used systems are the following (Md. Nasir Uddin February 2016, 52-53):

- a. **FCFS " first come first serve"**: Is a system that deals first with the oldest entry form. The action of FCF is when people exit the queue in the order that they arrive at. It is the fairest delivery of services where all consumers find themselves equal.
- b. **SFP " shortest processed first "**: SPF functions as a scheduling policy which first selects a lesser execution time to process. Within a store, a different paying counter only handles transactions that the consumer purchases products less than 10 items. Due to its simplicity, SPF can function well and minimizes the average waiting time for each operation. The drawback, however, is that if short processes are constantly implemented and consumers don't perceive the right degree of fairness from the system it takes a long time to complete.
- c. **SG " single queue"**: is the common snake format. Every individual waiting is in turn served and the format discourages pushing in. The queue also provides consumers with clear reassurance that they'll be treated equally as the queue progresses.
- d. **MQ "Multiple Queue"**: Multiple queues, MQ is SQ improvement, it is important to use this approach when dealing with larger numbers of people. This queue is the model which is often used in the supermarket.
- e. **DQ" Diffuse Queue "**: A diffuse queue is a system that does not have a structured queue line, but customers use tickets to register a place in the process.
- f. **HQ " Head of Queue "**: head of the queue, is the model where puts the next person to serve stays in a single and specific queue environment. This procedure is relevant when the payment number is more than five. Consumers need to be able to see the location of service along the line to prevent major service delivery delays.

3. Queue size or system capacity:

- g. It means the group of service seekers represented by those waiting in line and those who receive the service, and this group is limited or unlimited (Said 2007, 339).

3. The number of customers allowed in the system:

This characteristic relates to the number of authorized clients in the system. It may be specified, meaning that the arrival of any new customer is not authorized, or unrestricted, to participate in the system (Hamad Saad Nour El chamrani 2007, 458).

4. Service mechanism:

The service mechanism identifies the services and the resources that are needed.

The manager of the company should consider the following questions (Lee 2019):

- a. How many servers do you have?
- b. Is there a different queue for every single server?
- c. How long does it take to satisfy a customer?

As with the arrival process, the service mechanism lets you find out the pattern of operation.

5. Queue discipline:

The queue discipline demonstrates the way the units are taken for duty. Service demand is also expressed as $a = \lambda/\mu$, the mean number of arrivals per unit time being taken as the mean service time. This quantity is called the load provided (or the traffic intensity); it is a quantity without dimensions and is expressed in "Erlang" (in honor of A. K. Erlang, the founder of queue theory). The load provided is a measure of what the customers want (J.MEDHI 2003, 47-64).

6. Population or an input source:

It refers to the source that generates customers who enter the service and wait system. In this context we can distinguish two types of inputs sources in waiting systems, the first is the finite source as is the number of machines in the factory that need repairs from the maintenance staff, Requests for service in one of the floors of the hotel for which one of the employees is responsible ...etc, in all these cases the number of clients is limited (Nadjem 2008, 564).

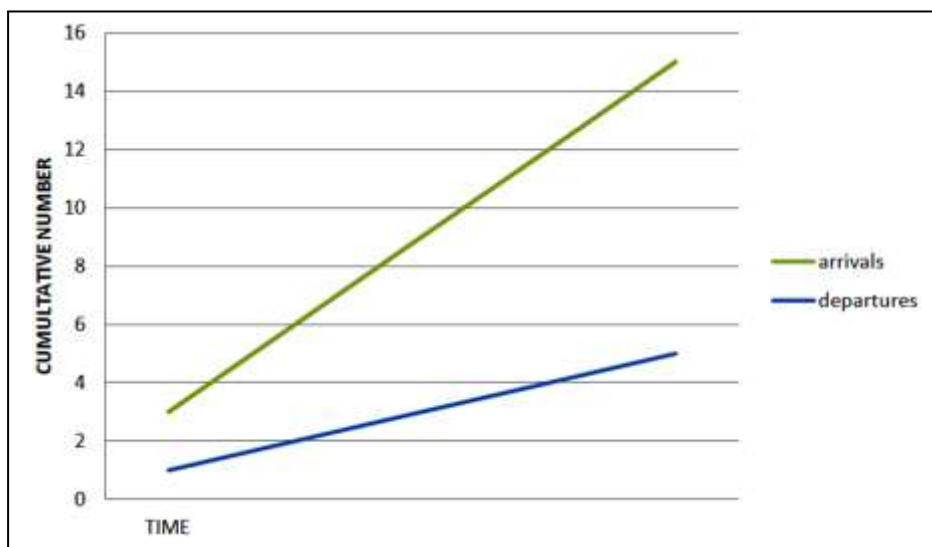
The second is the unlimited source or infinite source as is the potential number of clients that exceed the system capacity by a large number in the central markets, banks, theatres, ..ect In all these cases, the number of customers is enormous and the service is not restricted to a specific category of them (Nadjem 2008, 564).

The following are the most important symbols used in the mathematical models' equations for the queue system (Fatima 2011, 97-98):

- a) **n**: represents the number of units in the system (the units in the waiting line + the units in the service center).
- b) **λ**: represents the number of units coming to the system multiply in a unit of time (the arrival rate for each time unit).
- c) **μ**: represents the number of units leaving the system (the service rate for each time unit).
- d) **P**: represents the probability of finding units in the system.
- e) **P₀**: represents the probability of never finding any unit n in the system.
- f) **L_q**: the average of expected units in the waiting line.
- g) **L_s**: the average number of units who requesting service in the system.
- h) **W**: the average time spent by a customer in the system.

The following figure depicts the relation between the cumulative number of arrivals and departures in a queuing system.

Fig1. Depicts the relation $L = \lambda W$



Source: J. MEDHI (2003), Stochastic Models in Queueing Theory, Second Edition, Academic Press, pp. 47-64.

It should be to mention that Sundarap and Ian gave the followings as the basic characteristic of the queue system (Adegoke S. Ajiboye 2018, 303):

- a. The input or arrival pattern,
- b. The service mechanism,
- c. The queue discipline,
- d. The system capacity,

Nevertheless, these two researchers are talking about the same characteristics which are mentioned above.

III-3- Types of the queue management system:

We will try to shed light on the several types of the queue management system according to the different parameters. For this, we need to look at two specific queue management criteria, which are the number of channels (or servers) and the number of operation phases.

Consider channels as the number of stations you are accessing the service, and stage as the number of steps you need to take to achieve service.

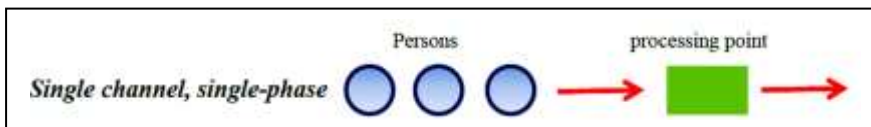
Two values can be taken from each parameter: single (one) or multi (several). Stream and process combinations give us four distinct forms of queue management:

1. Single channel, single-phase:

A single channel single phase is one of the easiest models and sometimes named the single-channel system. The units in this model arrive at the service center consecutively on one waiting line and provide them with one phase (California State University, Sacramento n.d.).

The following figure clarifies this model:

Fig2. Depicts a single channel, single-phase model



Source: California State University, Sacramento (2020), S Waiting Line Models, detailed website: <https://www.csus.edu/indiv/b/blakeh/mgmt/documents/opm101supplc.pdf> (10/05/2020).

The following assumptions are made when we model this environment (California State University, Sacramento s.d.):

- a. The consumers are patient (no balking, reneging, or jockeying) and come from an infinite community.
- b. The arrival of customers are represented by a Poisson distribution with a mean arrival
- c. Rate of λ (lambda). This means that the time between successive customer arrivals follows an exponential distribution with an average of $1/\lambda$
- d. A Poisson distribution with an average service rate of μ (mu) defines customer service performance. It assumes that one customer's service time follows an exponential distribution with an average of $1/\mu$.

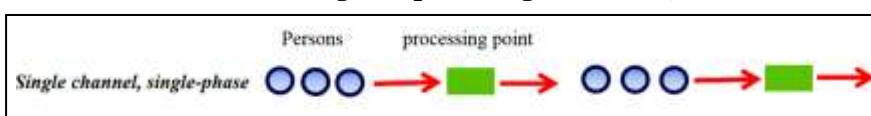
The priority rule used for the waiting line is First-come, First-served.

2. Single Channel, Multi-Phase:

This model is more complicated than the first one; it consists of multiple stations through which a customer needing service will have to transfer from such network (California State University, Sacramento n.d.).

A multi-phase single-channel company has one server and multi-phase service operation. Example: Retail banking, the following figure gives us more details:

Fig3. Depicts Single Channel, the Multi-Phase model

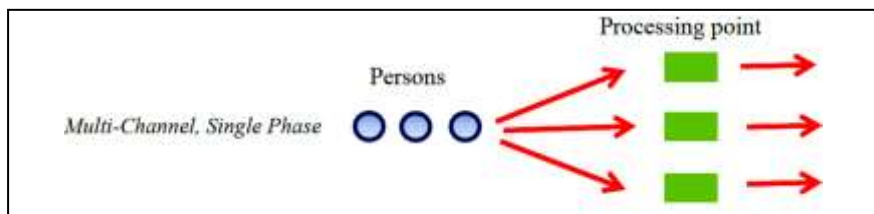


Source: California State University, Sacramento (2020), S Waiting Line Models, detailed website: <https://www.csus.edu/indiv/b/blakeh/mgmt/documents/opm101supplc.pdf> (10/05/2020).

3. Multi-Channel, Single Phase:

A Multi-Channel, Single Phase system has many servers and one-step servicing. Example: airline ticket counters with separate queues for passengers in business class and economy class (Lee 2019).

Fig4. Depicts Multi-Channel, Single Phase

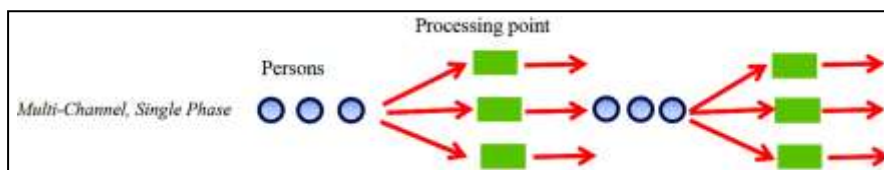


Source: California State University, Sacramento (2020), S Waiting Line Models, detailed website: <https://www.csus.edu/indiv/b/blakeh/mgmt/documents/opm101supplc.pdf> (10/05/2020).

4. Multi-Channel, Multi-Phase:

This case is similar to the previous case with the difference that some different services are provided in sequence in one channel. An example is the admission of a patient to the hospital, where he is provided with consecutive services, until he arrives in the hospital's room after several examinations (Chikh 2009, 350).

Fig5. Depicts Multi-Channel, Multi-Phase



Source: California State University, Sacramento (2020), S Waiting Line Models, detailed website: <https://www.csus.edu/indiv/b/blakeh/mgmt/documents/opm101supplc.pdf> (10/05/2020).

5. Fixed service time model:

A fixed service time model is characterized by the following (Korstanje 2020):

- using distribution of Poisson for the number of arrivals by time.
- Period of fixed operation (no variation), called D for deterministic.
- On the same waiting line, "c" servers (c can range from 1 to infinity).

An automated photo booth for security scans in airports may be an instance of such a scenario. If we take the hypothesis that it takes exactly the same amount of time for each passenger to take the images, and people arrive following a distribution of Poisson, This would coincide with a fixed time model (Korstanje 2020).

IV- Improving service quality by implementing an adequate queue management system:

Due to its clear effect on corporate efficiency, reduced costs, consumer satisfaction, customer loyalty, and efficiency, service quality has become an important area of emphasis for experts, managers, and researchers over the past few decades (Nitin Seth 2005).

Parasuraman et al. (1988) adopted a 22-item index to assess service quality, called **SERVQUAL**. The concept has been extensively applied across businesses (Oh, Service quality, customer satisfaction, and 1999).

Quality has been conceptualized differently in the context of service companies and multiple scales have been formulated for service quality assessment based on various conceptual frameworks (Gupta 2004).

There are several service quality dimensions such as communication, serviceability (responsiveness, timing, flexibility, tools, reliability...etc, so it can be easily noticed that many service quality

dimensions can be achieved by implementing a good queue management system especially timing, continuity and the conform to customer requirements.

As for quality evaluation indicators, we can say that the queue management system contributes clearly and effectively in the effect on these indicators especially on:

1- The possibility of obtaining the service: This indicator is one of the important indicators in the assessment of the quality of the service so that the more the company implements an effective queue management system, the more it can maximize this indicator, which means producing time utility (the ability to provide the service in the appropriate time) and placing utility (the ability to put the service in the right place).

2- The response: as well as the company can raise the rate of their customer's response by providing the service just in time, so a good queue management system can give the company the ability to maximize this indicator and in an adequate manner.

In this context, it is worth noting that some studies indicate that 72% of customers agree that valuing customer's time is the most important aspect of a company. With minimal effort and stress-free, visitors care about getting serviced as soon as possible. A QMS is responsible for this by (Lee 2019):

- a. Reducing real and expected waiting times.
- b. Remove the risk of getting on the wrong track.
- c. Inform clients in a queue about their real-time status.
- d. Allowing customers to spend more efficiently in their queuing time.

On another hand queue management system can help managers and frontline clerks to contribute in an effective way in increasing service quality indicators by raising customers response rate and their ability to get the service at the right time through the following (Lee 2019):

- a. Makes queues easier to efficiently handle crowds.
- b. Does not require customers to sign in during the closing hours.
- c. Offer Client guidance.
- d. Boost job climate.
- e. Assessing consumer behavior.

Administration and company owners are concerned also with the overall customer experience and company profile. A queue management system has proved valuable by (Lee 2019):

- a. Tracking success by employees.
- b. Allowing better timing of the assets.
- c. Measuring the effectiveness of improvements.
- d. The making company seems tech-savvy and creative.

Improving service quality is considered one of the most important elements that must be followed to face intensive competition. Therefore, the queue management system is a primordial approach for improving the service quality by following a set of integrated strategies as follows (BLOG 2017):

1- Keep the client engaged and updated:

This strategy is based on keeping the customer distracted while waiting their turn in the queue, therefore the company can use multiple tools and ways to achieve this aim such as displaying content on TV, keep informing the client about the time left to attend their turn by sending message or having the ticket through the internet. It is worth to mention that the provision of this information must be kept on a continuous basis throughout the waiting period, because the lack of adequate information at the right time is one of the most important elements that lead the customer to be furious and unsatisfied, and this situation can push him to stop buying the product.

2- Launch the service process as soon as possible:

The wait basically finishes as soon as the procedure starts, which leads to attendance. In their view, any mission that places the customer at a crossing point for service will be successful. The multimedia self-service/check-in kiosks serve as a model and give the customer an independence that allows them extra time and removes the need to go to the cash register, fill in information forms personally, along with many other duties that render all service as quickly and efficiently as possible.

3- Be quiet and provide your client with distinct solutions:

Managers need to take into account that there are always certain customers who will be in a rush or in a terrible mood and get bored with standing in the queue for a long time, so they will definitely not be pleased and the company has to cope with this situation because there is no way to dispose of an unsatisfied customer.

It is important to stay calm and, over all else, to have various solutions, like not "forcing" the customer to stay in the position or even warning him how long it will take to take proper care of it.

4-Be dynamic:

Submit data in a creative and collaborative way. Get the customer amused while waiting. So this is very essential, since it improves loyalty and engagement with your customer, in addition to reducing the feeling of waiting.

In addition of all above there are other strategies to reduce the waiting time and improve the service quality as following:

1- Improvements in the service operation:

One of the most important examples of improving the service process is what the Bank of Chicago has done by creating an electronic waiting system that helps a lot in easing the flow of customers in addition to providing them with the right service. As a result of these improvements, wait time is reduced by 30% and deposit operations are reduced by 35%. To provide consultations and inquiries, the time required is reduced by 50% (Hamid El Tai 2009, 234-235).

2- Changes in the human resources:

This strategy includes the following (Fatima 2011, 89):

1. Assign someone to organize waiting times for clients and transact with them more quickly.
2. Hiring several officials outside of the organizational structure to work during peak times.
3. Give officials who follow the company's organizational structure additional motivations if they improve their productivity and performance according to clear criteria for performance appraisal and productivity measurement.
4. Reprogramming rest periods so that cannot affect absolutely the process of providing rapid services to clients.

3- Customer-oriented improvement to the delivery system:

The former bank mentioned in the first strategy set simple tables on busy days to provide quick service to its customers and give answers to any inquiries, and this bank has also extended its working time from 38 to 56 hours per week, including Sundays. In addition to that, the bank issued a brochure entitled How to Reduce Waiting Times, in which it alerted customers to avoid busy hours and made several suggestions to avoid delays, such as segmentation as an alternative to First-Come, First-Served (Hamid El Tai 2009, 235-236)

The segmentation strategy uses sometimes to design waiting strategies that put in place different priorities to different types of beneficiaries (Hamid El Tai 2009, 236).

In this context we can mention the following examples (Hamid El Tai 2009, 236-237):

- A. Urgent of the job.
- B. Duration of service transaction.
- C. Payment of a premium price.
- D. Importance of the customer.

V- Conclusion:

In contemporary economics that is characterized by the increased competition, most service companies strive to have the shortest waiting line as possible, and in a manner that satisfies the customer. Not only this but also ensures that the client does not leave without receiving the service, this goes beyond the customer's conviction to receive the service even the next time. But the characteristics which distinguish services from physical goods put their suppliers facing a demand problematic, as those providers cannot stock these services in the shrinking period demand, and also providing these services in large quantities amplify their delivery cost.

Managing these variables put companies in front of choosing between costs related to providing good quality for clients and their waiting costs to receive this service in a way that can lead to reducing total costs and achieving customer satisfaction, and therefore the queue management system gives the ideal solution for making these decisions.

Based on the above, we can summarize the general results in the following points:

- 1- There is a clear and significant relationship between the queue management system and the quality of service, as the queue management system allows the company to reduce the waiting time in addition to reducing the frustration rate, and all this leads to an improvement in the consumer satisfaction rate.
- 2- The choice of the correct queuing model depends on researching the needs of the consumer in order to implement the appropriate model that leads to improving the delivery system as well as improving the quality of service.
- 3- Scientific management waiting lines in the company has become one of the most important factors in order to obtain competitive advantages by enhancing the company's ability to provide services with high quality as possible.
- 4- Creating and implementing special waiting models during peak times in addition to increase the number of workers.
- 5- In view of the current conditions that characterize the massive spread of the Coronavirus, it is of utmost importance to establish and adopt new and distinct waiting lines on the basis of ensuring and achieving the rule of social distancing.

According to the results above, we will try to present a set of suggestions as follows:

- 1- All companies must adopt the correct and appropriate waiting line models based on scientific standards.
- 2- The main goal of the queue management system is to improve the service quality, therefore all policies and techniques around creating and managing waiting lines must focus on this goal.
- 3- Companies can make profits from the queue management system when they combine demand and supply; therefore every company should invest in this field especially in the smart queue management system approach.
- 4- Different and distinct waiting lines must be adopted in the company, according to the nature and specificities of each service.
- 5- It is of utmost importance to organize periodic training courses for employees responsible for managing queues to enhance and update their capabilities and competencies.
- 6- Due to the Corona-virus pandemic, all waiting lines models must take into consideration the social distancing rule.

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