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School of Commerce

Department of Logistics and Supply Chain Management

Assessment of Waiting Line System in Improving Customer Satisfaction: The case of Addis Ababa City Administration Drivers and Vehicles Licensing and Control Authority.

A Research Thesis Submitted to Addis Ababa University in Partial Fulfillment of the Requirements for the Award of MA Degree in Logistics and Supply Chain Management

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ADDIS ABABA UNIVERSITY
SCHOOL OF COMMERCE
DEPARTMENT OF LOGISTICS AND SUPPLY CHAIN MANAGEMENT

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DECLARATION

I, **Biruk Alemu** declare that, this thesis work entitled " **Assessment of waiting lines system in Improving Customer Satisfaction: The case of Addis Ababa City Administration Drivers and Vehicles Licensing and Control Authority**" is my original work and has not been presented for a degree in any other University, and that all the sources of materials used for the thesis have been duly acknowledged.

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CONFIRMATION

This is to approve that the study made by Biruk Alemu, entitled: **Assessment of waiting lines system in Improving Customer Satisfaction: The case of Addis Ababa City Administration Drivers and Vehicles Licensing and Control Authority**, and submitted in partial fulfillment of the requirements for the Degree of Masters of Arts in Logistics and Supply Chain Management complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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ABBREVIATIONS

FIFO	_____	First-In First-Out
LIFO	_____	Last-In First Out
SRO	_____	Service For Random Order
SPSS	_____	Statistical Package for Social Sciences
PS	_____	Priority Service
DVLCA	_____	Driver and Vehicle licensing and control Authority
AA- DVLCA	_____	Addis Ababa Driver and Vehicle licensing and control Authority
WLS	_____	Waiting Line System

ABSTRACT

This study gives the reader a deeper insight into the impacts of waiting line systems application in relationship to improving the customer satisfaction and the general performance of the public services organization. The objective of the study was to assess such things as customer arrival and waiting time management system application as a factor for enhanced customer satisfaction. The methodologies used for data collection were site observation, in which structured observation check lists were used, a pre-tested/ adopted questionnaire and scheduled interview questions. For the site observation an entire customers randomly visiting the centers within the sampled time intervals have been accounted taking systematically every 3rd customer for data collection. A sample of 370 customers was taken for the data collection. The queue variables used under the study were perceived waiting time, actual service time, services quality, rate of customers' compliance and the queue discipline before and after the application of WLS. Scheduled Interview questions were presented to three branches managers of Addis Ababa Drivers and Vehicles Licensing and Control Authority to assess impact of the queue management system has had on to improve customers satisfaction reducing the actual situation of customer waiting lines at, the compliance rate of clients after and before the application of the system, and the planed actions. For the analysis of the data, observational interpretation data collected using various software's like SPSS. Single queue-multiple server model of queue analysis was used, while frequency tables, graphs and correlation analysis were used for analyzing the data collected through questionnaire. Imagining about the many times someone had to wait in line in the last month or year and the time and the frustration that was associated with those waits has become a central concern to this study in line with its impact on the customers satisfaction. The study stipulated that application of the Queue Management System is one of the remedial solutions to enhance the overall organizational performance and above all boost customers' satisfaction in public services organizations. To keep their organizational reputation, Public sectors as well as the Private business organizations have to increase their customers' satisfaction by delivering instant and timely services. In services, waiting has great impact on service level and customer satisfaction. Consequently, in time-based competition, one of the main objectives of service companies is to minimize customer waiting and thus the ultimate management objective should be the maximization of customer satisfaction implementing time efficient technologies such as Waiting Line Management systems. Therefore, the managers can use the results in process mapping and improvement areas to improve their customers' satisfaction by limiting waiting time, reducing customers' compliance and enhancing services quality. As service capacity increases, there is a reduction in the number of customers in the line and in their waiting times, which decreases queuing cost and compliance.

**Keywords: Addis Ababa Drivers and Vehicle Licensing and control Authority,
Waiting lines, Application, Queue, Customer Satisfaction**

CHAPTER ONE

INTRODUCTION

One of those governmental organizations, which incorporates a great number of customers is Addis Ababa Transport and Authority Bureau, which is a regulatory body for the drivers and vehicles licensing and control authority. The sector in fact holds a significant number of issues, despite all the most specific issue raised mostly is that, the very corrupted manner experienced in the area, resulting from the customers need to minimize the very hectic, Bored, and long waiting lines. In our day to day life, we surely came across boring and hectic waiting lines in most of our interactions like Transportation, Hospitals, Entertainment places, Banks, and the like. But most importantly when approaching governmental offices, It has become a known fact that, if we have some even minor case's in governmental offices, we must be accompanied by some "brokers" who are the ambassadors of the guys working in those service giving areas, or we are forced to spend our valuable time in no use waiting long for the service. What irritates most is that, without any proven evidence, most of the governmental offices are liable to the dissatisfaction of customers, usually arisen from, very hectic, Bored, and long waiting lines. Hence, this Master thesis will attempts to conduct a detail analysis and forward suggestion.

1.1 Background of the study

Palmer and Cole (1995: 34), state that “Service is the production of essentially intangible benefits which through some form of exchange satisfies an identified consumers’ need”. Consequently, there are service providers to satisfy customers ‘needs. In verified terms, standing in line can cause extreme boredom, annoyance and even rage to customers. Customers are often forced to wait in line whenever the service facility is busy (*Chamalwa 2014*). As most customers do not like to wait long time to receive service, it came to disclose the level of satisfaction of customers (*LEE 2000*).This show as that, customer satisfaction can be measured directly in line with the amount of time they spent, that is customer service measures the speed of the service in terms of how long the customer actually waits prior to being served (*M.Davis 1990*).

According to Kotler (1999), when customers wait in queues, there is the danger that waiting time will become excessive, leading to the loss of some customers to competitors. In Hillier (2000), findings show that the number of hours the citizens of USSR waste waiting in queues to purchase basic necessities and Americans waste in a year in a queue can amount to 20 million person-year of useful work. Queuing model has been seen as a veritable model to attack this notorious state. Mayhaw, Les, Smith, David (December 2006) see it as a mathematical study of waiting line which enables mathematical analysis of several related processes including: arrival at the back of the queue, waiting in the queue (essentially, a storage process) and being served by the server(s) at the front of the queue.

The theory permits the derivation and calculation of several performance measures, including: the average waiting time in the queue or the system, the expected number of waiting or receiving service and the probability of encountering the system in certain states such as empty, full or having to wait a certain time to be served (Tijmns, 2003).

We are a living witnesses that in most of places we visit a day, are basically time consuming. Especially the governmental bureaus are the most difficult centers to perform our tasks. The basic issue behind is that those difficulties, are performed in a shorter path, when dealing with brokers around. This all are created mainly because customers are not unable to wait beyond expected time of service. Hence, the greatest challenge for the managers in charge is that performing the expected service, and delivering, at the pre-estimated service delivery time. Which would result in eliminating the risk associated with underperformance, which in turn result in chained corruption.

As queues are formed when customers demanding service have to wait because their number exceeds the number of servers available; or the facility doesn't work efficiently or takes more than the time prescribed to service a customer. Some customers wait when the total number of customers requiring service exceeds the number of service facilities, some service facilities stand idle when the total number of service facilities exceeds the number of customers requiring service (Bakari, Chamalwa& Baba, 2014). When we see it in public service providers, the lack of proper waiting line management will result in Bad Governance.

In Ethiopia's Context application of waiting line system in managing service delivery with reference to customer satisfaction is in its infant stage. Thus, the application of waiting line system to manage service efficiency and customers' satisfaction is at almost not much practiced by most Ethiopian organizations that usually have long customers' queue. Few federal organizations like Federal Documents Authentication and Registration Agency and the banking service sectors like Commercial Bank of Ethiopia are recently practicing the Waiting lines system. As a result, almost all non-government organizations and many of other governmental organizations are lagging behind in using the Waiting line machine. Hence, different studies need to be conducted on the area and on the existing situation to come up with improvements in the service delivery system and the related customers' satisfaction, mainly by the service industries. Accordingly, this is the thematic area where this study aims to assess and contribute to the efforts of boosting customer's satisfaction in the services sectors in general and in Addis Ababa Vehicles and Drivers Document Authentication and Control Authority.

1.2 Background of the Organization

The Addis Ababa City Transport Authority was a branch office under the Federal Transport Authority until 2010 G.C. But after 2011, the bureau was organized by Addis Ababa City administration and started its operation and transport management activities under the organs of municipal services, accountable to the city mayor under the management of general manager. In 2014, The Addis Ababa City Transport Bureau (AACTB) has developed and implemented the development of traffic, transport and vehicle inspection management in autonomous bodies, particularly The Traffic Management Agency, Addis Ababa Transport Authority and Drivers & Vehicles Inspection & Control Authority which are accountable to it in proclamation no 43/2007.

The main Reason for the establishments of these bodies were said to be bringing better management and control because the administration realized the need for power decentralization. From this autonomous bodies The Addis Ababa City Administration Drivers and Vehicles Licensing and Control Authority main objective is to organize, follow-up and control drivers and vehicles related institutions in the city in order to enhance their performance, improve service provision, accessibility, efficiency and effectiveness to ensure licensing and capacity of drivers and vehicles.

The authorities Vision and Mission as published on the company's billboard and brochures are:

The vision of the organization is to realize service accessibility, Fast service delivery, and achieving excellence in making the authority a model Institution in 2020 E.C. The mission is serving the public with having organizing the Addis Ababa Administration Driver and vehicle Institutions; Following their Performance and improving them by conducting continuous researches; making them accessible and productive in the service delivery.

The outstanding Services that were provided to the customers by the organization include; Issuance of New Driving License, Issuance of Renewed Driving License, Authorization of Annual Vehicle Inspection, and Vehicle Ownership Transfer Services.

As to the issuance of New Driving License, anyone who wants to drive vehicle are required to get a driving license which attests the sufficient skill of driving of the possessor. The drivers training institutes present their request for the service of issuance of driving license for their students to the Addis Ababa City Administration Drivers and Vehicles Licensing and Control Authority. The authority keeps files of the students' list that the training institutes requested to train and admit them for driving skill test whenever sufficient theory and practice of training are delivered.

Issuance of Renewed Driving License is another important service of the Authority. Driving License must be renewed every two years. The Addis Ababa City Administration Drivers and Vehicles License and Control Authority provides the service of renewing driving license. Holders of driving license are required to submit their service request for renewal of driving license within two months before the expiry date of their driving license.

Authorization of Annual Vehicle Inspection is the service provided to the customers on the yearly bases where inspection of vehicles operational quality and hazardous effects controlling service is delivered. Vehicles are required to be inspected each year in order to operate.

After conducting annual vehicle inspection, the Addis Ababa City Administration Drivers and Vehicles Licensing and Control Authority provides authorization of annual vehicle inspection based on procedures of the service provision.

Vehicle Ownership Transfer Service is also a very important services component of the organization. Vehicles ownership can be transferred due to sales transaction conducted between buyer and seller of a vehicle. The Addis Ababa City Administration Drivers and Vehicles Licensing and Control Authority provide the service of Vehicles ownership transfer to the applicant. These are the most accessed services which are delivered through The Addis Ababa City Administration Drivers and Vehicles Licensing and Control Authority.

Accordingly, this Study was conducted in Three branches (Bole, Lideta and Kirkos sub city) of Addis Ababa City Administration Drivers and Vehicles Licensing and Control Authority which was selected carefully based on the number of customers the organization serve and the queue management system applied recently on the selected branches of the Authority to assess the impact of the Waiting line system on customers satisfaction. According to the study in 2020 result of Authority, the selected three branches customers' satisfaction level and performance of Services standard of the Authority is Bole, 50.44%and 45.87% ; Lideta, 63.48%and 68.4% ; and Kirkos, 43.07% and 41.74%.

1.3 Statement of the problem

It is a known fact that Queues affect customer satisfaction (*Onions, 2015*), from many of customer dissatisfaction sources, different researches proved that the mismanagement of waiting line leads to unwanted queue. Especially when the case is related to governmental organizations it tends to be more problematic, resulting in corruption and unnecessary wastage of multiple economic and social costs. This automatically force the customers to engage in illegal interaction or unacceptable way of seeking services through brokers or extra pays to services providing frontline employees. Like a soaring corruption, also the engagement of brokers almost in every line, the mistreatment of the officers, and the unnecessary wastage of time are the most monotonous problems that usually face the customers.

Customers identify waiting in line as frustrating, stressful and expensive. What determines customer behavior is the comparison between the expected benefit of getting the service and the expected cost of waiting (*Conte, Scarsini and Sürücü, 2016*). If customers/clients have the service time/ Perceived time, they can arrange their time according to that. And when receiving the service if the time consumed is greater than pre-assumed that will end up in dissatisfying the customer, that would yield to a long queue and mismanagement of the work order.

When we look to the case organization, it is common to witness the crowded halls of the Addis Ababa City Administration Drivers and Vehicles Licensing and Control Authority in every corner Branches within the working Hours. There are eleven Branches in each sub city of Addis Ababa, which base their structure in sub-city formation. And each of these branches is providing service for their respective sub-city service clients. Similarly you can notice the crowdedness and mismanagement of the waiting line. This observation of the scene and preview of the different literatures has motivated the researcher to conduct detailed research in the field of operational quality and customers' satisfaction.

The other factor which initiated the researcher to undertake this study was that no more is done in the field of customer satisfaction as a utility brought by using modern technologies like waiting lines queues as a solution for mitigation of customer compliance in services public organizations in Ethiopia.

The study done by Assefa Demilew, entitled, “**The Application of Waiting Lines System in Improving Customer Satisfaction: A Case Of Kifiya Financial Tech Plc –Lehulu**”, for instance, raised the Queue line system taking case of the private company that works on financial technology. My research differs from his that primarily it case takes the experience of services delivery and customer satisfaction conditions in the public organizations. In addition, he looked from the technology point of view where as my study more concerned with the customer side of the study dealing on the resulting impacts of the Waiting Line system on improving the general services, boosting customer’s satisfaction and reducing compliance cases before and after the application of this technology.

Furthermore, the research done by Mesfin Chernet entitled, “**Contribution of Queue Management System on customers satisfaction in the case of Commercial Bank of Ethiopia Branches in Addis Ababa**” is also a conducted on the financial services sector and only recommended that the Waiting Line improved the services provision by banks.

Hence, no in-depth studies were conducted in the public services sector, especially transportation services sector of the public organization in the City of Addis Ababa on assessing the impact the queue system brought on the customers’ satisfaction. Thus, this research is conducted to fill the identified research gaps in the areas of transportation services sector in the public organization.

Thus, the key objective this study is addressing by analyzing the existing trends related to waiting line management systems in public services sector, the impacts of applications of waiting line systems, and the changes it brought on customers’ satisfaction by reducing customer compliance. Cost of handling compliance problems in the organization in a more comprehensive and detailed manner is essential which enables the organization to generate residual revenues accrue more economies of scale. By doing so the researcher investigated the perceived time, and actual time on practical services delivery improvements since the beginning of the system implemented and tried to point out the major contributions of the queue brought about on the customers’ satisfaction in comparison to the services standard of the organization.

1.4 Research Questions

- ❖ How parallel is the pre-estimated and actual service time in line with customer's expectation before and after the WLS application?
- ❖ How do customers put their level of satisfaction towards the services quality of DVLCA?
- ❖ Why the waiting line system applications reduce compliance/boost customers' satisfaction?
- ❖ How do customers rate state of queue discipline of the organization?

1.5 Research Objective

1.5.1 General Objective

The main objective the study is to assess the changes brought by application of Queue Management System on boosting of customer satisfaction in case of Addis Ababa Driver and Vehicle Licensing and Control Authority.

1.5.2 Specific Objective

The specific objectives of the study are:

- ✓ Explain the customers' expectations while waiting on time and about service time during the Queue practices
- ✓ Examine the extent of customers' satisfaction towards the quality of service given before and after Queue Management System.
- ✓ Explain the Waiting Line System played in reducing rate of customers' compliance
- ✓ Describe the state of queue discipline accounting on the work overload of managers/staffs before and after the application of the system

1.6 Significance of the Study

The researcher believes that this research contributes to Addis Ababa City Administration Drivers and Vehicles Licensing and Control Authority be able to enhance services quality, stepping to a more quality level shall reduce the rate of customer compliance. As a service provider the organization should have to carefully view the interest of his customers primarily, and how to provide a reliable, and fast delivery of service.

For improving these situations and related issues, the research is valuable as a tool for the quality management and general organizational services improvement as a result of the research that indicated the benchmark of the level of customer satisfaction. Most importantly the customers will benefit of the research, because ultimately it attempted to suggest solutions that can reduce problems related to long queuing. In addition, this study is essential for it will help scholars and researchers who conduct further study in the field of queue and customer satisfaction taken as an input and resource material for scientific discourses.

1.7 Scope of the Study

Addis Ababa City Administration Drivers and Vehicles Licensing and Control Authority has eleven branches in each corner of the city, Due to the greater amount of customer they serve in a day it is difficult to conduct the research in all branches. Therefore the research was conducted only in three branches. The major reason for limiting the study in only the three branches was because of the time and financial constraints the researcher had to be able cover more branches. In fact, the researcher is confident to 95% confidence level as there are only 11 branches in the whole city so that the 3 braches adequately represent the total population of the study. Thus, the research was exclusively conducted in the office compounds of the AA-DVLCA and did not include those customers who did not visit during the study period to the quest of services. The study covered through March to May for three months in the city of Addis Ababa.

1.8 Limitation of the Study

One of the Delimitation of the study will be that, the institution encompass other problems like a system problems, poor file management and the like, which are considered to be reason for grievance; resulting still in dissatisfying the customers. However the research e focused only in the problem related to waiting line system application impacts on the customers' satisfaction. The other limitation could be not incorporating all branches, as it would be very difficult to engage all branches because of time and financial constraints.

1.9 Operational Definitions

Queue: customers waiting to be served form a waiting line (Brahma, 2013)

Queue Discipline: is the rule for determining the formation of the line or queue and the order in which jobs are processed (Brahma, 2013).

Servers: the facility that processes the customers in the queue (Nosek, et al. 2001)

Arrival rate (λ): is the way in which a patient arrives and enters the system for service (Brahma, 2013).

Calling population: the source of customers to a waiting line (Nosek, et al. 2001)

Service time (μ): is the time required to serve a customer (Brahma, 2013).

1.4. Organization of the Research

The research has contained a total of 5 chapters. The first chapter is Introduction Part, In which Background of the study, Statement of the problem, Research Questions/Objectives, Significance of the study, Scope of the study, Delimitation of the study were addressed. The second chapter deals on the literature reviews. The third chapter is Research Design and Methodology part. And the fourth part deals about the Findings, Interpretation and analysis part. The last chapter presents the conclusion Implications and Recommendation of the study.

CHAPTER TWO

LITERATURE REVIEW

This chapter presents the literature review part which covers different sources, such as from articles for definitions of the key concepts. The literatures are organized and categorized under theoretical review, empirical review, & conceptual frame work presented in detail.

2.1 Definition of key concepts

Definition of Queue (Waiting Line)

Queue is a common word that means a waiting line or the act of joining a line. It is formed when the number of customers arriving is greater than the number of customers being served during a period of time (Ishan, Sakhare, Shelke, Sawaitul, 2015). This can happen in a routine activities of our lives, starting from the queue in bakery shops, bus/taxi stations, gas stations, and etc., to non-routine ones like the queue's we pass in different governmental offices, Kebeles, Hospitals, pharmacies, banks, and etc. (Bakari, Chamalwa& Baba,2014) Defines Queue as it is a general phenomenon in everyday life. In general, a queue is formed at a queuing system when either customers (human beings or physical entities) requiring service wait due to number of customers exceeds the number of service facilities, or service facilities do not work efficiently and take more time than prescribed to serve a customer (Ishan, Sakhare, Shelke, Sawaitul, 2015).

The Meaning of Customer's Satisfaction and it's relation to waiting time?

Customer satisfaction/dissatisfaction has become an important issue for management practitioners (Palawatta, 2015). Customer satisfaction has been considered an issue that affects different organizations in need of providing the fast analysis of the customers' demands (Alghwery, et al. 2014). Further explaining that customer is an individual who uses the service or product that is offered by an organization, be it a public service or private, being served is directly related to becoming a customer. Customer will be dissatisfied when their expectation is not the one that is provided in the treatment of their expectations, so to meet the satisfaction of the customer, it should be near to the expectations.

Kotler (1999: 55) define quality as “The totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied need”. According to Johnson and Clark (2005), service quality can be understood as the same thing with satisfaction, i.e. perceived service quality, as well as a match between a customer’s expectation of a service and perception of its delivery. Service quality is more appropriately termed perceived service.

Shortly, Customer satisfaction is a result from comparing a product or service perceived performance in relation to his or her expectations (Lahap, et al., 2018). With all the necessity to help provide a better service to the customer, the basic element still holds on the average customer waiting time, as it gets longer than expected, the level of customer satisfaction is found to be declined (Lahap, et al., 2018).

2.2 Theoretical Framework

Businesses of all types, industries, schools, hospitals, cafeterias, book stores, libraries, banks, post offices, petrol pumps, theatres – all have queuing problems (Shanmugas undaram and Banumathi, 2016) and so everyone experienced the inconvenience of waiting in line when approaching these businesses to get the respective services. Because time is a valuable resource, the reduction of waiting time is an important topic of analysis (Taylor, 2013).

Waiting in lines or queues seems to be a general phenomenon in our day to day life (Yusuf, et al., 2015). However, the known fact is that standing in line can cause extreme boredom, annoyance and even rage to customers. Ensuing customers to be often forced to wait in line whenever the service facility is busy (Bakari, Chamalwa& Baba, 2014). Any system in which arrivals place demands upon a finite-capacity resource may be termed a **queuing system**. In particular, if the arrival times of these demands are unpredictable, or if the size of these demands is unpredictable, then conflicts for the use of the resource will arise and queues or waiting customers will form (Leonard Kleinrock, 1975). According to Yusuf, Blessing &Kazeem (2015) queuing has become a symbol of inefficiency of publicly funded bank in the world. For customers, having to wait for service can range from being acceptable (usually short waits), to being annoying (longer waits), to being a matter of life and death (e.g., in emergencies). Certainly, when the average rate exceeds the capacity, then the system breaks down and unbounded queues will begin to form; it is the effect of this average overload which then dominates the growth of queues (Leonard Kleinrock, 1975).

2.3 Queuing Theory

Queuing Theory is mainly seen as a branch of applied probability theory. Its applications are in different fields, e.g., communication networks, computer systems, machine plants and so forth. Queuing Theory tries to answer questions like, e.g., the mean waiting time in the queue, the mean system response time (waiting time in the queue plus service times), mean utilization of the service facility, distribution of the number of customers in the queue, distribution of the number of customers in the system and so forth (Ishan P Lade, Chowriwar, Sawaitul 2013). Queuing system can be characterized by four components or four main elements. These are: The arrival, the queue discipline, the service mechanism and the Cost structure. On the other hand stated that queuing systems are characterized by five components:

The arrival pattern of customers; the service pattern, the number of servers, the capacity of the facility to hold customers, and the order in which the customers are served (Bakari, Chamalwa& Baba, 2014). Mathematical analytical method of analyzing the relationship between congestion and delay caused by it can be modeled using Queuing analysis. Queuing theory provides tools needed for analysis of systems of congestion. Mathematically, systems of congestion appear in many diverse and complicated ways and can vary in extent and complexity (Sundarapandian, V. 2009) When a consumer/customer is contented with either the product or services it is termed satisfaction. According to Kotler and Keller (2009), satisfaction can also be a person's feeling of pleasure or disappointment that results from comparing a product's perceived performance or outcome with their expectations. As a matter of fact, satisfaction could be the pleasure derived by someone from the consumption of goods or services offered by another person or group of people; or it can be the state of being happy with a situation.

2.4 Queue and Terminologies

2.4.1 Waiting Psychology

In his article stated that basic principles for waiting lines as: Emotions Dominate, Eliminate Confusion: Provide a Conceptual Model, Feedback and Explanation, The Wait Must Be Appropriate, Set Expectations, Then Meet or Exceed Them, Keep People Occupied: Filled Time Passes More Quickly Than Unfilled Time, Be Fair, End Strong, Start Strong, and Memory of an Event Is More Important than the Experience further explaining each in a detailed manner Donald A. Norman, 2008.

Russle & Taylor mentioned that some techniques used by different companies to make waiting more pleasant, like use of costumed characters to entertain customers waiting in line and distract them from the long waits, selling food, drinks, and souvenirs to people in line, providing accurate wait times, which are more tolerable than vague ones, and providing frequent updates, for customers who are particularly annoyed by long waits, selling special passes for a fee that allows customers to go to the front of the line, providing magazines and newspapers for customers in waiting rooms to read while waiting, and also availing televisions occasionally in waiting areas Russle& Taylor, 2011.

2.4.2 Expected waiting time

According to (Spreng et al., 1996) expectations are beliefs about the likelihood that a product is associated with certain attributes, benefits, or outcomes, whereas desires are evaluations of the extent to which those attributes, benefits, or outcomes lead to the attainment of a person's values. Expectations are future oriented and relatively flexible, whereas desires are present oriented and relatively stable (Palawatta, 2015). Expectation has two levels, the upper level being the desired level and the lower level being the adequate level and in between the zone of tolerance. Expectation in the case of waiting time is expected waiting, whereas adequate level in the case of waiting time is the acceptable waiting time (Lahap, et al., 2018).

2.4.3 Arrival Time (λ)

The arrival is the way in which a customer arrives and enters the system for service (Yusuf, 2015), and it is a process in which customers joining the waiting lines System (Shastrakar, 2016). There are different classifications of arrival of customers which include: Single line or multiple lines, Finite or infinite, Single customer or customers comes in bulk, Arriving customers are totally under control or partially or no control, Deterministic or Probabilistic process, Empirical or a Theoretical Probability Distribution, Independent or conditionally dependent variables, and Sometimes arrivals of customers is stationary.

2.4.4 Service Time

The service mechanism describes how the customer is served (Yusuf, 2015). It includes the number of servers and the duration of the service time-both of which may vary greatly and in a random fashion. The number of lines and servers determines the choice of service facility structures. The common service facility structures are: single-channel, single – phase; single-channel, multiphase; multi-channel, single phase and multichannel, multiphase. Chambers and Johnston stated that if the ‘customers’ waiting in a queue are real human customers; an important aspect of how they judge the service they receive from a queuing system is how they perceive the time spent queuing Slack, Chambers and Johnston, 2010.

2.4.5 Number of Servers

A server is one who provides the arriving customer the necessary service. It may be persons in the counter or machines, etc (Yusuf, 2015). The basic processes being held through that, is to hold the arriving customer, providing the requested service The queuing system consists primarily of the waiting line(s) and the available number of servers. Here we discuss issues pertaining to waiting line characteristics and management, line structure, and service rate. In a practical sense, an infinite line is simply one that is very long in terms of the capacity of the service system. Examples of *infinite potential length* are a line of vehicles backed up for miles at a bridge crossing and customers who must form a line around the block as they wait to purchase tickets at a theater. Gas stations, loading docks, and parking lots have *limited line capacity* caused by legal restrictions or physical space characteristics. This complicates the waiting line problem not only in service system utilization and waiting line computations but also in the shape of the actual arrival distribution.

The arrival denied entry into the line because of lack of space may rejoin the population for a later try or may seek service elsewhere. Either action makes an obvious difference in the finite population case. Number of lines, single line or single file is, of course, one line only. The term multiple lines refer to the single line that form in front of two or more servers, or to single lines that cover at some central redistribution point. The disadvantage of multiple lines in a busy facility is that arrivals often shift lines if several previous services have been of short duration or if those customers currently in other lines appear to require a short service time.

2.4.6 Nature of Customer

As usual it is depending on the nature of arriving customers whether he is willingly accepted a waiting line or refuses it. If the system is filled up to its capacity, then the arriving customer is naturally rejected. In some other cases if there is a rejection of the primary system, the customer accepted secondary system and 'queue up' in an informal waiting line to enter in to the system. We note that there are mainly four items which must be specified for any given Queuing System i.e. Balking, Reneging, Collusion and Jockeying (Yusuf, 2015).

Balking is if the customer experiences that waiting time are very large as the queue is moving very slowly, the customers might balk and refuse to join the queue. Reneging occurs after joining the queue customer experience that it will take too much time to enter the system which is worthless then he customer reneges i.e. leaves the queue. Collusion is a condition when several customers may cooperate and only one of them may stand in the queue to reduce the waiting time and buy the required service. Jockeying is if there are more number of queues, there is a way for customers to change the queue which gives fast service than the other. In this process the customer scans the lines for the purpose of changing it (Yusuf, 2015).

According to Jonson and Clark (2005: 134), "Customer satisfaction is the result of a customer's assessment of a service, based on a comparison of their perceptions of service delivery with their prior expectations". The level of satisfaction of customers depends on their perceptions and expectations of the service. Customer's satisfaction occurred when the requirements of customers are exactly fulfilled by the service; i.e. to satisfy customers, service providers are required to deliver a service that can at least meet or exceed their expectations. If customers perception of the actual service is below their expectation, service gap is said happened and their satisfaction level is rated as poor (Baron and Harris, 2003).

2.4.7 Queue Discipline

The **queue discipline** is the order in which waiting customers are served. The queue discipline is the sequence in which customers or customers are processed or served (Yusuf, 2015). It works on the rule by which customers are selected from the queue for service. These rules are classified as: First-In First-Out (FIFO), Last-In First Out (LIFO) Service For Random Order (SRO) and Priority Service. (PS).The most common type of queue discipline is **first come, first served**-the first person or item waiting in line is served first (Krajewski, Ritzman and Malhotra, 2010).

2.5 Empirical Review

Waiting to be served or waiting for numbers to be called in private or public counter service is part of everyday routine and it can be distressing (Lahap, 2018). This experience occurs in every corner of the world, also here in our country we face similar issues in every days of our lives. Queuing theory is the formal study of waiting in line and is an entire discipline in operations management. Having a long exposures, queuing theory has been used in the past to assess such things as staff schedules, working environment, productivity, customer waiting time, and customer waiting environment (Yusuf, 2015).

A study conducted by Munirat Olafemi Yusuf, Nwaiwu Blessing, Aina Olalekan Kazeem (2015), on Queuing Theory and Customer Satisfaction: States that most customers in banks are not satisfied based on the queue they experience before been attended. The study has demonstrated that, majority of the customers (bank customers) were dissatisfied with the services offered and the major cause of dissatisfaction was the long waiting time. The study concludes, recommending for additional banking facilities and bank administrators to address gaps in human resources, logistics and other internal procedures aimed at reducing waiting times and thus ensuring an effective banking delivery system.

In a study conducted by, Johanudin Lahap, Rabiatal Iylia Azlan, Khairil Anuar Bahri, Noraslinda Mohd Said, Dahlan Abdullah& Razlan AdliZain (2018), on The Effect of Perceived Waiting Time on customer satisfaction: which was based in a restaurant aiming to examine the effect of perceived waiting time on customer satisfaction in the context of fast food restaurant in Malaysia.

The study theoretically, confirmed the effects of perceived waiting time on customer satisfaction. As the better service quality includes achieving to the perceived waiting time of the customer.

The other study conducted by; Palawatta (2015) on Waiting Times and Defining Customer Satisfaction; In this study, the definition of satisfaction/dissatisfaction was tested using continuous variables expected waiting time, perceived waiting time, prior predicted waiting time, posterior predicted waiting time and the acceptable waiting time.

And the study found that, disconfirmation between expected waiting time and the perceived waiting time is the best definition for satisfaction/dissatisfaction followed by expected waiting time and perceived waiting time.

Asefa Demelie (2017) in his study on application of waiting line system on improving customer satisfaction, assessed Kifiya Financial Tech Plc, DVLCA centers. Talking four samples the study evaluate the improvement on the applications of waiting line. The study recommend the improvement of the waiting lines.

2.6 Conceptual Framework

2.6.1 Queuing Theory and Customer Satisfaction

According to the study by (Nosek and Wilson, 2001) on queuing theory and customer satisfaction, the primary issue in queuing management and customer satisfaction is not the actual amount of time a customer waits for service, but the customer's perception or expectations about that wait and the associated level of satisfaction. As to that, we can consider the **perceived waiting** time as a determinant factor in customer satisfaction. The Other variables that determine customer satisfaction with waiting line management can be the **information provided** in case of delay (Hui and Tse, 1996). The other variable is also the attractiveness of the **waiting environment** related to its physical design in terms of comfort, space and decor. Furthermore, the queue discipline is another variable for waiting lines management that influences customer satisfaction.

In the past, the process of long- term relationship building has occurred primarily through face -to - face contact with staff during delivering the services. Zineldin (2000) further argued that while the need for relationship development is important, it is not complete without the use of technology. Kapoulas et al. (2002) refer to this phenomenon as "technological ship" marketing, which they regard as a symbiosis of technology and marketing which tends to enhance the relationship - building process.

The technology interface service quality (TISQ) model proposed in this paper encompasses the **Queue Systems or “Q-matic systems”** technological interface that might have shaped customer perceptions of service quality.

Queue systems or “Q-matic systems” have been very helpful in bringing order to otherwise chaotic queues in the branches (Yavas et al., 1997). The banks try to explore the advanced versions of Q - matic systems to market their services where customers look at TV screens to keep track of their number in the queue while still getting information about services. In the banking sector, customers tend to use the different service delivery channels in a complementary way. Hence service satisfaction will not merely be based on isolated service encounters and experiences but rather on the overall feelings of satisfaction.

In today's fast moving life time has become more precious and valuable commodity especially in developed countries where the standards of living are very high. So as a result people are less willing to wait for services. This condition brought a growing realization by organizations to make their customer satisfied and also to retain them to get business in today's competitive environment. Finally, advances in technology such as computers, internet etc., have provided firms with the ability to provide faster services. Addressing the problems of queuing involves a trade-off between the costs of customers waiting time and the cost of providing faster service. Katz et al. (1991) argued that we can control service waits by two techniques: the first one is operations management and second one is perceptions management. The operation management deals with the management of how customers (students), queues and servers can be coordinated and cooperative towards the goal of providing effective service at the lowest possible cost.

Therefore, Conceptual framework is formulated as taking The perceived waiting time, Services quality, Customer Compliance and State of Queue Discipline as Independent variable influencing the dependent variable that is Customer satisfaction.

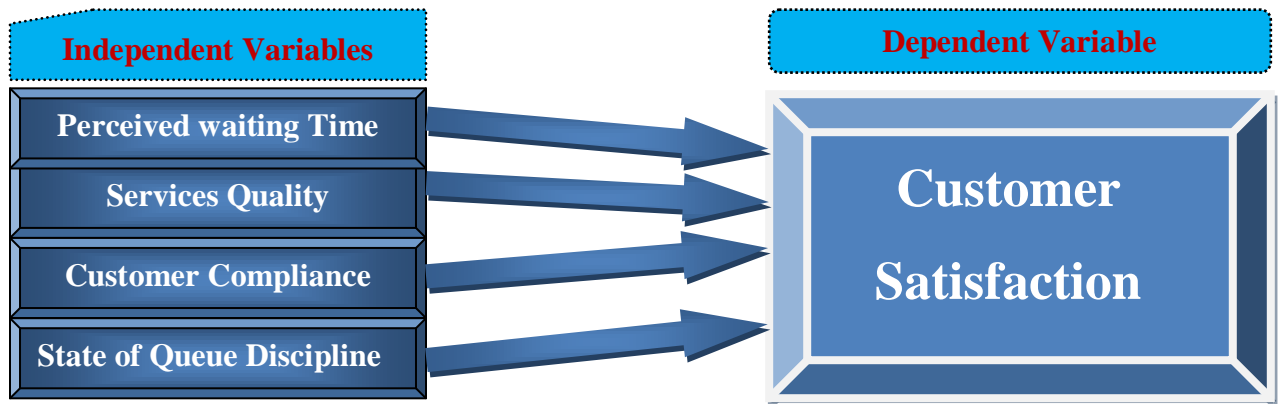


Fig. 1 Conceptual Framework perceived waiting time, Services quality, Customer Compliance and State of Queue Discipline

(Adopted, from Kamau, G. (2012), used in a study on ‘Waiting Lines Management and Customer Satisfaction in Commercial Banks in Kenya, "Asefa, 2017"')

2.6.2 The Concept of Services Standard and Customers Satisfaction

Czepiel et al (1974) maintain the validity of two factor theory in relation to analyzing customer satisfaction. Two factor theory states that customers can be satisfied and dissatisfied with a product or a service at the same time, because satisfaction and dissatisfaction will be about different aspects of the product or service, thus, they will be unrelated.

The dual factor theory was further developed by Swan and Combs (1976) to change the names of the factors to instrumental performance and expressive performance. According to this theory instrumental performance relates to physical aspects of the product or service, whereas expressive performance refers to psychological aspects. The theory specifies expressive performance as a necessary component of customer satisfaction. Customers will be left unsatisfied if they are not satisfied with expressive performance of products and services, regardless of the fact that their instrumental performance have been satisfactory or not.

Concerning the services standard, as noted on the Citizen’s charter of the Authority, the services time for punishment fee of those violated the rule is 20 minutes; to change the service lines 30 minutes, Transfer of ownership minutes 50 minutes; New license 2 day; Renewal of licenses 3 hours and change of plate number 3 days of regions to Addis Ababa or vice versa.

According to the Customer satisfaction study by the Drivers and Vehicles Licensing and Control Authority (2019) the level of Customers satisfaction of the Authority is only 40.9% as per the study conducted by the Bureau in 2018 at the city's general services level of the Authority before application of the Waiting line Management. Regarding meeting the services standard, it is at 44.2% as per same study. According to the study in 2019 result of Authority, the Authority's general customers' satisfaction level and Services standard of the Authority, it is 54.87% and 41.6 on average respectively. According to the study in 2019 result of Authority, the selected three branches customers' satisfaction level and performance of Services standard of the Authority is Bole, 50.44%and 45.87% ; Lideta, 63.48%and 68.4% ; and Kirkos, 43.07%and 41.74%(DVLCA, 2019)

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

The main purpose of this chapter is to present the underlying principle of research design and methodology, research paradigm, approach, sampling design, the selection of appropriate research data collection techniques and method of data analysis in line with research questions proposed before the study.

3.1 Research Design

This study used was both explanatory and descriptive study design. In order to do the research, both qualitative as well as quantitative type of data were collected, analyzed and used in order to get full information. The data were collected through questionnaire from different customers who visited the organization in the study duration. Thus, descriptive and explanatory research designs were employed to conduct the study. In this regard the qualitative data collected through interviews and group discussions were presented using explanatory methods.

The size of customers served per branches was also taken into account in the research design process of the study. The study used quantitative research approach to quantify the variables by way of generating numerical data or data that can be transformed into usable statistics relying on responses to pre-formulated questions using graphs, tables and percentages as a design presentation tools.

3.2 Sample Size

The population is all customers who visit the Addis Ababa City Administration Drivers and Vehicles Licensing and Control Authority seeking services. From the total of 11 Branches, the study selected a sample of 3 Branches based on the specific criteria of research design and sampling techniques were applied.

According to the pre-survey data collected from the three branches of the Authority, the total number of customers of these branches are about 253,478 clients where, 44,078 are from Lideta sub city, 74,400 from Kirkos and 135,000 from Bole sub city. And observational interpretation of all customers who arrive during the observation period was carefully conducted. The 3 samples branches were selected for the study based on the criteria of representativeness of sample selection. The criteria used was the number of customers visiting the organization, and the application of the waiting line systems are the main ones. Since the number of customers who arrive at a given point of time and dates cannot be known the researcher systematically selected and observed randomly arriving customers.

The sample size was calculated using a formula called Slovin's formula and thus the sample size account of the Authority's employees from three branches of the city.

Sample size determination formula thus used:

$$n = \frac{N}{1 + N(e)^2}$$

Where n is number of respondents

N stands for total population

e stands for error term of 5%

e = Error tolerance - at desired level of confidence, take 0.05 at 95% confidence level

Where n = number of samples

$$n = \frac{N}{1 + (N * e^2)}$$

$$n = \frac{253,478}{1 + (253,478 * 0.05^2)} = 370$$

To determine sample size representation the criteria of representation from highly customer congested, medium customer congestion to low customer congestion services branches in line with geographic locations to hot spot services areas was applied. Finally, to determine the each branch sample size, proportionate sample method used. Consequently, from total of sample population of 370; the sample size of Lideta was 65 from low customer area , the sample from Kirkos is 109 from medium and from Bole Sub city is 196 which is the high customer congestion are in Addis Ababa Drivers and Vehicles Licensing and Control Authority.

3.3 Sampling Techniques

The sampling technique that was used in this study is probability sampling (simple random sampling) on the customers visiting the Addis Ababa City Administration Drivers and Vehicles Licensing and Control Authority. Simple sampling method used because of the uniformity of services and there is more similarities among the customers for almost all the customers come to get services related to vehicles and licensing. Thus, simple probability sampling techniques considering case of every 3rd client conducted. The computation was as there are about 6-7 key services categories the DVLCA provides, for instance for Issuance of New Driving License, Issuance of Renewed Driving License, Authorization of Annual Vehicle Inspection, Vehicle Ownership Transfer Service, Other service related to Vehicle Management, Service related to Driving license, fee payments to roads services charge and exchange of the plate number of their vehicles to and from regions to Addis Ababa.

Therefore, the sampling techniques used were simple and was conducted in such a way to include all types of customers who came for different services. This is made to ensure the representation of all customers from different services. Accordingly, as the system applied since two years now, the sampling technique attempted to encompass all clients who were customers before the application of the system as well as those customers who visited after its application, even though the aim of this study is not more concerned with the study of length of years of customers.

3.4. Data Sources

The Researcher used both primary and secondary data from multiple sources in order to get different outlooks and facts on waiting lines and customer satisfaction. The data was collected from primary and secondary sources using self-administered questioners, interviews, observations and analysis of earlier documents of the Drivers and Vehicles Licensing and Control Authority, Internet, and published journals.

3.4.1. Primary Data

The researcher will use both interview and questionnaires. An in-depth interview was conducted on the Branch Managers of the Addis Ababa City Administration Drivers and Vehicles Licensing and Control Authority and In addition to this data was collected by distributing structured questionnaires i.e. open-ended and closed-ended questionnaires to the customers of the bureau.

3.4.2. Secondary Data

Secondary data was collected from Organizations Broachers, newspapers, and published journals in the study theme when necessary; materials were downloading from most referred web sites.

3.5 Data Collection

The data were collected through observation of the customer's arrival time and service time, and departure time using questionnaires, key informant interviews, Observational Interpretation and Focus Group Discussion methods. The Data were collected through detail observational interpretation of waiting time & service time at the centers, an in-depth key informant interviews with 5 senior officials of the Authority. The semi-structured questionnaires designed and distributed to the customers who were visiting the organization in search of the respective services.. Data collection was done during both peak & normal days and hours to represent the real scenario of the problems related to customer satisfaction management by the organization.

For administering the questionnaire, 10 data collectors were deployed at the centers providing a number customers sequential numbers with respect to their arrival, and at the counters who collected the sequential order of numbers from the customers on their arrival at the counter and recorded the start of the service time and then observed and recorded the end of the service time, and finally recollected the filled questionnaires from the customers.

Questionnaires were distributed to customers on simple random bases taking every 3rd visiting customer from those who arrived at the centers during the time allocated for data collection from the centers and it was done side by side with the detail observations & recording of arrival times, queue time & service time. This sampling technique for selection of respondents for the data collection intended to encompass the multiple customers' services in the study. The researcher engaged in the data collection as a supervisor and worked on the key-informants interviews and the leading the focus group discussion sessions.

3.6 Methods of Data Analysis

The analysis of the data deploys explanatory and quantitative methods and the use of descriptive statistics method is more preferred for analysis of data from questionnaire. This is because it helps to harness rich data during carrying out data collection from the selected samples allowing a thorough and easy analysis of the respondents' opinion. Moreover, co-relational research design will use in this study in order to examine the relationship between waiting lines and customer Satisfaction. These three branches selected on the basis of their level of performance in services standard and level of satisfaction compared to the other 11 sub-branches of the Authority, where Lideta is best performing, Bole is moderate and Kirkos is among low performing branches in the application of Waiting lines system and customer satisfaction standards.

As time can be considered as a resource and it can be spent waiting, some (negative) utility can be assigned to waits. This decrease of utility caused by waiting corresponds to the effect of waits on satisfaction. Using the two-moment decision model, to approximate customer dissatisfaction caused by waiting, only the means and variances of waiting times are needed. Therefore, rapid modeling based on the formulae of queuing theory used for data analysis to find sufficient information to approximate customer satisfaction in different queuing systems.

The information gathered were edited to eliminate the errors, and the data were then coded and grouped according to the study which ensured ease of analysis. Statistical techniques such as frequency distribution tables, percentages & graphs were used to analyze the data. The analysis involved the use of average figures from the collected data through questionnaire & detail observation. Structured questionnaire parameters to measure customers' perception level on the perceived waiting time, waiting environment & satisfaction level were used, and also interview parameters to get information from the Head managers & branch managers of the Authority on the queuing management system, average waiting time in queue, their knowledge on arrival rates, etc. were used. These were analyzed qualitatively.

Accordingly, the data from the detail observation, like number of arrivals, arrival rates, average service time, and the like were calculated quantitatively and the description of data from key informants and focus group discussions was made qualitatively. Queuing theory model (**M/M/C** model assumptions & formula) was used to calculate arrival rates & service rates. The interpretations of the results were analyzed against the research questions indicated.

Likert Scale of continuum of 5 with the following assigned value was used to quantify the extent of customers' satisfaction level [(1) Very dissatisfied (2) Dissatisfied (3) Neutral (4) Satisfied (5) very satisfied]. Completed data was recorded and processed using the software, Statistical Package for the Social Sciences (SPSS) v23. To test if there is a linear relationship between the independent variables & the dependent variable, Correlation analysis using Pearson correlation coefficient was used. Validity and reliability tests were also conducted to elucidate the quality of the data and reduce the probability of error at 95% confidence level.

Multiple-Channel Queuing Model is used for analysis of the data as the organization uses one Queue and two or more servers or channels are available to handle arriving customers. As observed in most Branches of the organization, the current practice is using single-queue, multiple servers and hence, the project assumptions were from this model perspective. The formulas for determining the operating characteristics for the multiple-server model were based on the same assumptions as the single-server model—Poisson arrival rate, exponential service times, infinite calling population and queue length, and FIFO queue discipline.

Also, recall that in the single-server model, $\mu > \lambda$; however, in the multiple-server model, $s\mu > \lambda$, where s is the number of servers.

Finally, all the encoded data on queuing and customer satisfaction was then analyzed using SPSS software application. The findings were interpreted in light of the research objective and reviewed in order to attach meaning to the Data collected conducting careful and through analysis.

3.7 Ethical Consideration

Whenever the researcher conducts on with people, the well-being of research participants must be given top priority. The interview was conducted and questionnaires were distributed with full knowledge of the management. Ethical issues in this research concerned with maintaining confidentiality about the information that the researcher gathered from respondents, using secured data for academic purpose only and ensuring that the respondents personality were not discriminated and exploited in any conditions on the basis of sex, race color or religion. Thus, fair representation and involvement all respondents with equal treatment has been done during the field data collection process.

3.8 Validity and Reliability

3.8.1. Validity

Validity is the extent to which a test measures what it claims to measure (Lakshmi and Mohideen, 2013). A measure is valid if it measures what it is supposed to measure. According to Kindy et al. (2016), content validity is the extent to which the items in an instrument covers the entire range of the significant aspects of the area being investigated.

It is the degree to which the measurement device, in this case, the measuring questions in the questionnaire, provides sufficient coverage of the research investigative questions. To maintain the validity of the instruments, most of the questionnaires were adopted from previous researches. Some of the questionnaires were developed based on careful review of literatures. In addition, pilot testing of questionnaires was conducted to obtain a feedback from the respondents on the validity and responses were collected and questionnaire was adjusted subsequently.

The questionnaire and key informant interview checklists were developed with due care containing multiple questions, and discussion facilitation questions. The data collected through questionnaire were supported by the triangulation of different data collected through focus group discussions and key informant interviews. Maximum effort was applied to create logical link between the items in the questionnaire and the research questions as well as the objectives of the study. Therefore, in order to ensure validity of the items incorporated in the instrument lecturers, and other professionals who have concise knowledge in the area of descriptive statistics participated to devise the questionnaires, and other research tools. For the purpose of reliability all the data collectors were first Degree graduates who distributed it to the sample population and carefully recollected it from the respondents in all professional stance.

3.8.2. Reliability

Reliability is the extent to which measurements are repeatable when different persons perform the measurements on different occasions under different conditions with supposedly alternative instruments which measure the same thing (Drost, 2011). Reliability is consistency of measurement or stability of measurement over a variety of conditions in which basically the same results should be obtained.

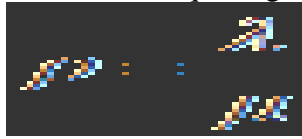
Mean of each variable was carefully computed and then the reliability check was made based on the Means. Internal consistency of items incorporated in the instrument were checked by using Cronbach Alpha.

Cronbach's coefficient alpha, is the most popular method of testing for internal consistency in the behavioral sciences.

Cronbach's alpha reliability coefficient normally ranges between 0 and 1. Gliem and Gliem (2003), provide the following rules of thumb: if " $\alpha > 0.9$ – Excellent, $\alpha > 0.8$ – Good, $\alpha > 0.7$ – Acceptable, $\alpha > 0.6$ – Questionable, $\alpha > 0.5$ – Poor, and $\alpha < 0.5$ – Unacceptable".

Cronbach alpha was computed and compared with the threshold value of 0.7. An overall value of 0.955 was obtained which implied that high level of internal consistency of research instruments used to undertake this study.

To compute the measurement of effectiveness of the queuing system, first we need to compute the



ratio traffic intensity and the probability that the system is idle P_0 .

Input:

- Arrival rate (number of customers/unit time) = (λ)
- Service rate (number of customers/unit time) = ψ
- Number of servers = s

Output:

oU= Utilization factor = percentage of the time that all servers are busy,

$$P_0 = \left(\sum_{j=0}^{s-1} \frac{\rho^j}{j!} + \frac{\rho^s}{s!} \left(\frac{s\rho}{s\rho - \lambda} \right) \right)^{-1}$$

o P_0 = probability that there are no customers in the system,

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSION OF FINDINGS

This chapter includes the general description of data gathered from customers of Addis Ababa DVLCA of Ethiopia, which includes general description of respondents and descriptive statistics of research variables. Data was mainly collected from Three (3) branches of Addis Ababa Vehicles and Drivers Licensing and Control Authority (Bole, Kirkos and Lideta), out of eleven (11) branches. This study was undertaken in public services organization of Addis Ababa city in which has one waiting line in a form of calling to the free server. Customers are served on a first-come, first-served as a teller called them when they become at screen display queue management system. The questionnaire is used to gather firsthand information from customers on simple random sampling method.

A total of – respondents were 370 which were selected from each branch by criteria of representation of customers total population size and services hotspot location. The data has also been collected from each servers report for five randomly selected days on the month of February and observational interpretation was also used. The data were collected from customers and interviews were conducted with Customers Compliance Handling and Services Quality Audit Managers using key interviews and Observation was used for Servers and client front line services lines.

4.1 General Information about Respondents

Table 4.1: *Sex, Age, Educational Background and Duration of Customer ship*

Item	Frequency	Percentage
Sex		
Male	238	64
Female	132	36
Total	370	100
Educational Status		
Certificate or Less	67	18.1
Diploma	225	60.8
Degree	43	11.6
Masters and Above	35	9.5
Total	370	100

Age Category		
18-25 and	99	26.8
26-35	135	36.5
36-45	67	18.1
46 and above	69	18.6
Total	370	100
Duration of Customer's relationship with Authority		
Less 2 years	97	26.2
2-5 years	165	44.6
5 years and above	108	29.2
Total	370	100

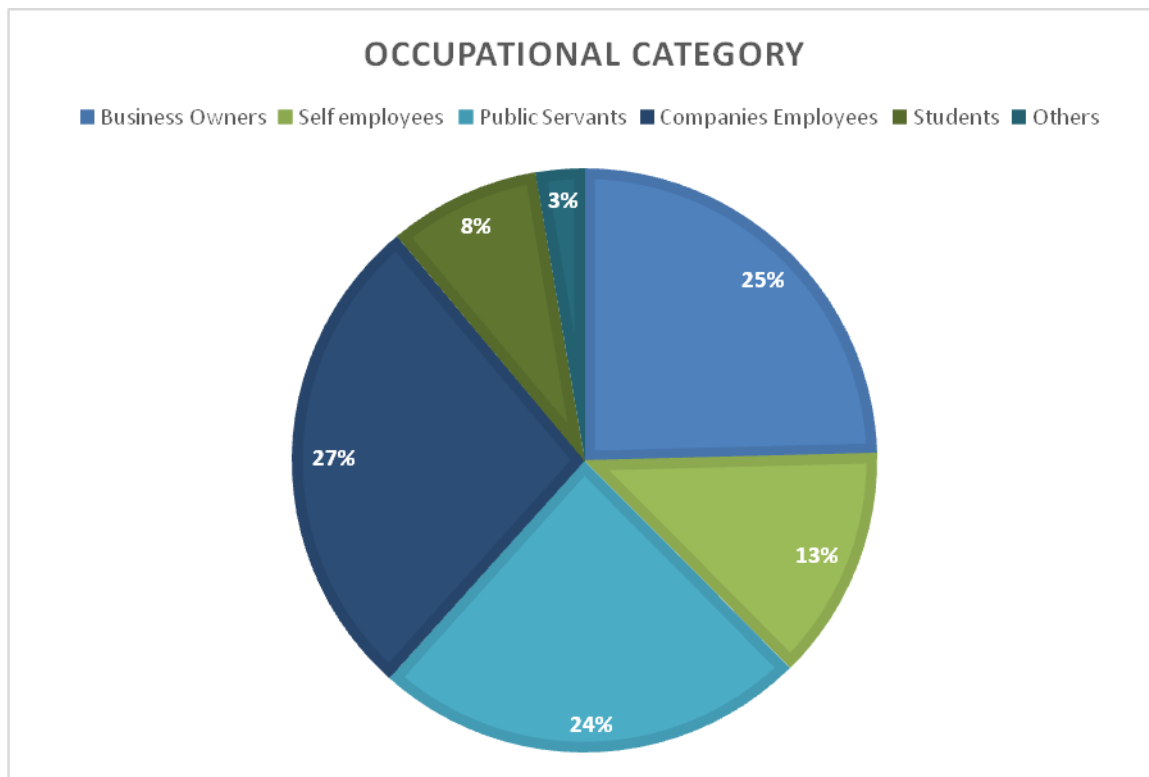
Source: Survey data, 2020

As can be seen in Table 4.1 below, a total of 370 questionnaires were distributed. Out of distributed questionnaires, 238 (64%) are males and 132(36%) are females filled and returned to the research survey questionnaire and participated in the study. Concerning the educational background, majorities (60.8) of the respondents are graduates of some kind of diploma. Regarding age distribution of the **respondents**, the age distribution of the respondents depicts that all the age groups are fairly represented in the study (Figure 4.1). The highest percentage of the respondents for this study were from the age group 26-35 (36.5%) followed by 18-25 (26.8%), 36-45 (18.1%) and 46 and above (18.6%).

Regarding the experiences of the respondents and length of clients in attachment with the organization's services, the data revealed that 26.2 % are less than 2 years of experiences; 44.6 are customers of the Authority in 2-5 years ranges and the rest 29.2% are customer of the organization's services for more than 5 years and above. We can infer from this data that almost 71.8% of the respondents are in the range of more than 2 years' experience in recurrently visiting to the organization seeking the services. This implies that as the AA-DVLCA implemented the application of Waiting Lines System two years ago, this lot of customers are convenient and are aware of the services condition as well as the queue practices of the organization before and after its application. Therefore, the data show it is convenient to assess the before and after situations of the Authority and the effects the WLS brought on the services improvement as well as the changes on the customers satisfaction index.

4.2 Occupational category of The Respondents

The chart below shows the job category and occupational classification of respondents

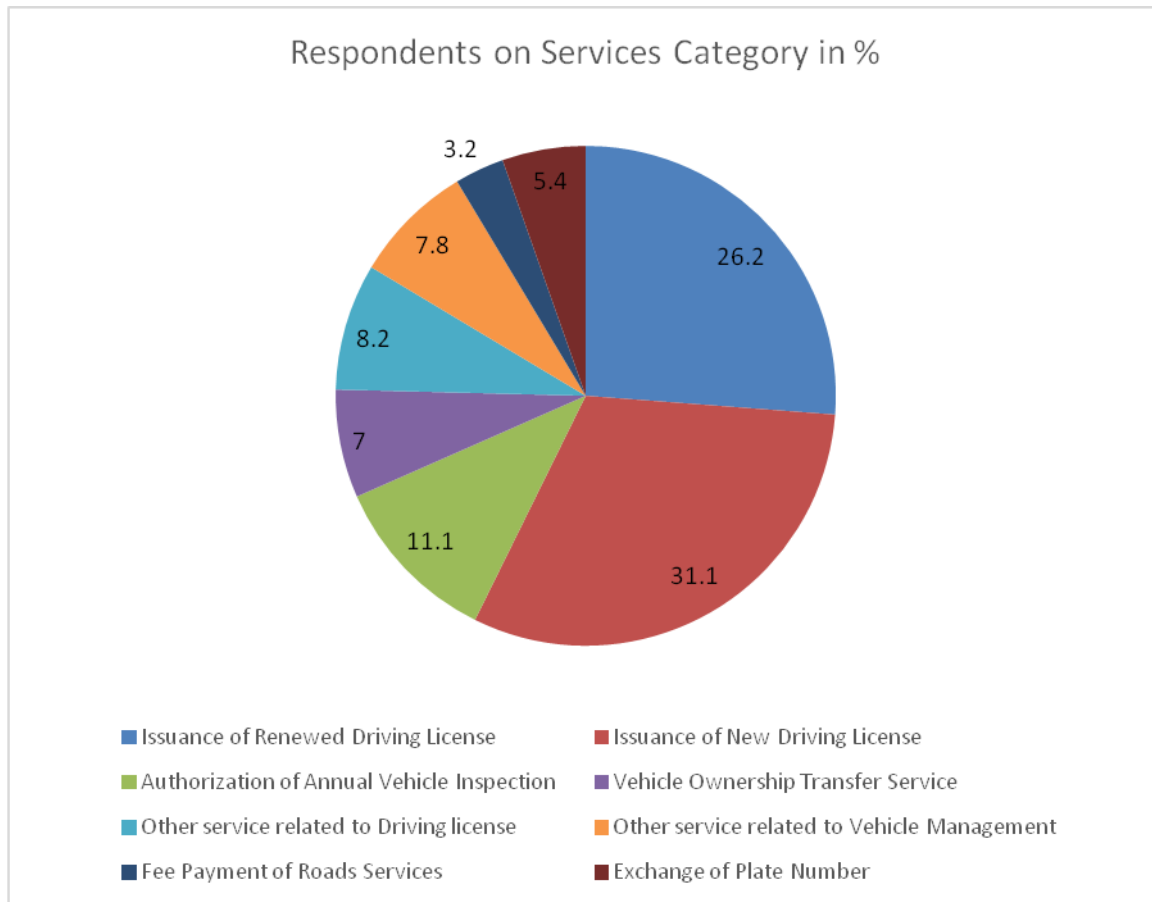


Source: Survey data, 2020

Fig-4.1: the Occupational category of the Respondents

As can be referred from the above chart, majorities of the customers engaged in the survey are company's employees (27.2%) followed by business owners 24.6% and public servants (24.1). Self-employed persons account 12% and students account 8.4%. Other respondents unwilling to reveal their job account 2.8%.

4.3 Data of Respondents on Services Category



Source

e: Survey data, 2020

Fig: 4.2: Respondents Category on Services Issued at the Authority

The data from the above chart shows that 31.1% visited for Issuance of New Driving License

26.2% visited for Issuance of Renewed Driving License, 11.1% visited for Authorization of Annual Vehicle Inspection, 7.0 % visited for Vehicle Ownership Transfer Service, 7.8% said that they visited for Other service related to Vehicle Management, 8.2 % for Other service related to Driving license, 3.2% were for fee payments to roads services charge and 5.4% visited to exchange the plate number of their vehicles from a setup of other region into Addis Ababa City car plate numbers.

4.4 View of Number of Customers on Queue after and Before Application of WLS

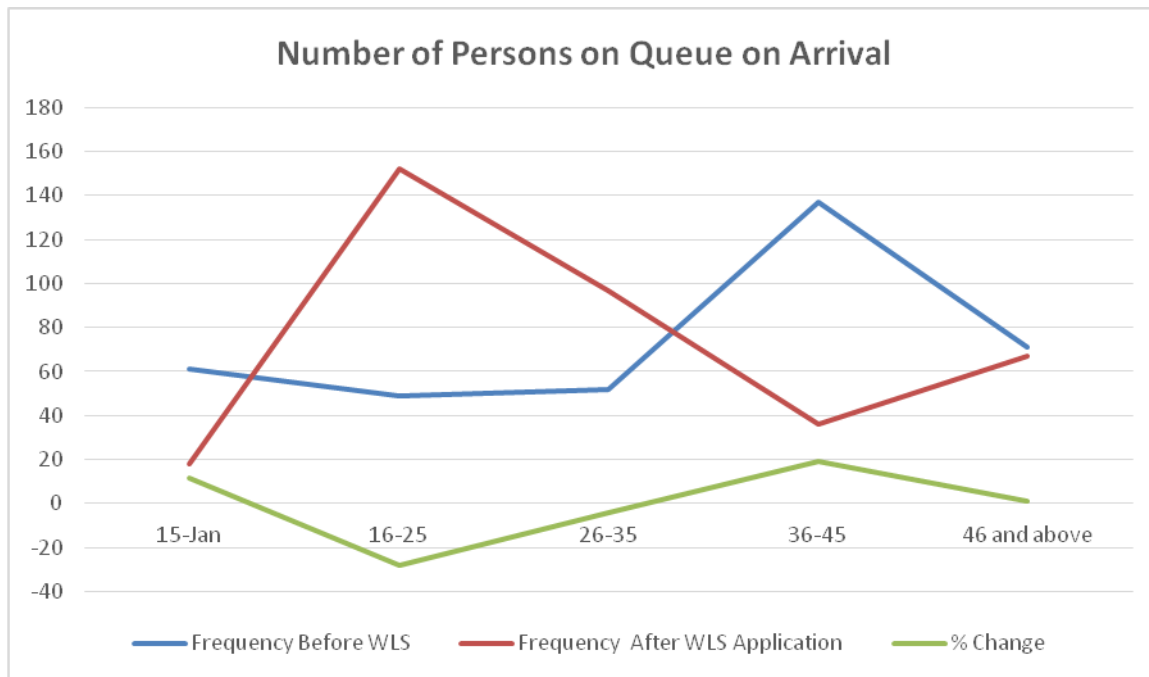
The data shown below indicates the View of the Number of Customers on Queue after and Before Application of WLS.

Table:-4.2: Number of Customers on Queue before and After WLS Application

Number of Customers on A Queue on Arrival	Before WLS Application		After WLS Application	
	Frequency	Percent	Frequency	Percent
1-15	61	16.5	18	4.9
16-25	49	13.2	152	41.1
26-35	52	22.1	97	26.2
36-45	137	28.9	36	9.7
46 and above	71	19.3	67	18.1
Total	370	100	370	100

Source: Survey data, 2020

The AA-DVLCA implemented the application of Waiting Lines System two years ago, and about 71.8% of customers are aware of the services condition as well as the queue practices of the organization before and after the application of WLS.



Source: Study Survey, 2020

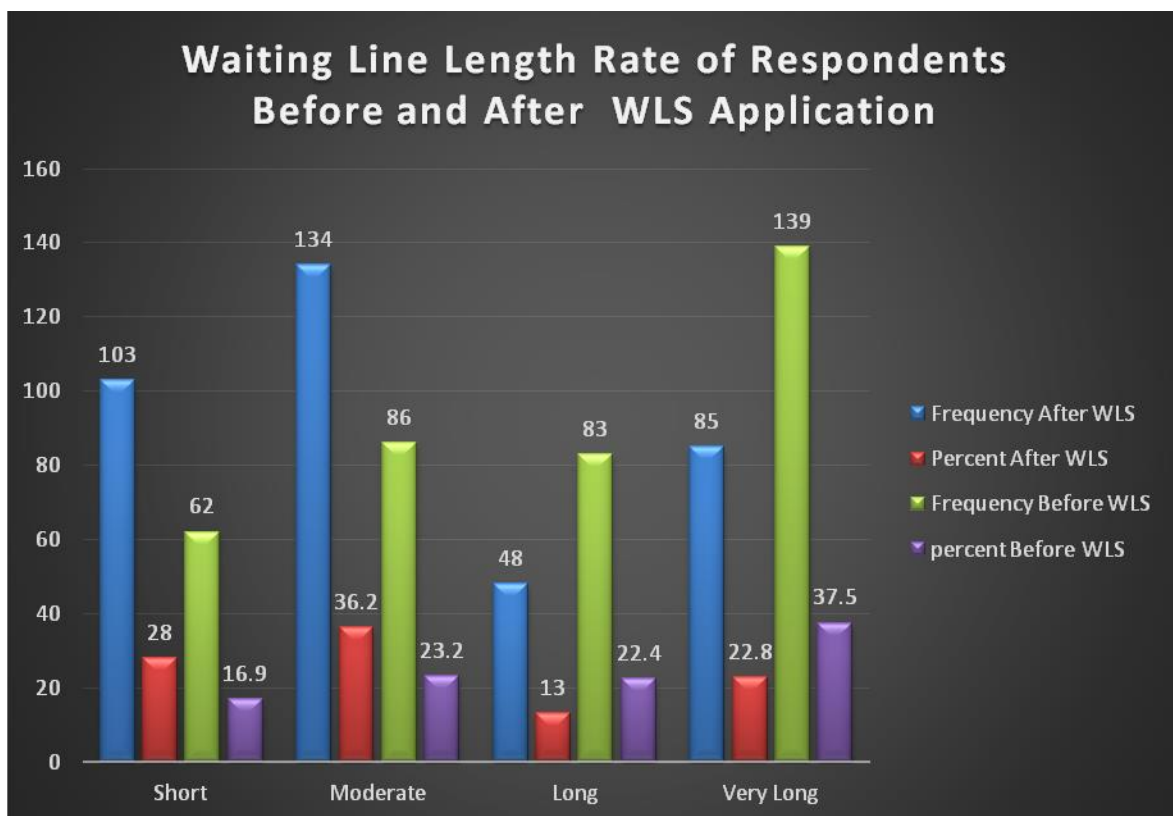
Fig:-4.3: Number of Persons on Queue on Arrival

As it can be observed in table 4.3 and from the graphic chart above, respondents view on the number of customers in the Queue after application of WLS, out of the total of 370 respondents that 18 (4.9%) are faced below 1-15 customers when they are entered in the Queue, 152 (41.1) respondents encountered 16-25 in the Queue when they arrived in the Branch to get served, 97 (26.2%) of the respondents faced customers in the range between 26-35 customers who are waiting their turn for service, 36 (9.7%) of the respondents waited for service by looking more than 36-45 customer and, the rest 67 (18.1%) are waited more than 46 and above customer to get served on the queue. Accordingly, 24.1% of the respondents waited 15-35 customers on the queue on average for the service after application of the WLS. The data also show that the branches can perform the services for 89 persons in the time interval of 15-35 minutes which shows increased efficiency of handling more customers with the application of the WLS. From this data we can infer that, the improvement on the size of customers in the queues in respective branches minimized the number of customers in queue increased as a result of waiting line performance and the application of the WLS has enhanced the level of the customers' satisfaction as per the set services standard.

As the interpretation of the line graph shows that the application of waiting line system is directly related or have positive correlation with the waiting length, that when the length or number of customers are high in queue, the level of customer's satisfaction is low as the graph of the percentage change is negatively skewed shown. The skewing of the graph down when the number of customers on the queue were greater and greater before the application of the WLS which shows more waiting and long queue is there before the application of the system which often has an implication of the low level of satisfaction of the customers.

4.5 Customers' Ratings of Waiting Lines Length after and before WLS Application at DVLCA

The following data in the fig 4.4 display the Customers' Ratings of Waiting Lines Length after and Before WLS Application at DVLCA.



Source: Study Survey, 2020

Fig:- 4.4: Waiting Line Length before and After the WLS

As the main objectives of this study is to assess the current queue management practice of **DVLCA** centers and its rating by customers. To attain this objective then, responses of the customers participated in the survey analyzed and presented accordingly of the customers rating on the length before and after the application of the WLS.

In relation to rating the waiting lines one of the questions that were presented to the customers was on how they perceive and rate the queue length at DVLCA before and after application of the WLS in the services provision. Accordingly, it was identified that 23.2% (86) of them perceive the queue length as Moderate before application system implemented, 16.9% (62) of the customers perceived it as short , 22.4% (83) perceive it as long and 37.5% (139) perceive it as very long before application of the queue management system. Conversely, it was identified that 36.2% (134) of them perceive the queue length as Moderate after application system implemented, 28.0% (103) of the customers perceived it as short , 13.0% (48) perceive it as long and 22.8% (85) perceive it as very long.

From this analysis we can say that the variance of the level of customer's satisfaction as per the percentage indicators of the variables after application of the WLS could be 11.1% of additional utility for the reduction of the queue length resulted from the application of the system. Furthermore, the situation was worse as the customer's satisfaction determined by the length of queue that the length of queue was 9.4% of customers waited a long queue before application whereas about 14.7% of customers were waiting a very long queue and therefore a total of 24.1% of the customers could not be satisfied with the Authority's service before the Waiting Line System was applied. For instance, as the mean value for the queue lengths of the middle 3 values from table 4.2 above the mean value of frequency after application of the WLS is 95 whereas the mean of frequency before application is about 79.3 implies that there is a positive correlation between the application of the system and the improvement in customers' satisfaction.

4.6 Rate of Attitude of the Counter Clerks

Table:-4.3 Rate of Attitude of the Counter Clerks

Attitude of Counter Clerks	Frequency	Percent
Very polite and friendly	189	51
Can't say much	112	30
Not polite and unfriendly	69	19
Total	370	100

Source: Study Survey, 2020

As we can see from the above table 4.3, the customers were also asked if they happy with the attitudes of the counter clerks in the services delivery and accordingly, 51.0% (189) of them agreed for the behavior of staffs in providing the service very polite, while 30.0% (112) were reacted that their attitude is enough for the services provision sake as indicated they are neutral on the idea and 19.0% (69) of them replied as the Authority's staffs are not polite and sometimes unfriendly. This indicates that a significant number of the customers agree that the counter clerks' attitude in provisioning of the services is friendly and can ensure customer satisfaction to a reasonable degree. However, the study found out that there is a need to somehow an improvement in the staffs attitudes towards the customers services delivery.

4.7 Customs' Response on Service Quality before and After WLS Application

Here, the researcher tries to compare and contrast the service Quality in line with compliance rate of the clients on the services provided by the Authority before the implementation of Queue management system and after the Organization introduced the System depending on the respondents view.

The Respondents comparison of Compliance Rate before and after QMS is presented on the table below.

Table-4.4: Services Quality before and after WLS Application

Number of Customers' Compliance Rate	Before WLS Application		After WLS Application	
	Frequency	Percent	Frequency	Percent
Never	59	16	150	40.5
Rarely	97	26.2	110	29.7
Mostly	116	31.3	72	19.5
Always	98	26.5	38	10.3
Total	370	100	370	100

Source: Study Survey, 2020

As can be interpreted from the data on the table 4.4, the study shown that 59(16%) and 150(40.5%) never complained before and after the application of the WLS, respectively. About 97(26.2%) and 110(29.7%) rarely complained; 116(31.3%) and 72((19.5) mostly; 98(26.5%) and 38(10.3%) always complained before and after the application respectively. From this data we can infer that significant number of the respondents responded that the services quality improved after the application of the system than before its application. For instance when we see the gap of frequency of the respondents in the never complained category, with the variance of 24.5% or about 1/4th of the respondents agree that there is improvement in the quality of services compared to those before its application .

4.8 Serving Capacity of the WLS

Customers often have to wait long queues during the process of acquiring certain services and consuming many products. Once customers have entered the queue system they must be served as per their expectation. The physical meaning of service depends on the system's serving capacity. Customers those who go through the Queuing process need to be served as fast as possible. These waiting experiences are typically negative and have been known to affect customers' overall satisfaction with the product or service. The table below shows the serving capacity of the WLS applied by the Authority.

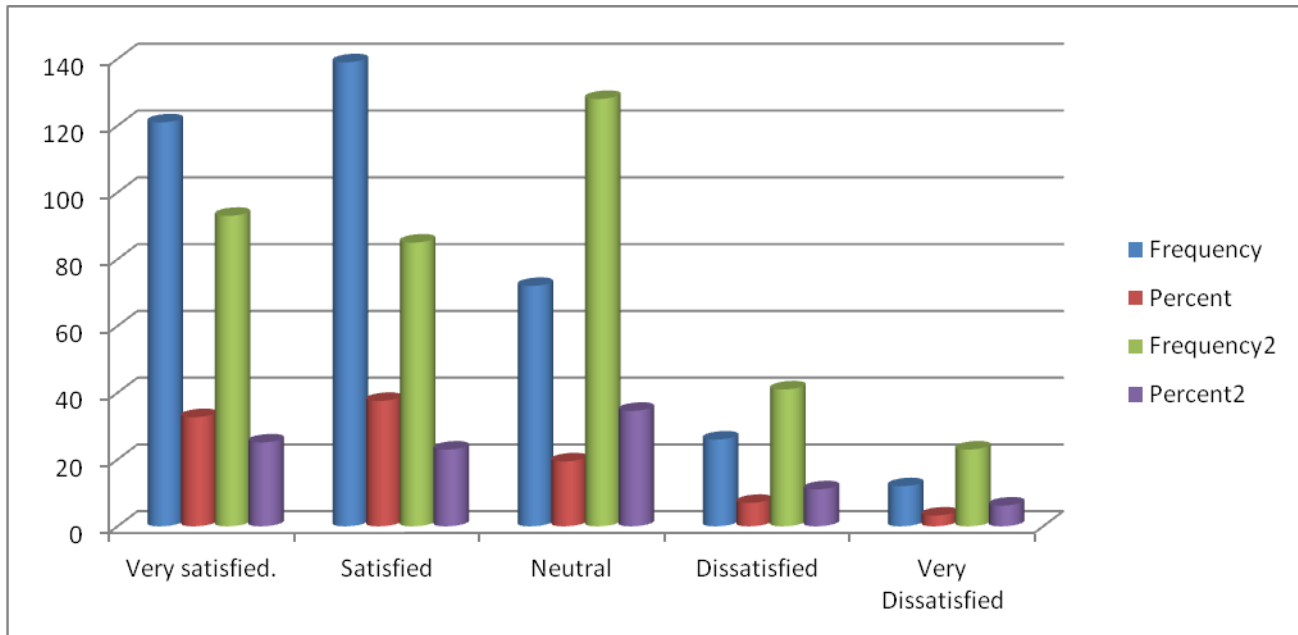
Table; - 4.5: Serving Capacity of servers

Responses on Serving Capacity of the servers	Frequency	Percent
Very satisfied.	93	25
Satisfied	142	38
Neutral	79	21.3
Dissatisfied	43	11.6
Very Dissatisfied	13	4.1
Total	370	100

Source: Study Survey, 2020

As can be presented on the above table, 25% (93) of the respondents are very satisfied with the server capacity, 38% (142) were satisfied and 21.3% (79) were feeling neutral with the server capacity. The rest 11.6% (43) are dissatisfied and 4.1% (13) are very dissatisfied. From this data we can say that there is of general customers satisfaction on the capacity of the servers used as about 63% or 235 out of 370 respondents rested under the satisfied and very satisfied category in the study.

4.9 Queue Discipline



Source: Study Survey, 2020

Fig- 4.5: Queue Discipline

As the figure above shows that 32.7% are very satisfied after the application of the WLS, where as 37.6% are satisfied and 19.5% maintained neutrality with the queue discipline. As the statistical test made using parson's correlation coefficient queue discipline test of before the WLS application is 2.427 and after application it is 4.983. This implies that significant change has been made after the application of the WLS and the waiting queue become so ordered regarding the queue discipline. However, about 10% of the respondents still said that they are dissatisfied and need some improvement in queue discipline. The reason for the existence of such customers who are not happy with the implementation of the rule could be due to the fact that queue discipline is controlled manually by security guards when the power interrupts and so sometimes the controlling could be loose and result in not being respected by some customers.

Conversely, the queue discipline was worse before the application of the WLS significant number of as shown 25% and 22% are very satisfied and dissatisfied. Another queue discipline that brings satisfaction to customers is the prioritizations given to elderly, pregnant women and differently abled customers.

Customers were asked to indicate their satisfaction levels towards the implementation of the rules are not well facilitated and the queue discipline is relatively need improvement. Except the Kirkos branch, the other two branches are not accessible for the people with disabilities as the services place is located in the above 3rd floor of the building block.

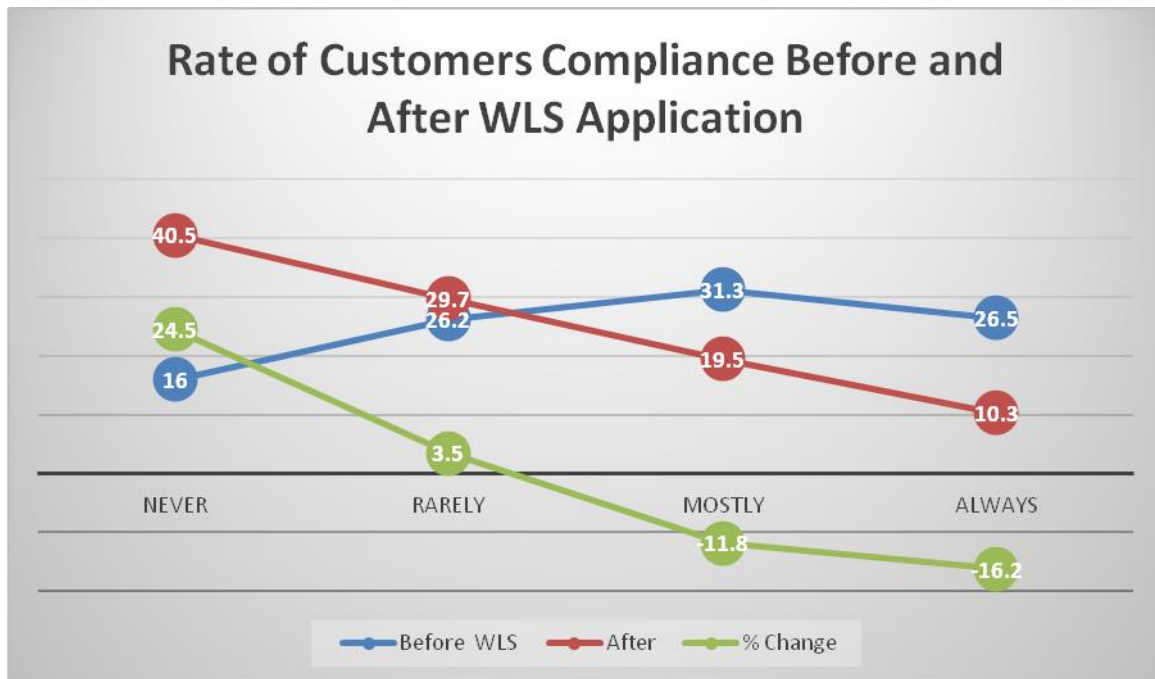
4.10 The Interruption of System

The table below shows that the interruption of the system in the services delivery for the customers.

Table: 4.6. The Interruption of System

Response on Interruption is a factor on customer satisfaction	Frequency	Percent
Yes	116	31.3
No	254	68.7
Total	370	100

As we can see from Table 4.6 from the total 370 respondents 254 (68.7%) are expresses their feeling towards Queue interruption or there are customers without waiting their turn, but 198 (31.3%) customers are not experienced any Queue interruption and they believed that they were delivered with the services accordingly of the priority rules only on their own turn commenced. Thus, we can infer from this data that the interruption of power is not such a serious problem even though distort the queue in managing the queue as most 254 (68.7%) of the respondent dents did not experience the interruption as problem for the services during their visit.



Source

e: Study Survey, 2020

Fig-4.6: Rate of Customers' Compliance before and After Application of WLS

As we can see from **Table 4.6** regarding customers complain over slow service before the Authority started to apply Waiting Line Management System out of the total respondents 16% (59) are never complained over slow service before Waiting Line Management System, 26.2%(97) of the respondents are rarely complained over slow service, 31.3% (116) of the respondents are complained in most of the time regarding slow service before Waiting Line Management System, the remaining 26.5% (98) of the respondents are always complained over slow service. As can be inferred from the above data, the study found out that the customers compliance reduced time by time after application of the WLS.

Regarding customer complain over slow service after Waiting Line Management System out of the total respondents 40.5% (150) are never complained about slow service given by the Authority, 29.7% (110) are rarely complained regarding slow service, 19.5% (72) of the respondents Mostly they complained over slow services, 10.3% (38) of the respondents are always complaining over slow service they gained from the Authority. When we analyze the trends regarding customer compliance rate, more of the customer complaint minimized and reduced the customer's dissatisfactions after the application of the system significantly.

As we can see from the line graph above, the % change of compliance level reduced by 24.5% compared to that of the compliance of customers before the application of the system. As it is executed in the parson’s correlation coefficient on customers’ compliance it scored .535 and .961 before and after the application of the WLS. The study found out that there is positive correlation between the improvement of customer satisfaction and the application of WLS. Therefore, we can infer from this data that the system has had brought a significant contribution in n boosting services quality, reducing customers’ compliance and improving the level of customer’s satisfaction.

4.11 Customer Satisfaction as a Function of Waiting Time

Waiting time is a significant function of customer’s satisfaction indicator. The Table 4.5below shows the Average waiting time to get services by the customers in the Authority.

Table- 4.7: Waiting Time before and after the WLS

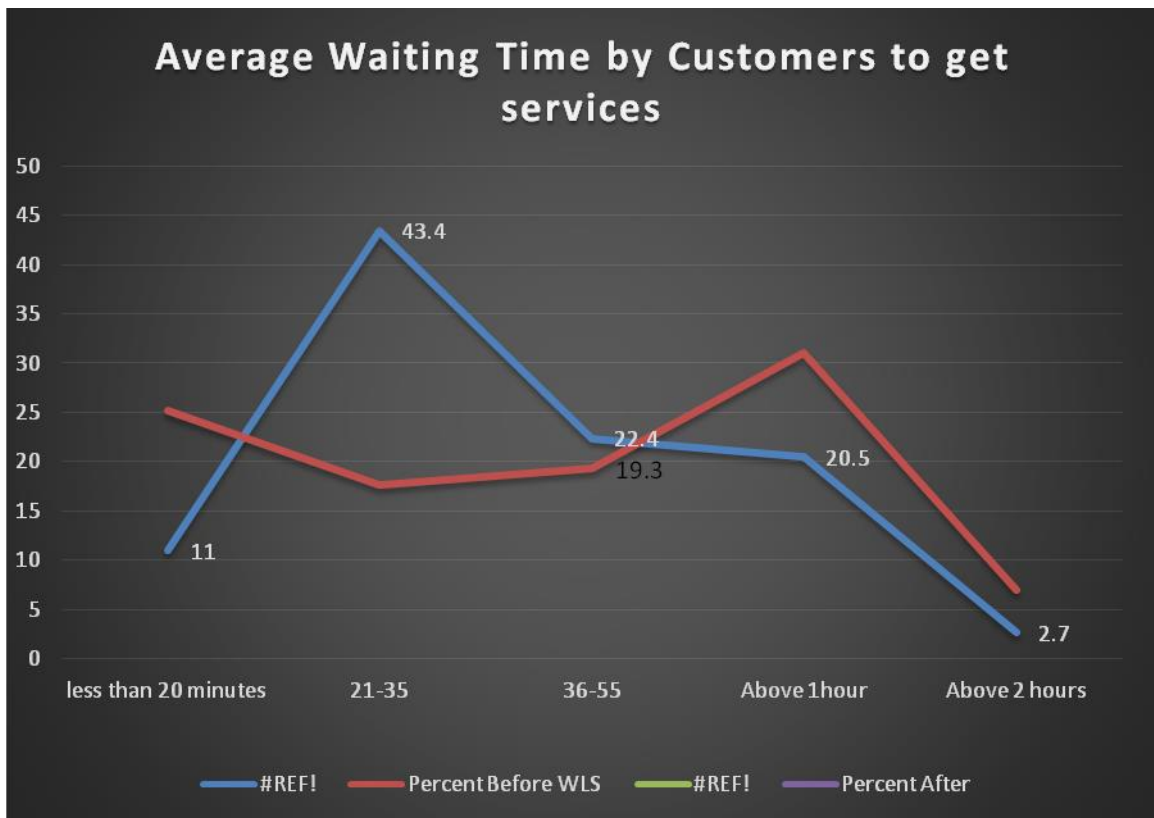
Rate of Customers’ Compliance Rate	Before WLS Application		After WLS Application	
	Frequency	Percent	Frequency	Percent
less than 20 minutes	93	25.1	41	11
21-35	65	17.6	160	43.4
36-55	71	19.3	83	22.4
Above 1hour	115	31	76	20.5
Above 2 hours	26	7	10	2.7
Total	370	100	370	100

Source: Study Survey, 2020

It is important to analyze this queuing system because excessive waiting times can make customers angry enough during services time and detract the relationship between the clients and the government. Waiting a long time serves only to increase their dissatisfaction.

As can be seen from the above table majority of the respondents; for instance only 25.1% (93) said they waited less than 20 minutes to get service before the application of the WLS. Whereas, after the application of the WLS about 11% of respondents waited for only less than 20 minutes. As the statistical test conducted for the waiting time using parson's correlation of coefficient, it is .438 and .961 respectively before and after application. Thus, the study indicates there is significant improvement on waiting hour length after the application of the WLS and this shows that the Authority is serving the customers at lowest possible time length and the customers.

However, the study revealed that the effect of the WLS application well functioned with improving compliance level after WLS application at 21-35 Minutes duration showing highest frequency and percentage change in waiting lines being 43.4%(160) could get the services in shortest possible time after application of the system compared to only 17.6%(65). As the % change is 25.8%, before and after the application of the system this implies that the Authority's compliance reduced significantly after the application of the WLS.



Source: Study Survey, 2020

Fig- 4.7: Waiting Time before and after the WLS

When we see graphically, out of the 370 respondents 38% were waiting above 1-2 hours to get a service before the application where as 23.2% reacted that they waited for the same length. Thus the % change between the before and after application of the WLS i.e., 14.8% shows that there is improved customer satisfaction.

As the statistical test conducted for the waiting time using parson's correlation of coefficient, it is .438 and .961 respectively before and after application. Thus, it can be said the customer compliance on waiting time length has been significantly diminished in the organization after the application of WLS.

From the view of the respondents in this study, we can consider that time can be considered as a resource. As such, a resource, like money, time can be gained and can be lost, that is, can be saved and can be wasted. In time-based competition, one of the main objectives of service companies is to minimize customer waiting. Waiting, however, can be defined in several ways. Different customer groups can have different average waiting times. Besides the mean, the standard deviation or the distribution of waiting times are also important characteristics of the waiting process.

Moreover, the actual and perceived length of waits can also be differentiated. Independently of how waiting is defined and measured, the main objective of operation optimization is to maximize customer satisfaction, that is, to minimize customer dissatisfaction related to waiting times. Hence, the Authority should strive to implement the WLS system application in all the branches to boost the transportation sector services and thereby improve the customers' satisfaction.

4.12 Multi Server Model Analysis of the Study

In queuing theory, the multi-server queuing model describes a system where arrivals form a single queue and are governed by a Poisson process. Further decisions about waiting lines and the management of waiting lines are based on the average values for customer arrivals and service times. Different queuing formulas for the operating characteristics of the multiple-server model were used and calculated as indicated below. Among three branches selected, Lideta branch is taken for observational interpretation study.

Table 4.8 below illustrates the current serving capacity of the servers of Addis Ababa Drivers and Vehicles Licensing and Control Authority.

Table; 4.8. Daily transaction results of arrival and service rates of the Branch

S.no	Time	No, of Arrivals	Can serve/30 minutes/server	CAN SERVE DURING 30 MIN /2.2 SERVER 14 (TOTAL)
1	2:00	16		0
2	2:30	33		7.7
3	3:30	47		7.2
4	4:30	46		11.5
5	5:30	45		10.9
6	6:00	39		11.1
7	7:00	53		9.5
8	8:00	51		7.3
9	8:30	47		10.07
10	9:30	38		10.85
11	10:00	31		6.64
		Ave Arrival=40.5		30.7
				4.4x 14= 62 persons
				18.6

As shown in the above table= the arrival rate (average number of arrivals per hour) i.e. mean arrival rate; is 40

μ = the service rate (average number served per hour) i.e. mean service rate; is 18.6 c =Number of servers =14; and that $c\mu$ (93)<260.4); this means customers are served at a faster rate than they arrive.

In our case study from above table, given c = number of servers = 14, λ arrival rate =40.5 customers per half an hour; μ serving rate = 18.6

Customers per server per hour and $c\mu$ (14) (18.6) = 260.4. (Service rate for 14 servers)

- The utilization of the servers is given by: $U = 0.97 = 97\%$
- The probability that there are zero people or units in the system is= 0.22(22%)

L = 18.6, Customers on average on each branch

The average time a unit spends in the waiting line and being serviced (namely, in the system) is:

$$W = L/\lambda$$

$$W = 18.6/40.5$$

$W = 0.5$ hour, Average time per customer in the system to get served

$W = 0.5 * 60 = 30$, Thus the waiting time in Minutes per branch/per person is **30 minutes**

Queuing Model Statistical Results Interpretation

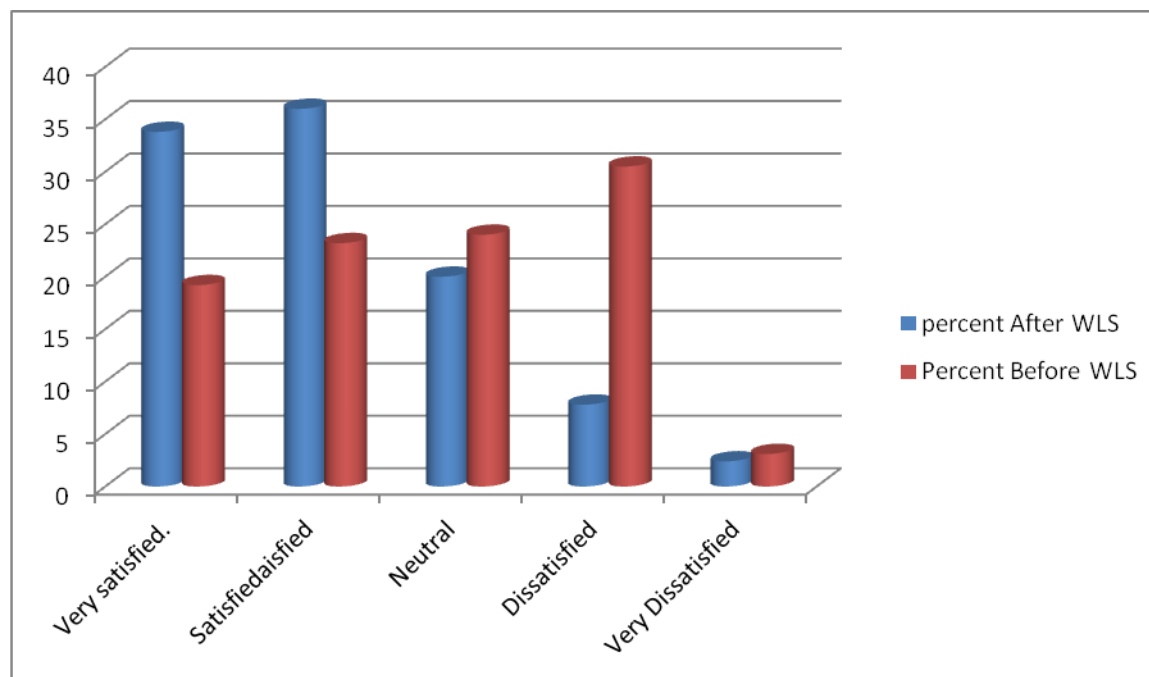
In our case study, on a day, customers arrive at an average of 260.4 customers per hour, and an average of 18.6 customers can be served per hour by the system. If a customer arrives and at least one server is available, then the customer is immediately dispatched to that server. It is assumed that all servers are identical; thus, if more than one server is available, it makes no difference which server is chosen for the customer. If all servers are busy, a queue begins to form. As soon as one server becomes free, a customer is dispatched from the queue using the dispatching discipline in force which is first come –first served in our case and in most cases. The performance of the branch service on a day is almost in a full capacity. We can see that the probability for servers to be busy is, 0.97, i.e. 97%.

4.13 Overall Satisfaction level of Customers with the Services before and After WLS

Table 4.9: Overall satisfaction of Customers After and Before WLS

Level of Satisfaction	After WLS		Before WLS	
	Frequency	Percent	Frequency	Percent
Very satisfied.	125	33.8	71	19.2
Satisfied	133	36	86	23.2
Neutral	73	20	89	24
Dissatisfied	29	7.8	113	30.5
Very Dissatisfied	10	2.4	11	3.1
Total	370	100	370	100

Source: Study Survey, 2020



Source: Study Survey, 2020

Fig- 4.8 Overall satisfaction of Customers After and Before WLS

Out of the total 370, only respondents 39.2% (71) are very satisfied with the services delivery of those Branches, and about 23.2%(86) are satisfied. Accordingly, about 24 %(89) respondents said that they are neutral, 30.5 %(113) are dissatisfied and about 3.1 %(11) are very dissatisfied. Conversely, out of the total respondents, 33.8 %(125) are very satisfied, about 36 %(133) are satisfied after the application of the WLS. In a different situation, 20 %(73) of the respondents are feeling happy after the application of the system.

After effect of the WLS showed that the 7.8 %(29) said they are dissatisfied. And only 3.1 %(11) were reacted that they are very dissatisfied. As the interpretation of the data shown on the table, it indicates 27.4% variance between the level of satisfaction before and after the WLS application. This implies that the utility of satisfaction gained from the systems have positively impacted on the general services satisfaction of the customers on the services rendered by the Authority.

4.14 Descriptive Statistics

Table-4.10: Descriptive Statistics of the Finding

Descriptions	Mean	Std. Deviation	N
How satisfied are you with perceived waiting time?	2.2610	1.00796	370
How satisfied are you with the quality of services?	2.7535	1.07841	370
How satisfied are you with rate of customer compliance?	3.2465	1.1569	370
How satisfied are you with the queue discipline	3.6897	.98976	370
How satisfied are you with the prioritizations given to elderly, pregnant women and disabled customers?	3.4933	1.02627	370
How satisfied are you overall with the Authority's Waiting Line Management System?	3.0085	1.18397	370
Grand mean	3.0755		

Source: Study Survey, 2020

As can be inferred from the above descriptive analysis of the correlation coefficient results it can be seen that all the significant variables have fairly strong relationship with the overall customer satisfaction and that shows all the variables have positive correlation as the grand mean of the computation of all the coefficients is **3.0755**.

When comparison is made between each, it seems that perceived waiting time has stronger relationship with overall satisfaction and has larger effect on overall satisfaction, followed by queue discipline, services quality and rate of customer compliance, before and after the use of WLS indicating that all the variables have medium effect of correlation.

As can be referred from the analytical data, the Pearson correlation coefficient statistical depicts it in the range of 0.5867. This indicates that correlation is significant at the 0.01 level (2-tailed). We can also say that when the availability of these independent variables is increased at the centers, they will also positively impact/increase the satisfaction level of the customers. As it also can be observed above all of the variables have statistical significance at 0.01 levels (2-tailed). On the other hand, except queue disciplines, for the all variables the standard deviations are small and are closer to the mean, that indicates the customer satisfaction is significantly ensured by the application of the waiting line system.

4.15 Qualitative Data Analysis and Discussion of Results

Qualitative data were collected using different methods and the Interviews and discussions were also presented to the managers of DVLCA respective branches, to assess the level of understanding the queue management has on the actual situation of customer waiting lines at the centers, on the existing processes & performance of the respective branches. In responding key informants from customers especially by observing the arrival, actual services time and departure time; employees and branch management heads as well as clerical officers was addressed through interview and discussions. Citizens' expectation with regard to service delivery, and also the follow ups made by the management to improve it further operational quality and improve the customers' satisfaction level. The responses given are analyzed below.

In response to the question "which of the DVLCA branches are the busiest in terms of customers queue?" the management indicated that Lideta, Kirkos and Bole are the busiest centers. On the other hand it was also indicated by the manager that Bole center is serving large number of customers. Hence, this confirms that if more of the busiest centers were analyzed in this study the results generated for queue length could have even been higher. Waiting a long time serves only to increase their impatience.

In our statistical study, on a day, customers arrive at an average of 89 customers per hour, and an average of 40.5 customers can be served per hour by the system. The observation during the study revealed that the average size of the servers is 20 at Bole, 14 at Lideta and 18 at Kirkos on that make the average number per each branch 14 in respective branches. Then the analysis is done for the model involving one queue and 14 parallel servers and the average serving capacity of the server is 40 persons per hour which show good statistical correlation to the findings of the questionnaire survey.

The interview revealed the currently arrivals are about 70-90 arrivals on average in an hour to the branches. According to the study finding the branch center can have a queue of about 89 arrivals on average per hour. This implies a counter clerk or a server has on average to actually serve 2.2 customers in half an hour which means 4.4 per hour, according to the finding from observation. Accordingly, the serving rate is $4.4 \times 14 = 62$ persons as noted by the discussion groups.

If a customer arrives and at least one server is available, then the customer is immediately dispatched to that server. It is assumed that all servers are identical; thus, if more than one server is available, it makes no difference which server is chosen for the customer. If all servers are busy, a queue begins to form. As soon as one server becomes free, a customer is dispatched from the queue using the dispatching discipline in force which is first come –first served in our case and in most cases. The performance of the branch service on a day is almost in a full capacity. We can see that the probability for servers to be busy is 0.97, i.e. 97%.

The average number of customers waiting in a queue is $L_q = 18.6$ customers per 14 server. The waiting time in a queue per server is $W_q = 30$ min which might still be longer than the customers' expectation so that further efforts to be done to ensure customers satisfaction to its fullest. Given customers' expectations, we believe that it is unacceptable for a customer to wait 30 minutes in the queuing system.

In respect to the standard time defined for queue length at DVLCA branches, it was also confirmed by the management that 26-35 minutes is the KPI to get service from DVLCA branches. And in response to a question on how much is the Authority working to meet this standard time across the centers,

it was indicated that efforts are being made in checking up each queue & service time at the centers, increasing the efficiency of customer service officers (counter clerks), controlling service time and waiting time using a system called QMS (Queue Management System).

Hence, it can be said that although the follow up is made on the queue & service times at the centers, in terms of taking the remedy actions to improve for those with the longest queue time is not much.

Another question that was presented to the management was on whether the average arrival rate of customers at the above mentioned busiest centers is known by the management. Accordingly it was indicated that on average a customer could arrive between every 15 minutes to 25 minutes at the busiest centers. However, as per the results of this study it was observed that at least 1 customer arrives every 3 minutes at the sample branches studied.

In relation to how the management characterizes the current waiting line management of DVLCA centers, it was indicated that the management feels that the current status is good and to minimize the waiting time at the centers efforts are being made to enable the 40-50 customers opening the centers starting before 8:00 am to minimize long queue.

However, as per the results of this study it was observed that most of the time service time per transaction is higher than the indicated time. On the other hand, it would be good to note also that some customers come with expectations more than 2-3 services to settle which could contribute to the length of service time at some counters.

Another important question that was presented to the management was whether there were any studies/ analysis that were conducted on the waiting line at different DVLCA centers and if done so what major findings were identified and corrective actions taken based on it. The responses indicated that a reconnaissance survey of such studies was conducted so far. And so, this study could be taken as the first one in the in-depth respect. It is obvious that it is due to the lack of such studies that not much consideration was given by DVLCA to the psychological and economical aspect of waiting in queue and its impact on customers' satisfaction and so accordingly not many efforts were made to improve it (except the application of Queue Management System to monitor the service time at the centers).

In relation to any future plans designed by the Authority to improve the waiting line management at the centers and increasing customer satisfaction, the management indicated that they are planning to increase the number of the centers and also increasing the number of counters at the centers. They have also indicated that they do plan to conduct continuous studies to improve it further. Again as indicated in the above paragraph, the psychosocial and economies of scales aspect of waiting in line and factors that affect the perception of customers is not given consideration in the future plans of the organization.

In response to what factors does the management say affects customers perception of waiting lines and their satisfaction towards it, the management indicated that power fluctuations and system interruptions are the major ones that affect the customers' perception. Here also it can be understood that factors like information provided, the queue discipline & the waiting environment that has an impact on customers' perception of waiting lines are not given much consideration.

With respect to the recommendations that the management say should be done to improve the waiting line system at the centers and increase customer satisfaction, what the management indicted were: creating awareness to customers about the extended working hours of DVLCA centers (Monday – Friday, from 8:00am – 7:00pm and on Saturday from 8:00am – 4:00pm) and minimizing the queue length at the centers during the beginning and ending payment periods.

Efficiency indices for queuing system are: the expected waiting time in queue (W_q) and the expected number of customers in queue (L_q) with the given λ = mean arrival rate and μ = mean service rate. Thus the time spent by the customer in the queue is of interest to the decision maker. One of the objectives of study of queuing is to find out the optimum service rate and the number of servers (counters) so that, average cost of waiting in queuing system and the cost of service are minimized. The results of queuing analysis, referred to as operating characteristics, are probabilistic and those operating statistics (such as the average time a person must wait in line to be served) are used by managers of the branches containing the queue to make decisions. It is important to analyze this queuing system because excessive waiting times can make customers angry enough with the services the government and political turmoil's might happen.

CHAPTER FIVE

SUMMARY, CONCLUSION, AND RECOMMENDATION

5.1 Summary of Findings

The main objective of this study is to assess the waiting line system application on improving the customers' satisfaction. The study had come across several findings and for the purpose of meeting the set objectives, the main findings of the study are presented below from the perspective of the variables indicated in the study.

The three selected branches of AA-DVLCA have between 14, 20 and 28 service counters at their service centers in Lideta, Kirkos, and Bole respectively. And this implies there are 14 functional servers per branch on average based on the analysis of the sample data collected through observation. 24.1% of the respondents waited 15-35 customers on the queue on average for the service after application of the WLS. The data also show that the branches can perform the services for 89 persons in the time interval of 15-35 minutes which shows increased efficiency of handling more customers with the application of the WLS. From this data we can infer that, the improvement on the size of customers in the queues in respective branches minimized the number of customers in queue increased as a result of waiting line performance and the application of the WLS has enhanced the level of the customers' satisfaction as per the set services standard.

Regarding the length of waiting time, the % change between the before and after application of the WLS i.e., 14.8% shows that there is improved customer satisfaction. As the statistical test conducted for the waiting time using parson's correlation of coefficient, it is .438 and .961 respectively before and after application. Thus, it can be said the customer compliance on waiting time length has been significantly diminished in the organization after the application of WLS.

According to the result of Queue Model statistical analysis, customers arrive at an average of 260.4 customers per hour in the 3 branches, and an average of 18.6 customers can be served per hour by the system. If a customer arrives and at least one server is available, then the customer is immediately dispatched to that server.

It is assumed that all servers are identical; thus, if more than one server is available, it makes no difference which server is chosen for the customer. If all servers are busy, a queue begins to form. As soon as one server becomes free, a customer is dispatched from the queue using the dispatching discipline in force which is first come –first served in our case and in most cases. The performance of the branch service on a day is almost in a full capacity. We can see that the probability for servers to be busy is, 0.97, i.e. 97%.

The study found out that, it is indicated 27.4% variance between the level of satisfaction before and after the WLS application. This implies that the utility of satisfaction gained from the systems have positively impacted on the general services satisfaction of the customers on the services rendered by the Authority.

Regarding compliance of customers, the % change of compliance level reduced by 24.5% compared to that of the compliance of customers before the application of the system. As it is executed in the parson's correlation coefficient on customers' compliance it scored .535 and .961 before and after the application of the WLS. The study found out that there is positive correlation between the improvement of customer satisfaction and the application of WLS. Therefore, we can infer from this data that the system has had brought a significant contribution in n boosting services quality, reducing customers' compliance and improving the level of customer's satisfaction.

Regarding the Queue discipline, the study revealed that 32.7% are very satisfied after the application of the WLS, where as 37.6% are satisfied and 19.5% maintained neutrality with the queue discipline. As the statistical test made using parson's correlation coefficient queue discipline test of before the WLS application is 2.427 and after application it is 4.983. This implies that significant change has been made after the application of the WLS and the waiting queue become so ordered regarding the queue discipline. However, about 10% of the respondents still said that they are dissatisfied and need some improvement in queue discipline. The reason for the existence of such customers who are not happy with the implementation of the rule could be due to the fact that queue discipline is controlled manually by security guards when the power interrupts and so sometimes the controlling could be loose and result in not being respected by some customers.

As the descriptive statistical analysis of the variables, the correlation coefficient results indicated that all the significant variables have fairly strong relationship with the overall customer satisfaction and that shows all the variables have positive correlation as the grand mean of the computation of all the coefficients is **3.0755**. When comparison is made between each, it seems that perceived waiting time has stronger relationship with overall satisfaction and has larger effect on overall satisfaction, followed by queue discipline, services quality and rate of customer compliance, before and after the use of WLS indicating that all the variables have medium effect of correlation.

As can be referred from the analytical data, the Pearson correlation coefficient statistical depicts it in the range of 0.5867. This indicates that correlation is significant at the 0.01 level (2-tailed). We can also say that when the availability of these independent variables is increased at the centers, they will also positively impact/increase the satisfaction level of the customers. As it also can be observed above all of the variables have statistical significance at 0.01 levels (2-tailed). On the other hand, except queue disciplines, for the all variables the standard deviations are small and are closer to the mean, that indicates the customer satisfaction is significantly ensured by the application of the waiting line system.

5.2. Conclusion

Based on the above summary, we can conclude that governments are confronted by uncertain and complex challenges whose scale and nature call for new approaches and innovative technologies to problem solving. Some of them have started to use systems approaches in policy making and service delivery to tackle complex or “wicked” problems in areas ranging from education to healthcare, mobility and transportation sector services management. For instance, a system which requires passengers to have the exact fare ready when boarding the bus and advance purchase of tickets from road side vending machines are common in most countries. Whatever the system of payment, it should be easy and more user-friendly than others (Iles, 2005).

Consequently, there is high % change of compliance level reduced by 24.5% compared to that of the compliance of customers before the application of the system. Therefore, we can conclude from this point that the system has had a significant contribution in n boosting services quality and improving the level of customer's satisfaction. However, the performance of the branch service on a day is almost in a full capacity. We can see that the probability for servers to be busy is 0.97, i.e. 97%. The average number of customers waiting in a queue is $L_q = 18.6$ customers per 14 server. The waiting time in a queue per server is $W_q = 30$ min which might still be longer than the customers' expectation so that further efforts to be done to ensure customers satisfaction to its fullest. As a result waiting in lines may be due to overfull, overfilling or due to overcrowding. Any time there is more customer demand for a service than can be provided, a waiting line forms. Therefore, Waiting line models are important to a business performance of the public organizations because they directly affect customer service perception and impact on the costs of providing service.

Though there is improvement on the size of customers, the branches should minimize number of customers waiting line performance and waiting time to increase the level of their customers' satisfaction as per the set services standard.

However, changing entire systems in the public sector is difficult, in part because they cannot be turned off, redesigned and restarted; public services must be continuously available. Systems approaches can help navigate this difficult transition by allowing new practices to be rolled out while core processes are still running. Furthermore, systems approaches can help organizations better manage complexity by striking a balance between simplification (focusing on the intended outcome) and complicating (tackling multiple factors within a system at the same time). Changing the system also requires building internal skills in organizations to help face and adapt to new circumstances. Therefore, application of the Waiting line system in the city transportation has similar dimension, as one sub city applying the system while the other is still in the preparatory stage.

Customers spend a significant amount of time waiting in lines. For instance, the average wait before being seated at a restaurant in the U.S. is 23 minutes, extending up to an hour at popular establishments. Collectively, people in the U.S. spend an estimated 37 billion hours in line each year (Perry Kuklin, 2019).

As time is a resource, the effect does all this waiting around have on customer behaviors and attitude has to be the central question that should answered by public services sectors and business firms equally.

Customer satisfaction is a theme stressed throughout this text. Customer satisfaction is the customer's feeling that a product has met or exceeded expectations. Utilizing various technologies like waiting lines management systems fulfils specific expectations of the customers and then crafting marketing strategy to meet or exceed those expectations need to be a major contributor to the success of an organization as this ensures the customers maximum utility from the services and thereby sustain the organizations' services.

5.2 Recommendation

According to the finding of the study, about 24.1% of the respondents waited 15-35 customers on the queue on average for the service. From this result we can conclude that, though there is radical improvement on the size of customers, the branches should minimize customers waiting line performance and waiting time to increase the level of their customers' satisfaction as per the set services standard.

- Informing customers publicly about the extended working hours of DVLCA centers (Monday – Friday, from 8:00am – 4:00pm including Saturday from 8:00am – 12:00pm) and minimizing the queue length at the centers during the beginning and ending payment periods.
- The management should decide on how to effectively handle the queue when power interruption occurs.. From our observation the branches have a space to increase its window or servers so they should identify its prominent customers and differentiate the counters or windows based on the service given. The branches are mostly busy on performing the renewal of driving license and Annual inspection.
- The Queue management system is yet seen as observation study some manipulations by the waiters and clerks especially when the queue discipline interruption occur due to power failure. Sometimes, therefore, priority (FCFC) principle happen to not work on branches. Therefore, strict rules should be regularized and nonconformity to that rule should be followed by effecting a serious fines and punishment on a defaulter.

- The Waiting line management system is not implemented in all branches of the city. Therefore the authority has to implement the system on all sub-branches to boost customers satisfaction and increase the services performance in all branches.
- Respondents 254(68.7%) expresses their feeling towards Queue interruption or there are customers without waiting their turn, but 198 (31.3%) customers are not experienced any Queue interruption and they believed with their own tern. Here, the Authority should avoid Queue interruption by installing backup generators when the power is off as much as possible because at any term the first customer should be served first.

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APPENDIX 1

RESEARCH QUESTIONNAIRE

ADDIS ABABA UNIVERSITY COLLEGE OF
Business & Economics School of Commerce
Department of Logistics and
Supply Chain Management

Dear Respondents,

I am a graduate student at Addis Ababa University School of Commerce Department of Logistics & Supply Chain Management. I am conducting a research study on the title "*The Impact of application of Waiting Lines System in Improving Customer Satisfaction: (The case of Addis Ababa Drivers and Vehicles Licensing and Control Authority)*" in partial fulfillment of the requirements for my Master's Degree in Logistics & Supply chain Management. You as esteemed customer of The Addis Ababa City Administration Drivers and Vehicles Licensing and Control Authority, have been nominated to participate in this research survey, and I would like to thank you in advance for taking your time and answering all the questions. Please answer the following questions as frankly as possible, as your genuine response is of high importance for the outcome of the project. It will only take you a few minutes.

I assure you that this questionnaire is intended for academic purpose only and your responses will be accorded confidentiality. Thank you in advance for devoting your precious time.

Biruk Alemu (Mobile No: 0930109730), (Email: birukealem24@gmail.com)

Questions for Customers

SECTION A: Demographic & General Information

1. What is your Sex?

- (a) Male (b) Female

2. Education Status

- (a) 18 - 25 (b) 26 - 35 (c) 36 - 45 (d) 46 and above

3. What your age group

- (a) 18 - 25 (b) 26 - 35 (c) 36 - 45 (d) 46 and above

4. Occupation Distribution

- (a) Student
(b) Public Servant
(c) Small business owner/ employee
(d) Big business owner/ employee
(e) Other

SECTION B-1 Customs' Response on Services Quality before and After Waiting Time Line

1. Service you are seeking

- (a) Issuance of New Driving License
(b) Issuance of Renewed Driving License
(c) Authorization of Annual Vehicle Inspection

(d) Vehicle Ownership Transfer Service

(e) Other service related to Driving license

(f) Other service related to Vehicle Management

(g) Fee payments for roads services charge

(h) Change of Plate Numbers to and from regional

(i) Issuing Rule break fines payments

6. Since when you become the created the customer relationship to Addis Ababa City Administration Drivers and Vehicles Licensing and Control Authority?

(a) Less 2 years

(b) 2-5 Years

(c) 5 years and above

2. How many times you visit Addis Ababa City Administration Drivers and Vehicles Licensing and Control Authority before the Waiting Time Line Applied?

(a) one - three times

(b) Four - Nine times

(c) More than Ten times

1. How do you rate the time spent on seeking the service before Waiting Time Line system

(a) 10-30 minutes (b) 31-45 Minutes (c) 46-60 Minutes (d) 1-2 hours, More than 3 hours

2. How do you rate the time spent on seeking the service before Waiting Time Line system

3. How do you rate the time spent on seeking the service before Waiting Time Line system

(a) 10-30 minutes (b) 31-45 Minutes (c) 46-60 Minutes (d) 1-2 hours, More than 3 hours

SECTION B: 2. Customers' ratings of waiting lines

1. How do you rate the queue length at Addis Ababa City Administration Drivers and Vehicles Licensing and Control Authority?

(a) Short

(b) Moderate

(c) Long

(d) Very long

2. How do you rate the serving time taken by the officers?

(a) Fast

(b) Moderate

(c) Slow

3. Have you ever turned away due to long queue/ long time being taken to be served?

(a) Yes

(b) No

(c) Can't remember

4. If yes to No. 3, how many times have you done such?

(a) One time only

(b) Very few

(c) Most of the times

5. If yes to No. 3, how have you solved the issue?

(a) Jumped the queue

(b) Went and came back on same day

(c) Went away and came another day

6. Is the first come first serve priority rule fair and strictly implemented?

(a) Yes, always

(b) Sometimes Yes

(c) Not at all

7. What do you think they should do to improve serving time?

(a) Work harder

(b) Increase staff

(c) Both of the above

(d) Not sure

8. How do you rate the attitudes of the officers?

(a) Very polite & Friendly

(b) Can't say much

(c) Not polite & friendly

9. What do you think with the serving capacity of servers

Very satisfied.

Satisfied

Neutral

Dissatisfied

Very dissatisfied

SECTION B: 3. Customers' Extent of satisfaction level

In this section state to what extent are the following waiting lines management strategies satisfies you. Use the scale of 1= Very dissatisfied 2= Dissatisfied 3= Neutral 4= Satisfied 5= very satisfied.

No.	Customers' level of satisfaction.	(1)Very Dissatisfied	(2) Dissatisfied	(3) Neutral	(4) Satisfied	(5) Very Satisfied
1	How satisfied are you with perceived waiting time?					
2	How satisfied are you with the information provided?					
3	How satisfied are you with the waiting environment?					
4	How satisfied are you with the queue discipline?					
5	How satisfied are you with the prioritizations given to elderly, pregnant women and disabled customers in serving?					
6	How satisfied are you with the overall management of waiting lines in the services branch?					
7	How do you rate the network failures of ICT and services interruptions are problems					

8	How do you rate the services improvement before the Line Management system application					
9	How do you rate satisfaction on the customer compliance level reduction before Waiting Line Application					
10	How do you rate the services improvement after the Waiting Line Management system application					
11	How do you rate the services improvement before the Waiting Line Management system application					
12	How do you rate the general impacts the Queue/ Waiting Line System application on boosting Customers Satisfaction					

Any additional comment, concerns, or question? Topics you believed weren't mentioned.

APPENDICES 2

APPENDIX 2.1: Interview Questions

The following Interview questions are for management of Addis Ababa City Administration Drivers and Vehicles Licensing and Control Authority, with respect to waiting line management of the institution.

1. What is your position in the Addis Ababa City Administration Drivers and Vehicles Licensing and Control Authority?
2. How long have you been working under the organization?
3. Which of the Branch office is the busiest in terms of customers queue?
4. What is the standard time defined for queue length at Addis Ababa City Administration Drivers and Vehicles Licensing and Control Authority?
5. How much do you say Addis Ababa City Administration Drivers and Vehicles Licensing and Control Authorities working to meet this standard time across the centers?
6. Is the average arrival rate of customers at the above mentioned busiest centers known by Addis Ababa City Administration Drivers and Vehicles Licensing and Control Authority?
7. If yes to No.6, what is the average arrival rate at these busiest centers?
8. How do you characterize the current waiting line management of Addis Ababa City Administration Drivers and Vehicles Licensing and Control Authority?
9. Was there any studies/ analysis conducted on the waiting line at different Branches?
10. If Yes to No.9, what were the major findings and the corrective measures taken?
11. Is there any future plans designed by the organization to improve the waiting line management at the Branches and increase customer satisfaction?

12. If yes to No. 11, what visible measures will be taken to improve the waiting line situation?

13. What factors do you say affect customers perception of waiting lines and as a result their satisfaction to it?

14. What do you recommend should be done to improve the waiting line management at the branches and increase customer satisfaction?

Appendix 2.2 Checklist of Observation Questions

1. The existence of customer compliance handling system in each branch over services

2. The FIFO Principles implementation

3. The queue discipline

4. The queue interruption rate

5. The customer compliance

6. The time used to complete a piece of service per customer

7. The queue environment of the services

8. Friendliness of the floor for people with disabilities and pregnant women

9. Accessibility of Windows to clients for easy information communication

10. Exposition level of queue for manipulation for third party
