Addis Ababa University

College of Natural Science

School of Information Science

Factors Influencing the Adoption of Information System at Addis Ababa Water and Sewerage Authority

By

Aman Demissie

Advisor

Tibebe Beshah (Ph.D)

Feb, 2020

Addis Ababa, Ethiopia

ADDIS ABABA UNIVERSITY

COLLEGE OF NATURAL SCIENCE

SCHOOL OF INFORMATION SCIENCE

Factors Influencing the Adoption of Information System at Addis Ababa Water and Sewerage Authority

A Thesis Submitted to the School of Information Science College of Natural Science Addis Ababa University in Partial Fulfillment of the Requirements for the Degree of Master of Science in Information Science

By

Aman Demissie

Feb, 2020

ADDIS ABABA, ETHIOPIA

ADDIS ABABA UNIVERSITY

COLLEGE OF NATURAL SCIENCE

SCHOOL OF INFORMATION SCIENCE

Factors Influencing the Adoption of Information System at Addis Ababa Water and Sewerage Authority

A Thesis Submitted to the School of Information Science College of Natural Science Addis Ababa University in Partial Fulfillment of the Requirements for the Degree of Master of Science in Information Science

Name and Signature of Members of the Examining Board

Name	Title	Signature	Date
Tibebe B. (PhD)	**Advisor**	_____	_____
Temtim A. (PhD)	**Examiner**	_____	_____
Werkshet L. (PhD)	**Examiner**	_____	_____

ACKNOWLEDGEMENT

First and foremost, I thank the almighty God for giving me the ability to do this research study. My special gratitude goes to my advisor Tibebe Beshah (PhD) and I would like to appreciate you for shaping and guiding my thoughts and steps on the right track through your insightful comments. I also want to admire your diligence, on time response and encouragement. I am also thankful to all my friends and family for their encouragement, and all who have contributed to this work in one way or the other. I also would like to thank to the staff and management of all the AAWSA for their response to research questionnaire and interview.

DECLARATION

I declare that the thesis is my original work and has not been presented for a degree in any other university.

Aman Demissie

_____

Feb, 2020

This thesis has been submitted for examination with my approval as university advisor.

Tibebe Beshah (PhD)

_____

Feb, 2020

List of Tables

List of figures

Abbreviations and Acronyms

ICT	Information and Communication Telecommunication
AAWSA	Addis Ababa Water and Sewerage Authority
IS	Information System
IT	Information Technology
MAIS	Monitoring and Assessment Information System
WWDR	World Water Development Report
NBS	Nature Based Solutions
WASA	Water and Sewerage Authority
TPS	Transaction Processing Systems
MIS	Management Information System
DSS	Decision Support System
EIS	Executive Support Systems
AIS	Accounting Information System
SIS	Strategic Information System
NGO	Non- Governmental Organization
ROI	Return on Investment
JTS	Jordan Telecom Sector
TOE	Technology-Organization-Environment
HMIS	Health Management Information System
LDC	Least Developed Countries

TAM	Technology Acceptance Model
ITU	International Telecommunication Union
SWM	Smart Water Management
IPR	Intellectual Property Rights
SPSS	Statistical Package for Social Science
CICP	Center for Information Communication Process

Table of Contents

Abstract

Paul (2010) defines information system (IS) as it refers to a system of people, data records and activities that process the data and information in an organization, and it includes the organization's manual and automated processes. Information system can be applied in different social, economic, political and organizational contexts to facilitate the day to day activities of institutions in the world.

The objective of this study was to investigate the factors influencing /affecting the adoption of information system at Addis Ababa Water and Sewerage Authority. Due to the scarcity of studies on the influence of information system on water and sewerage authorities, the study aimed to investigate factors affecting information system adoption in these institutions.

For a better understanding of the situation a quantitative research approach was employed. Questionnaire was used as means of data collection. The quantitative data generated was analyzed using descriptive and inferential statistics with the help of Statistical Package for Social Sciences (SPSS). Frequency, mean, standard deviation, correlation and regression were used for analyzing the quantitative data. The study was guided by technology acceptance model. From the finding all the independent constructs (Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Information System Strategy (ISS), Information System Infrastructure (ISI) and Information System Awareness (ISA) and dependent construct (Behavioral Intentions to Use) show or demonstrate a positive inclination of employees towards the behavioral intension and actual usage of information system. Moreover the study indicates that infrastructure and Budget are the main challenges to adopt information system at AAWSA.

CHAPTER ONE

Introduction

1.1 Background of the Study

Paul (2010) defines information system (IS) as it refers to a system of people, data records and activities that process the data and information in an organization, and it includes the organization's manual and automated processes.

Ndaw (2015) states Information Communications Technology (ICT) growth and uptake is changing the landscape of developing countries. Initial applications are showing how ICTs can further WASH facilitate (Water, sanitation and hygiene) goals and priorities, including increasing access, improving service delivery and improving governance. Water for life is very necessary and the water sector needs Ict infrastructure and equipments in order to ease the work flow processes and there is still lack of ICT adoptions in organization. Melitski, Gavin and Gavin (2010) suggest that Organization culture and technology adoption are two of the most critical issues facing organizations in a global society. Increasingly, organizations operate in uncertain, networked, decentralized environments, where adoption and use of information technology has become central to fulfilling organizational missions. Their paper also suggest that cultural factors such as the organization of work, communication flow, decision-making practices, control, coordination and the absence of bureaucracy in an organization influence individual decisions to utilize new technologies in the workplace. In addition, job satisfaction and the relationships among peers and with supervisor's impacts individual technology adoption.

Amare(2014) states Addis Ababa water and sewerage Authority is one of the public organization established under the municipality of Addis Ababa for the supply of clean water and provide west water disposal service to the inhabitants of the capital city of Ethiopia, Addis Ababa. AAWSA headed by city administration council board of management, and have eight branches and a project office in the city. AAWSA's objective and responsibility as public organization lies manly in the supply and provision of water and sewerage service which are among the most basic human needs. Considering the growth of the service both in volume and complexity following the rapid growth and expansion of the capital the challenges to be facing are enormous

and too heavy. The involvement of workers in the development process and the role played is enormous. Employee of AAWSA has symbiotic roles to play. As a consumer they need its services and as employees of AAWSA give the services.

1.2 Statement of the problem and justification

Now days the rapid growth of the technologies and the infrastructure in every section of organization is changing the overall activities of the employee's environment with ICT equipment. One of the application areas of IS is related to public service organizations including telecom, electricity and water agencies. There are a number of studies conducted on the impact of IS on these government organizations. This study focuses on identifying factors that affect the adoption of IS on water agencies particularly Addis Ababa water and sewage authority AAWSA. According to Otuke (2013), in the upcoming years, new ICTs will affect the entire water cycle and the management of the water resource related activities. The overall process of bringing ICT into the water resource sector represents a major task in present and coming years. The integration and implementation of new ICT into the existing implemented water management systems remains one of the most challenging tasks facing technology and water experts. Developing an integrated comprehensive smart water management solution that uses ICT for the measurement, automation, control, monitoring of water supply and demand has a definite positive impact on the entire economy.

Ndaw (2015) states that the lack of data and information on existing water and sanitation assets and their current management constitute a barrier for the extension of the services to the poor. Additionally, the poorest lack adequate platforms to hold their service providers accountable and to be heard by decision-makers. On his case study Kebede (2012) studies the methodology for the adoption of information systems in least developed countries particularly in Ethiopia. In his report he states that literacy is a big stumbling block for adopting ICT in Ethiopia, clearly if one cannot read or write it is very difficult then to introduce ICT.

According to Finlay and Adera (2012), information and communication technologies have a potential to contribute towards improvements in water resource management techniques; strengthen the voice of the most vulnerable within water governance processes; create greater accountability; provide access to locally relevant information needed to reduce risk and vulnerability; and improve networking and knowledge sharing to disseminate good practices and

foster multi stakeholder partnerships, among others . Different organizations have adopted information system emphasizing the benefits it provides for facilitating the day to day activity of these institutions. In addition different researchers have conducted studies that show the impact of adopting information systems in different public and private organizations like telecom, electricity corporations, insurance companies, government and NGOS in local and global context. Despite all these studies in different organizations across the world there is a need to conduct a study focusing on local IS adoption context due to the difference in organizational structure, organizational behavior, social norms and availability of information system infrastructure. As stated by Melitski and Gavin (2010) technology adoption and diffusion literature in the public and private sectors have largely been studied as an organizational factor. However, more work needs to be done to determine factors that affect individuals' willingness to adopt new technologies. Hence this study focuses on identifying factors affecting ICT adoption on water companies in local context.

The study was guided by the following research question.

1. What are the factors that influence adopting information system at Addis Ababa Water and Sewerage Authority?

1.3 Objective of the study

1.3.1 General Objective

The general objective of this study is to assess/investigate the factors influencing the adoption of information system at Addis Ababa Water and Sewerage Authority.

1.3.2 Specific objectives

The study was guided by the following

1. To identify the determinant factors that affect the acceptance and use of IS in the authority.
2. To explore IS strategy related issues in information system adoption at AAWSA.
3. To identify information system infrastructure related issues at Addis Ababa Water and Sewerage Authority in adopting in formation system.

4. To assess challenges faced by Addis Ababa Water and Sewerage Authority at adopting IS
5. To provide conclusion and forward the recommendations

1.4 Significance of the study

Since the water sector needs to achieve its better service delivery, the overall organizational functions should be supported by information system. The finding of this research provide to Addis Ababa Water and Sewerage Authority. A ground for transforming the manual service to IS enabled system. Furthermore, the research will create the idea of considering and using the identified factors influencing information system adoption in the authority. The study is vital in saving huge cost and to increase employee's satisfaction. The research findings will be used to review, improve and strengthen information utilization in public services.. The study will also benefit not only the authority but also other sectors as an effective management system as they shall benefit from networked system which shall explain the factors that influenced the adoption of information system.

CHAPTER TWO

Literature Review and Related Work

2.1 Overview

The purpose of this chapter is to see literature review and related work in the area of Information System adoption in different organizations and specially IS Adoption in the water sector. Many researches have been conducted related to the need of adopting information system in water management sectors by identifying the factors that can affect this process in different organizations in the world for effective delivery of service to customers.

2.1.1 Information System

In order to fully understand the paper and convince the reader of this paper, it is necessary to define the information System in scholarly manner. Many researchers defined information system based on the area of application.

Boell and Cecez-Kecmanovic (2015) analyzing around 34 definitions of IS they define and identify information system into four distinct conceptualizations of IS: a technology view, a social view, a socio-technical view and a process view. These four views are based on the main aspect emphasized by each definition: (a) technological aspects, including the processing, storage and transformation of data; (b) social aspects, emphasizing that IS are intrinsically social systems; (c) socio-technical aspects, arguing that IS include both social and technological components that are interrelated; and (d) process aspects - conceptualizing IS in terms of performing and supporting activities and processes.

a) **Technology View**: The system utilizes computer hardware and software; manual procedures; models for analysis, planning, control and decision making; and a database. The emphasis is on information technology (IT) embedded in organizations.
b) **Social View:** An information system is a social system, which has embedded in it information technology. The extent to which information technology plays a part is increasing rapidly. But this does not prevent the overall information system from being a

social system, and it is not possible to design a robust, effective information system, incorporating significant amounts of the technology without treating it as a social system.

c) **Socio-Technical View:** The information systems field examines more than just the technological system, or just the social system, or even the two side by side; in addition, it investigates the phenomena that emerge when the two interact.

d) **Process View:** An IS is a work system whose process and activities are devoted to processing information, that is, capturing, transmitting, storing, retrieving, manipulating, and displaying information.

From these four definitions of information system, the researcher selected the process view which it is assumed to be convenient for the study

Similarly,Alter (2008) in his article define information system as a work system whose processes and activities are devoted to processing information, i.e., capturing, transmitting, storing, retrieving, manipulating, and displaying information. Thus, an information system is a system in which human participants and/or machines perform work (processes and activities) using information, technology, and other resources to produce informational products and/or services for internal or external customers.

In addition, Paul (2010) defines information system in two senses: In a general sense, the term information system (IS) refers to a *system* of people, *data* records and activities that process the data and information in an organization, and it includes the organization's manual and automated processes." So an I.S. includes Information Technology (the latter part of the sentence from 'data records. . .' onwards). But the next and third sentences in the same opening paragraph says

"In a narrow sense, the term information system (or computer-based information system) refers to the specific application software that is used to store data records in a computer system and automates some of the information-processing activities of the organization. Computer-based information systems are in the field of information technology.

2.1.2 Water and sewerage Authority

In this section of literature review, an overview of Water and sewerage Authority papers are seen in local and global context as well as the role they play to customer delivery services.

A research conducted on information systems which support water management by Quin(2012)states that water management in case of Uganda and Sweden, there are similar challenges to achieving information support for action, such as information quantity and quality is limited; the use of information to support action is inhibited. All actors are not involved in information system processes; in particular, local-level actors. Overall, there is limited support of strategic decision-making and weak support of operational, or local, decision-making.

A research conducted by Nyaga (2007) identifying the problem and formulating strategy for Water and Sewerage Services is characterized by inefficient management and poor investment. Implementation of the commercialization process in bits and pieces while tackling each and every isolated problem separately proved to be ineffective and time wasting, Poor state of water and sanitation services has in the recent past attracted a lot of public interest. The public blamed the local authorities for the poor services. The move to commercialize these services to improve on efficiency in services provision has been echoed by both public and the executive arm of the government. The critical factor is what strategies the water companies can put in place to turn around the low level of service provision to meet customer requirements and at the same time run the services in a sustainable manner. This calls for effective commercialization through strategies which can drive the business.

On a symposium discussion about information systems for water resources monitoring and assessment by Harris et al (2011) in department of water affairs and forestry has undertaken to improve the management of information for decision-making for integrated water resources management by coordinating data acquisition, data storage and management, and information generation and dissemination within the department and between the department and other organizations. The discussion also pointed out that monitoring and assessment information system (MAIS) is the focus of these efforts and is based on the precept that information needs are defined by the business processes of water resources management. Data acquisition program design, as well as the generation and dissemination of information, should fully support meeting these information needs.

On a report by WWDR (2018)World Water Development seeks to inform policy and decision-makers, inside and outside the water community, about the potential of nature-based solutions (NBS) to address contemporary water management challenges across all sectors, and particularly regarding water for agriculture, sustainable cities, disaster risk reduction and water quality. The report also added that more than 2 billion people lack access to safe drinking water and more than double that number lack access to safe sanitation. With a rapidly growing global population, demand for water is expected to increase by nearly one-third by 2050.

It is visible that papers on water information system are not available as much as the water is very essential for life and sustainable development for a country to grow. Still there are lack of integrate information system for water and sewerage authorities but there some countries that deployed system for service delivery to customers.

According to WASA (2013) Water and sewerage authority of Trinidad and Tobago, Water is one of the basic necessities to sustain human life. It is also a vital component in the operation of an industrialized society. As such, Government is faced with the challenge of satisfying the needs of its citizenry on one hand while catering for the increasingly sophisticated demands of a dynamic and expanding economy on the other.

2.1.3 Types of Information System

Now a days information system is being applied in many organizations are structured based on function areas such as hospitals, government and non-government organizations, public service sectors, private sectors, telecom industries, electricity, financial institutions and water authorities. Here are some of information system application areas overviewed by different researchers.

According to Tadesse et al (2014) Effective Health Management Information System (HMIS) is essential for setting priority for community based problems, for allocation of budget and human resource and decision making in general to managers and stakeholders. In Africa there are many problems in data management in the health sector in relation to missing of data in reports this leads to a picture which could not represent the country health information.

Navaz (2013) discusses information system into six application areas in different perspectives .

Transaction Processing Systems (TPS): Processing system has the task of the organization's events that are recorded. The MIS, records and stores information about the queue and Chiefs organization collects, processes and provides them in the form of documents, reports, or information systems and decision support information.

Management Information System (MIS):- MIS is the most popular information systems.

MIS receives internal data from the operation processing system and summarized in the form ofmeaningful and useful as management reporting. To be used when performing administrative tasks such as controlling and decision making. The aim of Management Information Systems is to enhance the presentation and reduce speculation in resolving problems at different organizational levels.

Decision Support System (DSS):- Decision Support System is defined as a computer-based system to be used by a manager or group of managers at any organizational level decision process for problem solving DSS, helps decision makers with putting together human judgment and computerized information to solve .A DSS can help the decision maker, but they are never replaced.

Executive Support Systems (EIS) :- (EIS) is a special type of DSS can help the decision-making high levels .Accurate picture of the performance of the system and shows a summary of the activities of competitors. The system is easy to work with, because they provide information in a way that can be easily downloaded (as a graphic and charts). In summary, the purpose of the EIS is to support the management of the information supplied in accordance with operational managers.

Accounting Information System (AIS):-AIS System describes the data that collect organization's activities and convert the data into information. Gives the available information to internal and external organization's users. The AIS is a system that provides information for various units

(SIS) Strategic Information System: - SIS is one of the most important information systems applications, organization, management, politics, the military, business and strategic information

is provided for supplying to achieve its strategic objectives. Mainly in terms of strategic information systems are complex, challenging, unpredictable, and chaotic critical applications.

2.1.4 Technology Acceptance Model and Theories

This section provides a literature review on the popular theories and technology acceptance models in a manner that focuses mainly on the characteristics of the models and finally compare and contrast them and based on their importance conclusions were drawn. Different researchers have been conducting many studies on the adoption of information system in different organizations in order to examine and evaluate the characteristics (factors) of IS adoption on a given sector. Basically, these papers are concerned with technology adoption theories and acceptance models. In their study which focuses on a review of Technology acceptance models and theories Alomary and Woollard (2015) presented the characteristic of each Technology acceptance models and theories which is presented below.

Theory of Reasoned Action (TRA) (1975)

Alomary and Woollard (2015) summarizes the theory of reasoned action as it was introduced by Ajzen and Fishbein first in 1975 which the individual's attitude towards a given situation combines with subjective norms to shape the behavior intention, which in turn influences the individual's actual behavior. It links the perception, norms, and attitudes to the intentions of a person in making a decision, and from there predicts the behavior which may result as a consequence of this intention. It has been criticized, however, because it does not consider the individual's ability to control. In addition, Davis and Bagozzi(1989) conclude that it is general model and not designed for a specific behavior.

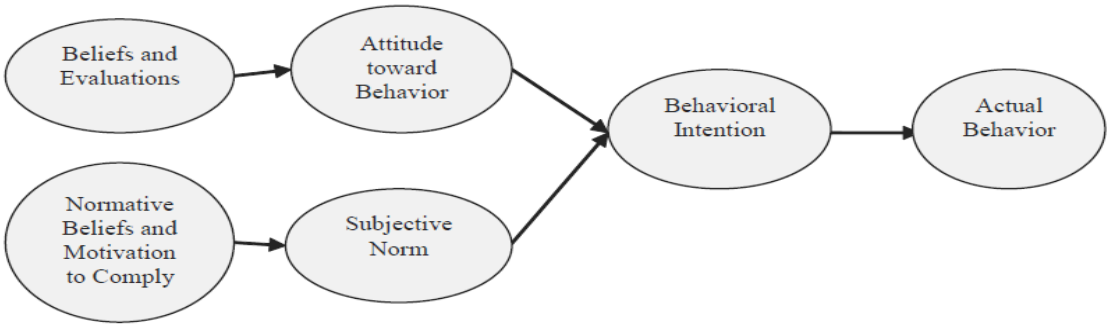


Figure 2.1 Theory of Reasoned Action

Social Cognitive Theory (SCT) (1986)

The social cognitive theory (SCT) was developed by Albert Bandura in 1986 which learning occurs in a social context with a dynamic and reciprocal interaction of the personal factors, environmental factors, and behaviors .It suggests that users acquire and maintain behavior while considering the social environment in which they develop the behavior. It gives concept to the concept of the theory of planned behavior (TPB), the technology acceptance model (TAM), and the innovation diffusion theory assume that there are only unidirectional causal relationships across the main variables in their models. On the other hand, the social cognitive theory proposes that environmental factors, personal factors and behaviors are determined reciprocally. However, Flamand(2017) criticizes that it is loosely structured, ignores biological and hormonal response and psychological problems.

Technology Acceptance Model (TAM) (1986, 1989)

Fred Davis developed the TAM first in 1986 in his doctoral study. The TAM originated as an adaptation of the more generalized TRA and was developed more specifically later to predict and explain technology usage behavior and it was developed to identify the factors which lead to user's acceptance or rejection a technology by integrating technological aspects with organizational behavior concepts. In this model two important factors are perceived usefulness and perceived ease of use are identified. By manipulating these two determinants, system developers can have better control over users' beliefs about the system and so can predict their behavioral intention and actual usage of the system. Attitude towards using a new system has

been classified as a determinant that guides future behavior or as a cause of intention which eventually leads to certain behavior and this model used the TRA as a theoretical basis to find the links between these two factors as well as the user's attitude, intention and actual technology behavior. Legris et al (2003) states that in fact TAM provides feedback on two factors: usefulness and ease of use. But, it doesn't provide any feedback on some factors that may enhance the adoption like integration, flexibility, completeness of information currency.

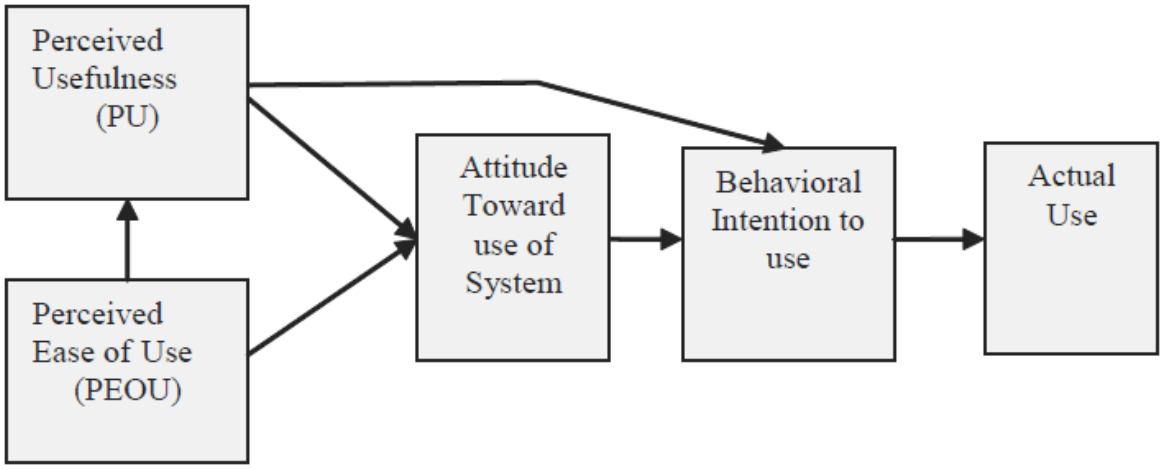


Figure 2.2 Technology acceptance model (TAM) (Davis et al., 1989)

Theory of Planned Behavior (TPB) (1991)

Alomary and Woollard (2015) describes that TPB was conceived with the intention to improve upon some of the drawbacks of TRA. It was developed by Ajzen in 1991 as an extension of TRA, with the additional determinant of intention perceived behavior control. Perceived behavioral control refers to the perception of whether performing the behavior is easy or difficult. This theory examined the factors of attitude, subjective norms, perceived behavioral control, and intentions on the actual behavior. Citing Sharma & Chandel, (2013) Alomary and Woollard (2015) state this theory focused on mandatory situations, whereas TRA focused only on voluntary situations.

Truong(2009) complains that it does not show the planning mechanism of individuals and how it relates to TPB with no mention to other variables that affected on behavioral intention and

motivation, such as fear, threat, mood, or past experience. It does not take into account the environmental or economic factors that may influence the individuals' intention to perform a behavior.

Model of PC Utilization (MPCU) (1991)

Thompson et al. (1991) predict PC utilization behavior model. According to them, "Behavior is determined by what people would like to do (attitudes), what they think they should do (social norms), what they have usually done (habits), and by the expected consequences of their behavior" (Thompson et al., 1991, p.126). They identified six determinants to technology acceptance in this model which are job fit, complexity, long-term consequences, affect toward use, the social factor and the facilitating conditions. Citing Tirandis' (1997) Alomary and Woollard (2015) presented the basis of the MPCU, which considers the theory of human behavior in connection with technology acceptance. His theory of attitudes and behavior is a competing perspective to those of the TRA and TPB. Finally, they made a distinction between the cognitive and affective components of attitudes.

Motivation Model (MM) (1992)

The motivation model has been applied by Davis et al. to study ICT adoption and use (1992). It posits that the individual's behaviour is based on intrinsic and extrinsic motivation. Intrinsic motivation arises from a person's inner drive to perform the task and relates to perceptions of pleasure and satisfaction. On the other hand, extrinsic motivation arises when the cause of motivation is outside the person or outside the task. In this model, computer playfulness and enjoyment are determinants of intrinsic motivation and perceived usefulness, perceived ease of use, and subjective norm are determinants of extrinsic motivation. This model is based on the psychological aspects of technology acceptance.

Combined TAM – TPB (1995)

This model was developed by Taylor and Todd in 1995 by linking the predictors of TPB with the constructs of perceived usefulness and ease of use from TAM. It is also known as the 'decomposed' theory of planned behavior because the belief structure is decomposed in this model. Attitude is thus decomposed to be affected by perceived.

usefulness (relative advantage), perceived ease of use (complexity) and compatibility. The normative belief structure is affected by peer influence and superior influence. The control belief structure is affected by self-efficacy and facilitating conditions.

Innovation Diffusion Theory (IDT) (1995)

The innovation diffusion theory was developed by Rogers in 1995 Innovation is an idea, process, object, or practice that can be considered to be new, and diffusion is the process by which it gets into the social system. This theory is considered to be the permanent theory of acceptance of innovation and is appropriate in both an individual or organizational context. In this theory, there are five determinants of the rate of innovation that affect adoption and acceptance behavior. They are relative advantage, compatibility, complexity, trial ability, and observability.

Extension of TAM (TAM2) (2000)

As cited by Alomary and Woollard (2015), Venkatesh & Davis (2000) developed the TAM2 by adding two more determinants to the original TAM: social influences and cognitive instrumental processes. The social influences include subjective norms and images. On the other hand, the cognitive instrumental processes includes job relevance, output quality, result demonstrability and perceived ease of use. TAM2 keeps the concept of perceived ease of use from the original TAM as a direct determinant of perceived usefulness. All of these additional elements are believed to influence the acceptance of technology. There are two moderating variables in this model, which are experience and voluntariness. In contrast with TAM, the variable of attitude has been removed in TAM2.

Unified Theory of Acceptance and Use of Technology (UTAUT) (2003)

As cited by Alomary and Woollard (2015) combining the various technology acceptance theories and models Venkatesh et al. (2003) developed a unification theory in which they integrated the components of eight technology acceptance models and theories. TRA, TAM, the motivational model, TPB, combined TAM-TPB, the model of PC utilization, innovation diffusion theory and social cognitive theory.The UTAUT model used four main determinants of usage and intention; these are performance expectancy, effort expectancy, social influence and facilitating conditions. These stand alongside four moderators of gender, age, experience and voluntariness of use.

This theory has been criticized for having too many independent variables for predicting intentions and behavior. However, it is considered to be more robust than other technology acceptance models in evaluating and predicting technology acceptance.

Technology Acceptance Model (TAM3) (2008)

According to Alomary and Woollard (2015), Venkatesh & Bala (2008) to give a higher level of significance to 'perceived ease of used further modified The TAM. They also added the dimensions of computer self-efficacy, perception of external control, computer anxiety and computer playfulness. Two adjustment variables have also been added, which are perceived enjoyment and objective usability. TAM3 is constructed on a theoretical framework of four classifications which Venkatesh and Bala (2008) claim is a synthesis of all prior TAM researches. These four classifications are individual differences, system characteristics, social influence and facilitating conditions.

Extending Unified Theory of Acceptance and Use of Technology (UTAUT2) (2012)

According to Alomary and Woollard (2015), the extension of the unified theory of acceptance and use of technology has been developed by Venkatesh et al. (2012) to pay particular attention to the consumer use context. This model included the independent variables of UTAUT but added three more which are hedonic motivation, price value and habit. They have integrated these three independent variables into UTAUT in order to tailor it to the consumer technology use context. Moreover, by combining these three salient constructs into UTAUT, Venkatesh et al. expand the overall framework with regard to technology use. This theory includes age, gender and experience as moderating variables; however, voluntariness has been ignored.

Citing Silva and Dias (2007) Alomary and Woollard (2015), the acceptance and use of information technology is a subject that has received the attention of researchers and professionals in the Computer Science, Information Systems and Information Science. Because the prospect that a well-developed system will be used, since start with the assumption that good solutions in software, can bring competitive advantage to businesses and individuals.

Bradley (2009**)** surveyed literatures focusing on the development and extension of the technology acceptance model and explored other user acceptance model. From his conclusion,

the TAM model is widely used and has been validated many times. Researchers have extended the model to encompass the impact of dozens of variables. A central principle of the TAM model and its extensions is the measurement of behavioral intention to use and user attitude, and understanding as well as explaining user behaviors.

Alomary and Woollard (2015) concludes that TAM has been widely used in information and communication technology research to help understand as well as explain user behaviors hence technology acceptance model is selected for this research paper.

2.1.5 Information System Adoption

IS adoption is related to applying information systems and application on different activities of a given organization which helps in facilitating the organizations daily transactions. Hence it is noted that IS has been improving the day-to-day activities of different organization in making the service delivery effective and efficient. There are different organizations including government, public institutions, NGO and etc. that rely on adopting technology to facilitate the service delivery to their customers. Different studies have shown how IS can enhance their work performance and increase their return on investment (ROI).

Zabadi (2016) studies the adoption of Information Systems (IS) and factors that influencing IS usage and its effect on employee in Jordan Telecom Sector (JTS). Using TAM and TOE models the research urges organizations to better understand the factors in terms of technological, organizational, and individual characteristics that promote or inhabit the adoption of IS. He also recommends it is useful to study in depth the individual factors which an organization constitutes both managerial and functional departments' personal attributes, skills and attitudes affects greatly IS adoption.

Naing(2006) conducted a study on identifying factors influencing the adoption of information system in private hospitals in Malaysia. On his research he states that harnessing the power of information technology for the health care field, we can enhance the effectiveness of the care we provide patient safety, increase workforce productivity and satisfaction, streamline payment-billing and administrative systems, and meet consumer expectations for service and access to information. On his report by using the frame work TOE (Technology-Organization-Environment) he concluded that factors such as technological characteristics, organization

characteristics, environmental characteristics and size of hospital influence the adoption of information system at the administration department in private hospitals.

The adoption of information system in Management Information System plays an important role in decision making process. Al-Mamary, Shamsuddin and Aziati (2013) studied factors affecting successful adoption of management information systems in Organizations. Based on a theoretical framework they proposed they developed a hypotheses based on seven factors. Those factors are categorized into three categories which are technological factors, organizational factors and people factors. Where the implementation of this model in organization will affect on perceived usefulness and user satisfaction toward enhancing the organizational performance. .

On a dissertations by Imre,(2017) using TOE (Technology –Organization- Environment) model he argue that certain aspects like competitive pressures seem to not influence the adoption process, unlike how they are argued to be influential in IS adoptions. Moreover the case study shows that the IS adoptions are influenced by social norms. Generally, the dissertation argues that there are various social worlds in information system adoptions, and various factors ranging from organizational structure to social norms that often affect why and how the organization undergoes an adoption process.

We are in the information society that information is power for an organization for sustainable development of the organizations goals. In this regard any stakeholder who is directly or indirectly affected by any system implementation in any organization is the factor resulted from. Moreover there are factors that determine the attitude or characteristics of employees. Using information system has also its own factor that can impact or influence the structure and attitude of organization in general. In this research paper, factors that influence the adoption of information system in the authority will be identified in detail.

2.1.6 Information System Adoptions in Ethiopia

In this section of literature review Information System Adoption research papers will be seen in local context (Ethiopia).

Using technology-organization –environment model (TOE) Bultum (2014) indicates that, the major barriers in Ethiopian banking industry faces in the adoption of Electronic banking are: security risk, lack of trust, lack of legal and regulatory frame work, Lack of ICT infrastructure and absence of competition between local and foreign banks. The study suggests a series of measures which could be taken by the banking industry and by government to address various challenges identified.

Kidane, Gebeye and Tadesse (2014) assessed the effectiveness of health management information system (HMIS) using cross sectional study. They found that more than 95% of the reviewed patient cards were complete. Out of the questioned 50 staffs (93%) have good attitude towards HMIS. Data consistency between register and the tally sheets was measured as 72.2% even though the value difference was not largely seen. There was 78.6% an average report completeness measure in the HMIS the facility was low. In addition, information was not still used for action. The original HMIS tallies were not used in the hospital instead minimized and photocopied tallies were used. Refreshing training was not given to staff. Therefore; training should be given to the higher bodies and all staffs about the importance of HMIS and the value of health data in decision making. The performance monitoring team should have to be established. The HMIS unit staffs should have to be trained on basic indicators calculation.

Demeke, Olden and Nocera (2016) studied the factors affecting the adoption of information and communication technologies. The analysis of the findings indicates that factors affecting the adoption of ICT in these organizations can be arranged according to three levels: individual, organizational and national. The major factors that affect the adoption arise from the national level factors: the political, socio-economic, and technological and legal factors that play a critical role in the adoption or rejection of ICT in this sector.

Ali (2010) studied acceptance and use of e-library services applying the SO-UTAUT technology acceptance model and cross sectional survey. The study found out performance expectancy as a major determinant factor which demonstrated the most significant contribution (36.2%) on

behavioral intention to use e- library services. Moreover, behavioral intention has shown to be the core determinant factor (40.2% contribution) for the actual usage behavior. Awareness has demonstrated a significant moderating effect on relevancy and facilitating condition constructs. More over the researcher put some hypothesis based on his acceptance model (SO-UTAUT).

Admassie and Ayele (2009) on adoption of improved technology in Ethiopia result shows that younger farmers, famers with larger land size, farmer living closer to market, and farmers who had closer contact with the extension system are more likely to adopt new technology and use it more. The result underscores the need for research and extension programs to be sensitive to the needs of farmers when developing and disseminating technologies that are relevant to their agrotecologies.

Asefa (2017) on adoption of information and communication technology in the public administration in Oromia. The findings show that the public administrations are mainly hindered by a group of challenges related to strategy design on ICT tools. The challenges include infrastructural, standard Internet connectivity design issues and the forces that drive the ICT adoption and ICT awareness creation among the top managers. Possible actions for management intervention are also forwarded based on the key findings.

Similarly, Essa (2017) concludes factors influencing ICT adoption in public healthcare organization. He found that availability of ICT infrastructure is a major factor that negatively influence the ICT adoption in Yekatit 12 Hospital. The study further revealed that, top management, lack of employees ICT skill, and lack of regular ICT training are the main factors influencing ICT adoption.

Ayele (2010) applying Roger's model of innovation diffusion as a core component for the proposed structural model on information system he studied the innovation, adoption and diffusion of IS in Ethiopian Higher Learning Institutions. From the result 49 % of the variation in the utilization of the available IS infrastructure of the university and the overall model assessment was rated as moderate. The model has also shown that the perceived attributes of innovation has strong negative effect on the ICT use of the academic staff which strengthened the inefficiency of the model to show the adoption and diffusion of IS in different contexts. On the contrary, it was found that ICT facilities and access have strong direct positive impact on the

use of ICT by the academic staff of the university. Majority of the staff responded that they use ICT for searching information in the Internet about their course and as a means of communication considering the two dimensions of ICT use in higher learning institutions: instructional and managerial.

On a case study by Kebede (2012) he studied the methodology for the adoption of information systems in least developed countries (LDCs). He indicated that significant problems includes lack of human resources and awareness of ICT and associated issues, failure to fully develop the infrastructure, and the need to privatize the ICT infrastructure to promote development. Another issue is the expansion initiatives which were challenges in quality of service.

2.1.7 Information System Strategy

For a clear view of the topic on information system strategy, it is important to start from the definition of the term strategy. According to International, Inc. (2000) at its most basic and generic level, then, strategy may be defined as a plan, method, or series of actions for obtaining a specific goal or intended result. And also it is not the mission it is the plan that allows the company to accomplish the mission.

2.1.7.1 What is Information System Strategy?

By observing 27 article on the definition of information system,Chen et al (2010)information system strategy is an essential part of the organization and the ultimate goal of the IS function to support and enable business performance. In these articles they found that information system strategy is a plan that runs the IS functions effectively and efficiently. And also it is identifying the required IS assets, including personnel (e.g., IS staff and its capabilities), structure (e.g., IS processes), monetary resources (e.g. IS budget), and technologies (IS applications and infrastructure); and allocate the existing IS assets in the most efficient way.

2.1.7.2 Elements of Information System Strategy

Chen et al (2010) citing (Davis 2000)'s work states that information systems of an organization consist of the information technology infrastructure, data, application systems, and personnel that employ IT to deliver information and communications services in an organization.

Similarly according to Willey(2008) to the plan an organization uses in providing information services. Information system allows business to implement its business strategy, helps determine the company's capabilities. Four key IS infrastructure components are key to IS strategy (These key components are sufficient to allow the general manager to assess critical IS issues.

Ibrahim and Majed (2016) states that use of strategic information system requires a change in the objectives of the organization or its relationship with consumers, suppliers, internal processes, and structure information. Organizations that build a successful strategic information system can go beyond the regulatory barriers between jobs and allow the participation of information between the organization and the various functions, and between consumers and suppliers. Many organizations including hospitals seeking to improve the quality of services provided in order to reach the point of excellence.

To sustain and achieve an organization should have to formulate strategy. According to Porter (2012) a company is said to have a competitive advantage over its rivals when it is able to sustain profits that exceed average for the industry.

The following are information system strategy elements.

2.1.7.2.1 Information System Staff (People in Information Systems)

According to Davis and Bourgeois (2014) People in information systems are those who play different roles in designing, developing, the use of information systems, work with information systems and users of information systems. For this work, information system staffs are personnel who work with information systems in organizations.

2.1.7.2.2 Information System processes

Davis and Bourgeois (2014) also describe information system process as it is a series of steps undertaken to achieve a desired outcome or goal. Information systems are becoming more and more integrated with organizational processes, bringing more productivity and better control to those processes. But simply automating activities using technology is not enough – businesses looking to effectively utilize information systems do more. Using technology to manage and improve processes, both within a company and externally with suppliers and customers, is the ultimate goal.

2.1.7.2.3 Information System Budget

Tam (1992) conducting on capital-budgeting in information systems development shows a result based on 134 senior MIS(management information system) personnel and management executives indicate that capital budgeting has little impact on information system investment. He also suggests that the decision authority varies according to the project value and the type of decisions being undertaken.

2.1.7.2.4 Information System Infrastructure and Applications

Valacich and Schneider (2010) define information system infrastructure as it is interconnection of basic facilities and services enabling the area to function properly. They also conclude that businesses rely on IS infrastructure to support business processes, decision making and competitive strategy. IS infrastructure includes the following components. hardware, software, networks, data, facilities, human resource and services.

Figure 2.3 Information System infrastructures (Valacich and Schneider (2010)

2.2 Related Work

2.2.1 Information System in Government Organizations

Navaz (2013) categorizes information system into two approaches based on the use of IS .These two approaches are both originated from the use of computers and IT in the organization's activities. Proponents of these approaches seek to exploit ways of using information systems, computer and communication technology. First approach: this approach is focused exclusively on the inherent capabilities of computer and communication technology and how it can be used to improve efficiency. So there is emphasis on improving system performance through process efficiency and reliability of performance, not the specific use of the capabilities of computer and communications technology. Second approach: this approach focuses on the organization's strengths and opportunities and assessing how the use of information technology the situation.

Bretschneider (1990) conducted an empirical study on management information systems in public and private organizations and states that management information systems are increasingly important to both public and private sector organizations. More and more managers recognize that access to accurate information, available in a timely fashion, can influence decisions and, in turn, can affect the efficacy of the overall organization.

Similarly, Sundgren (2005) summarizes the use of information system in public and private sector. There are public information systems both in the public sector and in the private sector, and both citizens and businesses may be users of such systems. Public information systems are analyzed from several perspectives as regards users and usages, data contents, and technical, organizational, and legal aspects. Some proposals concerning future research in this truly interdisciplinary and application-oriented research area are presented.

On a report by United Nations (1995) the idea that the use of information technologies in public administration and management will not end with the implementation of two or three information technology projects. Computerization, establishment of information systems, and other IT uses in public sector, are processes instead of events. Once information systems are

established in a government agency, they must be continuously improved. Established systems and adopted technologies need to be continuously upgraded and renewed in order to keep pace with the state of the art in information technologies and to pursue higher efficiency and productivity. Also, data stored in government information systems need to be updated regularly. Public information, as valuable information resources, needs to be continuously explored and developed. Rapidly increasing technical performance and a continuing decline in costs will probably characterize IT for the foreseeable future. Computerization will no doubt be one of the indispensable essentials of the development process of developing countries in their efforts to modernize. In view of this, having a long term plan is necessary for smooth and healthy development of IT use.

2.2.2 Use of Information System in Water and Sewerage Authorities

As stated in the above literature review IS has been applied in various organizations to support the daily activities in serving customers demand. One of these organizations is water and sewerage authorities. In relation to this, different scholars have studied the impact of adopting information system in water and sewerage authorities and factors that influence this adoption process. Below the researcher, present some of the studies.

Ramy and Fathy (2014) state that today, the applications of Information and Communication Technologies (ICTs) have become very essential tools in the water management sectors. Water is a crucial need for human survival. Hence, many initiatives that are implemented today are designed to improve water availability, efficiency, accessibility, and sustainability by the application of various ICT tools. Such tools are one of the most effective methods in enhancing scarce land and water resources, which consequently maximize food production and secure human life. Developing an integrated comprehensive smart water management solution that uses ICT for the measurement, automation, control, monitoring of water supply and demand has a definite positive impact on the entire economy.

On a report by ITU (International Telecommunication Union) (2014) information and communication technologies (ICTs) have played a pivotal role in the lives of cities. With rapid urbanization becoming an inevitable fact, cities are facing increasing challenges to secure financially sustainable water and sanitation services for its citizenry. If matched with appropriate

and effective ICT solutions, in the form of smart water management (SWM), water issues within cities can be properly addressed and managed.

Smart water management (SWM) in cities seeks to alleviate challenges in the urban water management and water sector through the integration of ICT products, solutions and systems in areas of water management and sanitation, as well as storm water management. Such technologies are adapted to continuously monitor water resources and diagnose problems in the urban water sector, allowing to prioritize and to manage maintenance issues more effectively, as well as to gather data needed to optimize all aspects of a city's water management system and feed information back to citizens, water operators, and technical services of cities.
On a report by ITU (2016), developing an integrated comprehensive smart water management solution that uses ICT for the measurement, automation, control, monitoring of water supply and demand has a definite positive impact on the entire economy.

Smit, Tutusaus, and Curry (2015) state that most mentioned drivers for adopting smart water technology in all segments are cost reduction, sustainability and energy reduction. Each of these drivers result in different requirements with respect to water related information presented, granularity of the presented information and feedback channels/devices.

Similarly Tonda (2014) has studied Technology Challenges and tools for the implementation of the water related sustainable development goals and targets. Form the study he concluded that access to information, Cost competitiveness, Knowledge and skills, Public awareness and professional education, Social legitimacy, Cultural barriers, Absorptive capacity and intellectual property rights (IPR) enforcement are some of the factors that affect implementation of technology in the water agencies.

Similarly on a study conducted by Otuke (2013) on role of information communication technologies in water management he concluded that limited staff skills, limited resources (finance), lack of customized applications, lack of detailed top level management support and appreciation of the role of ICT by other departments were challenges facing the implementation of ICT applications in the company.

2.3 Summary

On the literature review the researcher have seen that many of the papers are adopted in government organizations such as public hospitals, educational institution, governmental administrations, financial institutions and Ethiopian farming sectors. However, these papers are not enough to conclude about the effect of technology in Ethiopian organizations. Research papers on adopting information system in local context is still in the infant stage specially a consideration should be given to IS adoption in water and sewerage agency.

Otuke (2013) studied the role of information communication technologies in water management in kenya. He recommends that a similar study can be carried out in other regional water authorities in the country to establish the role of ICT in water resources management and water use efficiency. He also recommends that a similar study should be carried out in other organizations in the East African region and beyond to determine role of ICT in water resources management and water use efficiency. His study further recommends that a study should be carried out to establish the extent to which the organization has adopted ICTs in water resources management and climate change adaptation. Taking the above issues (gaps) into account, this research paper will focus on factors affecting the adoption of information system in the water and sewerage authority.

2.4 Conceptual frame work

In depth literature review, that technology acceptance model can be applied prior application of information system in different organizations and this model can further predict attitudes of employees toward technology usage and behavioral intensions to use information system. According to Turner (2009) technology acceptance model (TAM) was proposed in 1989 as a means of predicting technology usage. However, it is usually validated by using a measure of behavioral intention to use (BI) rather than actual usage. Hence having technology acceptance model which is construction of factors such as perceived usefulness, ease of use and behavioral intension to use. In addition to the existing constructs the researcher created and modified new constructs such as IS infrastructure, IS strategy and IS awareness from prior studies. These constructs were assumed to be appropriate to the new proposed methodology. In addition, these constructs (factors) have strong influence on employees of the organization towards using the technology (information system) and identify the behavioral intension to use the information

system and answer the research objectives as well. Therefore this research paper adopted technology acceptance model as theoretical frame work for the new proposed methodology.

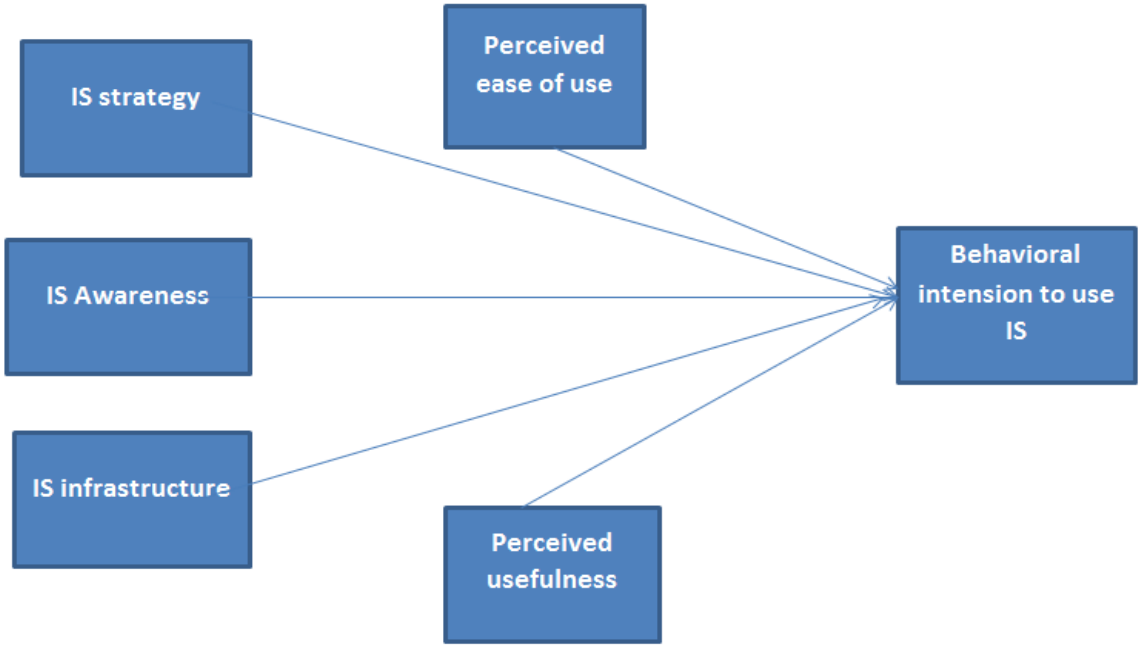


Figure 2.4 Conceptual frame work based on TAM.

Operational Definition of the Constructs

Perceived Usefulness (PU): The degree to which employees believe that using information system will enhance their task.

Perceived Ease of Use (EOU): The degree to which employees believe that using information system will be free from effort.

Behavioral intention to use IS (BIUIS): The employees' likelihood to engage information system

Information System Strategy (ISS): the degree to which employees will accomplish the authority's goal if the authority adopts information system strategy.

Information System Infrastructure (ISI): the extent to which employees will use information system if there is information system infrastructure in the authority.

IS Awareness (ISA): the degree to which employees will be capable of using information system if they get trained.

There are five constructs in the conceptual model, their relationship is discussed as follows.

Information system strategy

In order to implement an organization information system strategy in the organization, it is necessary to understand the perception of employees towards the usage of technology in the organization. According to Sargen et al (2012) understanding the factors that can influence individuals' intention to utilize technology can assist managers to implement strategies to increase and improve the uptake of technologies and improve the innovation adoption process. From the study analysis, the researcher also concludes that there is strong relation or between information system strategy and behavioral intension to use information system. The study also investigated that the information system strategy can influence behavioral intension of employees in the authority.

Perceived usefulness

Abdelrahim(2016)citing the work of Davis, an individual's intention to use the system and its applications is explained and predicted by his perception and attitude towards the technology's usefulness and its simplicity / complexity to actually use, TAM posit that perceived usefulness is influenced by perceived ease of use and both predict attitudes More precisely, TAM characterizes the causal relationship between user's attitudes and perceptions toward IS and the actual adoption and use of information system. In addition the study concluded that perceived usefulness influences the behavioral intension to use information system.

Perceived easiness

Zeithaml et al. (2002) stated that the degree to which an innovation is easy to understand or use could be considered as perceived ease of use. Moreover, Chen and Barnes (2007) have empirically found that the technological aspects of the interface, namely perceived usefulness significantly affect end user adaptation intentions. From the analysis of the study there is strong relationship between perceived easiness and behavioral intension to use information system

Information system infrastructure

Chuttur(2009) citing the works of Venkatesh and Davis (1996) concludes that adding change brought to the original TAM model was the consideration of other factors referred to as external variables that might influence the belief of a person towards a system. Form the conceptual model information system infrastructure is one external factor added that and has a direct relationship with the behavioral intension of employees. More over the analysis shows that there is a strong significant relation with a positive result of 0.808 which has a positive correlation coefficient.

Information system Awareness

From the study investigation, it shows that when employees have more information about information system (technology), their intension to use technology were more likely influenced by their awareness. From the above conceptual frame it shows the relationship between technology awareness and behavioral intension to use information system. More over the analysis result also shows that information system awareness predicts that employees have an inclination to use information system. According to Bernard(2007) awareness of the threats posed by negative technologies is a strong predictor of user behavioral intention toward the use of protective technologies. More interestingly, in the presence of awareness, the influence of subjective norm on individual behavioral intention is weaker among basic technology users but stronger among advanced technology users.

CHAPTER THREE

Study Design and Methodology

3.1 Overview

This chapter discusses the methodologies that will be followed in this study. Hence, the general approach, study area, study design, target population, data collection method and tools, sampling technique, sample size , data collection procedures, reliability and validity of the data collection method and tools have been discussed in detail.

3.2 Study Area

The study will be conducted at Addis Ababa Water and Sewerage Authority which primarily focuses on the provision of water and waste water disposal services to the city where its head quarter is located around Megenagna.

3.3 Study Design

According to Akhtar (2016) research is valid when a conclusion is accurate or true and research design is the conceptual blueprint within which research is conducted

As research design, the researcher uses a descriptive research approach. According to Ngechu (2004) descriptive research approach is the collection of information from a group through interviews or the application of questionnaires to a representative sample of that group. There for this approach is appropriate to achieve the research objective because it is considered suitable for gathering quantitative information and generating / describing appropriate conclusions with respect to the research question.

3.4 Target population

The population selected for the study is a total population of 1070 who work in the different branches of AAWSA.

3.5 Sampling Techniques

The researcher used stratified sampling technique . This sampling technique has been applied in the head quarter (Meganagna) and three branch offices (Gullele, Gurdsholla and Arada) where the study included representatives from each branch office. The four offices were selected as

target research study area mainly because of their longer experiences and their proximity to the researcher. Budgetary, time and other resource requirements were also considered. From each branch office simple random sampling was applied to select departments. Hence from each department sample were drawn.

3.6 Sample size

To identify the sample size the researcher used Cochran's formula. Guwahati (2013) categorizes Cochran's formula in to two. These are: calculating sample size when population size is finite and calculating sample size when the population is infinite. Hence to sample size the population, the researcher derived the first part of Cochran's formula which is used to calculate sample size when population size is finite.

$$n_o = \frac{z^2 pq}{e^2} \qquad \text{Equation } 1.$$

Where n_o is the sample size, z is the selected critical value of desired confidence level, p is the estimated proportion of an attribute that is present in the population, q = 1− p and e is the desired level of precision.

Suppose we want to calculate a sample size of a large population whose degree of variability is not known. Assuming the maximum variability, which is equal to 50% (p =0.5) and taking 90% confidence level with ±7% precision, the calculation for required sample size will be as follows.

p = 0.5 and hence q =1-0.5 = 0.5; e = 0.07; z =1.96

$$n_o = \frac{(1.645)^2(0.5)(0.5)}{(0.07)^2} = 137$$

Cochran's formula for finite sample size: $n = \frac{n_o}{1+\frac{(n_o-1)}{N}}$ Equation 2.

Hence n_o is the sample size derived from equation 1and *N* is the population size of this research.

$$n = \frac{137}{1+\frac{(137-1)}{1070}} = 122$$

Those 122 respondents were distributed to collect data through the questionnaire. In addition interview question was used to gather data from one ICT head and three ICT officers. 45 samples were chosen from Center for Information Communication Process (CICP)and 30 samples were chosen from Human Resource Management in the head office. The rest 47respondents were drawn from branch office. 20 respondents were chosen from Gullele in the ICT office ,10 respondents were also chosen from Gurdsholla and 17 were from Arada in the record office. From the distributed 122 questionnaires 12 were rejected. 100 questionnaires were collected and analyzed. The rest

3.7 Data Collection Method and Instruments

The researcher collects data from AAWSA head quarter and eight branch offices. In order to get adequate and detailed information for the study, diverse set of data gathering instruments were employed. Observations were prepared as checklist to supplement the questionnaire method during analysis. Interview has also been used to confirm the availability of information system infrastructure in each of branch offices. In addition, each of branch office managers and directors has been interviewed.

3.7.1 Instrument Design

Prior to the design of the instrument, a thorough reading and analysis of various literatures were conducted regarding technology acceptance models and theories. Particularly, TAM (technology acceptance model). Questionnaires were adopted from Gao and Krogstie(2011) who adapted the existing Davis et al (1989). Hence this research customized these questionnaire items in such a way that they appropriate to local context and in accordance with the authority's situation. In addition, information system infrastructure checklist is prepared by the researcher.

3.7.2 Secondary Data Collection

Secondary data was collected from relevant materials such as academic journals, magazines, books, periodicals, brochures, and the organizations website.

3.7.3 Data Analysis

After the data had been collected the following data analysis techniques was applied.

3.7.3.1 Quantitative Analysis

Descriptive and inferential statistics is applied. For quantitative data analysis, the descriptive research method includes frequency, mean and standard deviation etc. The inferential statistics help the researcher to provide procedures to draw inferences about a population from a sample. The techniques include correlation, regression etc. SPSS is used as the main tool for data presentation and analysis.

3.7.7.1 Pre-test

The survey instrument was subject to pre-testing to enhance face validity. A modification to the questionnaire was made based on their respondent suggestions. Ambiguous questionnaire items were identified and clarified.

3.7.4 Validity of the instrument

According to Borg and Gall (1985) validity is the accuracy and meaningfulness of inferences which are based on research results. Content validity is the extent to which a measuring instrument provides adequate coverage of the topic under study. If the instrument contains a representative sample of the universe, the content validity is good. Its determination is primarily judgmental and intuitive. Content validity was revised in close consultation with the supervisor. The instrument was also reviewed by researcher's peers.

3.7.5 Reliability

According to Taylor and Todd (1995) pilot tests was conducted to further improve the scales, to determine problems in completion of the instrument and to estimate the time required to complete the questionnaire. Pilot test participants are required to have an organization profile similar to that of the main study's participants. The paper-based data collection strategy was used in the follow-up process. Respondents were given the opportunity to provide qualitative comments about the instrument items and to suggest ways to improve it. According to Kothari (2004) reliable measuring instrument does contribute for validity. Hence, to prove reliability of

the instrument, the researcher has distributed some questionnaires as a pilot test and then made some adjustments if there was any inconsistency. Finally, reliability of the questionnaire has been tested by using Cronbach Alpha. Cronbach‟s Alpha can be interpreted as like a correlation coefficient; its coefficient range lay on the value from 0 to 1. A reliability coefficient (alpha) is higher than or equal to 0.7 considered as acceptable reliability. That means the targeted questions raised in the questionnaires are capable to answer the objective of the study. Therefore, as required on table the SPSS result shows that the questionnaire's reliability is 0.981 Cronbach‟s Alpha which is excellent compared to George and Malley (2003) rules.

Case Processing Summary

		N	%
Cases	Valid	10	100.0
	Excluded[a]	0	.0
	Total	10	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.981	28

Table 3.1 Reliability statistics of questionnaire

3.7.6 Data collection Procedures

To collect data, observation, in-depth face to face interview and survey questionnaire was used. The following data collection procedure was applied.

1. A permission to collect the data was obtained first.

2. After designing instruments, the researcher contacted each branch office directorate to distribute the questionnaire.

3. The questionnaire was distributed to each respective sample with the help of the branch directors.

4. Appropriate follow up was made to check whether the questioners are filled.

5. For the interview data each individuals was contacted through each branch director in a convenient time.

6. Once all the data are collected, data was analyzed for further processing.

7. Relevant findings and interpretation were made based on data analysis.

3.8 Ethical Considerations

The researcher ensured that the research ethics were observed. The respondents were informed that participation in this study was voluntary before being presented the questionnaire. Confidentiality and privacy was also observed. This was done by not revealing the identities of the respondents. The researcher also respected the respondents' decisions on what information to give. In this case, the researcher did not force the respondents to give any information or give their feedback. The objective of the study was explained that it was for academic use only. Finally, the researcher explained to the participants that he was more than willing to share or give feedback of the research findings to the respondents.

CHAPTER FOUR

Data Analysis and Presentation

4.1 Overview

This chapter presents the findings of the study on factors affecting the adoption of information system at Addis Ababa Water and Sewerage Authority. In this chapter the researcher presents the results of the research. The data was collected using quantitative data collection method. In order to answer the research questions the data was analyzed in the following manner. Quantitative data was presented to triangulate the finding of one data source by another data source. The quantitative data collected were fed into the Statistical Package for Social Sciences (SPSS) version 21 was used as data analysis tool.

4.2 Demography Characteristics of Respondents

The researcher calculated the demographic characteristics of respondents in order to validate that the respondents are well enough to answer the questionnaire based on their age, experience and level of education in addition the researcher assumed that the more they have more experience the more likely they understand the questionnaire .

4.2.1 Frequency distribution of gender of respondents

The research establishes the gender distribution of the respondents, from the research findings the study revealed that majority of the respondents as shown by 62.7% were males whereas 37.3% of the respondents were females. This implies that respondents were fairly distributed in terms of their gender.

Gender		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	64	62.7	62.7	62.7
	Female	38	37.3	37.3	100.0
	Total	102	100.0	100.0	

Table 4.1 Gender of respondents

4.2.2 Frequency distribution of age of respondents

The study establishes the age distribution of the respondents, from the research findings the study revealed that majority of the respondents are between the ages of 31-40 years as shown by percent of 49.0%. Whereas 34.3 % of the respondents were found in between the age of 20-30 years and few of respondents were found in between 41 to 50 as shown by percent of 13.7% and very few of respondents were found over 50 years by percent of 2.9 %.

Age Range		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20-30 years	35	34.3	34.3	34.3
	31-40 years	50	49.0	49.0	83.3
	41-50 years	14	13.7	13.7	97.1
	over 50	3	2.9	2.9	100.0
	Total	102	100.0	100.0	

Table 4.2 ages of respondents

4.2.3 Frequency distribution of education level of respondents

The study establishes to what level the respondents were educated (See Table 4.3). With regard to the level of education the study revealed that most of the respondents as shown by 71.6% had bachelor degree whereas 17.6% of the respondents had attained master's degree and only 9.8% of the respondents had college diploma. This implies that respondents were educated and therefore they were in position to respond to the research question with ease

Education Level		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	1	1.0	1.0	1.0
	Diploma	10	9.8	9.8	10.8
	Bachelor	73	71.6	71.6	82.4
	Masters	18	17.6	17.6	100.0
	Total	102	100.0	100.0	

Table 4.3 Education level of respondents

4.2.4 Work experience of respondents

From (table 4 4), we can understand that majority of the respondents as shown by 30.4% had served the authority for more than 5 years whereas 21.6% of the respondents had served for 5 years and 21.6% of the respondents had served for 4 years as well.11.8 % of the respondents had served for 3 years and 11.8 % of the respondents had served for 2 years. Only 2.9% had less than one year. This implies that majority of the respondents had served the authority for a considerable period of time.

Work Experience		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than one year	3	2.9	2.9	2.9
	Two years	12	11.8	11.8	14.7
	Three years	12	11.8	11.8	26.5
	Four years	22	21.6	21.6	48.0
	Five years	22	21.6	21.6	69.6
	More than five years	31	30.4	30.4	100.0
	Total	102	100.0	100.0	

Table 4.4 Work experience of respondents

4.3 Analysis on factors affecting the adoption of information system at AAWSA

According to Term (2004) Likert's model is more principled than existing models. It treats people's underlying attitudes as latent variables, and it species a relationship between underlying attitudes and responses that is consistent with attitudinal research. Based on Likert's scale the researcher provided 27 Likert scale variables to the respondents if they agree, neutral and disagree to the statement. The variables consists of five constructs such as Perceived usefulness, perceived ease of use, Information system strategy, information system infrastructure and information system awareness.

4.3.1 Perceived Usefulness (PU)

For the purpose of clarity the researcher categorized likert scales into three main groups which are agree, neutral and disagree. 83.3% of the respondents agree on concerning with the question that information system would enhance the efficiency of daily work in the authority. 8.8% of the respondents disagree for the statement and 7.8 % are neutral that means they have no opinion for this question. For the question Information system would make easier to keep truck weekly tasks scores 79.4 % of the respondents agreed to accept information system and 7.9% of the respondents disagree and the remaining 12.7% are neutral to give any opinion concerning the statement. 78.2% of the respondents agree regarding the question, IS would allow to better schedule time and 7.1% of them disagree and 12.7% remained neutral. When asked if IS would be useful for as an employee in the authority 79.5 % the respondents agreed on the statement and 7.8% of the respondents disagree. The others 11.8% remain neutral.

The final question based on perceived usefulness is information system help to save resource and time. On this question 78.5% of the respondents agree and 7.8% of them disagree and 12.7% remains neutral. In addition from the responses, the respondents agreed with a mean of 4.12 and a standard deviation of 1.074 that information system would enhance the efficiency of their daily work and help them to save resource and time.

Variables	Ratings					Total	Mean	Std. deviation
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree			
Information system would enhance the efficiency of my daily work.	43.1%	40.2%	7.8%	2.9%	5.9%	100%	4.12	1.074

IS would make it easier to keep truck of my weekly tasks	41.2%	38.2%	12.7%	3.9%	3.9%	100%	4.09	1.025
IS would allow me to better schedule my time	39.2%	39.2%	12.7%	2.9%	4.9%	100%	4.02	1.117
IS would be useful for me as an employee.	42.2%	37.3%	11.8%	2.9%	4.9%	100%	4.06	1.124
Information system help to save resource and time	41.2	37.3	12.7	2.9	4.9	100%	4.04	1.125

Table 4.5 Perceived usefulness

4.3.2 Perceived Ease of Use (EOU)

77.5% of the respondents agree on concerning the question IS would easily find the information the employee looking using the system and 7.9% of the respondents disagree and the remaining 13.7% of them are neutral. In the same manner that the analysis goes on to if the user interfaces of the system is clear and intuitive, the respondents agree on 69.6% of them and 7.8% of them disagree and 21.6% are neutral. If information system is flexible to interact with regarding requirements of business process, the respondents are interested (covered) 73.6% and agree 6.8% of them disagree on the statement and 18.6% of the respondent choose to be silent or neutral. Regarding user friendliness of the system, 66.6% of them agree and 5.9% of them disagree the remaining 27.5% become neutral. Concerning with free of errors while using the system, 63.7% of them agree while 10.8% of them disagrees and the others do not give any opinion on the statement. On the issue of maintaining and troubleshooting the system, most of the agree them that means 63.7% of the percentage and 11.8% of the respondents disagree on the statement and the others are neutral and from Table 4.6,both the mean and standard deviation shows that perceived ease of use can influence the adoption of information system in the authority.

	Ratings			

Variables	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Total	Mean	Std. deviation
IS would easily find the information I'm looking for using the system.	25.5	52.0	13.7	2.0	5.9	100.0	3.86	1.072
The user interfaces of the system is clear and intuitive.	24.5	45.1	21.6	4.9	2.9	100.0	3.80	1.025
I would find IS flexible to interact with regarding requirements of business process	26.5	47.1	18.6	2.9	3.9	100.0	3.86	1.034
I would find IS easy to use (user friendly)	23.5	43.1	27.5	2.0	3.9	100	3.80	.955
IS is free of errors while using the system	19.6	44.1	24.5	5.9	4.9	100.	3.65	1.078
IS is easy to maintain and trouble shoot.	22.5	41.2	23.5	6.9	4.9	100	3.67	1.111

Table 4.6 perceived ease of use

4.3.3 Information System strategy (ISS)

Regarding with information system strategy, the respondents were engaged to agree to use information system if there is information system strategy at the authority. This covers 56.9 % of the respondents whereas 11.8% of the respondents disagree on the statement. The others are neutral this covers 30.4%. The next question based on information system is, If the authority's goal and objectives are accomplished by information system strategy, the respondents agree to use IS that covers 54.9% and 14.7% of them disagree and 28.4% of them are neutral. The other question is if IS strategy allows to accomplish the Authority's mission, they show intension to use the system that reveals 57.8% and 9.8% disagree and 30.4% are neutral. Concerning with that if IS takes competitive advantage, they agree 69.6% and disagree 9.8% and neutral 20.6 by percent. When the question goes to if IS improves efficiency of the authority, the agree 70.6% of

the question and 8.9% remain disagree and others left neural that covers 19.6 by percent .similarly, the mean and the standard deviation shows that information system strategy has strong influence when compared with the adoption of information system in the authority.

Variables	Ratings					Total	Mean	Std. deviation
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree			
there is information system strategy at the authority	20.6	36.3	30.4	6.9	4.9	100%	3.58	1.103
the authority's goal and objectives are accomplished by information system strategy	22.5	32.4	28.4	7.8	6.9	100%	3.50	1.233
IS strategy allows to accomplish the Authority's mission	22.5	35.3	30.4	3.9	5.9	100%	3.59	1.172
IS strategy allows the authority to take competitive advantage	22.5	47.1	20.6	4.9	4.9	100%	3.77	1.014
IS allows to improve the authority's efficiency	23.5	47.1	19.6	3.9	4.9	100%	3.77	1.071

Table 4.7 Information system strategy

4.3.4 Information System Infrastructure (ISI)

62.8% of the respondents agree on concerning the question if there is reliable internet connection and 9.8% of the respondents disagree and the remaining 27.5% of them are neutral. In the same manner that the analysis goes on to if there is communication and collaboration with clients and peers (website/intranet/extranet), the respondents agree on 60.7% of them and 14.7 % of them disagree and 24.7% are neutral. If services are delivered to customers properly and timely, the respondents are interested (covered) 61.7% and agree 11.8% of them disagree on the statement and 24.5% of the respondent choose to be silent or neutral. Regarding if data and information are safe and secured, 61.8% of them agree and 11.8% of them disagree the remaining 25.5% become neutral. Concerning with materials like, software, cables, computers, are purchased and delivered at the right time, 58.8% of them agree while 14.7% of them disagrees and the others do not give

any opinion on the statement. On the question of if the authority has fully functional website, so that employees and customers can access it, most of them agree that means 55.9% of them agree and 15.7% of the respondents disagree on the statement and the others are neutral. The other question is if the information system infrastructure is well installed,56.8% of the respondents agree on the statement and 15.7 of them disagree and some of them becomes neutral that accounts 27.5%. In addition to the responses from respondent, the mean and the standard deviation shows that information system infrastructure related questions can influence the adoption of information system having the mean the 3.69 and the standard deviation of 1.015 which approaches to positive response.

Variables	Ratings					Total	Mean	Std. deviation
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree			
There is reliable internet connection	20.6	42.2	27.5	4.9	4.9	100%	3.69	1.015
There is communication and collaboration with clients and peers (website/intranet/extranet).	22.5	38.2	24.5	8.8	5.9	100%	3.63	1.107
Services are delivered to customers properly and timely.	23.5	38.2	24.5	5.9	5.9	100%	3.62	1.194
Data and information are safe and secured.	24.5	37.3	25.5	5.9	5.9	100%	3.66	1.147
ARE materials like, software, cables, and computers, are purchased and delivered at the right time.	23.5	35.3	26.5	7.8	6.9	100%	3.61	1.136
The authority has fully functional website, so that employees and customers can access it.	23.5	32.4	28.4	10.8	4.9	100%	3.59	1.111
the information system infrastructure is well installed	22.5	34.3	27.5	10.8	4.9	100%	3.59	1.102

Table 4.8 information system infrastructure

4.3.5 Information System Awareness (ISA)

From Table 4.9 the analysis shows that 49% of the respondents agree on the question if a proper training is delivered before the actual usage of IS. The others disagree by percent of 22.6 and the remaining become neutral that covers 27.5. Regarding If they had experience related to ICT/technology, they use IS that shows 50% of agreement and 19.6% disagree on the statement. The remaining are neutral the covers 29.4% percent. The last question concerning information system awareness is peer to peer awareness creation mechanisms and opportunities to communicate and share knowledge among colleagues. On this issue they 50% agree and 22.5 disagree and 26.5% are neutral. Similarly, from the above table 4.9, it shows that information system awareness can influence the adoption of information system in the authority in general.

Variables	Ratings					Total	Mean	Std. deviation
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree			
A proper training is delivered before the actual usage of IS	18.6	30.4	27.5	16.7	5.9	100 %	3.36	1.192
I had experience related to ICT/technology	21.6	27.5	29.4	14.7	4.9	100 %	3.40	1.229
There are peer to peer awareness creation mechanisms and opportunities to communicate and share knowledge among colleagues.	20.6	29.4	26.5	14.7	7.8	100 %	3.37	1.242

Table 4.9 information system awareness

4.3.6 Correlation of Variables (Relationships between variables)

Based on the conceptual framework the researcher formulates five hypotheses for factors influencing the adoption information system at AAWSA in order to accept or reject the analysis.

Null Hypothesis*: there is no correlation between behavioral to use and* perceived *usefulness, perceived ease of use, information system strategy, information system infrastructure and information system awareness*

Hypothesis 1: *there is correlation between perceived usefulness and behavioral intension to use.*

Hypothesis 2: *there is correlation between perceived ease of use and behavioral intension to use.*

Hypothesis 3: *there is correlation between information system strategy and behavioral intension to use.*

Hypothesis 4: *there is correlation between information system infrastructure and behavioral intension to use.*

Hypothesis 5: *there is correlation between information system awareness and behavioral intension to use.*

According to Evans (1996) Correlation is another way of assessing the relationship between variables. To be more precise, it measures the extent of correspondence between the ordering of two random variables. He presented correlation coefficient in the picture below.

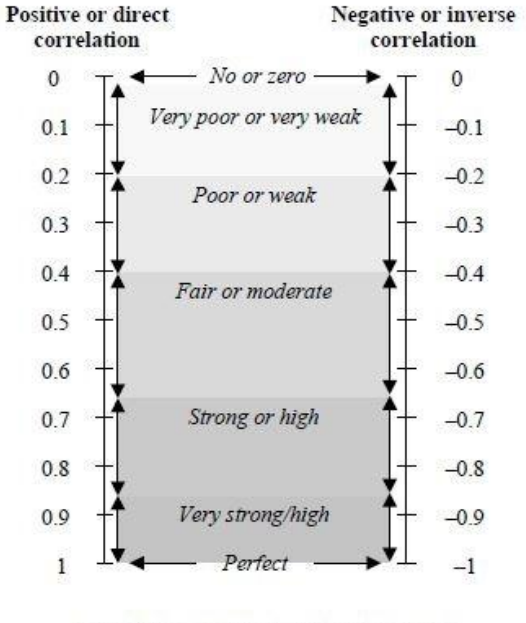


Figure 4.1 Interpretation of correlation coefficient Evans (1996)

The results of the study regarding the five hypotheses have been discussed to check if they are supported or rejected by the study data.

Hypothesis 1: *there is correlation between perceived usefulness and behavioral intension to use.*

Related to perceived usefulness (PU) and behavioral intension to use, there is a significant relation with a positive result of 0.482.This Shows. Furthermore there is a fair or moderate and positive statistically significant relationship between perceived usefulness (PU) and behavioral intension to use. Below is a description on the relation between perceived usefulness (PU) and behavioral intension to use.

Correlations

		BIU_Q27	PUcombined
BIU_Q27	**Pearson Correlation**	1	.482**
	Sig. (2-tailed)		.000
	N	102	102
PUcombined	**Pearson Correlation**	.482**	1
	Sig. (2-tailed)	.000	
	N	102	102

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4.10 correlation of (PU) and behavioral intension to use (BIU)

Hypothesis 2: *there is correlation between perceived ease of use and behavioral intension to use.*

Concerning with perceived ease of use (PEOU) and behavioral intension to use, there is a significant relation with a positive result of 0 .677 which depicts a moderate and positive correlation coefficient. Furthermore, there is a statistically significant relationship between perceived ease of use and behavioral intension to use IS.

Correlations

		BIU_Q27	PEOUCom
BIU_Q27	**Pearson Correlation**	1	.677**
	Sig. (2-tailed)		.000
	N	102	102
PEOUCom	**Pearson Correlation**	.677**	1
	Sig. (2-tailed)	.000	
	N	102	102

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4.11 correlation of (PEOU) and behavioral intension to use (BIU)

Hypothesis 3: *there is correlation between information system strategy and behavioral intension to use.*

Regarding with information system strategy (ISS) and behavioral intension to use, there is a strong significant relation with a positive result of 0.808 which has a positive correlation coefficient. Moreover, there is a statistically significant relationship between information system strategy and behavioral intension to use IS.

Correlations

		BIU_Q27	ISSCom
BIU_Q27	**Pearson Correlation**	1	.808**
	Sig. (2-tailed)		.000
	N	102	102
ISSCom	**Pearson Correlation**	.808**	1
	Sig. (2-tailed)	.000	
	N	102	102

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4.12 correlation of (ISS) (PEOU) and behavioral intension to use (BIU)

Hypothesis 4: *there is correlation between information system infrastructure and behavioral intension to use.*

Regarding with information system infrastructure (ISI) and behavioral intension to use, there is a strong significant relation with a positive result of 0.735 which is found between strong or high correlation coefficient. Moreover, there is a statistically significant relationship between information system infrastructure and behavioral intension to use IS.

		BIU_Q27	ISIcom
BIU_Q27	**Pearson Correlation**	1	.735**
	Sig. (2-tailed)		.000
	N	102	102
ISIcom	**Pearson Correlation**	.735**	1
	Sig. (2-tailed)	.000	
	N	102	102

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4.13 correlation of (ISI) and behavioral intension to use (BIU)

Hypothesis 5: *there is correlation between information system awareness and behavioral intension to use.*

When information system awareness (ISA) and behavioral intension to use are correlated, there is a significant relation with a positive result of 0.665 which is found between fair and moderate coefficient having positive correlation coefficient. Moreover, there is a statistically significant relationship between information system awareness and behavioral intension to use IS

		BIU_Q27	ISAcom
BIU_Q27	**Pearson Correlation**	1	.665**
	Sig. (2-tailed)		.000
	N	102	102
ISAcom	**Pearson Correlation**	.665**	1
	Sig. (2-tailed)	.000	
	N	102	102

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4.14 correlation of (ISA) and behavioral intension to use (BIU)

When concluding from the above SPSS statistical analysis and the assumption of the hypothesis, it indicates that the determinant factors such as perceived usefulness (PU), perceived ease of use (PEOU), information system strategy (ISS) information system infrastructure (ISI) and information system awareness (ISA) positively affect the adoption of information system at AAWSA. Especially information system strategy has strong significant relation with a positive result of 0.808 which has a positive correlation behavioral intention to use information system. The analysis suggests that it is necessary to adopt information system in the authority.

4.3.7 Regression of variables (Dependent variable and independent variable)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.860[a]	.740	.727	.520

a. Predictors: (Constant), ISAcom, PUcombined, ISSCom, PEOUCom, ISIcom

As shown in the table above, the independent variables have an R square of value 0.740. This shows that the independent variables comprise 74 percent for the Behavioral intention (BIU) to use Information system.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.676	.287		-2.356	.020
	PUcombined	.083	.070	.085	1.176	.243
	PEOUCom	.159	.092	.149	1.718	.089
	ISSCom	.565	.103	.449	5.466	.000
	ISIcom	.198	.093	.199	2.119	.037
	ISAcom	.116	.073	.134	1.595	.114

a. Dependent Variable: BIU_Q27

From the table above we can generate a regression equation to the impact of independent variables on Behavioral intention to use Information system. This depicts for any IV(Independent variable) Value given the Behavioral intention will be affected by

$$Y= -0.676+ X * IV$$

Where Y represents the value of Behavioral intention (BIU), -0.676 is the constant (intercept) between Independent variables (IV) and BIU value, X represents the slope (Regression coefficient) value of any independent variable and IV represents the independent variable.

4.4 Discussion

In this section determinant factors that influence the adoption of information system at AAWSA are discussed to identify that data analysis and research question and objectives are met. These factors include perceived usefulness (PU), perceived ease of use (PEOU), information system strategy (ISS) information system infrastructure (ISI) and information system awareness (ISA)

Information System Strategy (ISS)

The study revealed that among the factors influencing the adoption of information system is the information system strategy (ISS). It is the main factor. According to the finding of the research, most of the respondent revealed that, the existence of information system strategy (ISS) at AAWSA enables to achieve the authority's goal and objectives. Scoring correlation of 0.808 (See Table 4.12). According to the quantitative study most respondents were engaged to agree to use information system if there is information system strategy at the authority. This covers 56.9 % of the respondents. So lack information system challenges to achieve the authority's goal.

Information System Infrastructure (ISI)

The second factor that influences the adoption of information system at AAWSA is information system infrastructure that reveals correlation score of 0.735. The existence of reliable internet connection, communication and collaboration with clients and peers (website/intranet/extranet), Services delivery and software, cables, and computers, are purchased and delivered at the right are the most important factor that information system adoption affects in the authority.in the interview section also shows that information system infrastructure is crucial for the adoption of the system.

Information System Awareness (ISA)

This factor is the third most determinant factor that can influence the adoption of information system at the authority. Factors related with information system awareness are proper training; experience and peer to peer awareness creation mechanism are also factors that can influence the adoption of information system at the authority. From Table 4.9 the analysis shows that 49% of the respondents agree on the question if a proper training is delivered before the actual usage of IS. in addition the interview section proves that these factors are important in order to adopt information system.

Perceived usefulness (PU) and perceived ease of use (PEOU)

From the quantitative questions, the researcher concludes that perceived usefulness and perceived easiness are also factors that can influence the adoption of information system at the authority. Perceived usefulness has significant relation with a positive result of 0.482 having the inclination to use information system and that of perceived easiness has also significant relation with a positive result of 0 .677.

In addition, the regression analysis predicts that the use of information system at AAWAS is influenced by the five factors: such as: perceived usefulness, perceived ease of use, information system strategy, and information system infrastructure and information system awareness.

CHAPTER FIVE

Conclusion and Recommendations

5.1 Overview

This chapter presents the conclusions, recommendations and suggestions for further research. It is divided into three sections; the first section presents conclusions of the study, the second section presents recommendations of the study while the third section presents suggestions for further research.

5.2 Conclusions

In this section the researcher presents the conclusions derived from the analysis of the research question which is "What are the factors affecting the adoption of information system at Addis Ababa Water and Sewerage Authority?"

Using the data collected through questionnaire, the study has tried to investigate the determinant factors that affect the adoption of information system at Addis Ababa Water and Sewerage Authority using the Technology Acceptance Model in Ethiopian context. The model has been empirically tested and proved that, it fits to the current study setting and can predict the acceptance of technology in the authority.

Concluding the analysis on the perceived usefulness of information system, most of the respondents agree to accept information system in the authority recognizing the benefits related to saving resource, scheduling time, keep track of weekly tasks and increasing efficiency of daily work.

Similarly on the inquires related to perceived ease of use of information system, most of the respondents agree to accept information system in the authority recognizing the benefits related to easily finding the information, simple and friendly user interfaces, flexible to interact, easy maintenance and trouble shooting.

Moreover related to information system strategy, most of the respondents agree to accept information system in the authority knowing the benefits related to accomplishing organizational

goals, missions and objectives, taking competitive advantage and improving the authority's efficiency as well.

When summing upon analysis on the information system infrastructure aspect, most of the respondents agree to accept information system in the authority distinguishing the necessity of information system related to reliable internet connection, easy communication and collaboration with clients and peers (website/intranet/extranet), proper services delivery, on time purchasing of software, cables and computers, proper accessibility functionality of website and a well installed infrastructure.

Concluding the analysis on the information system awareness, half of the respondents agree to accept information system in the authority recognizing the necessity of information system by emphasizing the delivery of a proper training, enhanced employee experience related to ICT/technology and a properly organized peer to peer awareness creation mechanisms and opportunities to communicate and share knowledge among colleagues.

The study has also shown that the employees in the authority have an inclination (behavioral intention) to adopt and use information system that there is a significant relation with a positive result of 0.482 correlation regarding Perceived Usefulness (PU) of the information system. Similarly the study also concludes that Perceived Ease of Use (PEOU), Information System Strategy (ISS), Information System Infrastructure (ISI) and Information System Awareness (ISA) have significant relationship with behavioral intension resulting a positive correlation coefficient of 0 .677, 0.808, 0.735 and 0.665 respectively.

Moreover, all the independent constructs (Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Information System Strategy (ISS), Information System Infrastructure (ISI) and Information System Awareness (ISA) and dependent construct (Behavioral Intentions to Use) show or demonstrate a positive inclination of employees towards the behavioral intension and actual usage of information system.

In addition, responses of interviewees from the interview indicate that awareness, skilled manpower, budget, and user training should be improved so as to facilitate and increase users 'acceptance and usage of the technology. Moreover the interviewees complained that IS infrastructure and Budget are the main challenges to adopt information system.

5.3 Recommendations and Future Work

5.3.1 Recommendation to AAWSA

Based on the findings, this research recommends that the authority should train and aware the employees on the information systems prior to their adoption. This will ensure that the authority will easily understand the functionality of information systems and will also serve to reduce resistance to the actual usage of the system. Secondly, this research also recommends that the main constructs of information system such as information system infrastructure and information system strategy must be fully adapted prior to the adoption of information system.

5.3.2 Recommendation to Government

This study also recommends that the government formulates a policy of assisting public sectors who may not have adequate finances for adopting information systems; this will be well enough in improving the quality of water service delivery to all citizens of the city.Similarly, this research also recommends that it is important for the government to incorporate information systems training in all ways as it is an important factor that facilitate adoption of information system.

5.3.3 Suggestions for Future Work

This study focused on five factors that were considered to affect the adoption of information system, this research recommends that future research should look into more factors that may influence adoption of information systems.

This study was done on Addis Ababa city only, therefore this research recommends a research be done on a wider area to allow for more generalizability. This study also recommends that multiple case studies or quantitative surveys to involve more regional towns in the study to further improve the generalizability of the findings. Through contrasting the responses received from large number of cities or towns, the information systems adoption situation can be explored more fully and new insights into the information systems adoption practices can be acquired.

6. References

1. AAWSA. (2002). Wastewater Master plan, "Design Study Services Addis Ababa Sanitation Improvement Project", 1.
2. Admassie, A. and Ayele, G. (2009) on adoption of improved technology in Ethiopia.
3. Akhtar, I. (2016) research design "Research in Social Science: Interdisciplinary Perspectives".
4. Ali, N. (2010). Information system innovation adoption and diffusion in Ethiopian Higher Learning Institutions in the case of Hawassa University.
5. Al-Mamary, Y. H., Shamsuddinand A. ,Aziati N., (2013). Management Information Systems, 8(4), pp. 010-017.
6. Alomary, L. and Woollard, J.(2015). How is technology accepted by users? A review ofTechnology acceptance models and theories" proceedings of the ires 17th international conference".
7. Alter, S. (2008). Defining Information Systems as Work Systems "Implications for the IS Field".
8. Amare, W.(2014) .assessment of employee performance appraisal practice" the case of Addis Ababa water and sewerage authority"
9. Amare,W. (2014). Assessment of employee performance appraisal practice" the case of Addis Ababa water and sewerage authority"
10. Asefa(2017) on adoption of information and communication technology in the public administration in Ormia
11. Ayele, A. A. (2010). a acceptance and use of e-library services in ethiopian universities: the case of addis ababa and adama Universities
12. Borg, W.R.S. and Gall, M.D. (1985). Education Research. An Introduction. 4th Edition. Longman Publishers. Newyork,
13. Bretschneider,S.(1990) . Management information systems in public and private organizations an empirical test.
14. Bultum, A. G.(2014). Factors Affecting Adoption of Electronic Banking System in Ethiopian Banking Industry.
15. Cecez-Kecmanovic, D. and Boell, S. K.(2015). What is an Information System?
16. Chen,D.Q., Teubner,A., et al (2010). Information systems strategy "reconceptualization, Measurement, and implications"

17. Chuttur, M.Y. (2009).Overview of the Technology Acceptance Model, Origins, developments and Future Directions," Indiana University, USA. Sprouts: Working Papers on Information Systems".
18. Davis,T. and Bourgeois (2014) Information Systems for Business and Beyond "Subtitle: A look at the technology, people, and processes of information systems"
19. Demeke ,W., Olden,A and Nocera,J. A. (2016) on factors affecting the adoption of information and communication technologies analysis.
20. Essa, M. (2017). Factors influencing ICT adoption in public healthcare organization in the case of Yekatit hospital.
21. Evans, J.D. (1996) Straightforward Statistics for the Behavioral Sciences
22. Finlay, A. and Adera, E. (2012) Application of ICTS for Climate Change Adaptation in the Water Sector, "Developing country experiences and emerging research priorities International Development Research Centre (IDRC)".
23. Gao, S. and Krogstie, J. (2011). Developing an instrument to measure the adoption of mobile services. PP.45-67
24. Guwahati, (2013). determination of appropriate Sample Size, V. 12.
25. Harris,J.,Howman,.D(2011). Information Systems for Water Resources Monitoring and Assessment.
26. Ibrahim ,A. Majed.,and Sadulah,J.(2016).The Role of Strategic Information System Characteristics on Customer Service Quality,V.3,Issue.2.
27. Imre, O. (2017).Adopting Information Systems,"Perspectives from Small Organizations", dissertations No.1895.
28. International, Inc.(2000).the real meaning of strategy.
29. ITU (2010). ICT as an Enabler for Smart "Water Management ITU-T Technology Watch Report ".
30. ITU (2014). Smart water management in cities,"ITU-T Focus Group on Smart Sustainable Cities".
31. Kebede, S.(2012). A methodology for the adoption of information systems in least developed countries (ldcs) "Case Study Ethiopia"
32. Kothari, C. R.(2004).Research Methodology, 2nd. New Delhi: New age international limited.

33. Melitski, J., Gavin, D., and Gavin, J. (2010). Technology adoption and organizational culture in public organizations.
34. Naing, T.(2006). Factors influencing the adoption of information system in private hospitals in Malaysia.
35. Navaz, V. M. (2013). Concepts and applications of management information Systems"Arabian Journal of Business and Management Review (OMAN Chapter)", 2(6).
36. Ndaw, M. F.(2015). Unlocking the Potential of Information Communications Technology to Improve Water and Sanitation Services
37. Ngechu, M. (2004). *Understanding the research process and methods*, an introduction to research methods, Acts Press, Nairobi.
38. Nyaga, R. (2007). Strategies adopted by the Nairobi city water and Sewerage Company.
39. Olushola, T., and Abiola, J. (2017). The Efficacy of Technology Acceptance Model A Review of Applicable Theoretical Models in Information Technology Researches. Journal of Research in Business and Management,4(11), pp: 70- 83
40. Otuke, J.O.(2013).Role of information communication technologies in water management.
41. Paul, J. H., Patrick, Y. K., Olivia, S. R., and Tam, K. (2012). Examining the Technology Acceptance Model Using Physician Acceptance of Telemedicine Technology
42. Paul, Ray J. (2010). What an Information System Is, and Why Is It Important to Know This" Journal of Computing and Information Technology" , 2, PP: 95–99
43. Porter,M.(2012). Computetive advantage.
44. Quin.A.(2012). Information. System and water management " Information systems which support water management – cases from rural water supply in Uganda and WFD implementation in the North Baltic River Basin District, Sweden"
45. Ramy , K., and Fathy, A.(2014) .The Role of ICT in Water Resource Management"
46. Silva, P. M. and Dias, G. A. (2007). Theories about technology accepentace "why the users accept or reject the information technology?"
47. Sundgren, B. (2005).what is a Public information system?.
48. Tadesse, K., Gebeye ,E. and Tadesse, G.(2014). Assessment of health management information system implementation in Ayder referral hospital, Mekelle, Ethiopia" International Journal of Intelligent Information Systems", 3(4): pp, 34-39.
49. Tam, (1992). capital-budgeting in information systems development, v. 23, (6), p. 345-357

50. Taylor, S., & Todd, P. A. (1995). Understanding information technology usage: A test of competing models. Information Systems Research, 6(2): 144-176,
51. Term, H. (2004). Statistical Analysis of Likert Data on Attitudes
52. Turner, M., Kitchenham, B., Brereton, P., Charters, S., and Budgen, D. (2009). Does the technology acceptance model predict actual use? A systematic literature review
53. United Nations World Water Development Report(UNWWDR),(2018). Nature-based Solutions for Water.
54. United Nations(1995) . Government Information System," Guide To Effective Use Of Information Technology In The Public Sector Of Developing Countries"
55. Valacich,J.and Schneider,A. (2010). *Information Systems Today*: "Managing in the Digital World, 6th Edition"
56. WASA, (2013). Water and sewerage authority of Trindad and Tobago, visiting,
57. Zabadi, A.M. (2016). Adoption of Information Systems (IS): "The Factors that Influencing IS Usage and Its Effect on Employee in Jordan Telecom Sector (JTS)", 11(3), P.25.
58. Pual, R. J(2010). "What an Information System Is, and Why Is It Important to Know This", Journal of Computing and Information Technology , 2, P.95–99.
59. Bagozzi, R. P and Warshaw, P. R(1989) "User Acceptance of Computer Technology: A Comparison of Two Theoretical Models," Manage. Sci., vol. 35, no. 8, pp. 982–1003.
60. Flamand,L.(2017). The limitation Social Cognitive Theory.
61. Truong,Y.(2009) "An Evaluation of the Theory of Planned Behaviour in Consumer Acceptance of Online Video and Television Services," Electron. J. Inf. Syst. Eval., vol. 12, no. 2, pp. 177–186.

APPENDIX B. COVERING LETTER ACCOMPANYING QUESTIONNAIRE

Dear Respondent,

I am a post-graduate student in the School of Information Science at Addis Ababa University, currently conducting a thesis research on the topic "Factors affecting the adoption information system at Addis Ababa Water and Sewerage Authority" in partial fulfillment of the requirements for the Master's degree.

The purpose of this self-administered questionnaire is to collect data in order to investigate the factors that affect the adoption of information system at AAWSA. Your responses will be kept confidential. The information that you provide me through the questionnaire would be of paramount importance to the research I am undertaking as well as to your organization. So fill this questionnaire carefully.

Thank you in advance for taking your valuable time in completing the questionnaire.

Sincerely,

Aman Demissie
School of Information Science
College of Natural Science
Addis Ababa University,
Mobile: +251930537009

Instructions:

Kindly answer the following questions fully by ticking the appropriate response in one of the boxes provided. Do not write your names anywhere in this questionnaire. Please be as honest as possible.

SECTION: A: Demographic Information

1. Gender Male [ ] Female [ ]

2. Your age bracket (Tick whichever appropriate)

20– 30 Year [ ] 31 - 40 Year [ ] 41- 50 year [ ] Over 50 [ ]

3. What is your educational level?

College Diploma [ ] Bachelors' degree [ ] master's degree [ ] PhD [ ]

4. Years of service/working experience in the authority

Less than **1** year [ ] **2** year [ ] 3 year [ ] **4** year [ ] 5 year [ ] more than **5** year [ ]

SECTION: B. Factors Affecting the Adoption of Information System at AAWSA.

5. Indicate your level of agreement with the following statements relating to Factors affecting Adoption of IS. Key Use a scale of **1-5,** where:

5= strongly agree

4=agree

3=moderately agree

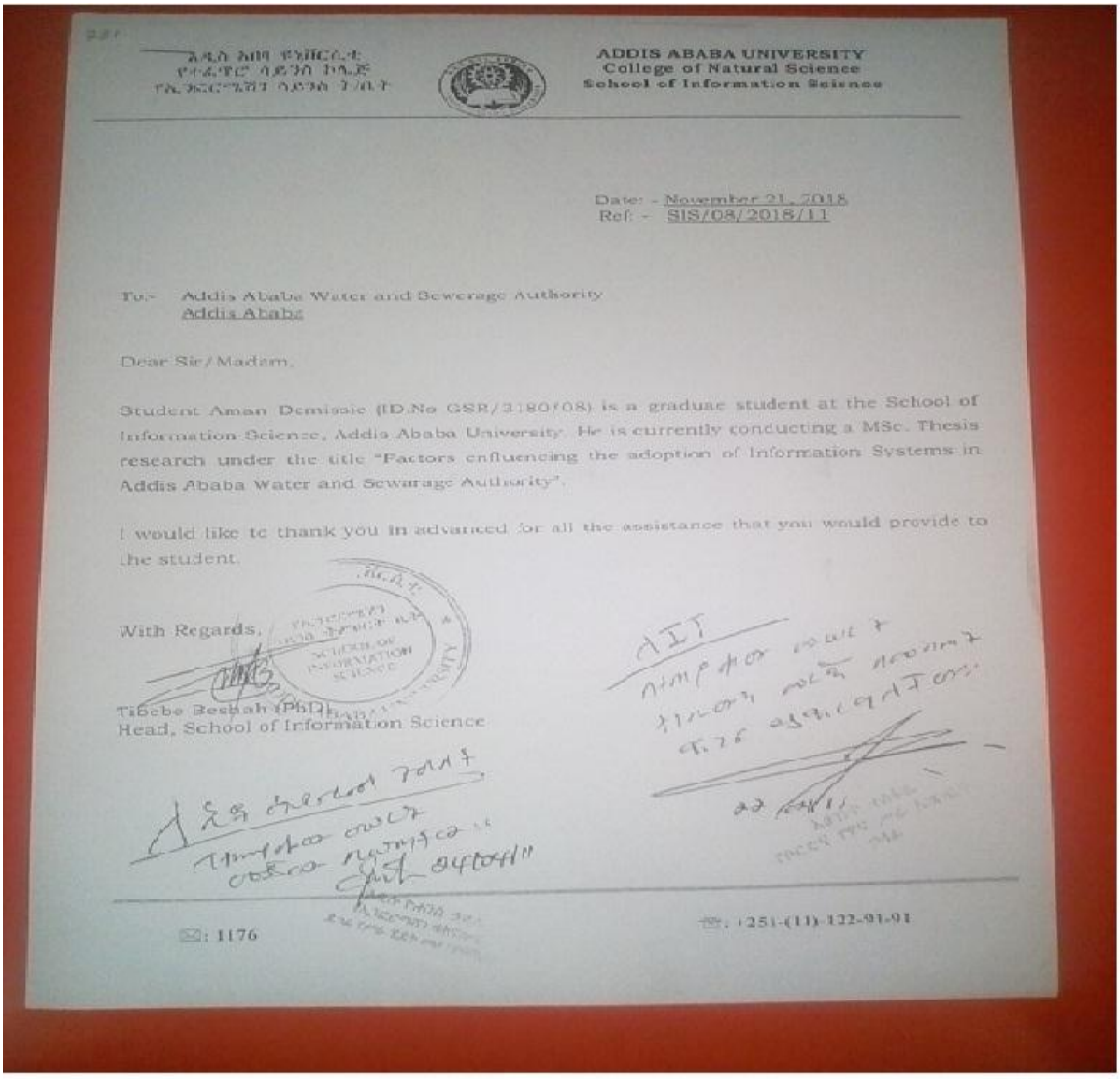
2=disagree

1=strongly disagree

Perceived Usefulness (PU) Related Questions **I could use IS…**	**Strongly disagree**	**Disagree**	**Moderately agree**	**Agree**	**Strongly agree**
PU 1. Information system would enhance the efficiency of my daily work.					
PU 2. IS would make it easier to keep truck of my weekly tasks.					
PU 3. IS would allow me to better schedule my time.					
PU 4.IS would be useful for me as an employee.					
PU 5. Information systems help to save resource and time.					
Perceived Ease of Use (EOU) Related Questions **I could use IS…**					
EOU 6. IS would easily find the information I'm looking for using the system.					
EOU 7. The user interfaces of the system is clear and intuitive.					
EOU 8.I would find IS flexible to interact with regarding requirements of business process.					
EOU 9. I would find IS easy to use (user friendly)					
EOU 10. IS is free of errors while using the system					
EOU 11. IS is easy to maintain and trouble shoot.					
Information System strategy(ISS) Related Questions **I could use IS…**					
ISS 12. there is information system strategy at the authority					
ISS 13. the authority's goal and objectives are accomplished by information system strategy					
ISS 14. IS strategy allows to accomplish the Authority's mission.					

ISS 15. IS strategy allows the authority to take competitive advantage					
ISS 16. IS allows to improve the authority's efficiency.					
Information System Infrastructure(ISI) Related Questions **I could use IS…**					
ISI 17. there is reliable internet connection					
ISI 18. There is communication and collaboration with clients and peers (website/intranet/extranet).					
ISI 19 services are delivered to customers properly and timely.					
ISI 20. Data and information are safe and secured.					
ISI 21. ARE materials like, software, cables, and computers, are purchased and delivered at the right time.					
ISI 22. The authority has fully functional website, so that employees and customers can access it.					
ISI 23.the information system infrastructure is well installed					
Information System Awareness(ISA) Related Questions **I could use IS…**					
ISA 24. A proper training is delivered before the actual usage of IS.					
ISA 26. If I had experience related to ICT/technology.					
ISA 27. There are peer to peer awareness creation mechanisms and opportunities to communicate and share knowledge among colleagues.					

APPENDIX C. PERMISSION LETTER



አዲስ አበባ ዩኒቨርሲቲ
የተፈጥሮ ሳይንስ ኮሌጅ
የኢንፎርሜሽን ሳይንስ ትምህርት ቤት

ADDIS ABABA UNIVERSITY
College of Natural Science
School of Information Science

Date: - November 21, 2018
Ref: - SIS/08/2018/11

To:- Addis Ababa Water and Sewerage Authority
Addis Ababa

Dear Sir/Madam,

Student Aman Demissie (ID.No GSR/3180/08) is a graduae student at the School of Information Science, Addis Ababa University. He is currently conducting a MSc. Thesis research under the title "Factors enfluencing the adoption of Information Systems in Addis Ababa Water and Sewarage Authority".

I would like to thank you in advanced for all the assistance that you would provide to the student.

With Regards,

Tibebe Beshah (PhD)
Head, School of Information Science

✉: 1176
☎: +251-(11)-122-91-91