ADDIS ABABA UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENT OF ACCOUNTING AND FINANCE

CHALLENGES AND APPLICABILITY OF ENERGY BILL SYSTEM IN ETHIOPIAN ELECTRIC UTILITY

BY

FEKADU KABA

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A THESIS FOR THE PARTIAL FULFILLMENT OF THE AWARD OF THE DEGREE OF MASTERS OF SCIENCE (MSC) IN ACCOUNTING AND FINANCE

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ADDIS ABABA, ETHIOPIA

STATEMENT OF DECLARATION

I hereby declare that this thesis entitled "Challenges and Applicability of Energy Bill System Ethiopian Electrical Utility Company", has been carried out by me under the guidance and supervision of Temesgen Worku (PhD). The thesis is original and has not been submitted for the award of any other degree in any other university all the sources used for the research has been duly acknowledged.

Researcher's Name	Date	Signature
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STATEMENT OF CERTIFICATE

This is to certify that the thesis entitles "Challenges and Applicability of energy bill system Ethiopian electrical Utility", submitted to Addis Ababa University College of Business and Economics Department of Accounting and Finance for the award of the Masters of Accounting and Finance and is a record of bona fide research work carried out by Fekadu Kaba, under our guidance and supervision. Therefore, I hereby declare that no part of this thesis has been submitted to any other university or institutions for the award of any degree or diploma.

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ABSTRACT

The purpose of this study is to identify challenges and applicability energy bill system EEU. The study guided by the following specific objectives: To assess the energy bill system applicability and challenges in Ethiopia Electric Utility. Both qualitative and quantitative research approaches were used in this study. The researcher used primary and secondary data. Primary data collected using systematic random sample of all professional categories of Ethiopia Electric Utility Head office staff and secondary data gathered from customer service manual and bill collection manual Ethiopia electric utility document. 264 sample respondents were selected from region office and CSCs. The data were analyzed using SPSS version 26. The descriptive result of the study shows the majority of customer CSCs. the descriptive statistics such as frequency, percent, mean and standard deviation was used for describing the characteristics of respondents and the dependent and independent variables. The findings of the descriptive statistics: further those have a positive and significant effect on the challenge and applicability energy bill system Ethiopian Electric Utility while customer type, income and educational level were found to be insignificant in this study. In addition to this age has a negative and significant relationship with the challenge and applicability energy bill systems. Finally, based on the findings, feasible recommendations were provided. Among them, address connectivity issues as a priority. Improve payment system reliability and expand customer support channels, offering alternative communication options for accessibility. Further, ensure prepaid cards are widely available and reduce infrastructure costs to facilitate adoption by small and medium businesses. Collaborate with regulatory bodies to gain support for new payment systems.

Keywords: *challenges and applicability energy bill system Ethiopian Electric utility (the complexity of the company's tariff structure).*

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LIST OF ACRONYMS

ATM	Automatic Teller Machine
AAWSA	Addis Ababa Water and Sewerage Authority
CBE	Commercial Bank of Ethiopia
CMS	Customer Management System
CSCS	Customer Service Centers
CBR	Customer Banking Representatives
E Or e	Electronic (As in e-Bill, e-Commerce, E-Banking, E-Payment, E-Wallet)
ETB	Ethiopian Birr
EEPCo	Ethiopia Electric power corporation
EEU	Ethiopian Electric Utility
GSM	Global System for Mobile
KWH	Kilo-Watt-Hour
SPSS	Statistical Package for Social Sciences

CHAPTER ONE

1. Introduction

This introductory part introduces five subtopics. The first section presents the background of the study, putting an emphasis on the area of focus for the study. The next section is the statement of the challenges and applicability of the energy bill system in the Case of EEU, which consisted of five chapters. Under this chapter, the study background on EEU and the problem statement have been presented. The next section in this regard involves discussing the significance, scope, limitation, and organization that have been documented in the development of the said study.

1.1. Background of the study

In the Ethiopian Electric Utility, electricity revenue is collected in two ways postpaid and prepaid. Sales are made either in cash or on credit. Adoption of prepaid billing system in revenue collection eventually witnessed the company's shift towards a pre- paid system where customers are required to purchase electricity in advance (Obura, et al., 2012).

To providing a quality service is therefore about meeting and even, depending on the company's capability, excelling customers' expectation. In other words, it is the difference between expectation prior to the service encounter and the actual perceived service that the company provides, making it to be reliant on the customers satisfaction/service experience. Therefore, this paper will try to analyze and asses the challenges of service quality in Ethiopian Electric Utility while trying to measure and focus on prepayment customer service (Akele, 2012).

The company has been undergoing various continued transformations, such as via Customers' Management System, decentralization of Accounting and Billing system from once highly centralized down to the regional distribution offices, districts, and CSCs, and Prepayment (Metering) System, in an effort to realize its long term strategic vision of ''becoming a center of excellence in providing quality electric service to everyone's doorstep and being competitive in energy export.'' The corporation has also set a mission of ''providing adequate and quality electricity generation, transmission, distribution, and sales services, through continuous improvement of utility management practices, and responsive to the socio-economic development and environmental protection needs of the public (Grönroos, 2008).

Conventional Metering System customers normally pay their electric consumption at the end of every month's consumption following after the lengthy process of bill preparation that involves manual meter readings (meter reading technicians), feeding the collected readings in to a computer at every CSC and /or districts, depending on the access to CMS and the number of customers, and finally preparing it all for data processing at a centralized data (bill) processing unit, which is found at the headquarter. Once the bills are ready for sell, they will be dispatched to CSCs, districts and Regional Offices, where then customers would pay for their regular consumptions at a predefined dates. This long process of bill preparation has been costly both for the corporation and more importantly for its customers as it involves a number of human and non-human errors, such as inaccurate readings, inputting errors, and preparation of wrong billing amounts, delays in bill preparation, swapping customers' bills, which result in unusually high or low bill amount than their actual consumptions, right from the collection of readings up to the sales of the bills. (Akele, 2012)

1.2 Statement of the problem

The present traditional billing system has many problems like problem of payment collection, energy thefts etc. due to which the traditional billing system is slow, costly and unreliable. The present billing system has chances of error and it is also time or labor consuming. The paper suggests a design of digital energy meter for improved metering and billing system. Poly-phase prepaid energy metering system has also been proposed and developed based on local prepayment and card reader. So it is essential to develop a billing system which solves the problem of billing manually and also reduces the manpower (Gourd,2014)

The Ethiopian Electricity utility announced in 2017 that it had bought modern technology for 60 million dollars; it has introduced a new energy bill system to enable them to pay their monthly energy bills online as an alternative to banks and CBE Birr (Capital News, 2024). The energy bill system plays a crucial role in the operations of utility companies like EEU. However, there are several challenges and considerations related to its applicability. Here are some key points to consider.

Ensuring the accuracy of meter readings and billing calculations is essential for building trust with customers. Inaccurate billing can lead to disputes, delays in payments, and a negative perception of the utility company's services. High levels of non-payment EEU may face challenges in collecting payments from customers, leading to financial difficulties for. This can be due to a variety of reasons, such as affordability issues or lack of awareness about energy conservation. Data management efficient data management is crucial for accurate billing and effective customer service. EEU should invest in robust data management systems to handle the increasing volume of customer data, ensure data security, and streamline billing processes.

One of the challenges of implementing and controlling a bill collection system in the Ethiopian Electric Utility Company is the complexity of the company's tariff structure. The company different types of customers such as residential, commercial, and industrial customers, each with its own pricing structure and billing requirements complexity of the tariff structure can make it difficult for customers to understand their bills, leading to disputes and delays in payment. This can impact the efficiency of the bill collection process and result in revenue losses for the company.in additionally; Managing and updating these tariff plans in the bill collection system can be complex and require careful coordination between different departments within the company.

Therefore, in order to determine and prioritize the main problems of electric bill payment that leads to customer complaints. To overcome these challenges addressing these challenges, the energy bill system can become more applicable and contribute to the efficient operation of the Ethiopian Electric Utility Company.

1.3 Basic Questions

I. How is the energy bill system applicability in Ethiopia Electric Utility?

II. What are the challenges of Ethiopia Electric Utility energy bill system?

1.4. Objectives of the study

1.4.1. General Objective

The general objective of this study is to describe the challenges and applicability of energy bill system of Ethiopian Electric Utility Company.

1.4.2. Specific Objectives

The specific objectives of this study are:

III. To assess the energy bill system applicability in Ethiopia Electric Utility.
IV. To assess the energy bill system challenges of Ethiopia Electric Utility.

1.5. Significance of the Study

This research may help the EEU to enhance the effectiveness of collecting consumer energy bills by recognizing and solving problems associated with the energy bill system. An effective energy bill system, through its timely and accurate provision of billing information, lead to higher consumer satisfaction. The customers would be more likely to pay on time if they trusted the billing procedure of the utility company. Utility Firm Utility firm may, in turn reduces the cost of human processing, late payments, and billing errors by application of an effective bill system. Without fines the research can also help the utility firm avoid imposition of fines and other legal consequences arising because of issues related to regulatory compliance and accelerate the energy bill process by saving time and resources.

Ensuring that the bill system meets all regulatory requirements is essential for the company's long-term success. A well-managed bill collection system can have a positive impact on the utility company's financial performance. By increasing revenue collection and reducing costs, the company can improve its overall financial health and sustainability. Furthermore, this study provides valuable insights to policy makers, financial institutions, strategies that use of online payment system. Finally, the information, data and results of this research can be a base for future researchers as a material to review.

1.6. Scope of the Study

The study focused on the challenges faced by the Ethiopian Electric Utility Company in implementing and controlling its bill system. It included an analysis of technological limitations, data management issues, staff training and capacity building, resistance to change, and regulatory compliance challenges. The study examined the significance of addressing these challenges in improving efficiency, enhancing customer satisfaction, achieving cost savings, ensuring regulatory compliance, and improving financial performance. The research involved gathering data from the EEU bill processes, interviews with key stakeholders and a review of relevant literature on bill systems in the utility sector.

The study provides recommendations for overcoming the identified challenges and improving the bill collection implementation and control system in the EEU. The geographical scope of the study limited to the operations of the Ethiopian Electric Utility Company within Ethiopia. The study focused on the current state of the bill system and potential areas for improvement, rather than historical or future projections.

1.7. Limitations of the Study

The study faced limitations in accessing confidential or sensitive data related to the EEU energy bill system. The research limited by the availability of key stakeholders for interviews and the willingness of participants to share information openly. The study constrained by time and resource limitations, which could affect the depth and breadth of data collection and analysis. The findings and recommendations of the study are specific to the context of the Ethiopian Electric Utility and not directly applicable to other utility companies or industries. The study limited by the researcher's own knowledge and expertise in the field of bill systems and utility operations. The scope of the study did not cover all possible challenges faced by the EEU in implementing and controlling its bill system, as some issues were not identified or included in the research. The study limited by external factors such as changes in regulations, policies, or market conditions that could impact the findings and recommendations.

1.8. Organization of the Study

This study is organized into five chapters. The first chapter is introduction, which consists of background of the study, statement of the problem, and objective of the study, significance of the study, scope and limitation of the study. The second chapter includes related literatures review; the third chapter describes the methodology used while preparing this paper. The fourth chapter is about analysis and discussion and finally chapter five comes up with the summaries and conclusions of the findings and forwards recommendations.

CHAPTER TWO

2. Review of Related Literature

The purpose of this chapter is to review the literature in the area of energy bill system and mainly focused on the challenges, and applicability energy bill system in the Case of Ethiopian Electric Utility Company. This review of literature establishes a framework, which can guide the study. The review has seven sections. Section 2.1 Billing system 2.2. Utility bill system in Ethiopia 2.3.Basic structure of a billing system, 2.4 Components of Electricity Bill, 2.5 Meters technology, 2.6. Meters technology , 2.8. Commercial Use & Home Energy Monitoring, 2.7. Electricity tariffs. And 2.8. Customer behavior, Relationship marketing and Prepayment adoption

2.1 Billing system

Paper bills are now the primary channel of communication between companies and their customers. However, their potential for personalization is limited, and they are not interactive. If a customer wants to react to something in his paper bill – for example, to make a customer service inquiry or to order a new service – he must make a telephone call. Internet Billing promises far more than a new and inexpensive way to deliver billing information. Industry experts predict that Internet Billing will fundamentally change the way companies interact with their customers. Eventually, the Internet Bill will be an interactive entry to a host of additional services including customer self-care, automated sales one-tone marketing (Al-Ani, 2012).

2.2. Utility bill system in Ethiopia

Households in Ethiopia are required to visit the various utilities' offices separately to pay their monthly bills. In 2013, a unified utility payment system (implemented through a public-private partnership) was introduced. The partnership arrangement created a unified billing system, 'Lehulu'(meaning 'for everyone' and 'for all services'), that replaced the independent utility payment centers for EEU, Ethio Telecom and AAWSA. The single window service allows customers to pay all their utility bills in one place, thereby reducing travel costs (Abera, 2016). Although 'Lehulu' was a unified utility payment system, customers still have to settle their utility payments in person, which often involves lengthy queuing. Due to this challenge, it is common for households to pay a ’bill messenger’ to make their utility payments at the relevant utility office or ’Lehulu’ center in exchange for around 10Birr (0.3 USD) per transaction. The one-stop service was also only available in three cities of the country, namely: Addis Ababa, Bahir Dar, and Mekelle; it covered only a relatively small proportion of the country’s population. The unified payment system came to an end in 2020 and recently the Commercial Bank of Ethiopia, a state-owned and the largest commercial bank in Ethiopia, started collecting utility bills in Addis Ababa at the branches through the tellers and via its mobile banking application, CBE Birr (Eleni , 2021).

2.3. Basic structure of a billing system

Basic structure of a billing system In order to understand and compare various billing platforms it is logical to start by taking a look at what the most usual methods and principles centered around billing system have in common. By forming an idea of a typical billing system it is easier to spot differences in services that deviate from the common pattern and aim to set them apart among competition. Even the basic structure of a billing system can be divided into several categories, showing the typical questions that billing system designers have to face during the design and initiation of their service. Two most basic types of billing engines are hosting billing and Telco billing. Hosting billing is basically subscription billing with a fixed amount each month on a single bill, compared to Telco billing, where the billing is based on numerous meters and records. The name comes from resemblance to practices that telephone companies have. This thesis mostly focuses on telco billing, due to fixed price billing being much simpler subject because of less variables used (Tero, 2014).

2.3.1. Manual Billing System

In the manual system, human labor plays an important role in taking note of customer’s consumed unit and its management. In this system, employees from the electricity service provider visit customer’s home once in a month, take the meter readings and submit to their billing offices. The electricity board officer generates bills by these meter readings. The accuracy of this system is most times not reliable. The system has no consistent means of keeping customer’s records and this allows poor access to billing records. Also, research carried out in revealed that 38% of the analogue meters that assist in this manual system were installed between eleven to twenty-one years ago. The study equally revealed that poor and unreliable power supply and often the bills issued by electricity service providers are based on estimates, thus contributing to poor consumer's response to payments of electricity bills. This system is inaccurate, costly and slow and lacks flexibility as well as reliability (Ebem, 2018).

2.3.2. Estimated Billing System.

In the Nigeria electricity distribution companies, some of the consumers are unmetered. This circumstance has continued despite efforts by the Nigerian Electricity Regulatory Commission (NERC) to reduce the gap in recent years. The problem of billing out-of-the meter gave room for estimated billing which was often against the electricity consumers. Under asymmetric billing pattern, consumers are faced with estimated bill, which does not depend on actual energy consumed. In the bill, the charged amount of energy consumed remains same for all customers under the same classification within a district, town or state. This is true irrespective of the variation in actual amount of electricity consumed by the persons concerned or the size of the buildings/household. According to electricity consumers alleged that distribution companies decided not to supply meters and uses estimated billing system as an avenue to extort energy consumers even when they do not enjoy constant power supply. Furthermore, energy consumers while condemning the system of estimated billings adopted by distribution companies said their pay do not reflect their consumption per month (Okebanama, 2018).

2.3.3. Prepaid Billing System

The incessant disagreement of customers and poor response to payment of electricity bills in Nigeria led to the introduction of prepaid billing system. However, there have been problems that have risen from this innovation. Though, researchers within and outside Nigeria have been working to improve this system. According to the present prepaid billing pattern in Nigeria is a well-established technology being introduced by many utility companies. It is a system where a customer pays for energy before using it but with numerous disadvantages ranging from: difficulty on tariff charge change, poor customer record keeping and difficulty in recharging the meter most times. Researchers have further designed systems to improve this existing system. In a system that uses Global System for Mobile (GSM) communication an optical fibre for transmitting customers consumed unit was proposed. A microcontroller is used as the smart card and the number of units recharged by the customer is written in it. But changing of the tariff is not remote or automation and recharging it is complicated most times (Okebanama, 2018).

2.3.4. Smart Meter Based Billing Systems

Smart meter billing system is the most recent power measuring device that is presently in use in most countries of the world. Different authors continued to propose new methods of improving the existing systems. In a system that can automatically send the consumed unit by a customer digitally to the billing office with the assistance of the GSM modem once in a day, the system equally generates a report and sends to the service provider once in a day through SMS. This system can be used to check the last units consumed by a consumer, with the demand request sent by the user through the same method. This system uses General Packet Radio Service (GPRS) technology provided by GSM networks. It only sends customer bills to them and they make payments in their distribution offices or in the bank. A system that uses a camera to capture customers consumed unit was proposed in. The camera is fixed in front of the meter to take snapshots. The captured image processed and the consumed units extracted. The bill amount is calculated and is sent to the customer as SMS via GSM module. The consumed unit is later sent to the billing office for documentation purpose. MAT lab enabled software is used to extract the number from the camera and store it as a variable. The meter's previous month's reading is subtracted from the present month's reading for accurate billing. The difference thus obtained is multiplied by the tariff and converted into electricity bill. The system keeps records of its present reading for calculating next month's readings based on the method (Arinze, 2018).

2.4. Components of Electricity Bill

Electricity bill is an important document for any electricity consumer to understand electricity charges, a pattern of consumption, and the impact of efficiency measures. It is also important to know various components of the bill to know their respective contribution to the total bill to ensure transparency in billing by distribution companies (Discoms). It has been seen that most of the consumers are oblivious of the tariff categories, codes, surcharges and duties levied in the electricity bill. This document attempts to inform the consumer about the electricity bill, its various components, and codes (Bask research foundation, 2020).

2.4.1. Consumption (Kilo-Watt-Hour)

Units consumed are the number of kWh (Kilo-Watt-Hour) consumed in a month. 1 kWh is equivalent to keeping a 100 Watts bulb on for 10 hrs. This information is calculated by finding the difference between meter readings of two consecutive months. This is the total monthly consumption by all the appliances that are connected to the meter. This is the value that needs to come down in order to reduce the electricity bill. An observation of consumption history can give an indicator of the appliances having higher electricity consumption (typically Air Conditioners increase consumption in summers (Bask research foundation,2020).

2.4.2. Tariff / Category

Category in the bill determines if the connection is domestic, agricultural, commercial or industrial. Tariff and Category determine the rate structure applicable on the bill. Typical tariff codes are four digit numbers allotted to different cases under each connection category. Domestic consumer's tariff code starts with with 1xxx and for Agricultural consumer, it starts with 4xxx. Recently, new tariff codes starting with 9xxx have been given to special cases of the Agricultural connection. Category in the bill determines if the connection is residential, commercial or industrial. Different rates/slabs are applicable for different tariff codes and thus it is important to validate that the right tariff code is applied on the electricity bill (Bask research foundation, 2016).

2.4.3. Load Factor

This is different from Power Factor. Some utilities base the charges on the customer's load factor. Load factor is a measure that describes how level, or consistent, the customer's electrical usage is throughout the month. For instance, a facility that used the same amount of electrical power day and night for a month would have a load factor of one. This is good from the utilities' standpoint (easy to plan capacity). A facility that uses a significant amount of energy for a few hours, and then shuts down for long periods (for example a church), would have a low load factor. One way to calculate a monthly load factor is to divide the month's total kWh by the maximum measured month's demand (kW) times 720 hours in the month (Scott,2017).

2.5. Meters technology

An electricity meter, electric meter, electrical meter, or energy meter is a device that measures the amount of electric energy consumed by a residence, a business, or an electrically powered device**.** .Electric utilities use electric meters installed at customers' premises for billing purposes. They are typically calibrated in billing units, the most common one being the kilowatt hour (kWh). They are usually read once each billing period. Basic unit of power is watts**.** One thousand watts is one kilowatt. If we use one kilowatt in one hour, it is considered as one unit of energy consumed. These meters measure the instantaneous voltage and currents, calculate its product and gives instantaneous power. This power is integrated over a period which gives the energy utilized over that time period. These may be single or three phase meters depending on the supply utilized by domestic or commercial installations. For small service measurements like domestic customers, these can be directly connected between line and load. But for larger loads, step down current transformers must be placed to isolate energy meters from higher currents (Nwagbo, 2022).

2.5.1. Purpose of Metering

Automatic electricity billing is a technology in which information is collected from the energy meter. Bill is calculated from the meter itself and the bill is then sent to the electricity board and the customer. To achieve this, a camera is placed in front of the energy meter of every house. The camera takes the image of the reading shown in the energy meter on a specific date of every month. The image is then processed using MAT lab software to extract the number from reading and store it in a variable. Previous month's reading is thus subtracted from this month's reading. The difference thus obtained is multiplied by the tariff and converted into electricity bill. The bill calculated is then being sent to the customer and to the electricity board via SMS using a GSM module. This month's reading is stored into the database for calculating next month's reading (Antony et al., 2016)

2.5.2. Type of Electrical Meters

An energy meter or electric meter is a type of device that can measure the amount of units consumed by the consumer. The basic type of energy meter, measures the energy in kilo-watt hours. There are two types of energy meters analog and digital. In Pakistan PEL manufactures energy meters are widely used under the licensed from ABB (USA).The quality of these meters are certified by KEMA laboratories (Holland).These meters are electro-mechanical meters and they are widely used for commercial as well as residential purpose (Mehmood et.al.,2011)

2.6. Electronic Energy Meters

These are of accurate, high procession and reliable types of measuring instruments as compared to conventional mechanical meters. It consumes less power and starts measuring instantaneously when connected to load. Electronic meters display the energy used on Liquid Crystal Display or Light Emitting diode display, and some can also transmit readings to remote places. These meters might be analog or digital. In analog meters, power is converted to proportional frequency or pulse rate and it is integrated by counters placed inside it. In analog type meters, voltage and current values of each phase are obtained by voltage divider and current transformers respectively which are directly connected to the load. For digital electric meter power is directly measured by high end processor. The power is integrated by logic circuits to get the energy and also for testing and calibration purpose. It is then converted to frequency or pulse rate. Digital Energy Meters are the 2nd generation of Energy Meters. These meters digitally measure the energy and other factors like voltage, current, instantaneous Power and show them on a Liquid Crystal Display. They can store energy consumption data up to 2 years' in EEPROM (electrically erasable programmable read only memory) (Nwagbo and Baah, 2022).

2.6.1. Smart Energy and Prepaid Energy Meters

It is an advanced metering technology involving placing intelligent meters to read, process and feedback the data to customers. It measures energy consumption, remotely switches the supply to customers and remotely controls the maximum electricity consumption. Smart metering system uses the advanced metering infrastructure (AMI) system technology for better performance

Figure 4 are capable of communicating in both directions. They can transmit the data to the utilities like energy consumption, parameter values, alarms, etc and also can receive information from utilities such as automatic meter reading system, reconnect/disconnect instructions, upgrading of meter software's and other important messages. These meters reduce the need to visit while taking or reading monthly bill. Modems are used in these smart meters to facilitate communication systems such as telephone, wireless, fiber cable, power line communications. Another advantage of smart metering is complete avoidance of tampering of energy meter where there is scope of using power in an illegal way. They can not only measure energy units but also send those units to the utility company through some communication medium like GSM/GPRS, Radio Frequency, PLC (Power Line Communication). Through these mediums company can control the load of consumer as well. While doing these basic responsibilities, these meters can also be used for load management and load forecasting purposes (Barida, 2022).

2.6.2. Energy meters metering

Electronic meters now use low-power radio, GSM, GPRS (General Packet Radio Service), Bluetooth as well as RS-485 wired link. The meters can now store the entire usage profiles with time stamps and relay them at a click of a button. The demand readings stored with the profiles accurately indicate the load requirements of the customer. This load profile data is processed at the utilities for billing and planning purposes. AMR (Automatic Meter Reading) and RMR (Remote Meter Reading) describe various systems that allow meters to be checked without the need to send a meter reader out (Nwagbo, 2022).

2.6.3. Time of day metering

Time of Day metering (TOD), also known as Time of Usage (TOU) or Seasonal Time of Day (SToD) metering involves dividing the day, month and year into tariff slots and with higher rates at peak load periods and low tariff rates at off-peak load periods. While this can be used to automatically control usage on the part of the customer (resulting in automatic load control), it is often simply the customer's responsibility to control his own usage, or pay accordingly (voluntary load control). This also allows the utilities to plan their transmission infrastructure appropriately. TOD metering normally splits rates into an arrangement of multiple segments including on-peak, off-peak, mid-peak or shoulder, and critical peak. A typical arrangement is a peak occurring during the day (non-holiday days only), such as from 1 pm to 9 pm Monday through Friday and from 6:30 am to 12 noon and 5 pm to 9 pm. More complex arrangements include the use of critical peaks which occur during high demand periods. The times of peak demand/cost will vary in different markets around the world. Large commercial users can purchase power by the hour using either forecast pricing or real time pricing (Baah, 2022).

2.6.3.1. Remote metering

The idea of remote metering was born in the 1960s. Initially, remote pulse transmission was used, but this has gradually been replaced by using various protocols and communication media. Today meters with complex functionality are based on the latest electronic technology, using digital signal processing, with most functions being implemented in firmware (Nwagbo, 2022).

2.6.3.2. Standards metering

The need for close co-operation between manufacturers and utilities was achieved relatively early. The first metering standard is the ANSI C12 Code for electricity metering was developed as early as 1910. Its Preface says: “While the Code is naturally based upon scientific and technical principles, the commercial side of the metering has been constantly kept in mind as of very great importance”. The first known IEC metering standard, Publication 43, dates from 1931. The high standard of accuracy is an outstanding characteristic that was established and maintained by the metering profession. Leaflets from as early as 1914 feature meter with an accuracy of 1.5% over the measuring range of 10% or less to 100% of maximum current. IEC 43:1931 specifies accuracy class 2.0. This accuracy is still seen as adequate for most residential applications today, even for static meters (Baah, 2022).

2.6.3.3. Power export metering

Many electricity customers are installing their own electricity generating equipment, whether for reasons of economy, redundancy or environmental reasons . When a customer is generating more electricity than required for his own use, the surplus may be exported back to the power grid. Customers that generate back into the "grid" usually must have special equipment and safety devices to protect the grid components (as well as the customer's own) in case of faults (electrical short circuits) or maintenance of the grid (say voltage on a downed line coming from an exporting customer’s facility). This exported energy may be accounted for in the simplest case by the meter running backwards during periods of net export, thus reducing the customer's recorded energy usage by the amount exported. This requires a "smart grid," which includes meters that measure electricity via communication networks that require remote control and give customers timing and pricing options. Vehicle-to-grid systems could be installed at workplace parking lots and garages and at park and rides and could help drivers charge their batteries at home at night when off-peak power prices are cheaper, and receive bill crediting for selling excess electricity back to the grid during high-demand hours(Baah ,2022).

2.7. Electricity tariffs

Electricity tariffs are the process of charging consumers for using electricity. Electricity tariffs now play a vital role in the electricity retail market, as they are considered the main aspect influencing consumers’ decisions. Additionally, they are crucial for boosting competition in the electricity market. Electricity pricing varies between countries or between regions within a country. In order to design electricity tariffs, there are various factors which influence electricity

pricing , such as the cost of producing electrical energy at the power plant, the cost of capital investment in transmission and distribution networks, the cost of operation and maintenance of delivering electrical energy, and a reasonable profit on the capital investment. “Reasonable” may be explained considering the electricity market competition principle, this profit is added to the price of generating and supplying electrical power and ensures the continuity and reliability service of the company supplying electricity to purchasers. The profit should be modest and limited to about 8% every year **(**Dina et al., 2022).

2.7.1. The electricity tariff reform in Ethiopia

Background to the electricity tariff reform in Ethiopia As indicated in the introduction, the electricity tariff rate for Ethiopia was the one of the lowest in the world (4–6 US cents per kWh) until December 2018. The Government of Ethiopia has repeatedly revised the tariff rate for both residential and non-residential customers since December 2018. The EEU is responsible for revising and implementing new tariff rates. Looking at the tariff rate for micro and small firms (which belong to the LV industrial category in Figure 1, and which are the focus of this study), the tariff rate has changed significantly. For example, compared to the base tariff rate in 2016/17, the 2018 tariff increased by more than 41%. In December 2019, it increased by 82.5% compared with the base tariff rate; the rate increased by 29.2% compared to the December 2018 rate. The tariff rate increased by 124% and 165% in December 2020 and December 2021 respectively, compared to the base tariff rate. Thus, the tariff rate had increased by 165% in December 2021 compared with the base rate that existed before the December 2018 increase. This does not include the demand charge, which was not included before the tariff reform. The demand/service charge was ETB 50 per month in December 2018, which then increased by 50 ETB every year to reach 200 ETB per month in December 2021. Unlike the rate for the commercial or general business, this service or demand charge is the same for both pre-paid and post-paid meter users (Abebe, 2022).

2.7.2. Component of Electricity Tariffs

In the last decade, many tariff types have been introduced. Tariffs differ according to the method of their calculation and the factors included in them. Tariffs can be main categories, energy-based and power-based. (Dina et al., 2022).

Flat rate tariffs: A price for each unit of electricity consumed, regardless of when it is used, plus a daily supply charge Time-of-use tariffs: Higher usage charges that apply during the peak period with lower usage charges applied to the rest of the time, plus a daily supply charge. Some have a third intermediate or ‘shoulder’ usage rate between peak and off-peak times. The time-of-use tariff incentivizes customers to shift some of their usage (for example pool pumps, dish and laundry washing, battery energy storage systems or electric vehicle charging, or other discretionary loads) to non-peak time to save on their bills. Some have the cheapest rate during the day which may be particularly useful to customers wanting to charge battery energy storage systems or electric vehicles.

2.8. Type Electricity Meter Tariffs

2.8.1. Flat rate tariff meter

In one form or another, this type of meter is the most commonly used? Turning the coin knob in this type of meter after the insertion of a coin in the slot advances a mechanical credit register the appropriate amount, and also closes the switch if it is not already closed. The coin is also registered on a counter which indicates the total number of coins inserted since the meter's installation. As the meter registers energy consumption, a linked gearing arrangement causes the credit register to progress towards zero when zero is reached a tripping device operates and causes the switch to break the supply. A differential device prevents interference between the coin mechanism and the metering register. The coin register drives the credit counter upwards when coins are inserted, but with no effect on the meter register, while the meter register drives the credit counter downwards with no effect on the coin mechanism. The force required to open and close the switch is provided by a strong spring, which is charged by the consumer turning the coin knob and discharged by a trip mechanism on the credit register when it reaches zero. Meter manufacturers adopt one of two ways of allowing for unit price changes. In one design the gearing between the coin knob and the credit counter could be altered; in the other it is the gearing between the meter register and tile credit counter. Either way allows the number of units per coin to be adjusted to suit the tariff (Alpha F,2014)

2.8.2. Two-part tariff - Fixed Rate Type

The next major development in prepayment metering is the Two Tariff-Fixed Rate type. This meter also incorporates a continuously running, constant speed motor. The motor is attached to the credit register via a differential gearing arrangement with a meter register. The mechanism used to calculate credit is the sum of the speeds of both the motor and the meter register through the differential gearing. The motor itself comprises the fixed charge collector. Running continuously through the differential gearing, it reduces the available credit in the meter even when energy is not being consumed. Because the motor runs at a constant speed, credit in the meter is reduced at a fixed rate per hour in addition to the number of units consumed, with a range of gears allowing for different fixed prices to be set (Alpha F.2014)

2.8.3. Two-part tariff - Variable Rate Type

This meter has replaced the fixed charge motor with a second gearing system connected to the coin mechanism. Insertion of coins diverts a proportion of the money to the credit register and the rest to affixed charge register, reducing the pre-set sum of money owed. When the fixed charge register reaches zero the associated gearing is disengaged from the coin mechanism, so that all future coins inserted are used only for consumption. The disadvantage with this type of meter is that it makes electricity seem very expensive during the period that the fixed charge is being repaid (Alpha F.2014)

2.8.4. Double tariff, Current Change-Over Type

Here the load current passes through a relay in addition to the load switch and current coil. The relay is designed to change the gearing between the meter register and the credit register depending upon its position. The solenoid remains in the off position when load currents are low (e.g. lighting only) and the customer pays a rate that is low per unit. When the load current increases to a certain level the solenoid operates causing the gearing between the meter register and the credit register to change consequently reducing the consumer's charge per unit. This allows consumers to use heavy loads, such as irons, radiators and water heaters, at a reasonable cost, yet enabling the suppliers to obtain a fair price per unit when only lighting is being used (Alpha F.2014)

2.8.5. Double tariff, time Change- over Type

Similar in operation to the current changeover meter, this meter employs a clock mechanism to change the gearing between the meter register and the credit register at certain fixed times of the day or night. Suppliers can thus offer their consumers low rates per unit at night and other off-peak periods. Consumers thus benefit from the lower unit prices for their consumption, whilst suppliers benefit from improved load factors. Electrolytic Prepayment Meter. It consists of a glass cell or jar containing a quantity of copper nitrate solution and a fixed plate of copper acting as a cathode. The anode is provided by a strip of copper wound round a bobbin, which is fed aShort length at a time into the electrolyte by the insertion of coins. The consumer's load (up to 4 amperes) passes through the cathode, anode and electrolyte, which results in the anode being dissolved and the copper being deposited on the cathode. Eventually, the anode would dissolve sufficiently to break the circuit at the surface of the liquid and is only remade by the consumer inserting more coins, causing more copper strip to be immersed into the solution. This meter suffers from a number of disadvantages. If overloaded, the copper deposited on the cathode has a tendency to become uneven and 'trees' often forms which eventually result in the electrolyte being short-circuited. The copper strip has to be replaced when used up and every two years or so the cathode has to be replaced and the electrolyte filtered and topped up customer service (Bitner et al., 2010).

Many Companies now have customer service centers Worldwide, allowing them to seamlessly offer customer service 24 hours per day and 7 days per week. Technology has also allowed customer service to move from employee-directed to (customer) self-directed through self-service technologies in a variety of industries, such as retail (e.g., grocery stores self-checkout lanes), travel (e.g., airline self-service check-in kiosks), fnance (e.g., automated voice response systems), and entertainment (e.g., movie rental kiosks). Mobile technology has allowed not only consumers to receive customer service from virtually anywhere (e.g., changing lights at the airport on a smartphone after an unexpected cancelation) but also frontline employees to provide customer service from virtually anywhere (e.g., sales staff at a furniture store carrying tablet computers with them to place orders, check inventory, and view product Specifications on the spot). The famous case of United Airlines breaking a musician’s guitar and the poor customer service that ensued serves as a prime example, with the musician’s YouTube video quickly going viral with more than 11Million views. The lesson for businesses is clear: they must pay attention to customer service orPay the price for negative word of mouth that has become amazingly easy to spread. Fortu-nately, technology also allows companies to be more accountable through tracking customer service and customer feedback in real time and measuring internal operations more effectively, allowing businesses to dynamically monitor andimprove customer service (Bitner et al., 2010).

2.9. Customer behavior, Relationship marketing and Prepayment adoption

The existing service experience relationship marketing and the prepayment service of EEPCo significantly influence the service quality and subsequently the way customers behave in response to the different marketing strategies which are supportive of diffusing the innovation. It was realized that the interviewed prepayment customers tended to have felt in one or the other way a negative customer service experience as a result of which they indicated that they wouldn't recommend it at all to others (post-paid). The resistance becomes even more widespread as the Corporation keeps trying to reach all its potential customers who don't read and understand English symbols and letters-the complex and key features of prepayment. However, those who actually rented their houses were very positive about it that it has avoided their worries of paying arrears that tenants might fail to pay for. Singles and the younger generation too found it interesting. As a result they thought that they would recommend it to other people, including friends and families who own and rent houses and offices. There was also another customer who switched from the post-payment to prepayment service due to his earlier dissatisfaction who was asked to pay exaggerated amount due to wrong estimation of meter readings. Especially, approaching resisting customers heavily relies on the whether or not the prepayment service is flexible enough for further modification taking in to account the tradition, norms, and beliefs of both the existing and potential customers (Akele, 2012).

2.9.1. Definition of Customer Experience

Customer Experience is defined as holistic in nature, based on personal interactions between a customer and a brand, service provider or product that is composed from various cognitive, affective, emotional, Social and physical responses of this customer. They also support and concretize the view on customer experience as a dynamic phenomenon that is present in all kind of phases of the customer journey, for example, search, purchase, consumption and after-sale encounters. Significant remark is that everything happens through multiple channels and multiple touch points. Each such touch point can also have its own role that the customer plays from the perspective of the customer experience. Depending on how much a customer influences such experience, roles can be, according to Bolton e. for example, a consumer, user, participant or co-creator. In relation to the multiplicity of roles, Cho and Park point out that in case of online shopping, customer shouldn't be recognized as just shopper, but also as, for instance, technology user and visitor (David, 2016).

2.9.2. Customer Satisfaction.

Customer satisfaction is a compelling issue because in the service industry customer retention is more important than attracting new customers. Retaining customers has a stronger impact on company profit than does attracting new customers. Therefore, companies, so as to maximize profits in the long term, should strive for zero defection through customer satisfaction. There is an increasing tendency to view satisfying customer as going beyond providing just a technically superior product or service, i.e., defect reduction and continuous improvement programs. Quality is also as such defined by the customer's perception, not by the service provider. However, it should also be born in mind that even if the first person who is considered as a customer is the buyer (end user), there are several other people who need to be considered as customer for the reason that their involvement in the production and distribution of the service or product, or project affects the quality of the service. Generally, customers may be of:

- Product/service end users- users expectations such as ease of use, safe operation, reliable products, durable goods, and easily maintained products, etc. which all together enhances better functional performance and or greater ease of use compared to other competing products/services.
- Boss (senior management) - the project director expects the project manager to effectively and efficiently undertake the work, including keeping informed every stakeholder as to its progress and potentials that could affect its success and relationship with customers, etc.
- Project team members- the team expects professional leadership of the project manager, safe work environment, clear directions pertaining to work, training for new works, and appropriate rewards for superior performance. Of course, the team members also expect loyalty from the project manager to shield them from outside interference with their work.
- Functional organization-involves an expectation of efficient use of assigned resources (human, material, financial, information, etc.)
- Vendors/suppliers- Vendors and suppliers have a vested interest in providing parts, components, and materials to the project meeting the quality requirements. These

customers have expectations of proper specification practices by project personnel and prompt payment upon delivery.

- Society- a special interest groups and is the guardian of such general areas as the environment and public safety. The issues addressed by society include environmental pollution of rivers and streams, maintenance of a natural habitat, etc.

How well a company addresses each and every requirement of these groups of customers determines the new product/service's success in the market. Therefore, companies should consider customers as their important part of gaining improved quality of service (Akele, 2012).

2.10. Commercial Use and Home Energy Monitoring

Large companies and industries use electronic meters to record power usage in chunks of thirty minutes. These grids have multiple demand surges within the day; the companies will be inclined to provide compensation to such customers, so as to decrease the demand at such times. One of the best ways to conserve energy consumption is to utilize the data obtained through smart meters. One of its salient features is that it provides real-time feedback. This real-time data reveals the consumption patterns of consumers. This in turn creates awareness among the consumers about how changes in their consumption patterns should be made and implemented. There have been several instances in recent times, where such data has positively impacted the behavior of consumers and brought a significant decrease in the consumption of energy. An experiment in Ontario using consumer readable meter in 500 homes in Hydro One showed an average of 6.5% drop in total electricity in total households. Subsequently, 30,000 customers were provided with power monitors. Many companies, such as Google, have espoused the use of power meters and endorsed their use, thereby enabling us to identify devices that consume maximum power along with those that use excess standby power. Though there are several models available in the market, the underlying principle remains one and the same. (Ramu, 2023).

2.10.1 Payment model

One of the basic problems in designing the billing system is how the customer is charged based on their usage of services resources . There is also an exceptional method of ad-based revenue model in which the revenue comes from advertisers rather than the users themselves; however, this is usually quite a rare model within cloud billing platforms due to expensive maintenance costs. There would have to be loads of advertisements to cover the upkeep costs of the service in case there is loads of hard disk space and memory and other hardware components concerned. However, for example a trial version of a cloud platform could probably be well profitable using this model, provided that usage limits have been set strict or the trial period is time limited with no easy workaround to reset the timer. These same problems mostly exist with fermium service model, as cloud service in its most typical form is usually quite a simple and invisible service that consists of few easily measurable basic services. This leads to a problem where somehow limiting the service causes a severe deterioration in service usability and quality. For example a basic cloud service limited to a quota of for example 256 megabytes of RAM and less than a gigabyte of hard disk space is mostly usable only for brief testing purposes. But as even that amount of service provided has its maintenance costs, it is usually more profitable to keep testing services both time-limited and in low capacity (Oinonen, 2014).

2.10.2. Electronic Bill Presentment and Payment and the financial chain

The concept of Electronic Bill Presentment and Payment goes beyond electronic invoicing, i.e. transferring the invoice from issuer to receiver using an electronic channel (bill presentment). It includes the electronic payment of the invoice (bill payment) as well as transferring payment data to the issuer (bill posting). Recently, (Skiera and Weitzel 2004) have postulated that financial processes – in contrast with traditional supply cha Chain for identifying potential improvements in financial processes and distinguish trade enablement, covering all processes prior to product or service delivery (qualification, sourcing, pricing, hedging), and trade settlement, referring to the processes thereafter (Pfaff et al. 2004b).

With reference to the concept of the Financial Chain, EBPP can be assigned to trade settlement. Complaints about incorrect invoices are not directly covered by EBPP, but exert a large impact on the costs of paper-based processes and days sales outstanding (DSO). A recent survey among the top 1000 German companies (excluding financial institutions and insurance companies) indicates that the greatest optimisation potential is to be found in the trade settlement phase, especially in invoice issuing (Skiera et al.2004).

2.11.3 Electronic bills (E-bills)

Electronic bills are a part of the E-payments which it’s a subgroup of the Electronic commerce, to move the purchasing and paying process to be online through internet for products and services, many types of E -payments are produced nowadays, E-payments become progressively popular because of the use of the online banking and shopping services. In 1999, the United States payments were becoming more electronic (Weiner, 1999).

At that time checks were the most popular and preferable way of non-cash payments. In 2016 Koulayev said that checks are still the choice of the non-cash payments, followed by credit cards (Koulayev et al, 2016). 12 In the online payments Chen applied a technology acceptance model (TAM) and innovation diffusion theory (IDT) TO monitor and explain the customer acceptance of mobile payments which it’s a part of the E payments (Chen, 2008).

This model could be used to increase the Customer Satisfaction by specifying the customer needs and ease of use of the E payments and make it more effective. After that many more models and theories were used to explore the consumer adoption and usage of the E-payments. In Jordan, Efawateercom is one of the most important examples of the Epayments systems and services, it’s an electronic system of presenting and paying bills owned by the Central Bank of Jordan and operated by Madfooatcom for Electronic Payments. (Jafar, 2017).

2.12.4. Bill Payment through the Bank

In this case, like in the case of payment through ATM the EEU has collaborated with different banks to ensure that its customers can easily clear their electricity bills through making bank deposits banks (Content, 2018).

In order to pay electric utility bill through bank customers has to follow the following alternative procedures.

2.12.4.1. Bill Payment through Cash

To pay the bill through cash: First, the customer goes with his / her bill or customer reference number to the bank then he/ she presents the bill/customer reference number to the cashier at the counter in the bank, also give the cashier the amount of money to be paid against the bill and wait for a receipt. Finally, the cashier issues a receipt that the customer must keep well (Content, 2018).

2.12.4.2. Bill Payment through Account Transfer

All the above procedures are the same except that customers are required to fill account to account transfer form‖ used only for monthly electric utility bill payment. Customers are required to have an account in the bank or to open a new account in that bank (Content, 2018).

2.12.4.3. Bill Payment through Direct Debit Standing Instruction

Customers are required to make an agreement of direct debit standing instruction with the bank, that order the bank to pay their monthly electric utility bill based on the data sent by EEU to the bank. Customers are required to have an account in the bank or to open a new account in that bank (wube, 2021)

2.12.5. Mobile banking

The great explosions of the use of mobile devices and initiatives in electronic commerce have attracted the attention of researchers on the issue of mobile banking adoption (Oliveira, 2017). According to the International Telecommunication Union, in its report measuring the Information Society Report 2017 - Volume 1, in 2015 there were 7.18 billion mobile phone subscriptions in the world, which represented 98.2 subscriptions per 100 inhabitants. And regarding smartphones, he mentions that according to the survey conducted by Pew Research Center, in 2015 "the global median of smartphone ownership was 43 percent. 68% in developed economies and 37% in developing and emerging economies"**.** With these data and considering that the smartphone has become one of the most significant factors that support people in their lifestyle. Many services are being offered through mobile devices that offer more channels for the interaction of companies with their customers. The banking sectors have also foreseen the essential use of this channel taking advantage of its ubiquity, confort, and interactivity; this is where the concept of mobile banking comes from. Mobile banking can be defined as "a service or product offered by financial institutions that use portable technologies" (Oliveira et al., 2017).

According to the 2014 report on the state of the mobile financial services industry for the unbanked of the Global System for Mobile Communications Association, banking services mobile phones are currently available in 61% of the countries in the developing world (85 out of 139 markets). In the last five years, mobile banking services have expanded throughout much of Africa, Asia, Latin America, Europe, and the Middle East. As of December 2014, there were 255 mobile banking services launched commercially in 89 markets, compared to 233 services launched through 83 international markets in 2013. Given this scenario, it was considered interesting to carry out a study on the research carried out regarding the adoption of mobile banking, the main objective of this document (Leticia et al., 2018)**.**

CHAPTER THREE

3. Research Methodology

3.1. Introduction

This chapter is a description of the research method and methodology that was used in this specific study. It outlines the research approach, research design, sources of data, Target population, Sample size and sampling procedure for data collection, research instrument, data analysis of the study, validity and reliability as well as ethical consideration.

3.2. Research Approach

There are three basic types of research approaches; quantitative, qualitative, and mixed approach. Quantitative research approach is based on the philosophy of post positivism world view. It is also reductionist in that the intent is to reduce the ideas into a small, discrete set of ideas to test, such as the variables that constitute hypotheses and research questions. In addition, quantitative approach uses statistical methods in describing patterns of behavior and generalizing findings from samples to population of interest, and employs strategies of inquiry such as experiments and surveys (Creswell 2003). Therefore, by taking the research objectives and nature of the study into consideration, the study adopted both quantitative and qualitative research approaches from the primary data gathered by standard questionnaire.

3.3 Research Design

The research design is the conceptual structure within which research is conducted. It constitutes the blueprint for the collection, measurement and analysis of data. There are three types of research design, namely; exploratory, descriptive, and explanatory (Kothari, 2004). By taking the research objectives and nature of the study into consideration, descriptive research design is used. As stated by Kothari (2004), descriptive research studies are those studies which are concerned with describing the characteristics of a particular individual, or of a group. Hence, in this study, it is used to describe the leaders' role focus in the Ethiopian Electric Utility. This study utilized descriptive research design method and both qualitative and quantitative data are collected and survey design is employed for this specific purpose and structured questionnaires were used. The research tries to find answer to the question through analysis's of both qualitative and quantitative data.

3.4. Sources of data

The main sources of data were primary data. The primary data constitute results from the questionnaires.

Primary data collected by using systematic random sample of all professional categories of Ethiopia Electric Utility Head office staff. Questionnaires were distributed to all categories of staff who are customer service manager, finance officers and bill collector of the organization across the organization across the district and service center to get a holistic view and understanding of the staff on the selected energy billing system.

Secondary data have gathered from relevant documents such as customer service manual and bill manual of Ethiopia electric utility document.

3.5. Target Population

A population can be defined as all people or items (unit of analysis) with the characteristics that one wishes to study. The unit of analysis may be a person, individual, organization, country, object, or any other entity that the researchers wish to draw scientific inferences (Kelley et al., 2003). The study population has been the entire Region, district and service center staff of Ethiopia Electric Utility Managers, directors and employees from which 246 samples selected. The total number of related to customer service staff was 600.

3.5.1 Sample Size

As a general rule, one can say that the sample must be of an optimum size i.e., it should neither be excessively large nor too small (Kothari, 2004). Sample size can be determined using certain formula in the case of quantitative study, whereas, in qualitative study, determining sample size is entirely a matter of judgment, there are no set rules (Cohen, Manion, and Morrison, 2000).

Thus, to get a representative sample for the population, Yamane (1967) finite and large population sample size formula with 95% confidence level was employed. The formula used to obtain this sample size is presented below:

n= N

1+N(e)2

Where: ***n*** represents sample size, ***N*** represents total number of population size, and ***e*** represents sampling error/level precision

According to the information obtained from Ethiopia electric Utility customer service Department, there EEU, which serves over 4.6 million customers nationwide, including more than 3.75 million post-paid and over 900,000 prepaid users, launched an international tender to enhance its technological capabilities. But the research taken a sample size is 600 customer in all aspect customer category. Therefore, based on the above formula the sample size of the study is 264. the researcher was allocated the sample size of each stratum through the method of proportional allocation under which the sizes of the samples from the different strata are kept proportional to the sizes of the strata. In order to do so, proportionate stratified sampling (PSS) formula (ni=Ni/N*ni) is used.

3.6. Data analysis techniques

This sub topic discusses how the results under this specific study will analyze. It used both results of descriptive and inferential analysis. Under descriptive analysis, frequency, percentages, mean and standard deviation will use.

3.7. Validity and Reliability

Validity and reliability of the measures need to be assessed before using the instrument of data collection (Hair et al., 2003). Validity concerns whether an instrument can accurately measure, while reliability pertains to the consistency in measurement. Therefore, in this study the reliability and validity tested as follows;

3.8. Reliability

The reliability of a measure indicates the stability and consistency with which the instrument measures the concept and helps to assess the goodness of a measure (Zikmund, 2003). In this study, the reliability of the items in the instrument will measure using Cronbach's alpha which is the most frequently use reliability test to measure internal consistency when using the Likert scale. According to Sekaran (2003), the closer the reliability coefficient gets to 1.0, the better it is, and those values over .80 are considered as good. Those values in the .70 are considered as acceptable.

3.9. Model Specification

As simple linear regression cannot be used with a binary outcome as the dependent variable, the binary logistic regression model, which is an extension of the binary logistic regression model, was used in this research. Logistic regression, as a statistical method, calculates an expected relationship between our predictors or independent variables and the dependent variable. Hence, in this analysis, logistic regression is used to predict the probability of a binary outcome from a set of explanatory variables. Now, I state the logistic regression equation as follows:

Y = Rate of Adaptation of Innovation" - Is this truly ×binary×? Logistic regression requires a binary outcome (0 or 1). "Rate of Adaptation" sounds continuous (a range of values). You must confirm if "Rate of Adaptation" has been recoded into a binary variable (e.g., "Adapted Innovation" (1) vs. "Did Not Adapt Innovation" (0)). This is ×crucial×. If "Rate of Adaptation" is not binary, logistic regression is the wrong method.

TYPC (Types of Customers): You state that TYPC = Types of Customers, and "0 = constant of the logistic regression equation". This is confusing and likely incorrect.

TYPC Needs to be explained: What are the different types of customers? Is it also a categorical or continuous independent variable? What do the other values of TYPC (besides 0) represent? The Constant (Intercept): The "constant of the logistic regression equation" is the intercept (β0), not a type of customer. The intercept is the value of the log-odds (or probability) when all independent variables are zero.

TYPC is a placeholder and should not be in the equation.

Assuming that "Rate of Adaptation" has been recoded into a binary variable, let's call it "Adapted", where 1 = Adapted the innovation and 0 = did not adapt the innovation. Assuming this is true and with corrections in place your equation will be:

Logit(P(Adapted = 1)) = β0 + β1\AG + β2\EDUC + β3\INCOME + β4\Employ

Where: **Logic(P (Adapted = 1)) = the log-odds of a respondent adapting the innovation.**

• β0 = the intercept (the log-odds when all other variables are zero).

• β1 = the coefficient for age (AG).

• β2 = the coefficient for education (EDUC).

• β3 = the coefficient for income (INCOME).

• β4 = the coefficient for employment status (Employ).

• AG, EDUC, INCOME, And Employ are the independent variables.

3.10. Validity

Validity is the degree to which a measure accurately represents what it is supposed to. It is concerned with how well the concept is defined by the measure(s). There are three types of validity: content validity, predictive validity, and construct validity. The content validity is the assessment of the correspondence between the individual items and concept. Validity is the criteria for how effective the design is in employing methods of measurement that will capture the data to address the research questions (Kazi, 2010).

Therefore, in this study in order to assure the validity of the research instrument, various relevant literatures and different previous research questionnaires will use. Also the draft survey questionnaire has pilot taste with at least 10 respondents in order to assure that the instrument is clear and unambiguous. Then, following the above-mentioned means and pilot testing, the researcher incorporated the feedback of the respondents into designing of the final survey questionnaire. So, after passing this all process, the research instrument will distribute to the respondents.

CHAPTER FOUR

4. Data Presentation, Analysis and Interpretation

4.1 Introduction

This chapter, present a discussion of the final results and the processes through which the results were obtained. First presents the profiles of the respondents and the statistical methods of analysis were discussed, which included a descriptive analysis, a correlation analysis, and regression analysis with the help of SPSS version 26.

4.2. Response Rate

In order to make the collected data suitable for the analysis, all questionnaires were screened for completeness. Hence incomplete questionnaires were considered as errors and removed from the survey data. Out of the 264 distributed questionnaires, 228 were found to be valid and used for the final analysis. According to Mugenda and Mugenda (1999) stipulation that a response rate of 50% is adequate for analysis and reporting; a rate of 60% is good and a response rate of 70% and above is excellent, this response was considered almost excellent for analysis and discuss the result.

4.3. Demographics Variables of respondents

overview of the demographic variables of the respondents, such as gender, age, customer type, employment status, level of education and income are considered and the summary of study participant's demographic information. The gender distribution of respondents is heavily skewed on the male side, where 54% were male and only 44% were female, from this it can be easily understood that males have dominated the respondents' gender distribution. In terms of age, most 37% of the respondents are between the age of 31and 41, while respondents in their young ages. Based on the service type that respondents have subscribed with EEU. The result shows that most 51 % of respondents use electricity for domestic purpose and the only 30% respondent use electricity for staff whereas of 11% of the respondents use electricity either for commercial and industrial activities.

Table 4. 1 : Summary of Respondents Demographic Characteristics

Variables	Valid	Frequency	Percentage
Sex	Male	125	54
	Female	101	44
	Missing	2	2
	Total	**228**	**100**
Age	20-30	57	25
	31-41	85	37
	42-51	71	31
	52-62	13	5
	Missing	2	2
	Total	**228**	**100**
Customer Type	Domestic	131	57
	Commercial	26	11
	Staff	69	30
	Missing	2	2
	Total	**228**	**100**
Monthly Income	1000-10000	69	30
	10001-15000	83	36
	150001-200001	66	29
	20001-30000	10	4
	Total	**228**	**100**
Education. Level	Diploma	36	16
	Degree	96	41
	MA/MAC	43	19
	Under diploma	52	23
	Missing	1	1
	Total	**228**	**100**
Employee statues	Worker	22	9
	Officer	109	48
	Management	89	39
	Missing	8	4
	Total	**228**	**100**
SPSS output of frequency distribution of the respondents			

In the above Table 4.1 the highest number of respondents had completed bachelor degree 41% and then followed by under either diploma or certificate 23% the remaining respondent diploma and Master 16% and 19% respectively. With regard to the employment status of respondents, the study revealed that majority (48%) of the respondents was officer in the office and 39 % respondent is management the reaming 9% who were employed as worker. Finally accordingly to table 4.1 the income distribution of the respondents cover a wide range of income groups where 36% fall within income level of10,001 to 15,000 ETH birr, 30% within income level between 1,000 and 10,000 ETH birr, 36%within income level between 15,001 to 20,000 ETH birr and 4% in the above 20,001 ETH birr. This analysis can help inform stakeholders about the educational and employment landscape among respondents and may guide future initiatives aimed at improving job opportunities and income levels within the community. Further research could explore factors influencing income disparities and career progression among different educational backgrounds.

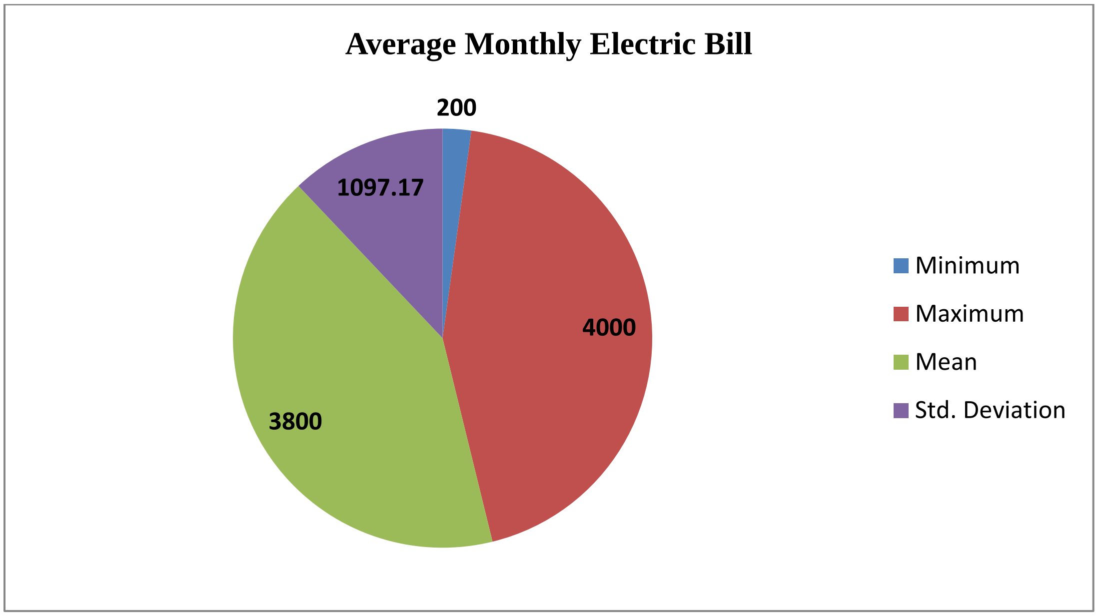
4.4. Electric Energy Bill Practice

The process for handling electricity bills in Ethiopia, particularly with the EEU, generally involves several key steps. While the specific details can vary based on location and any updates to the utility's procedures, here are the common practices: The EEU conducts regular meter readings to determine the amount of electricity consumed by each customer. This can be done monthly or bi-monthly, depending on the area. After reading the meter, the EEU calculates the bill based on the amount of electricity used, applying the relevant tariffs. Tariffs may vary based on customer categories (residential, commercial, industrial) and consumption levels. Once the calculations are complete, a bill is generated and sent to the customer. This can be done through physical delivery or electronically, depending on the customer's preference and available services. Customers can pay their electricity bills through various methods, which may include payment at designated EEU offices. Online payment platforms, mobile payment systems. and authorized banks and payment agents.

4.4.1. Average Monthly Electric Bill

The average monthly electric bill in Ethiopia can vary widely based on several factors, including the type of customer (residential, commercial, industrial), the region, and individual consumption patterns. For typical residential customers, the average monthly electricity bill might range from approximately 200 to 500 ETB, depending on usage. With higher consumption larger families or those using electric heating or cooling may see bills exceeding this range. Regardless to the type of customers, the minimum expenditure for electricity was 200 ETB while the maximum was 4000 ETB and the mean of monthly electric bill was about 3800 ETB as shown below in Figure 4-1.

Figure 1**Figure 4. 1: Average Monthly Electric Bill**



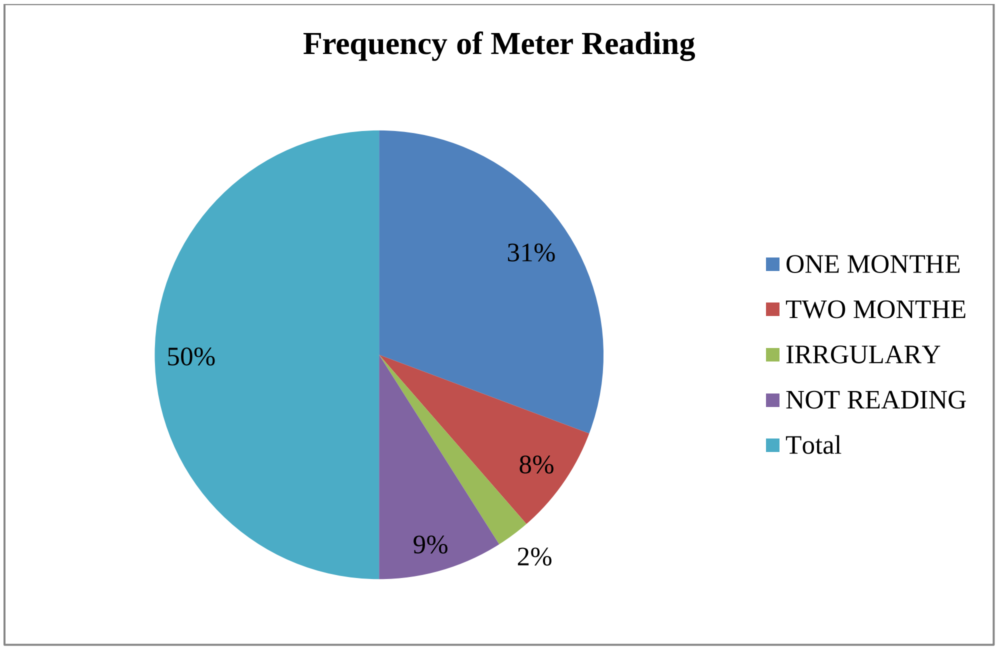
SPSS output of Average Monthly Electric Bill of the respondents

The analysis highlights significant variability in monthly electric bills across different types of customers in Ethiopia. While many residential customers may enjoy lower bills, a notable portion faces much higher costs, raising questions about energy consumption patterns, affordability, and potential interventions to promote energy efficiency and equitable pricing structures. Further research could help clarify these dynamics and inform policy decisions aimed at improving access to affordable electricity.

4.4.2. Frequency of Meter Reading

In Ethiopia, the frequency of meter reading for electricity consumption typically depends on the type of meter used (postpaid or prepaid) and the policies of the Ethiopian Electric Utility. while monthly readings are standard for postpaid customers, prepaid customers manage their usage independently without regular meter readings. For the most accurate and specific information regarding your area or situation, it's advisable to check with the Ethiopian Electric Utility or your local service provider.

Figure 24. 2: Frequency of Meter Reading



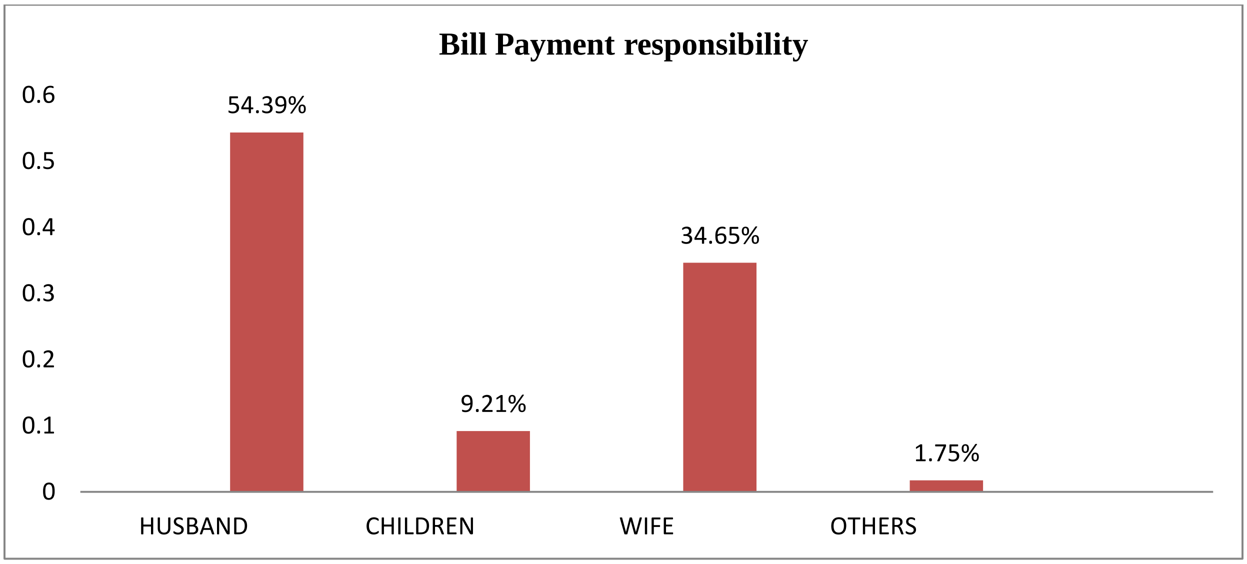
SPSS output of Frequency of Meter Reading of the respondents

The frequency of meter reading, as it can be realized that 50% of the respondents states that the frequency with which meter readers within one month has coming is irregular and the remaining 2% states that meter readers were coming monthly. While the metering and billing cycle of EEU is on a monthly basis, only 8% of the respondents are being metered two monthly. Thus a respondent will pay above or below their actual consumption of electricity since metering and billing cycle are not synchronized.

4.4.3. Bill payment responsibility

In Ethiopia, the responsibility for paying the electricity bill at home typically falls on the account holder, which is usually the person who has registered for the electricity service. This could be a homeowner, a tenant, or a family member who has taken on the responsibility of managing household expenses. As shown below in Figure 4-4. Accordingly out of the total 228 respondents 50.39% of them stated that husband has the responsibility to pay their electric bill, 34.65% of them stated that wife has the responsibility to pay their electric bill, and 9.21% stated that children is responsible and the reaming respondents 1.75 % others (e.g. friends, neighbor and relatives) can be conclude that the majority of male household head takes responsibility to pay electricity bill rather than female household head and their children.

Figure 3**Figure 4. 3: Bill Payment Responsibility**

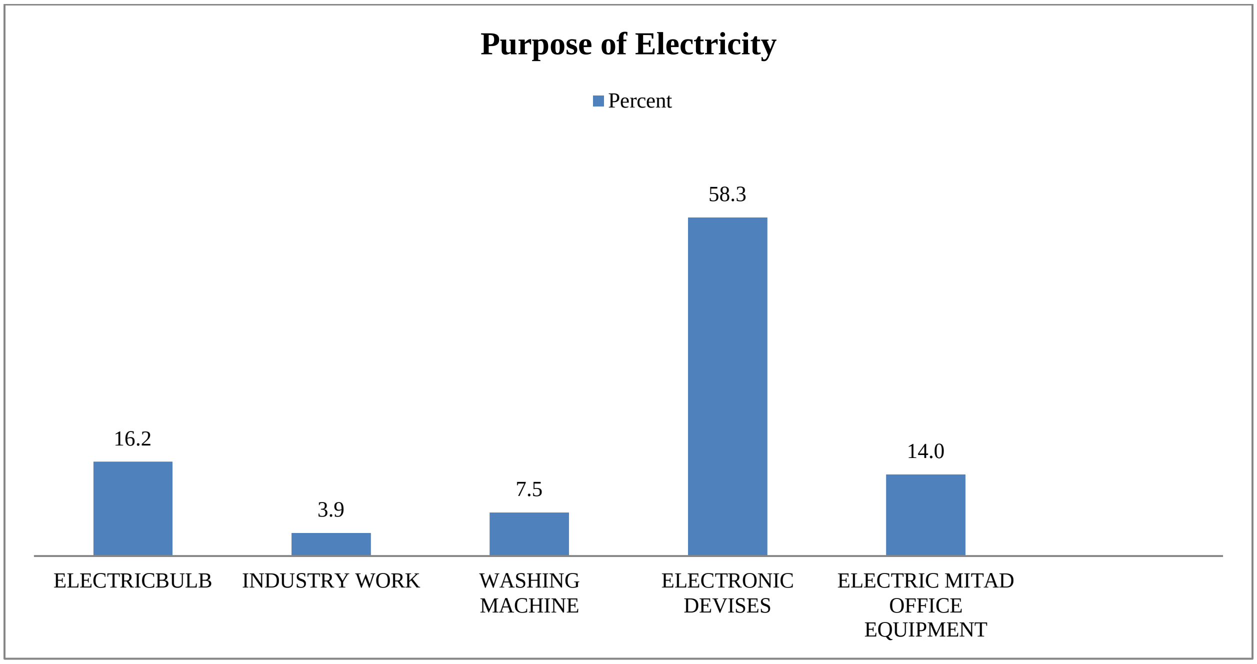


SPSS output of Bill payment responsibility of the respondents

4.4.4. Purpose of Electricity

In Ethiopia, households use a variety of electric-consuming devices, similar to many other countries. While the availability and use of these devices can vary significantly between urban and rural areas, as well as depending on individual household income, there is a growing trend towards increased electricity usage as access expands.

Figure 4Figure 4. 4: Purpose of Electricity



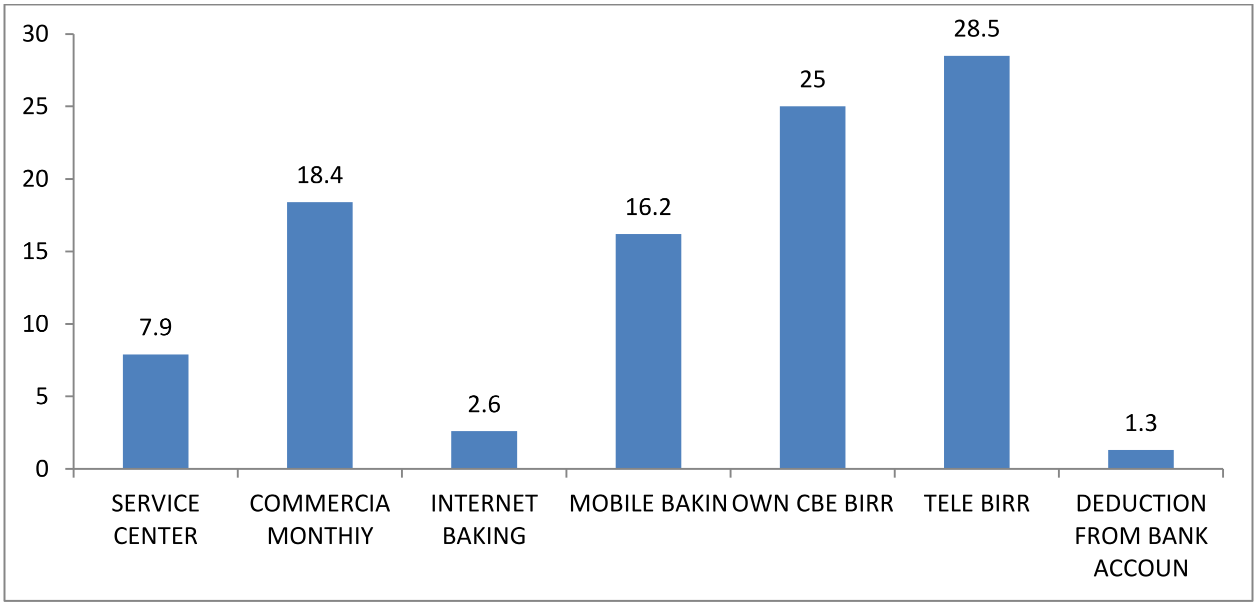
SPSS output of Purpose of Electricity of the respondents

As showed in the above Figure 4-4 all of the respondents use electronic devises 58.3 %, followed by 16.2% electric bulb and 14.0% Electric Mitad and office equipment Electronic devices (TV, Radio, Fridge, etc.), whereas 7.5% and 3.9% of the total respondents said that they use electricity for Industry work, Washing machine respectively. Thus, the respondents' use of electricity is primary for lighting, electronic appliances and cooking purpose.

4.4.5. Method of Electric Bill

The methods of electric bill payment in Ethiopia are evolving, with a mix of traditional and modern approaches. Customers can pay their bills in person at EEU offices or designated payment centers. This often involves cash payments, and sometimes checks, although cash is the most common. Some commercial banks in Ethiopia have partnerships with the EEU and allow customers to make payments over the counter, through bank transfers, or sometimes using their own online banking portals.

Figure 5Figure 4. 5: Method of electric bill payment



SPSS output of Method of electric bill payment of the respondents

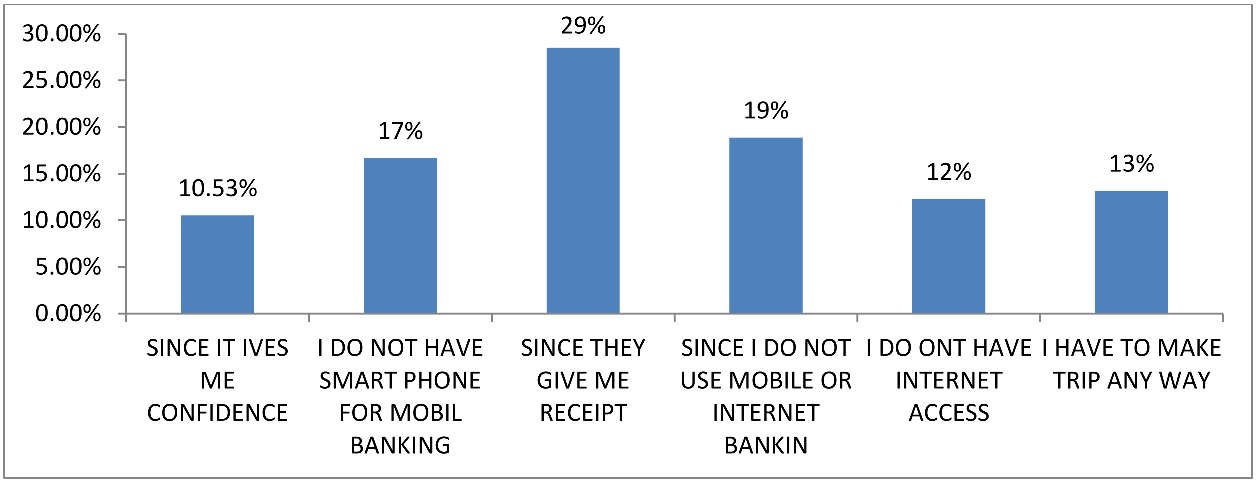
As shown above in Figure 4-5. 28.5% respondents are paid through Tele birr ,25% and 18.4 % at CBE and cash commercial bank of Ethiopia paid respectively, whereas respondents paid through nearby mobile banking, using cash service center ,Internet banking and deduction from bank account have 16.2%,7.9%, 2.6% and1.3% share respectively, however no one has paid through direct debit standing instruction. From this, it can be realized that 26.23% of respondents paid their energy bill paid through traditional cash basis methods which means all most one out of four respondents conduct bill payment at CSC and/or CBE by appearing in person. On the other hand, only 73.68% of the respondents are paid through online energy bill payment method. In general, we can see from the results of the study that the new online energy bill payment systems by the EEU are well used by the customers.

4.4.6. Reasons for Non-Adoption of Online Bill Payment Methods

The reasons why someone in Ethiopia might choose to pay their electricity bill with cash at a service center or a CBE branch, even when other options might be available. Many individuals, particularly in rural areas and among lower-income populations, may not have formal bank accounts. This makes online banking or direct debit payments impossible. No Mobile Money

Account: While mobile money is growing, not everyone has a mobile wallet or a phone capable of using it. This is especially true among older individuals or those in remote areas. Limited Internet Access: Even if someone has a mobile money account, the lack of reliable internet access, particularly in rural areas, may prevent them from using online or app-based payment options.

Figure 6**Figure 4. 6: Reasons for selecting a traditional electric bill payment method**



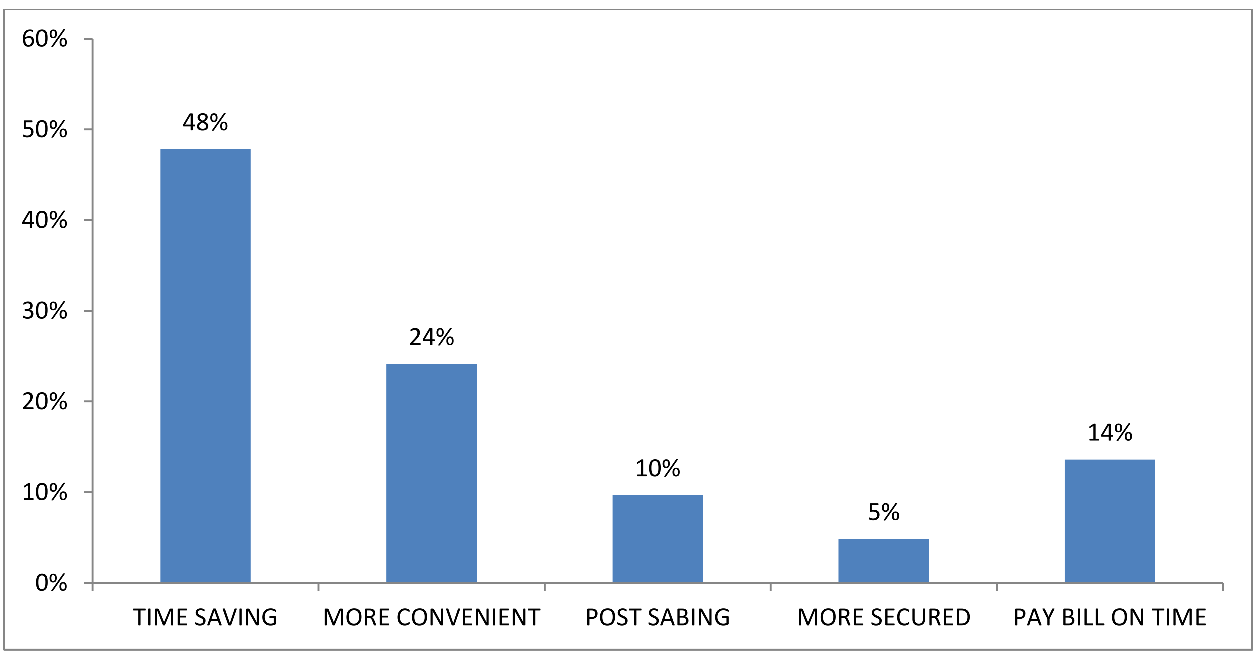
SPSS output of Reasons for selecting a traditional electric bill payment method of the respondents

As shown above in Figure 4-6 .10.23 % Confidence in banking a small percentage of respondents feel confident in their banking methods. This suggests that while some users trust traditional banking, there may be a need for banks to build more confidence in their mobile platforms. 17% Lack of Smartphone for Mobile Banking This indicates that a significant portion of users does not have access to the necessary technology to engage in mobile banking. This highlights a barrier to entry for mobile banking services.29% Receipt Provision the highest percentage here suggests that many users prefer receiving physical receipts, indicating a preference for tangible proof of transactions. This could mean that banks may need to find ways to provide digital receipts that are equally reassuring.19% Non-usage of Mobile or Internet Banking This group may either be unaware of mobile banking's benefits or may simply prefer traditional banking methods. Targeted education and outreach could help increase adoption rates among this demographic. (12% and 13%) Lack of Internet Access and I have to make trip any way These two responses indicate that internet access is a significant barrier for some users. This suggests that areas with poor internet connectivity may be underserved in terms of mobile banking services.

4.4.8. Online Energy Bill Applicability

The applicability that users in Ethiopia might experience when using various digital banking and mobile money platforms like CBE Birr, Mobile Banking (from various banks), Telebirr, Awashe Bank's banking services, or Internet Banking. Transactions can be conducted anytime, anywhere, without having to visit a physical bank branch or service center. Digital payments are faster than traditional methods, eliminating the need to wait in long queues or fill out manual forms. reduce the need for travel to payment centers. They provide a more secure way to handle funds, reducing the risk of theft or loss compared to carrying cash. These platforms offer access to financial services for individuals who may not have convenient access to traditional banking services.

Figure 7**Figure 4. 7: Online Energy Bill Applicability**



SPSS output of Online Energy Bill Applicability of the respondents

As shown above in Figure 4-7 Based on the result, 48 % Time Saving This is the most significant reason users engage with mobile banking. Nearly half of respondents prioritize the efficiency and speed that mobile banking offers. This suggests that users value convenience in managing their finances and prefer solutions that minimize time spent on banking activities. Banks could leverage this insight by highlighting time-saving features in their marketing and ensuring that their mobile platforms are optimized for quick transactions.24% More Convenient A substantial portion of users also finds mobile banking more convenient than traditional banking methods. This aligns well with the time-saving aspect but emphasizes ease of access users can bank from anywhere at any time. Banks should continue to enhance user experience through intuitive app design and functionalities that cater to on-the-go banking needs. 14% Pay Bill on Time This indicates that a notable percentage of users appreciate the ability to manage bill payments effectively through mobile banking. It suggests that features like reminders, automatic payments, and easy access to payment history are valued. Banks could enhance this feature further by offering customizable alerts or integration with budgeting tools to help users manage their finances better.10% Post Saving While lower than the other categories, this percentage indicates that some users are motivated by the ability to save money through mobile banking features. This could include budgeting tools, savings account options, or promotional offers for using certain services. Banks might consider promoting savings features more prominently to attract those interested in financial growth and .5% More Secured Security is a concern for many users, but it ranks lowest among the reasons provided. This might suggest that while users appreciate security, it is not the primary motivator for using mobile banking. However, given the increasing concerns around cyber threats, banks should continue to invest in robust security measures and communicate these effectively to build trust among users.

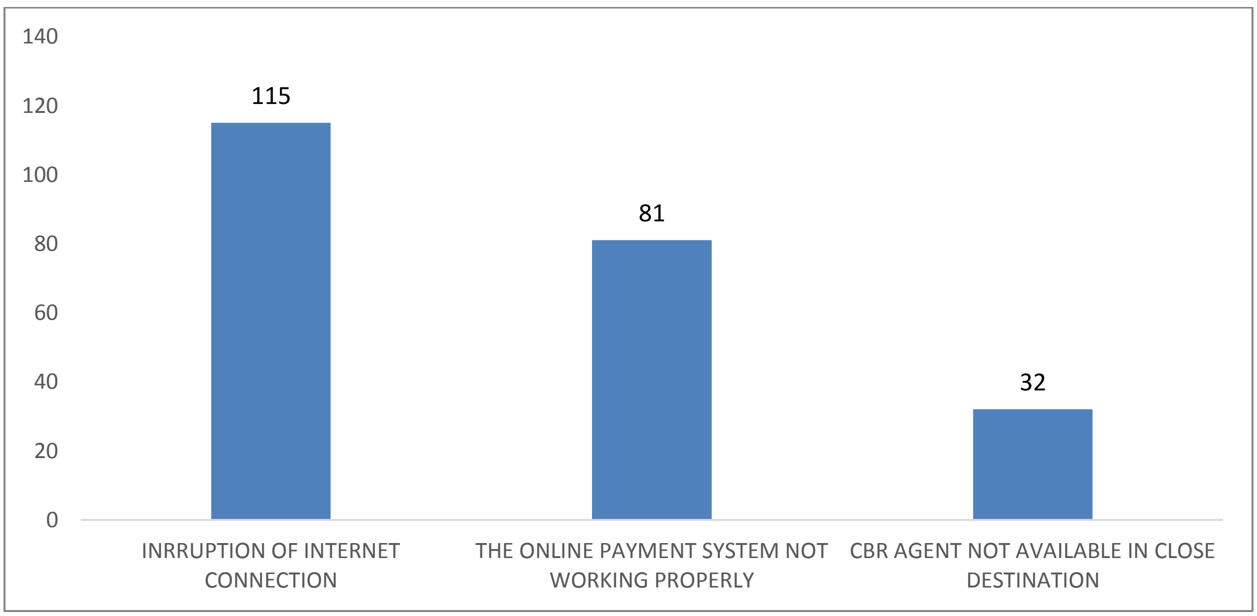
4.4.9. Challenges of Electric Bill Payment

The EEU faces a variety of challenges when it comes to electric bill payments. These challenges stem from a mix of infrastructure limitations, economic factors, socio-cultural norms, and technological gaps. The impact of war zones and colder areas on electric bill payments in Ethiopia is significant and multifaceted, affecting both the ability of customers to pay and the operational capacity of the EEU. War often leads to significant damage to electricity infrastructure, including power lines, substations, and transformers. This disrupts electricity supply and makes it impossible for customers to receive and pay for electricity. Meters can be damaged or destroyed, leading to inaccurate billing and difficulties in tracking consumption, hindering payment.

4.4.10. Challenges of Electric Bill Payment through Online Methods

The challenges that users in Ethiopia might experience when trying to use online bill payment methods. These challenges often stem from a combination of technological, infrastructural, and socio-economic factors. One of the most significant challenges is the lack of consistent and reliable internet access, especially in rural areas. This makes it difficult to initiate or complete online transactions. Even when internet access is available, slow speeds can make online payment processes frustrating and time-consuming. The cost of mobile data can be prohibitive for many Ethiopians, deterring them from frequent use of online payment systems.

Figure 8**Figure 4. 8: Challenges of Online Electric Bill Payment**



SPSS output of Challenges of Online Electric Bill Payment of the respondents

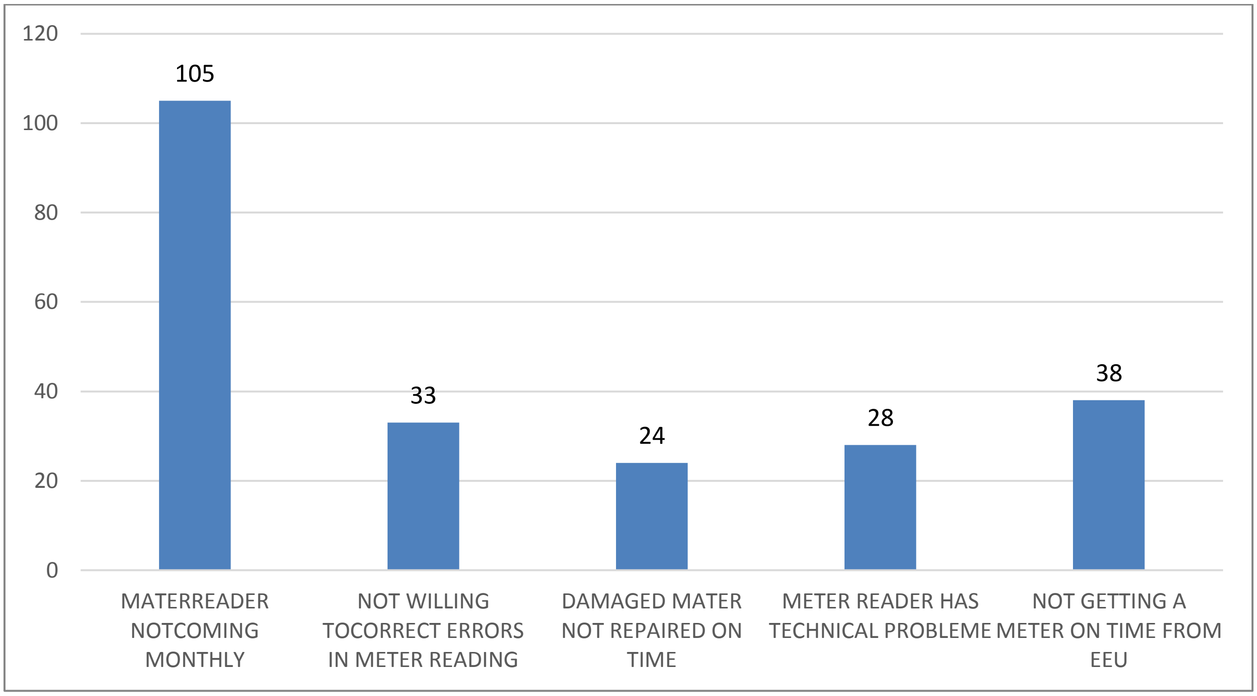
As shown above in Figure 4-8 Based on the result, 50.4% Interruption of Internet Connection The most significant issue reported by users is the interruption of internet connectivity, affecting over half of the respondents. This suggests that reliable internet access is a critical factor for successful mobile banking experiences. Users may face difficulties completing transactions, accessing their accounts, or using banking apps effectively when connectivity is unstable. Banks could consider investing in offline functionalities or providing tools that allow users to manage certain tasks without a constant internet connection.2.35.5% Online Payment System Not Working Properly A considerable percentage of users report issues with the online payment systems. This could involve payment failures, delays, or processing errors, leading to frustration and potential loss of trust in the service. Addressing this issue should be a priority for banks; they might need to enhance their payment infrastructure, conduct regular system maintenance, and ensure robust testing before launching new features to minimize disruptions and .14% CBR Agent Not Available in Close Destination While this is the least reported issue, it still reflects a concern for users who may prefer or require in-person assistance. The unavailability of CBR can hinder users who need support with complex transactions or have queries that cannot be resolved online. Banks should evaluate their customer service strategies, possibly increasing the number of accessible CBR agents or enhancing remote support options (like chat or video calls) to better serve customers.

4.5.2. Challenges of the meter reading

Meter reading, the process of measuring the amount of electricity, consumed by a customer, can present several challenges for utilities and consumers alike. Here are some of the key challenges associated with meter reading.

As shown below in Figure 4-11 among the problems related to meter reading the most prevalent one is monthly coming of meter readers, followed by not getting a meter on time from EEU as indicated by about 105% and (38%) of the total respondents respectively. Meter having technical problem and not timely repairing damaged meter are indicated by (24%) and (28%) of the respondents respectively where as 33% respondents stated that they are not willing to correct errors in meter reading. In addition to those problems, some of the respondents stated that meter readers are not transparent, give any information, and advises about their electric consumption.

Figure 9**Figure 4.9: Challenges in Meter Reading**



SPSS output of Challenges in Meter Reading of the respondents

4.6. Descriptive Statistics

They are a fundamental part of data analysis, providing a way to summarize and describe the main features of a dataset. Unlike inferential statistics, which aim to make generalizations about a population based on a sample, descriptive statistics focus solely on the data at hand Descriptive statistics provide a fundamental way to understand your data. By calculating and visualizing these measures, you can quickly gain insights into the central tendencies, variability, and shape of your data. These insights are essential for further data analysis and decision-making. This section presents the descriptive statistics of the dependent and independent variables used in this study. The dependent variable used in this study was the adoption of online bill payment system while the independent variables are simplicity, trial ability, compatibility, observability, and relative advantage, type of customer, employment status, age, educational level, and monthly income. Accordingly, in the following two subsections a separate comparison of adopters and non-adopters of online bill payment system was carried out for both categorical and continuous variables to see the pattern of association between the dependent variable and the independent variables.

4.6.1. Descriptive Statistics of Categorical Variables

Descriptive statistics for categorical variables focus on frequency counts, percentages, proportions, and the mode, helping to describe the distribution and prevalence of different categories in a dataset. Visualizations like bar and pie charts add another layer of understanding, allowing you to see the data clearly. descriptive statistics for categorical variables. Unlike numerical (or continuous) variables, categorical variables represent categories or groups. Because of this, we can't calculate means, medians, or standard deviations in the same way. Instead, we use different measures to describe their distribution and frequency.

4.6.2. Descriptive Statistics of Continuous Variables

The statistics for continuous variables. Unlike categorical variables, which represent categories or groups, continuous variables can take on any value within a given range (or even an infinite range). Because of their nature, we can use a broader range of descriptive statistics to understand their distributions and characteristics. descriptive statistics for continuous variables focus on central tendency (mean, median, mode), variability (range, variance, standard deviation, IQR), shape (skewness, kurtosis), location and order which can be visually analyzed through histograms, box plots, and scatter plots. These summaries provide a comprehensive overview of the characteristics of your continuous data, which is useful for data exploration and analysis.

Table 4. 2 Summary of Descriptive Statistics

	N	Mean	Minimum	Maximum	Median	Std. Deviation	Skewers	Kurtosis
SEX	**224**	**1.44**	**1.00**	**2.00**	**1.00**	**0.50**	**0.24**	**(1.96)**
AGE	**224**	**2.17**	**1.00**	**4.00**	**2.00**	**0.77**	**0.19**	**(0.82)**

SPSS output of Summary of Descriptive Statistics of the respondents

Sex mean is 1.44. This value is difficult to interpret since we usually treat sex as a categorical variable. If we assume that sex is a binary categorical variable (0 for female, 1 for male), this might indicate that the data contains more male individuals, given it's closer to 1. In this case however, it is treated as a continuous variable where the interpretation is different, as is addressed below. Median = 1: The midpoint of the variable when ordered is 1, indicating there are more values around 1 than 2.Standard Deviation = 0.5: The standard deviation shows the spread from the mean, but its value is not that useful here since the variable is a continuous representation of a categorical variable. A skewness value of 0.24 indicates that the distribution is slightly positively skewed. Since we are treating the categorical variable sex as continuous it would mean that there is a slightly more values on the higher end of the values and less on the lower end.

4.7. Multicollinearity Test

The multicollinearity, a crucial concept in regression analysis. Multicollinearity occurs when two or more predictor variables in a regression model are highly correlated with each other. This can cause problems with the interpretation and stability of the model. Multicollinearity is a common issue in regression analysis that arises when predictors are highly correlated. By using the techniques mentioned above to diagnose and address it, you can avoid unstable coefficient estimates and obtain more reliable and interpretable results from your models.

Table 4. 3 Multicollinearity Test Result

		Tolerance	VIF
1	Age	0.860	1.163
	Customer Type	0.954	1.048
	Monthly Income	0.831	1.204
	Education Level	0.935	1.070
	Employment Status	0.925	1.081
	Average Monthly Bill	0.778	1.286
	Average Time To Pay Bill	0.744	1.345
	Type Of Meter Reader	0.879	1.138
	Frequency Of Meter Reading	0.925	1.081
	Sex	0.830	1.205

SPSS output of Multicollinearity Test Result of the respondents

According to Myers (1990) VIF value greater than 10 is a indicate multicollinearity; whereas tolerance value of below 0.1 will indicate a problem of multicollinearity as suggested by (Menard, 2002). Thus, as shown above in Table 4-5, VIF for all predictor variables is lower than 10, and tolerance levels are above 0.1 indicating that there is no problem of multicollinearity. Therefore, the assumptions for performing binary logistic regression were met and the logistic regression model will be considered adequate to test hypotheses of this study Table 4-5, VIF for all predictor variables is lower than 10, and tolerance levels are above 0.1 indicating that there is no problem of multicollinearity. Therefore, the assumptions for performing binary logistic regression were met and the logistic regression model will be considered adequate to test hypotheses of this study.

4.8. Model Summary

Particularly in the context of statistical modeling, like regression analysis. A model summary is a concise collection of key information about your statistical model that allows you to understand its overall performance and interpret its results. It's a critical tool for model evaluation, selection, and reporting. A model summary provides you with all the details of the model, including the coefficients, its fit, assumptions, and if the model is significant. By understanding and using it appropriately you are able to make interpretations and make better decisions.

Table 4. 4: Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	304.957[a]	.010	.013

a. Estimation terminated at iteration number 3 because parameter estimates changed by less than .001.

SPSS output of Model Summary of the respondents

Table 4-7 headed model summary present the likelihood ratio test, another commonly used technique for measuring goodness-of-fit, which is simply the chi-square difference between the null model (i.e. the model that only includes the constant) and the model that contain predictors.

The -2 log-likelihood ratio statistics is 304.957. As displayed within Table 4-7, the value of Nagelkerke R2 is .013 that shows the model explains roughly 13% of the variation in the outcome. Whereas the Cox & Snell RSquare of .010 and Nagelkerke R-Square of 1% signify the Adjusted R-Squares within a logistic regression model indicated that 13% to 10% of the variability of the dependent variable (i.e., adaption of online bill payment) is explained by explanatory variables included in the study.

CHAPTER FIVE

5. Finding, Conclusion and Recommendation

Having employed both quantitative and qualitative research approach ,the general Objective of this study was to investigate the obstructions of energy bill system in EEU .to achieve objectives of the study data were collected on the current practice of energy bill system, the overall obstructions of energy bill system descriptive analysis were used to analysis the data through questioner. This chapter presents a summary of the major findings of the study, the conclusion and the necessary recommendations.

5.1. Summary of Key Findings

The study reveals significant variations in monthly electricity bills, ranging from 200 to 4000 ETH Birr, with an average of 3800 ETH Birr. Higher consumption is linked to larger families, electric heating, and cooling. Meter readings are irregular for 50% of respondents, with only 2% reporting monthly readings, despite the Ethiopian Electric Utility (EEU) stipulating a monthly billing cycle.

Gender dynamics play a role in bill payments, with husbands slightly more likely to be responsible, though wives also participate significantly. Recommendations should include gender-sensitive messaging to engage both stakeholders effectively.

Electricity use is primarily driven by electronic devices, followed by lighting and cooking. Tailored educational programs and energy-efficient practices for these areas are recommended. Promoting washing machine ownership or better washing practices may also be considered.

Payment methods show a strong preference for digital platforms, with 73.7% using online methods like Telebirr, mobile banking, and internet banking, while 26.3% rely on traditional cash-based methods. Time-saving, convenience, and effective bill payments are key motivators for digital adoption. However, challenges such as internet connectivity issues (50.4%), online payment system malfunctions (35.5%), and limited access to CBR agents (14%) hinder user experience.

Barriers to prepaid card adoption include limited availability, high infrastructure costs, and resistance from the EEU. Addressing these requires coordinated efforts from financial institutions, businesses, and policymakers.

In conclusion, the study highlights the need for gender-sensitive, energy-efficient strategies, improved digital payment systems, and systemic solutions to overcome barriers in electricity consumption and payment practices.

5.2. Conclusion

The study highlights a highly educated respondent group, with 70% holding bachelors or master's degrees, and 87% employed in office-based or management roles, potentially limiting the sample's representativeness of the general population. A critical issue identified is the EEU's irregular meter reading process, leading to inaccurate billing and customer dissatisfaction. Addressing this through operational improvements can enhance billing accuracy, rebuild trust, and ensure fair energy services.

Household financial responsibility for electric bills predominantly falls on husbands (50.39%), though a significant portion (34.65%) assigns this to wives, underscoring women's role in household finances. Electricity usage is primarily for electronic devices (58.3%), reflecting its importance in daily life, while lighting (16.2%) and cooking (14.0%) highlight its role in meeting basic needs.

Online payment methods, particularly Telebirr, are widely adopted, but traditional systems remain prevalent. Recommendations focus on improving online payment accessibility and reliability while accommodating all customer segments. Mobile banking users prioritize time-saving (48%) and convenience (24%), with fewer emphasizing savings (10%) or security (5%). Challenges include frequent internet interruptions (50.4%) and online payment system issues (35.5%), which hinder reliability and trust.

Prepaid card adoption faces barriers such as limited access (46.1%), high installation costs (21.1%), and regulatory resistance (32.3%). Meter reading issues, including irregular visits (105%), delays in new meters (38%), and technical problems (24%), further exacerbate customer dissatisfaction. Transparency and communication from meter readers are lacking, impacting customer understanding.

The analysis of sex as a continuous variable revealed a slight male skew (median = 1), but treating it as categorical is more appropriate for accurate statistical interpretation. The likelihood ratio test showed that the model, while statistically significant, explains only 1.3% of the variance in online bill payment adaptation, indicating limited predictive power. Neither sex nor meter type significantly influenced the outcome variable.

In summary, the study underscores the need for EEU to address operational inefficiencies, improve payment systems, and enhance customer communication to rebuild trust and ensure reliable energy services

5.3. Recommendations

To effectively address consumer behavior and energy efficiency, the following strategies are recommended:

- ❖ Tailor products and services to specific income segments. For instance, focus on affordability for income groups between 1,000-15,000 to reach the majority. This ensures accessibility and broad market penetration.
- ❖ Develop targeted programs addressing the prevalent use of electronic devices. Promote energy-efficient appliances, incentivize their purchase, and run awareness campaigns on efficient cooking practices and electricity usage.

  Segment customers based on electricity consumption patterns, household size, and energy needs. Evaluate and adjust tariff structures to better serve diverse customer bases, providing targeted support and promoting energy-saving practices.
- ❖ Prioritize consistent monthly meter readings by ensuring sufficient trained personnel. Invest in smart meters for remote and frequent readings, reducing dependency on manual processes. Optimize scheduling using technology to improve efficiency.
- ❖ Focus on husbands as the primary bill payers, but ensure wives are also informed about billing and energy consumption. Avoid targeting children, and maintain general access to bill information for other demographics.

- Enhance the most popular payment platforms while maintaining traditional methods for inclusivity. Promote direct debit systems and ensure all users have reliable access to payment options. Streamline user experience with customizable alerts and robust security measures.
- Address connectivity issues as a priority. Improve payment system reliability and expand customer support channels, offering alternative communication options for accessibility.
- Ensure prepaid cards are widely available and reduce infrastructure costs to facilitate adoption by small and medium businesses. Collaborate with regulatory bodies to gain support for new payment systems.
- Re-evaluate predictors in online bill payment adaptation models. Consider demographic factors, technological familiarity, and financial literacy. Explore machine learning techniques and qualitative research to gain deeper insights into user behavior.
- Expedite meter installations and establish a dedicated team to address technical issues promptly. Implement a reporting system for customers to easily notify the utility of problems. By implementing these strategies, utility companies can better serve their customers, promote energy efficiency, and enhance overall service reliability and satisfaction.

REFERENCES

Abebe D. Beyenea , et, al 022. Electricity pricing reform and firms' electricity consumption in Ethiopia , EEG Working Paper.

Belay Wube.(2021) Obstructions In Electric Bill Payment: The Case Of Ethiopian Electric Utility Jimma District.

Bayero Journal of Pure and Applied Sciences Vol. 2. Issue 1 pp 27-33.

C. C Ofonyelu, R. E. Eguabor,2017 "Metered and Unmetered Billing: How Asymmetric Are The Phcn Bills?" .

Chioma Lizzy Nwagbo 1 and Barida Baah 2022" A comparative study of basic types of energy meters and metering, Global Journal of Engineering 10(01), 117–124

Chris Stefanadis. (2002). Why Hasn't Electronic Bill Presentment and Payment Taken Off? Federal Reserve bank of New York Current issues volume 8 (7)

Christian Grönroos (2008) Service Logic Revisited: Who Creates Value? And Who Co - Creates. page 305 to 306

Christine Legner. Kristin Weber (2006). Electronic Bill Presentment and Payment. Conference Paper. University of Lausanne.

Claudia Leticia et al, (2018). Mobile Banking Adoption: A Bibliometric Analysis. Article. pp 19-22.

Dina A. Zaki , and Mohamed Hamdy.(2022) A Review of Electricity Tariffs and Enabling Solutions for Optimal Energy Management. Review. Page 2 to 17.

Davis, F. D. (2016). Customer Experience Management Overview. Brno University of Technology. Conference Paper.page 11 to 24.

Ebem, D.E., Arinze, U & Okebanama, U.F. An Optimized Web-Based Energy Billing System for Electricity Consumers in Nigeria. Article · September 2018, Vol. 4 No. 3,

Ebole Alpha Friday,2014. Electricity Power Theft Detection Using Wireless Prepaid Meter

F. Asu 2016 Crazy bills:No respite for Nigerian Electricity

L. Abdulwahab. 2009 "An Assessment of Billing Electricity Consumers via Analogue Meters in Kano, Nigeria"

Jeffrey Meyer. Dwayne D. Gremler. (2015).Customer Service. Bowling Green State University. Page 2

M. Babu, M. Antony et al 2016"Automatic Electricity Billing "International Journal of Advanced Research in

M. Ramu1, Lekha Varisa2 and N. Siva Mallikarjuna Rao (2023). Energy Metering and Billing Systems Using Arduino. Gitam University., page.73.

Noman Mehmood et al ,2011. Electronic Meter Reader & Data Base Management System aritcl.pp 69

Oinonen, Tero. (2014). introduction to Principles of Cloud infrastructure. Bachelor´s Thesis Page 20 to 27

Robert Scott Frazier. Understanding Electric Utility Billing. The Oklahoma Cooperative Extension Service BAE-1404-3. http://osufacts.okstate.edu.

Seyoum Akele.(2012) .customer service quality Ethiopia Electric Power Corporation (EEPco).Uppsala University, Department of Business studies. Page 9 to 13

Sapna Ganurkar, Pravesh Gour.(2014). Prepaid Energy Meter for Billing System Using Microcontroller and Recharge Card. International Journal Of Core Engineering and Management (IJCEM). Volume 1, Issue 1, pp .12.

WWF.(2007). Resources for Implementing the WWF Project & Programmer Standards. Work plans and Budgets.

Yesuf Awel,And Eleni Yitbarek,(2021). Mobile Money Demand In Utility Bill Payments: A WTP Estimates From Ethiopia. Article History. University Of Pretoria, Lynnwood Road, Pretoria, 0002, South Africa.

APPENDIX I:

QUESTIONNAIRE

ADDIS ABABA UNIVERSITY COLLEGE OF BUSINESS AND ECONOMICS

Dear Respondents;

This questionnaire is designed to identify the major challenges in energy bill system in Ethiopian Electric Utility. Your response will be kept confidential and used only for this study. Kindly provide your response based on your experience in the last year

Name :- Fekadu kaba
Email address: - fekadukaba21@gmail.com
fekadukaba21@yahoo.com

Part 1:- Give your Background Information in the space provided

Sex: ___________

Customer Type ______________ Age: ____________

Monthly Income ______________ Education level: ____________

Employment Status ______________ Average Monthly bill _____________

Average Time to pay bill ____________ Type of Meter Reader ______________

Frequency of meter reading ____________

Part 2:- Give your opinion to the following questions based on your experience in the last one year by putting tick mark (√) on the appropriate choice(s). You can select more than one choice whenever necessary.

1. Who is responsible for paying electric bill at home?
   - ☐ Husband
   - ☐ Children
   - ☐ Wife Others, __________________
2. Which electric consuming devises do you use at home?
   - ☐ Electric bulb
   - ☐ Electronic devises (TV, Radio, Fridge etc)
   - ☐ Industry work

- ☐ Electric Mitad
- ☐ Office equipment
- ☐ Washing machine

others, __

3. What challenges have you faced in connection to meter reading (postpaid meter reading)?
   - ☐ Meter Reader not coming monthly
   - ☐ Meter reader has technical problem
   - ☐ Not willing to correct errors in meter reading
   - ☐ Damaged meter not repaired on time
   - ☐ Not getting a meter on time from EEU Others,____________________
4. How do you pay your monthly electric bill?
   - ☐ By Cash at Customer service center monthly
   - ☐ Using my own CBE birr
   - ☐ By Cash at Commercial Bank of Ethiopia monthly
   - ☐ Using Internet Banking
   - ☐ Direct deduction from my Bank account
   - ☐ Using Mobile Banking
   - ☐ Direct deduction from my Bank account
   - ☐ Direct deduction from my Bank account
   - ☐ Using CBE birr of nearby agent
   - ☐ Using Tele birr
   - ☐ Awash birr Others,______
5. If you have paid by cash at service center or at Commercial Bank of Ethiopia, what are your reasons for selecting this method?
   - ☐ Since it gives me confidence/ Security
   - ☐ I do not have smart phone for mobile banking
   - ☐ Since they give me receipt
   - ☐ I do not have internet access
   - ☐ No awareness about the e-payment system
   - ☐ I have to make trip any way
   - ☐ Since I do not use mobile or internet banking others, __________________

6. What challenges have you experienced in relation to electric bill payment on cash basis (paper based Billing)
   - ☐ KWH consumed not entered timely for billing
   - ☐ Exaggerated payment most of the times
   - ☐ The cash collectors are not ethical
   - ☐ Cutting of electric line for delay in payment
   - ☐ Long waiting time for payment at the center
   - ☐ Not giving grace period for large payment
   - ☐ All payment systems not convenient to me Others,____________________
7. If you are using CBE birr, Mobile banking, telebeirr, Awashe banking or Internet banking, what benefit have you obtained?
   - ☐ Time saving ☐ Cost saving ☐ More Secure ☐ Pay bill on time
   - ☐ More convenient Others,___________
8. What challenges have you experienced in relation to online bill payment method?
   - ☐ Interruption of Internet connection
   - ☐ The online payment system not working properly
   - ☐ CBR agent not available in close destination Others,_____
9. What is the effect of war zone and colder area in electric bill payment?
   - ☐ It encouraged me to use online bill payment
   - ☐ I was exposed to war zone and colder area while paying bill
   - ☐ It reduced my income and unable to pay bill Others, ____________________________
10. What challenges prevented you from being a pre-paid card user?
   - ☐ The prepaid card not available easily
   - ☐ It is too costly to install prepaid card reader
   - ☐ EEU is not willing to make the change to pre-paid Others, _____________________

Part 3: Here are a list of reasons that you might have for gaining access to and using an energy bill system. For each reason that is mentioned, please indicate your level of agreement or disagreement as to whether this reasons would influence yourself to use energy bill energy.

No	**Items**	**Scale**			
		Strongly disagree	**Disagree**	**Agree**	**Strongly Agree**
1	Learning to operate energy bill system would be easy to me				
2	The steps in energy bill system are very simple to remember				
3	It takes less effort to make bill system compared to the traditional system				
4	Want to be able to properly try out energy bill system				
5	Energy bill system would enable me to accomplish my tasks more quickly				
6	Energy bill system is more secured than traditional cash payment				
7	Energy bill system would save my expenses associated to different things				
8	Energy bill system would be compatible with most aspects of my work.				
9	Energy bill system would fit my behavior and attitude				
10	Energy bill system would fit well with my living style.				
11	Other people seemed interested in energy bill system when they saw me using it.				
12	People can tell me that I know more about my energy consumption since I have used online payment				
13	Many people appreciated my use of energy bill system				
14	Meter hardware components (micro-processor , battery, IC-reader , relay , relay switch and others) failure due to improper meter fixing				
15	If there is no follow up, the customer may use his domestic tariff meter for commercial use.				
16	Network problems due to Ethio-Telocom service				

Part 4: Open ended Questions

1. Kindly provide any additional challenges related to energy bill system at Ethiopian electric utility.

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2. Kindly provide your own recommendations to the challenges related to energy bill system.

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