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MASTER OF BUSINESS ADMINISTRATION DEGREE

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EXPLORING REVENUE ASSURANCE STRATEGIES THAT LEVERAGE BUSINESS GROWTH IN STATE OWNED ENTERPRISES. CASE STUDY OF ZETDC

BY

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DECLARATION

Student`s declaration- I, Charlton Fambisayi, do hereby declare that this dissertation is the result of my own investigation and research, except to the extent indicated in the acknowledgements, references, and by comments included in the body of the report, and that this dissertation is therefore.my original work and has not been presented in part or in full for any other degree in any other University.

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DEDICATION

Special dedication to my late mother Mrs. Maimba Effie Dzvairo and my lovely daughter Passion Chiedza Fambisayi.

ACKNOWLEDGEMENTS

Firstly and foremost, I would like thank God the Almighty for giving me the power, determination and intelligence for making all things possible. Without God's guidance, this research couldn't have been successful at all.

I appreciate the endeavouring efforts of my supervisor Dr S Gumbe for mentoring me during the period of study. My gratefulness also goes to all Graduate School of Management (GSM) lecturers and colleagues for the opportunity we shared during the years of study.

My gratitude also goes to all the people from different facets of the power sector who took part in providing information by means of answering questionnaires and interviews. I appreciate all of these people's support.

ABSTRACT

The power utility revenue inflow for the past five years has been dwindling at an alarming rate due to loss of revenue within the power value chain; as a result, this impacted negatively to the company. Reviewed literature points out the future of the company lies on its ability to adopt and implement revenue assurance strategies effectively and efficiently. It is against this background that the study sought to explore revenue assurance strategies that leverage business growth of State Owned Enterprises a case of ZETDC. The main objective of the study is to assess the revenue assurance strategies for ZETDC which enhance business growth. The study adopted a positivism approach and employed a case study design so as to retain control of the whole study and easy data comparison. Data was obtained from 264 participants who were drawn from 780 ZETDC employees using a stratified simple random sampling technique. Questionnaire was used to collect data and obtained data was presented and analysed using SPSS version 23.0. A discussion of the research findings was guided by the research objectives and the information collected was presented in graphs, descriptive statistics and inferential statistics so as to try to infer more information from the sample data. The empirical evidence from the study revealed that there are revenue leakages in ZETDC which are due to both technical and non-technical variables. Revenue losses in ZETDC's revenue chain have the following effects; dwindling of profits, declining of electricity sales, shrinking of cash flows, impeding the introduction of new products and services, shrinking of the customer base growth, daunting of the infrastructure development and maintenance. All these have a negative impact on ZETDC growth. However, the Company has adopted various revenue assurance strategies, but most of them are not being practiced effectively and efficiently so as to curb revenue losses. It was discovered that there are vibrant revenue assurance strategies that can help the company to grow if adopted and implemented effectively and efficiently. This leads to a conclusion that revenue assurance strategies in the ZETDC revenue chain are not supporting its business growth since they are failing to curb the revenue loss. Therefore the hypothesis that revenue loss in the ZETDC revenue chain is affecting its business growth is supported. Based on findings, it was recommended that ZETDC should adopt strategies that plug revenue leakages. Further study should apply a survey design so as to have clue of State Owned Enterprises strategies.

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CHAPTER ONE

INTRODUCTION

1.0 Introduction

This chapter offers a general introduction to the study that has been conducted by the author leading to the production of this full dissertation report. The chapter also gives relevant information about the power sector and particularly Zimbabwe Electricity Transmission and Distribution Company (ZETDC) as the institution under study. Some of the headings covered in chapter one include problem statement, research objectives and questions, significance of the study, limitations of the study and ethical research issues. The main objective of the study is to explore revenue assurance strategies that leverage business growth in State Owned Enterprises.

1.1 Background to the Study

ZETDC is a subsidiary of ZESA Holdings and is responsible for the transmission of electricity from the power stations, the distribution of electricity as well as its retailing to end users. ZETDC currently obtains power from Zimbabwe Power Company (ZPC), Eskom of South Africa, and Hydro Cahora Bassa of Mozambique, SNEL of Democratic Republic of Congo (DRC) and Zambia Electricity Supply Company (Zesco) of Zambia. According to Dieter Betz et al (2009) Electricity transmission involves the transfer of electrical energy to electrical substations located near demand centres from generation. Electricity distribution is the final stage in the delivery of electric power to the final consumer from the transmission system to individual consumers as purported by Brown (2008). Electricity Distribution Company has a mandate to constructs and maintains equipment that transforms the power supply according to customer's specifications, meter installations, billing and payment collection. According to Brown (2008) it differs how countries, electricity distribution are managed either by the central government, private organisations or the local government.

Zimbabwe's energy sector has been battling with power deficit and high operating losses for more than two decades. According to 2017 ZPC power generation statistics report the power utility is failing to meet national power daily demand of about 2 200MW against generation capacity of around 1 500MW, ZETDC is importing to cover power supply shortfalls on an average monthly import bill of US$10.5 million dollars and this is negatively affecting its financial position.

ZETDC has a high rate of revenue losses in the Sub-Saharan African region within its power value chain processes after incurring transmission and distribution costs. According to ZETDC's Managing Director, in the fourth quarterly report of 2017 stated that on average the power utility company is losing 19% revenue within its revenue value chain as compared to a global average of 10%.There is a huge variance between, input-output ratios within the electricity supply value chain. Statistical meters installed at the Region's boundary points from Transmission bulk points and inter-region points estimate monthly Region losses by subtracting Total Energy Sales kWh from the Total Energy Sent Out (kWh) by statistical meters. ZETDC is facing challenges in identifying the main sources, causes of revenue losses and implementation of appropriate methods to reduce electricity these revenue losses. Such technical and operational inefficiencies undermine growth and performance of utilities, dissuade investment, and harm the environment.

In addition, ZETDC is losing millions of dollars monthly in potential revenues as a result of technical loss and non-technical loss due to poor infrastructure, theft or fraud, unprecedented bypassing, meter tempering, obsolete meter, illegal connections, unregistered meters in the billing system, vandalism and meters that adrift out of accuracy (reversing meters).According to a 2017 report presented by the ZETDC Retail Manager the company lost US $8.6 million up to October 2017, in revenue due to technical and non-technical losses. This was directly attributable to metering and billing anomalies for the 352 points that were audited in Harare and Eastern Regions.

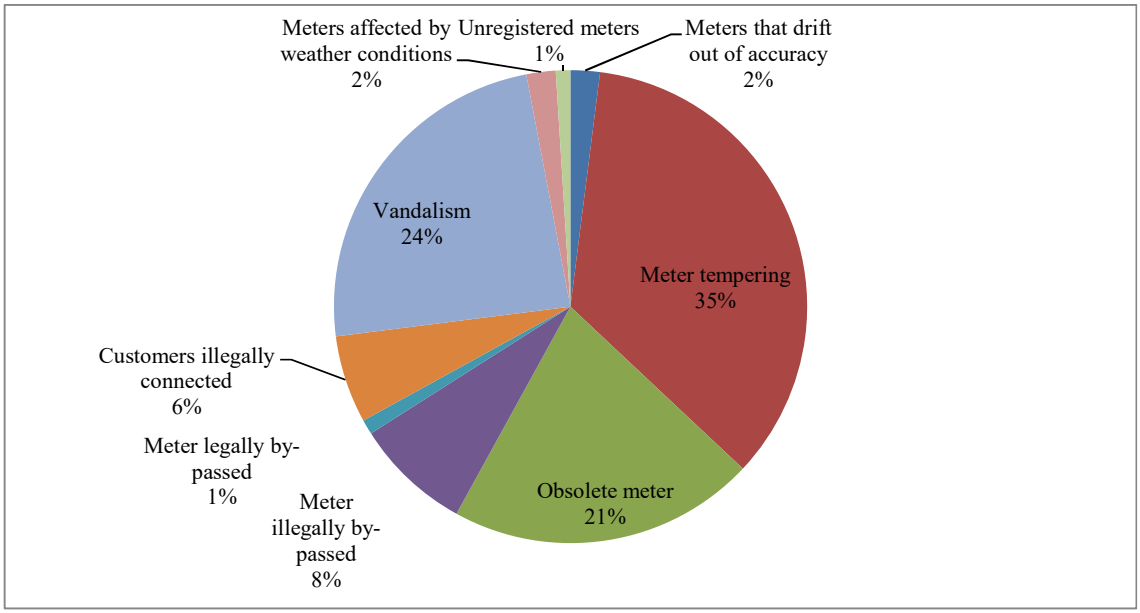
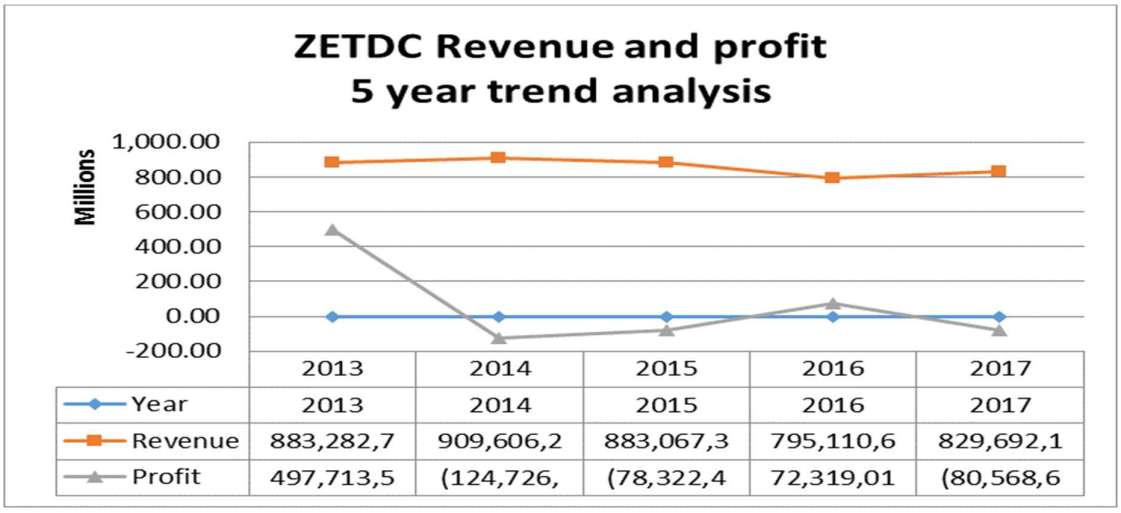


Figure 1:1 ***Causes of ZETDC revenue losses*** **Source: ZETDC 2017 Audit Report**

According to financial records the power utility, has incurred US$524 million losses since 2009, and this has been projected to rise to US$223 million by the end of this year 2018.

ZETDC has also been incurring fluctuating revenue figures since 2015, with $883 million being realised in 2015, $795 million in 2016, and $829 million in 2017. In 2018 to date, revenue of $504 million has been realised.



	2013	2014	2015	2016	2017
Year	2013	2014	2015	2016	2017
Revenue	883,282,7	909,606,2	883,067,3	795,110,6	829,692,1
Profit	497,713,5	(124,726,	(78,322,4	72,319,01	(80,568,6

Figure 1:2 Revenue and profit

According to the source (2017), ZETDC is facing cash flow challenges to pay its creditors including its sister Zimbabwe Power Company for the purchase of electricity, which it owes

a debt of $540 million. Zimbabwe is in the grip of perennial electricity shortages due to the diminished generating capacity of its ageing plants and lack of investment in new infrastructure. This research seeks to come up with effective revenue assurance strategies, proven solutions and technologies in curbing massive revenue losses in the distribution and transmission lines**, e**ffective electricity theft detection, identification & management system for revenue collection, pre-payment billing system to minimize & control electricity theft, smart metering in loss management reduction, and better operation practices of revenue assurance for electricity companies**.**

1.2 Statement of the problem

The power utility revenue inflow for the past five years has also been dwindling at an alarming rate due to loss of revenue within the power value chain due to meter tempering, obsolete meters, inefficiencies and vandalism of distribution infrastructure have significantly reduced customer revenue base. This has reduced profitability, causing it to fluctuate.

Poor cost-reflective billing has resulted in the company failing to pay its debts in time. Creditors have resorted to legal action and charging exorbitant prices to factor the delays in payments from ZETDC, thereby increasing financial losses for the utility. The power utility's actual costs averages $0, 11 per kWh which is insufficient to support operations of the company as compared to other regional peers which have since moved to cost reflective rates to enable viability in their power utilities. Cash flow problems have resulted in the power utility failing to invest in new capital projects in the wake of frequent breakdowns of its ageing infrastructure. ZETDC has been restrained by Zimbabwe Regulatory Authority to factor in any tariff increments, a move which has seen the company sinking deeper into insolvency. Another challenge which ZETDC is facing is to accurately measure electricity losses within the electricity supply value chain generation, transmission and distribution and appropriate methods to curb these huge revenue losses.

1.3 Aim and Objectives

Explore revenue assurance strategies that leverage business growth of ZETDC

1.3.2 Specific Objectives

(i) Ascertain the causes of revenue losses in ZETDC.

(ii) Establish the extent to which revenue losses are affecting ZETDC's growth.

(iii) Assess efficacy of existing revenue assurance strategies and their application to ZETDC.

(iv) To recommend revenue assurance strategies that ZETDC can adopt to achieve growth.

1.4 Research Questions

1.4.1 Main Questions

Do revenue assurance strategies leverage business growth of ZETDC?

1.4.2 Specific Questions

(i) What are the causes of revenue losses in ZETDC?

(ii) To what extent do revenue losses affect ZETDC's business growth?

(iii) Are the revenue assurance strategies in ZETDC applied effectively and efficiently?

(iv) What are revenue assurance strategies that ZETDC can adopt to achieve growth?

1.5 Hypothesis

H_0: Revenue loss in the ZETDC revenue chain is affecting its business growth

H_1: Revenue loss in the ZETDC revenue chain is not affecting its business growth

1.6 Justification of Research

It is essential for organizations to grow in its area of operation through revenue assurance strategies. This is the first study to be done in the power sector of Zimbabwe; this research will explore revenue assurance strategies as to be adopted by ZETDC to ensure that all revenue is collected in the electricity sector.

Since this is the first study to be undertaken in the country in the power sector, the study will contribute to the general understanding of the subject area from the Zimbabwean

perspective. The study will equip the researcher, management and employees of ZETDC with the relevant knowledge of revenue assurance strategies in the field of revenue protection. ZETDC will also benefit from the findings of this study through better understanding and implementation of the Revenue assurance strategies. Lastly, the study will benefit the academic community who can exploit the findings of this research.

1.7 Scope of the study

The study focuses on how revenue assurance strategies enhance business growth in ZETDC. The research was carried out using a sample from employees drawn within the ZETDC revenue value chain to enable a complete understanding of the study variables. The study covered the period August 2012 to July 2018 so as to consider the period of Prepayment metering project, ICS and SAP modules for the case study.

1.8 Ethical issues of the Research

According to Saunders, Lewis and Thornhill (2007), ethics in the context of research relates to questions relating how researchers formulate and clarify their research topic, design their research and gain access, collect data, process and store and analyse such data, write up their research findings in a moral and responsible way. For this particular research as in accordance to Colis and Hussy (2003), requires ethical considerations in the area of data protection anonymity. This was so because the researcher is any employee of the chosen organisation under study. Therefore it was necessary to consider ethical issues throughout the period of the research and remain sensitive to the impact of the work on those subjects who were approached to partake in this research. The researcher observed the anonymity of the respondents so that this research was, in any way, faces any repercussion. The consent of all participants where the survey was conducted was sought before undertaking of the field study.

1.9 Dissertation Outline

The study is divided into five chapters; the first chapter gives the background of revenue assurance strategies in ZETDC, statement of the problem, objectives of the research as well as the research questions and research hypothesis will be stated. The research scope will be outlined and also the study will be justified. In the second chapter, relevant literature will reviewed, the study has to be framework approach hence principles and theories underpinnings of revenue assurances strategies will be reviewed in line with the research objectives. Chapter three focuses on the research methodology that was applied in the study. Chapter four focuses on research findings through data collection presentation and analysis. The last chapter, which is chapter five, concludes the research by looking at the conclusion, recommendations from the study and identifies areas for future study.

1.10 Conclusion

The chapter has looked at the background to revenue assurance strategies. A brief analysis of the history of revenue assurance strategies in ZETDC was also done. The problem to be addressed by the research has been defined, the research objectives identified and the research questions outlined. The next chapter will review the literature of revenue assurance strategies and characterize the theoretical model which will form the hypotheses for the research.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

The chapter presents the literature review. It starts with the background and theoretical concepts that relates to power system losses in the electricity utility industry. The electricity losses studies which were conducted in various countries and the causes of revenue losses. The chapter also reviewed the effects of revenue losses on business growth of power utilities and revenue assurance strategies and their success stories. The main objectives of all power utilities are to maximize profit and minimize operational costs. This requires dealing with the common problems of losses. The research on the reduction of losses in electricity industries has been an active topic in the engineering field and it has proven that the solutions to these problems are unique for different countries and utilities.

2.1 Definition of Terms

Distribution system -is part of the total electric supply system and provides the final link between a utility's bulk transmission system and its final consumers (Chinwuko et al, 2018).

Electricity theft -is the difference between the power supplied and user's consumption, in the distribution system.

Electricity losses- refer to the electricity injected into a transmission and distribution network that is not paid for by the end-users and therefore represent an economic loss for the country.

Generation – A process of producing electric energy from hydro, coal, nuclear, wind, and gas or bio fuel.

Liquidity: Liquidity is the ability of leaders to settle a company's debts when they fall due (Rao & Apparao, 2014).

Meter – A device that measures and adds up the power consumed by a load and adds it to provide total Kilowatt-hour (KWh).

Outage – The loss of power supply resulting either from electricity shortage or equipment failure.

Profitability: Profitability is an accounting measure of the excess of revenues over expenses (Marwa & Aziakpono, 2014).

Revenue Assurance -data quality and process improvement aimed at prevention and management of revenue leakage or instances of fraud caused by subscribers, external parties, or employees.

Revenue management: Revenue Management is a management strategy for ensuring good financial performance and survival of an organization (Li, Miao, & Wang, 2013).

Strategies- Strategies are the dynamics of the relationship between a business and its environment for which actions taken help leaders to attain business goals (Ronda-Pupo & Guerras-Martin, 2012).

Substation – The node of the electric grid where voltage conversion, switching, metering, control, protection and regulation functions are performed.

Transmission – A process of transmitting energy from generation plants to dispatch or distribution centres.

2.2 Revenue Losses in Power Utilities Companies

2.2.1 Electricity Losses

Hussain et al (2017) defined transmission and distribution losses as the difference between energy input to feeder (Kwh) and billed energy to consumers (Kwh) divided by energy input multiplied by hundred. According to Navani, Sharma & Sapra (2012) distribution losses refers to the difference between the amount of energy delivered to the distribution system and the amount of energy customers is billed. In essence, electricity losses is that difference recorded between quantities of electricity produced and the amount recorded as sold to customers. According to the data from Northeast Group reported 89.3 billion US dollars losses have occurred during the year 2015 in all over the world. India has highest percentage of transmission and distribution losses estimated as 58% which translate to 16

billion US dollars in monetary value (Hussain, 2016) from its income due to electricity theft, Brazil $ 10.5 billion, Russian $ 5.1 billion and Pakistan $0.89 billion respectively.

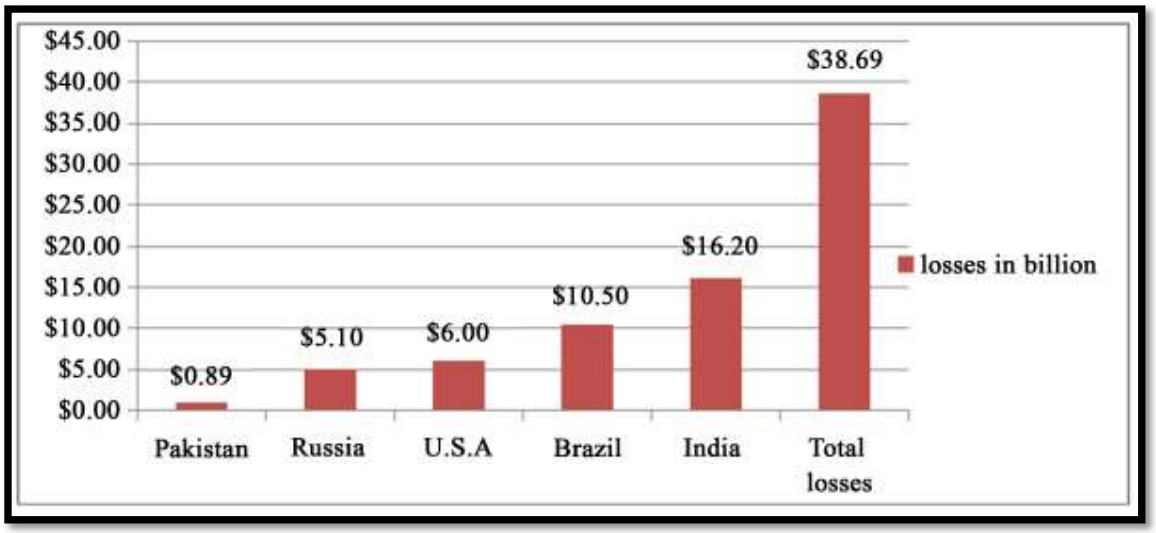


Figure 2:3 ***Northeast Group 2014 Report on World economies losses billions of dollars per year by electricity theft***

Transmission and Distribution losses in developed countries range from 4-12% (Navani, Sharma & Sapra, 2012). According to Inter-American Development Bank 2014, utilities electricity losses report is as follows:

- African countries are losing an average of 20.68% of electricity within transmission and distribution system.
- Latin American and Caribbean region is losing an average of 14.28% of Electricity losses.
- South Asia countries are recording an average of 13.51% of electricity loss from transmission to distribution.
- European countries electricity losses are 9.07 % below the world benchmark of 10%.

Electricity loss reduction contribute immensely to achievement goal of universal consumer access to electricity services and enhances greater financial sustainability of utilities, as additional revenues increase cost recovery, enhance the capitalization of the power sector, and improve the sector's capacity to invest (IADB, 2014). According to Hussain et al

(2017) there are two types of electrical power losses that occur during the generation, transmission and distribution of electricity from its sources of generation station to distribution point namely technical and non-technical losse**s**. Losses occurred due to different reason such as length wires, transformer heating, grid station distribution and meter tempering and modification (Jiguparmar in transmission and distribution, 2013).

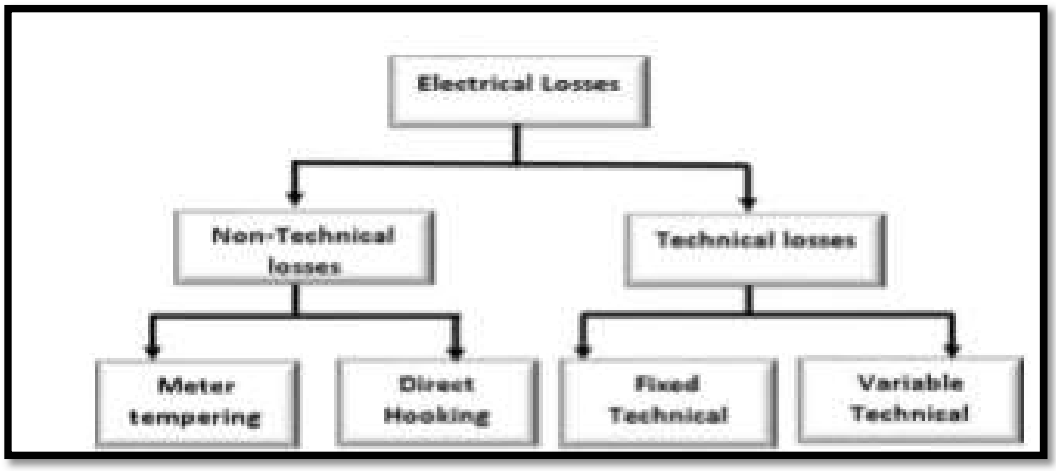


Figure 2:4: Electrical power losses in electric power System

2.2.2 Technical losses

Technical losses (TL) are natural losses occurred regularly in power sector and these losses are produced by physical structural properties of power system (Hussain et al, 2016). Technical losses mainly consist with transmission line, transformers, substation and electrical network losses (Navani, Sharma & Sapra, 2012). According to Hussain et al (2016) technical losses occurs due to lengthy single phase lines, improper cable earthling at remote sides, poor power loading, and power over loading on transmission lines as well as poor quality cable and equipment. Technical losses refer to occurring losses mainly of power dissipation in electrical system mechanisms such as measurement systems, transmission lines, and power transformers, as noted by Dike et al (2015). In essence technical losses are caused by the physical properties of the components of power systems (Suriyamongkol 2014, cited in Dike et al, 2015).

2.2.3 Non-Technical losses

Non-technical losses (NTL) occurs at electricity distribution points such as meter tempering, unregistered connection, direct hooking system, and meter connection bypassing and meter modifications (Selvam, et al., 2016). According to Hussain et al (2017) non-technical losses occur during transmission of electricity and is major electricity theft of electricity occur in NTL are of power sector. Furthermore, NTLs mainly caused by consumer malpractices and not accountable by electric power supply companies until the responsible person do not visit the remote site (Onat, 2010). Non-Technical losses disturb the supply of electricity, rise power load on grid station and escalation bill imposed on customers as highlighted by Hussain et al (2016).

2.2.4 Causes of Non-technical power losses in an electrical power system

According to Hussain et al (2017) non-technical losses include electricity theft, meter tampering, bill errors, un-meter connection, un-estimated consumer's accounts, false reading by meter readers, slow the meter reading disk, ignore unpaid customers, metering errors and are usually caused by a human being who is unaccountable to the power utility companies.

2.2.4.1 Meter tempering

Meter tempering is type of electricity theft where imposters manipulate the meter reading on electromechanical meter device (Hussain et al, 2017). Meter reading records the actual energy consumption utilized by electricity consumers but due to this electricity theft method the actual readings on the meter cannot be recorded by meter readers. This is the easiest way and technique to manipulate the electromechanical meter devices to hide the actual meter readings.

2.2.4.2 Un-registered connection.

According to Hussain et al (2017) unregistered connection is thieving technique where consumers do not have registration of their meter device to respective electric power utility

company. This theft technique is undetectable until the personal of respective company visit the remote places (Saikiran1, 2014).

2.2.4.3 Unpaid bills

According to Hussain et al (2017) unregistered connection is thieving technique where consumers do not have registration of their meter device to respective electric power utility company. This theft technique is undetectable until the personal of respective company visit the remote places (Saikiran1, 2014).

2.2.4.4 Direct hooking

Direct hooking from the main line of high transmission line (HTL) is a common used method, 80% of worldwide electricity stealing is by direct tapping from the HTL (Hussain et al, 2016). According to Hussain et al (2017) consumers tap wires on HTL from a point ahead of the electricity meter and acquire the electricity without using electricity meter panel. So the meter system cannot measure the power consumption of that particular consumer. (Depuru et al, 2011, Hussain et al, 2016).

2.2.4.5 Meter Modification

According to Hussain et al (2017) has highlighted a number of methods of electricity meter modification such as inserting external materials into the meter, penetrating holes in the electro-mechanical meter. Furthermore, the electromechanical meters can be tempered by putting a highly viscous fluid, directional changes of meter, exchanging the incoming and outgoing terminals by wiretapping, resetting meter reading, destruct the rotating density of coil by meter screws and using solid neodymium magnets for the disruption of disk (Zhan, et al., 2016),(Hussain. et al., 2017).

2.2.4.5.1 Inverse meter Reading

Inverse meter reading is thieving technique where intruder reverse the actual meter reading by opening the protective shield cover of electricity meter (Sultana, et al., 2016). After

inversion of the protective shield of metering system, meter will be wrapped again smartly that nobody can judged about reading inversion until electricity meter has been retested in the laboratory(Gaur and Gupta, 2016), (Hussain, et al., 2016).

2.2.4.5.2 Magnet material on rotating disk

According to Hussain et al (2017) Magnet material is used to stop the rotating disk of electricity meter. The imposter put the magnet material on the upper surface of rotating disk which create an obstacle in the free movement of rotating disk (Hussain et al, 2017). Slower moving disk is used because it measures less amount of energy consumption as compare to its normal state (Hussain, et al., 2016).

2.2.4.5.3 Directional Changes

This is another common electricity theft technique where the intruders changed the direction of energy meter from its actual position (Hussain et al, 2017). The speeds of the rotating disk will slow down due to directional change of electricity of the meter. The slowing down speed of rotating disk will result in measurement of less amount of energy (Hussain. et al., 2016).

2.2.4.5.4 Wires Tapping

According to Hussain et al (2017) electricity distribution through electricity meter panel is combination of the neutral and load wires, neutral and load wires must be connected to electrical panel board of meter for the proper measurement of electricity consumption and the free movement of meter rotating disk is necessary to measure the proper electricity consumption. Imposter taps and wraps wires of electrical panel board and connects the neutral conductor with external devices to acquire the neutral earthing. Thereby restricting disk from rotating freely and this will result in less energy measurement (Hussain. *et al.,* 2016).

2.3 The effects of revenue losses on business growth

Taking it from a business perspective, electricity losses result in economic losses to the power utility. Also, it affects consumers being billed for accurately measured consumption and regularly paying their bills are subsidizing those users who do not pay for electricity consumption. Jamil (2013); Winther (2012) concurred that utility companies are forced to apply for a electricity tariff increase from the regulator in order to sustain power supply and electricity prices increase will affect consumers. Electricity theft causes unnecessarily increment in the price of power, poor quality of supply, affects re-investment and unemployment for legitimate consumers (Saini, 2017). Lewis, F. B. (2015) concludes that electricity theft causes power disruptions and affects the overall economy and its various sectors. Therefore, power theft adversely affects the amount of re-investment and employment that can take place in the electricity sector by curtailing potential revenue that can be collected by utility companies. Lewis, F. B. (2015) argue that utility companies are forced to pass on both cost of energy lost and expenses for the maintenance of the distribution systems thereby affecting genuine consumers. Power theft adversely affects the quality of electricity supply and efficiency of the system due to overloading, which leads to intermittent power outages, as a result affecting consumers, loss in output and damaging electrical appliances (Mwaura, 2012; Tasdoven et al., 2012; Tishler, 1993). In short, power outages caused by electricity theft are costly to firms as they often stop vital production from taking place.

In summary, power theft also adversely affects re-investment and employment that can take place in the electricity sector by curtailing potential revenue that can be collected by utility companies. It negatively the amount of funds available to finance expansion of generating capacity, and therefore contribute to load-shedding i.e. cutting power to selected customers when there is shortage of electricity relative to demand. The State Electricity Boards (SEBs) rarely have profits and there are heavily subsidised for their losses. This has seen most of SEBs not able to pay neither their bills of power purchased from the central government or Independent power Producers (IPPs) nor for plant and equipment and worse still for the delivery of their coal. Navani, Sharma and Sornal (2011) also alluded that the Indian power system was in a devastating state and has been on the verge of financial collapse.

2.4 Revenue Assurances strategies and success stories

Effective and efficiency of the revenue assurance strategies determine the future growth of power utilities companies (Hussain et al, 2011). Revenue assurance strategies efficacy can be achieved through three main areas: cultivating the efficiency of your employees, cultivating the company's efficiency when dealing with clients, and cultivating the efficiency of the company as a whole. Non – technical losses are nearly impossible to quantify using power system analysis techniques and tools. Cabral, Pinto, Gontijo and Fihlo (2004) noted the difficulty in quantification as due to the lack of information and insufficient inputs in order to carry out meaningful loss calculations. Gathering of information normally is very difficult and there are slim chances that surveys conducted might accurate. This is due to the fact that rarely would people involved on the theft fairly participate on the surveys when their own illegal actions would be exposed. According to Smith (2004) non – technical losses are highly dependent upon the nature of customers and laws and regulations of the particular country. Therefore, there exists no single formula or software to calculate it by easy means.

There are several strategies which have been proposed or implemented in different parts of the world in the past to overcome and minimize revenue losses in an electrical power system. Hussain et al (2011) suggested a solution that covers entire electrical power system from transmission through distribution to the final user stage.

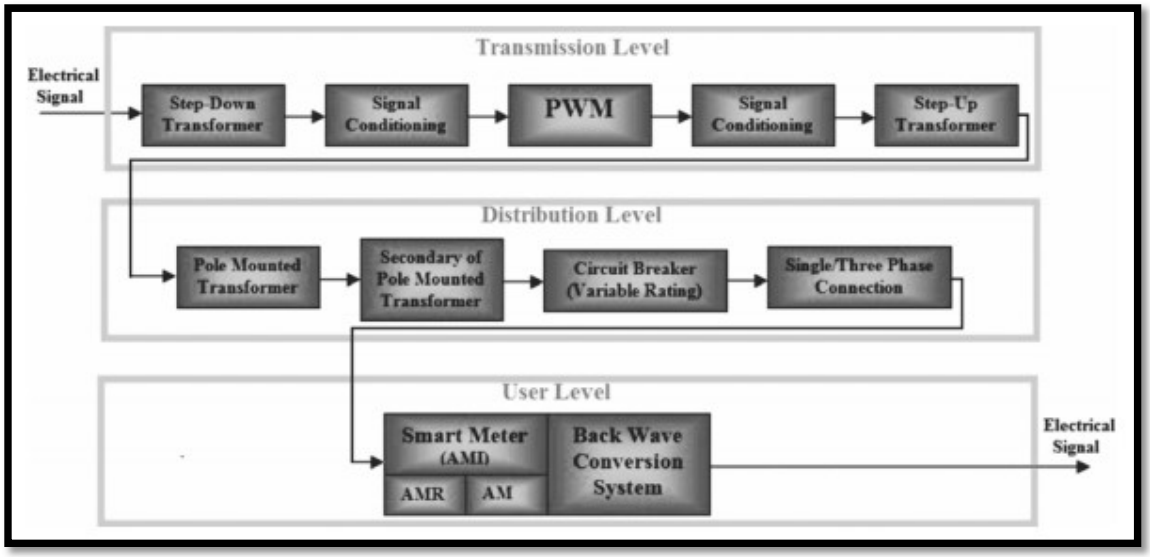


Figure 2:5: Block diagram of proposed solution

2.4.1 Wave conversion system based on PWM (Pulse Width Modulation)

According to Hussain et al (2012) electrical power transmitted by city substation is stepped down by the transformer and strengthened by signal conditioning circuit. There after conditioned electrical signal is changed into square wave signal by PWM technique, and after re strengthened it is stepped up into actual voltage level by the transformer. At Distribution stage, the power is stepped down by distribution transformer and then supplied to consumers in single and three phase connection system. Also Hussein at el (2012) proposed installation of adjustable rating circuit breaker when connecting every consumer. The advantage to the utility is that, no consumer will access electricity beyond the provided limit. According to Zhou (2011) and Liu (2011) cited by Hussein (2012) stated that any attempt to temper, circuit breaker would trip and the respective consumer would be disconnected immediately from the electrical supply system. On User stage, where the electricity is delivered by the conventional electrical meters, Hussein at el (2012) highlighted that installation of incredibly efficient Smart Meters technology is the way to go, because it possess a number of features along with two-way communication system and Back-wave conversion system producing actual electrical signal.

2.4.2 Prepayment Metering

Prepayment metering systems ensures that the consumer pays only for energy consumed and not the estimated bill in post-paid as can be seen in the large standard deviation in the units of energy consumed (Ogujor and Otasowie, 2010). Bandyopadhyay (2008) prepayment metering system is an Information Technology (IT)-based innovation that involves the payment of electricity by consumers prior to its use. Therefore in simple terms, consumers buy electricity in advance, once the amount is exhausted the meter automatically disconnects the supply after providing alarm and can only access electricity after buying recharge token and recharging the meter.

Prepayment metering system or pay as you is a way to improve customer service delivery, cash flow improvement and risk minimisation for utilities (Gupta, 2008). Geographically, prepayment meters have been deployed across the globe. South Africa and UK power utilities have successfully installed prepayment meters in huge volumes as compared to other countries. According to Bandyopadhyay (2008) prepayment systems have been

implemented in UK for over 70 years. Other countries that have adopted the prepayment metering system include USA, Argentina, France, Poland, New Zealand, Malaysia, India, Bangladesh, Israel, Brunei, Kuwait and Nigeria.

Table 1:1: The approximate number of prepayment installations in different countries by (2005).

Table 1 Prepayment installations

Country	*Number of prepayment installations*
South Africa	4 million
The UK	3.8 million
Turkey	1.3 million
France	1 million
New Zealand	50,000
Tanzania (Africa)	40,000
Australia	30,000
South America	20,000–30,000
The USA	20,000
Asia	19,000
Gabon, Ghana, Namibia, Mozambique, Botswana, Sudan, Nigeria, Morocco, Cameroon and Madagascar (Africa)	Less than 20,000 per site
Caribbean Islands	2,000
India	A few thousands

2.4.2.1 Prepayment Metering System benefits

Gupta (2008) highlighted several benefits for both Utilities and Electricity consumers by adopting prepayment meter system. Benefits to Utilities are as follows:

2.4.2.1.1 Utilities Prepayment Metering System benefits

(i) **Prepaid electricity**: Energy is paid for before it is consumed and is different from arrangement of paying for them after use because enhance cash flow for Utility.

(ii) **No unpaid bill**: Prepayment metering system eradicates collection of arrears and unpaid bills will be thing of the past.

(iii) **No meter readings**: The problems associated with the logistics of meter reading are eliminated, that's providing a substantial saving to Utility.

(iv) **Lower overheads**: there is reduction in overheads due to no meter reading, no billing, and no bill generation. Excess staff will be assigned to other critical departments.

(v) **No incorrect bills**: no bills are sent, incorrect billing as a result of inaccurate meter readings is no longer a problem.

(vi) **No disconnection/ reconnection**: Prepayment metering system removes the process of disconnecting and reconnecting errant consumers. This will result in utility savings in manpower, transportation and legal expenses.

(vii) **No account queries**: Efficiency will be achieved as a result of elimination of rechecking meter readings and statements as a result of queries from customers.

(viii) **Tamper and fraud detection**: Tamper and fraud detection allow phase failures, reverse energy, phase reversal, on power up resets, missing neutrals etc. to be time/date stamped, & reported.

(ix) **Load Control**: Prepayment metering system offers load control and demand side management.

2.4.2.1.2 Benefits to Consumers

(i) **Pay-as-you-go system**: It allows customer to buy electricity as and when he/she requires.

(ii) **No standing in long queues:** Prepayment metering system provides flexibility of purchasing prepaid electricity token through the mobile phone, internet, and would thus avert consumers from standing in long queues for purchasing electricity token.

(iii) **Allows the consumer to budget**: The prepaid system empowers customers to understand the cost of energy and therefore it enables them to budget in accordance with their financial position and lifestyle.

(iv) **Display of remaining credit:** The prepayment metering system have the option to display the actual remaining credit in monetary value as well as the total kWh consumption. The advantage is that consumers are in ability to manage energy purchase to suit their requirements and also, to co-relate the tariff with his expenditure.

(v) **Help become energy conscious:** Prepayment metering system enables consumers to be aware of the effects of electricity abuse and the environmental impact on

community due to display of remaining units and the consumption rate can readily adapt to become energy conscious.

2.4.3 Wireless Power Transmission

Bhutada and Maheshwari (2014) defined Wireless power transmission as transmission of electrical energy from a power source to electrical load without man-made conductors. It eliminates the use of wires to transmit power from generation to the final consumer. Due to increase in wireless data application the need of wireless energy transfer technology has increased tremendously. According to Bhutada and Maheshwari (2014) Wireless Power Transmission is the latest technology for direct powering and wireless charging of cell phones, game controllers, laptop computers, mobile robots, electric vehicles, flat screen TV's ,digital picture frames hanging on the wall without the use of an adaptor. The advantage is that Industrial systems, medical devices operate more reliable by eliminating wiring and replaceable batteries. Wireless power transmission significantly reduces transmission and distribution losses in power utilities. Bhutada and Maheshwari (2014) highlighted the reduction in cost of transmission and distribution and also the cost of electrical energy for the consumers**.** According to World Resources Institute (WRI) **(2008),** India's electricity grid has the highest transmission and distribution losses in the world a whopping around 27%. Statistics figures published by various Indian government agencies put that number at 30%, 40% and greater than 40%, this have been attributed to technical losses and theft**.** Theft, in Delhi, accounts for 42% of these losses as compared to China 3% loses of electricity due to theft as part of 8% total power transmission losses. OECD countries are experiencing transmission and distribution losses of 7%. According to Pike research worldwide revenues from wireless power transmission and charging systems will reach $11.8 billion by 2020 with a compound growth rate (CGAR) of 36%.

2.4.3.1 Merits of Wireless Power Transmission

Wireless Power Transmission system has evolved to transmit dozens of power over km wirelessly. The system eliminates high tension line cables, towers and sub stations which are seen as not very efficient way of energy transmission and it connect the entire power system globally. It offers a wide range of simple and convenient charging modalities from a mat that will charge several devices in a given range. The cost of transmitting and

receiving the energy becomes less thereby reducing the tariff rate. Loss of power through transmission is insignificant. The advantage is that natural hazards like earthquakes, landslides, floods, cannot cut the power in WPT system. Also, power failure due to short circuit of cables or faults in lines will not occur. The space occupied by infrastructures like power house, dam, substations and transmission grid will be eliminated

Other advantages are that driver cost like the overall cost per watt or kilowatt (tariff) for charging will be reduced as physical chargers and adapters are removed. This technology advances in wireless power are meant for both cost savings and higher consumer satisfactions in electrical vehicle market, industrial applications and military applications. Wireless Power Transmission system is clean energy and carbon reductions as reduction in cords, adaptors, and wall outlets. It also, this system reduces greenhouse gas emissions by eliminating the need for copper wire transmission grids. Transporting power from remote generation sources like PV arrays, wind plant. Collecting and utilizing micro power from ambient sources like cellular networks. Replacing costlier and carbon intensive electric sources like diesel generators.

2.4.3.2 Demerits of Wireless Power Transmission

Initial costs are high for its practical implementation. As microwave is used meaning interference is high. In laser technique attention losses radiation losses are the concerned factors. The major concern remains safety of waves it emits the biological impacts.

2.4.4 Smart Metering Technology

Bohil, Sorge and Ugus (2010) highlighted in the recent years Smart metering technology has attracted attention around the globe as a strategy to curb electricity theft. A number of countries are installing smart meters as way to reduce loss of revenue, it while others countries have set targets (Kadurek 2010, Pothamsetty, 2009). According to Depuru et al (2011) the very fantastic feature of smart metering is the efficient two-way communication between the Utility power supplier and the consumer. In other words, Smart meters communicate electronically, as advanced meters that identify consumption in more detail than conventional meters and communicate through a network back to the utility for monitoring and billing purposes (Climate Group, 2008, p. 85). As for today the only information a consumer receives outdated monthly bills from the power utilities after

consumption of electrical energy, even when bill is an estimate. The smart metering provides:

- Real-time information about energy use.
- It enables consumers to monitor and manage their consumption.

Popa (2011) and Haney (2009) asserted that smart meters are part of AMI (Advanced Metering Infrastructure). Singh, Bose and Josh (2017) stated that AMI is a combination of multiple technologies such as smart metering, home area networks, integrated communications, data management applications, and standardise software interface. AMI has the ability to provide consumers with the information they need to make intelligent decisions, also the ability to execute decisions, and a range of choices which leads to substantial benefits which consumers enjoy. According to Benzi et al (2011) smart meter is connected to the Electric power supplier, other market actors and can potentially be coupled to appliances in the home via HAN (Home Area Network).

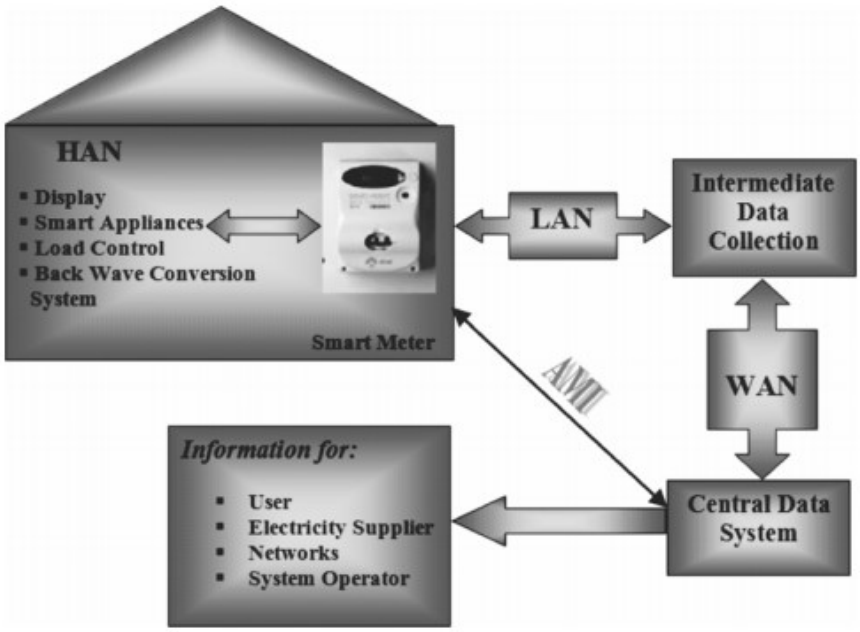


Figure 2:6: General layout of AMI

Fig. 2.3 shows how various communication networks connect part of AMI together. The AMI can be categorized by two ways that are differentiated by their levels of communication which are AMR (Automated Meter Reading) and AMM (Automated Metering Management).

2.4.4.1 AMR (Automated Meter Reading)

According to Shende, Mude and Jain (2014) Automatic meter reading (AMR), is the technology of automatically collecting data from energy meter and transferring that data to a central database for billing or analysis. According to Pandile et al (2017) there are two AMR systems, Wireless and wire based system, are based on GPRS, Bluetooth, and GSM technology for instant billing system. Electricity consumer's bills are based on actual consumption rather than on an estimate, which base on previous consumption, giving customers an opportunity to control use of electric energy. The Transmitter is connected to the meter and it counts pulses from it and displays it over the LED display. Also it transmits the data using the RF. Data is received by a receiver module which the microcontroller will display it over the LED display. Benefits of installing AMR is that all meters will billed using actual readings including those meters are installed inside customer's homes and were not accessible by meter-readers cannot record monthly consumption.

2.4.4.2 AMM (Automated Metering Management)

Negash, Sowjanya and TulasiRam (2008) defined Automatic Meter Management (AMM) as a system which records the meter readings remotely. AMM system improves services delivery offered to the clients by power utility companies using the low-voltage power distribution lines as physical support for communications (Negash, Sowjanya and TulasiRam 2008). Also AMM system provides several other benefits to the customer's generation of customer's electricity bills based on actual consumption not based on estimate. In addition, consumers have the choice to adjust their budgets. In other words, AMI (Automated Metering Infrastructure) refers to system that measure, analyse and read energy consumption and is also able to read electricity, gas, and heat and water meters remotely. AMI system is an extension of the simpler AMR system and AMM (Automated Meter Management) or smart metering is another expansion of a remote reading system.

2.4.5 Back Wave Conversion System

Back wave conversion system produces actual electrical sinusoidal signal, the simulation circuit on User stage. It comprises of two networks or circuits.

(i) Integration amplifier "Integrator".

(ii) Wave shaping network "Diode function generator".

According to Memon at el (2012) Integrator is based on op-amp produces integration of the input PWM signal. Diode function generator is a wave shaping circuit that produces sinusoidal signal with the combination of diodes and resistors (Kubanek, 2011cited by Memon at el, 2012).

2.4.6 Energy Management Information System

According to Negash, Sowjanya and TulasiRam (2008) Energy Management Information System (EMIS) is an important comprehensive energy management program, it provides appropriate information to key individuals and departments that enable them to make right decision on improve energy performance. An EMIS is characterized by its deliverables, features, elements and support. Deliverables comprises of early detection of poor performance, decision making support and effective energy reporting. Also features of an EMIS include data storage in a usable format, the calculation of effective targets for energy use and comparison of actual consumption with targets. Elements include sensors, energy meters, hardware and software and these exist as process and business performance monitoring systems. Vital support includes management commitment, allocation of responsibility, procedures, training, resources and regular audits.

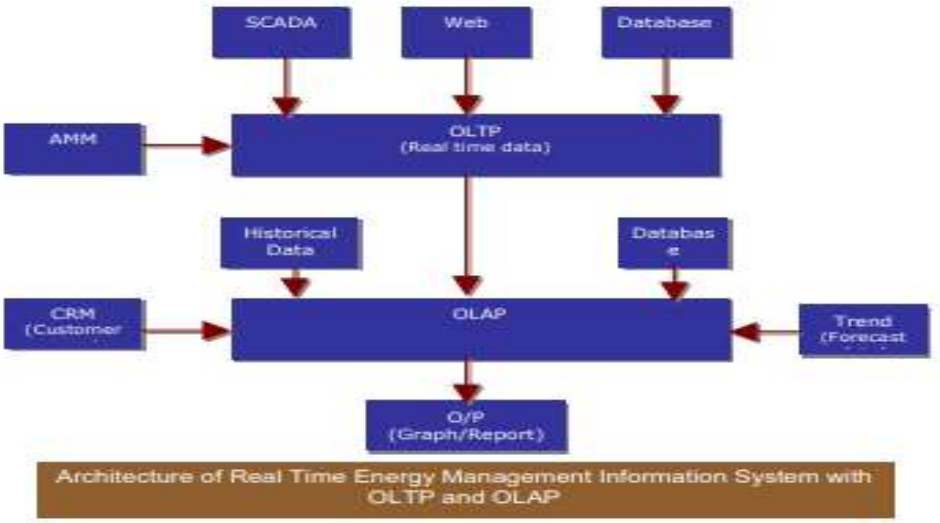


Figure 2:7: Block diagram of RTE MIS with OLTP and OLAP.

2.4.7 Other strategies that can be implemented to reduce technical and non-technical losses

Amadi and Okafor (2015) suggested several other strategies to minimise losses in an electric power system thereby reducing frequency of power outages, as a result the power system become more efficient and reliable.

(i) All KV lines of transmission and distribution, be it 11KV, 33KV, 330KV should be closely monitored to make sure that the lines voltages do not exceed the limits. Transformers in the distribution system and all electrical equipment and sub stations must be protected from overloading.

(ii) Electricity infrastructural systems must be inspected periodically. As well, preventative maintenance programmes should be implemented.

(iii) Utility companies should also ensure that the relevant personnel are properly trained in energy metering, this will motivate them. Rewards and adequate loyalty packages would also help employees carry out their duties effectively.

(iv) Prepaid meters and an integrated billing system must be installed and administered. After the installation, consistent monitoring of the consumption of energy by the meters as well as evaluation of meter readings statistically should be adopted.

(v) Upgrading of electricity meters to a modern day standard that will ensure they are accurate. The adoption of smart card technology and smart card metering would also ensure that usage is monitored. It will also become easier to detect meter tampering and theft more quickly.

(vi) Implementing uncompromising laws against the use of electricity illegally.

(vii) Awareness campaigns to inform the public to jealously guard electrical infrastructure from vandalism, in their respective communities.

(viii) Properly designing the electricity power system network, taking into consideration unpredictable futuristic needs.

2.5 Research Gaps

Majority research on Power Utilities world over has focused on the effects of Technical and Non-Technical losses on power outages (Amadi and OKafor, 2015) and An Optimum Solution for Electric-Power Theft (Memon et al, 2012). It has been established that power utilities are losing through Technical and Non-Technical losses are major losses affecting performance of power utilities. Revenue assurance strategies should be adopted to leverage

business growth in stated owned enterprises. There is limited research on revenue assurance strategies to curb revenue leakage within the revenue value chain of Zimbabwe Stated Owned Enterprises to enhance growth without the introduction of new products in the market. No such research has been done in the Zimbabwe's Electricity Industry to identify revenue assurance strategies to enhance growth without influencing demand. It is therefore crucial to identify techniques, tools, operational disciplines whose objectives is the maximisation of revenue collection and minimising of revenue loss in order to achieve business growth for ZETDC.

2.6 Conceptual Framework

A conceptual framework is a structure which the researcher believes can best explain the natural progression of the phenomenon to be studied (Camp, 2001 as cited in Adom, Hussien and Agyem, 2018). In a statistical perspective, the conceptual framework describes the relationship between the main concepts of a study. According to Grant & Osanloo (2014) conceptual framework is arranged in a logical structure to aid provide a picture or visual display of how ideas in a variables under study relate to one another. After the researcher has reviewed the literature he came up with a conceptual framework that may provide possible answers to the research questions raised in chapter one. Figure 2.6 below illustrates the conceptual framework.

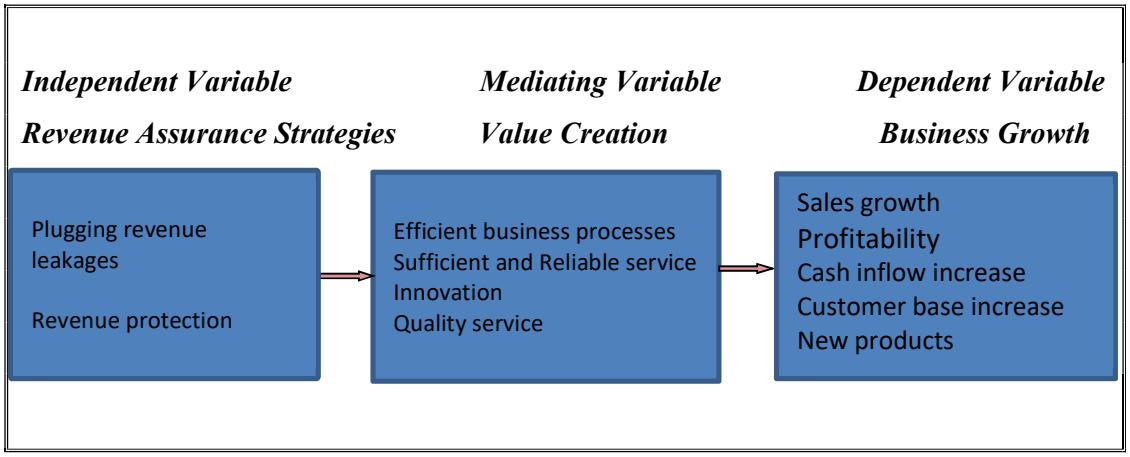


Figure 2:8: Conceptual Framework Source: Own Construction

The conceptual framework for this study was revenue assurance strategies for business growth in ZETDC. TM Forum defined Revenue Assurance as the quality of data and process improvement methods that advance profits revenues and cash inflows without manipulating demand. Revenue assurance strategies, in sum, are strategies aimed at ensuring that all revenue due to the organisation has been accounted and collected with the aim to improve profitability and cash inflows. Figure 2.6 illustrates the relationship amongst the revenue assurance strategies, value creation and business growth of ZETDC. The current thinking as elaborated in Figure 2.6 is that revenue assurance strategies (Plugging revenue leakages, revenue protection, business revenue chain analysis) have a positive influence on the value creation for the mutual benefit both ZETDC's and its various stakeholders. Furthermore, value creation through (efficient business processes, innovation and quality service) has a positive impact on the business growth of these State Owned Enterprises.

2.7 Chapter Summary

This chapter reviewed literature on Electricity losses, type of losses in the electricity industry and the causes of revenue losses. The section looked at the theoretical effects of revenue losses in terms of business growth of ZETDC. The literature review also outlined revenue assurance strategies that can be adopted by ZETDC to prevent revenue losses within its revenue value chain in order to achieve growth through quality service delivery. This chapter highlighted the benefits of prepayment smart metering technology both to the organisation and consumers at large. The chapter concluded by presenting the theorised conceptual framework to be used in revenue assurance strategies which enhances business growth of ZETDC through value creation. The next chapter outlines the research methodology which was used for this study in terms of the research design, sampling procedure, instrumentation, data analysis and ethical considerations.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter presents the methodology adopted for this study. The chapter mainly focusses on the research design, research philosophy, research strategy and research approach and the justification of the research design and approaches used in the study is also discussed. In this chapter the research population, sampling methods, research instruments, data processing and analysis procedures were also explained and justified. The chapter also discussed the validity and reliability of the study as well as the ethical considerations.

3.1 Research Design

According to Akhtar (2016) defined research design is a structure of research that act like glue and it holds all of the elements in a research project together, in short it is a plan of the proposed research work. According to Yilmaz (2013) research design is defined as a conceptual structure in which a research would be conducted. Therefore research design is a structure or a plan how to carry out a research. Research can either be descriptive, exploratory or explanatory.

3.1.1 Descriptive Research

A descriptive research simply describes the variables under study and does not highlight the causes of the situation because the researcher knows the variables to be studied already. It seeks to answer the research questions such as “who”, “where”, “how many”, “how much”, and not to test hypothesis as suggested by (Visagie, 2010).

3.1.2 Exploratory Research

An exploratory research helps in the understanding of the problem and it tackles new problems with which there are no previous studies or where little research has been done. Hence, exploratory research is done in order to provide better understanding of the situation under study but however, not coming up with the conclusive answers to the problems. Exploratory design is usually used when the research problem is in the preliminary stage and when the topic is new and it is usually performed through literature search and in depth interviews.

3.1.3 Explanatory Research

Explanatory research seeks to investigate the cause-and-effect relationships between variables under study and the researcher will have to test hypotheses of the study to establish the relationship between variables. The main aim of explanatory research is to confirm or disconfirm theory and variables are clearly defined (Visagie, 2010).

3.1.4 The research design adopted

For this study, the researcher adopted the exploratory approach with the aim to identify revenue assurance strategies to plug losses revenue within the ZETDC's revenue chain for the enhancement of business growth. So the researcher wanted to assess the efficacy of the existing revenue assurance strategies applied in ZETDC. The researcher wanted to compare and contrast the findings with the theory expressed in Chapter 2- literature review and be able to recommend revenue assurance strategies that ZETDC and other stated owned companies can adopt to achieve growth and future prospective through exploratory research design which is briefly presented.

3.2 Research Philosophies and Paradigms

Research philosophy refers to how a person views the world which then affects how he or she gathers and develops knowledge (Tuli, 2010). According to Creswell (2003) cited by Rahi (2017) described the term 'paradigms' as an essential collection of beliefs shared by scientists, a set of agreements about how problems are understood, how we view the world

and thus go about conducting research. In short, paradigms contain a basic set of beliefs or assumptions that guide inquiries for a research. The research philosophies available for research are interpretivism, pragmatism and positivism. These research assumptions underpin the research strategy and methods to be used as part of the strategy. According to Rahi (2017) supporter of interpretive paradigm believes on the deep understanding of the world in which they live and they develop subjective meanings of their experiences or towards certain objects or things. It is also know Constructivism, Social Constructivism or Qualitative Research paradigm. There is a belief by interpretive that true knowledge is obtained by deep interpretation. Pragmatism's aim is to find weaknesses in the study and to strengthen it using mixed methods approach (Onwuegbuzie, 2004 cited in Rahi, 2017). Rahi (2017) highlighted that there is believe that knowledge is obtained by mixed method approach and it is not affiliated to any system or philosophy and researcher can use both quantitative and qualitative approaches, the reason is to find the best techniques. Positivist paradigm is of the belief that knowledge is only valid if developed by testing hypothesis derived from the theory. Knowledge is valid if it is acquired objectively through facts and eternally when the researcher is detached from the respondent, knowledge is explained by the cause and effect relationships and it focus on facts gathered and measured using the quantitative methods like surveys and experiments (Yilmaz, 2013). A positivist approach is associated with a quantitative research and this type of research is factual, objective and the collected data can be measured. The paradigm depends on large samples and highly structured data collection.

3.2.1 Research Philosophy adopted

For this study, the researcher adopted the positivist research philosophy because it was the most appropriate paradigm since the sample size was large, the aim of the study was to identify revenue assurance strategies to plug losses revenue within the ZETDC's revenue chain for the enhancement of growth within its operations and data was collected using a structured survey questionnaire.

3.3 Research Assumptions

Assumptions available for research are ontological assumptions, epistemological and axiological assumptions (Tuli, 2010). Ontological assumptions are concerned with the nature of reality and it can either be objective or subjective. Ontologically objective assumption state that there is only one truth or reality and subjectivism portrays that there is multiple truths or realities. Epistemological assumptions are concerned with how knowledge is acquired (objectively or subjectively) for example, should the researcher closely interact with the respondents or should she maintain a distance? For this study, the researcher chose to closely interact with the respondents in order to get as much information why ZETDC and other state owned entities are losing the much needed revenue for business growth. Axiological assumptions are concerned with the researcher's view on the importance of values and ethical issues, for this research there was close interactions with the participants, but no sensitive questions were asked and respondents were allowed to be anonymous.

3.4 Research Approach

According to Castellan (2010) there are two main research approaches namely; inductive and deductive approach. According to Collis et al (2013) deductive is an approach where researchers do not get theory from observing theory that already existed but based on empirical observation on theory generated on conceptual and theoretical structure. In other words, researcher tests a theory by collecting fresh data from the participants and analyses the data by applying different statistical tests.

3.4.1 Deductive Approach (Quantitative Research)

Rahi (2017) highlighted that deductive method is generally recommended for specific studies in which researcher work on particular concept by creating and verifying assumptions. Deductive approach emphasizes the collection of quantitative data whereas inductive approach emphasizes the collection of qualitative data (Glenn, 2010). Deductive approach makes use of the available literature to classify the theories and ideas that the researcher will test using the collected data. Here the researcher develops a conceptual or

theoretical framework which will consequently be tested using data. Qualitative research makes use of the inductive approach and is often exploratory, which means there will be hypothesis formulating rather than hypothesis testing.

3.4.2 Inductive Approach (Qualitative Research)

Collins and Hussey (2013) defined inductive approach as a process where theory is developed by what the researcher could have observed during his/her research. In other words, inductive approach is when the data explored by the researcher in order to develop theories which will be subsequently related to literature by the researcher. Quantitative research is deductive in nature since the researcher will be testing the hypotheses based on literature. Quantitative research allows the researcher to gain a generalizable set of data through the use of larger samples (Yilmaz, 2013).

3.4.3 Research Approach adopted

For this study, the researcher chose the deductive (quantitative research) approach as the most suitable since the objective was to explore revenue assurance strategies with the aim for ZETDC and other state owned entities to achieve growth. The causes of revenue losses within ZETDC revenue chain were determined, since the data collected from the survey was statistically analysed to recommend strategies to curb these revenue losses.

3.5 Research Strategy

According to Rahi (2017) research strategy is a process of collecting and interpreting data with clear objectives. Thus, research strategy is general plan regarding the way the researcher goes about answering research questions. There are many strategies that be used for data collection which include surveys, experiments, ethnography, case studies, action research and grounded theory.

3.5.1 Research strategy adopted

The researcher adopted a survey strategy in this research study, since a huge amount of data was required to come up with strategies to curb the loss of revenue through ZETDC's revenue chain in order to achieve growth. Surveys are strategies which are popular in social sciences and are associated with deductive research approach (Mark et al, 2009 quoted by Rahi, 2017). According to (Rahi, 2017) in this strategy information is collected by interviews and pre- designed questionnaire. The researcher adopted self-administered and online-administered questionnaires to boost the response rate. Surveys in most cases are done using questionnaires and it enables the collection of quantitative data which can be analyzed using various statistical techniques. The use of the survey strategy presented some challenges some respondents chosen for the sample were not willing to participate in the survey. The researcher's job is therefore to send as many questionnaires as possible to a bigger sample in order to compensate for any respondents' shortage and making follow-up requests.

3.5.2 Research Instrument

The data analyzed came from questionnaires that were distributed using a stratified random sampling method to obtain the maximum respond rate. The instrument adapted questions from literature with the aim to collect accurate information. The study population was a randomly selected sample of employees from Transmission and Distribution departments of ZETDC and it consisted of 264 employees, Directors, managers, supervisors, and with at least 2 years' experience in the transmission and distribution of electricity. The questionnaire was sent to the randomly selected to employees within the revenue chain of ZETDC and the reason was to avoid consistency of characteristics which could result in biased responses. The instrument was self- administered and some were emailed to respondents.

3.5.3 Questionnaire Development

The questionnaire that was developed started with an introduction which explained the purpose of the research and its topic which is exploring revenue assurance strategies for ZETDC. The researcher also added that the responses collected are required only for academic purposes and they will be treated with highest confidentiality, so as to avoid any

potential bias in their replies. The questionnaire design was based on literature and contained items from developed and pretested by other researchers (Uzkurt et al (2012); Pratano (2014); Okey (2014); Masevo (2015) and Chiwara (2015). The questionnaire was divided into six major sections namely demographics, types of revenue loss within ZETDC's revenue chain, to ascertain the causes of revenue losses in ZETDC, the extent at which revenue losses are affecting ZETDC's' growth, evaluation of the efficacy of existing revenue assurance strategies and their application to ZETDC and revenue assurance strategies that can be adopt by ZETDC to achieve growth. Respondents were asked to rate on a Likert scale which ranged from 1 (strongly disagree) to 5 (strongly agree). The respondents selected the scale which corresponded to their level of agreement or disagreement to a particular statement. The researcher used a Likert scale because it is the most appropriate way of collecting quantitative data and also it is fast and easy for respondents to understand and answer the questions. In addition, answers from a Likert scale can be easily managed and coded using statistical techniques (Malhotra, 2010).

3.6 Population and Sampling Techniques

Samples are mainly used due to the impracticality of gathering data from the entire population. The sample frame of this study targeted 264 employees from Transmission and Distribution departments and the rationality of choosing employees within Transmission and Distribution departments because it is considered to be important within revenue chain of ZETDC.

3.6.1 Target Population

This research targeted all employees in ZETDC Commercial, Risk Management, and Transmission and Engineering departments and with the intention was to find out how ZETDC is losing revenue within its revenue chain in order to come up revenue assurance strategies to curb loss of revenue using survey questionnaires to collect data. The research targeted employees within ZETDC revenue chain when distributing the survey questionnaire to ensure that all departments within ZETDC revenue chain are well represented. The survey questionnaires were hand-delivered and others emailed to employees with the responsibility of transmission and distribution of electricity to the final

consumer from generation directors, management engineers. These were targeted because they usually have better information about transmission and distribution of power from generation to the final consumer within ZETDC revenue chain

3.6.2 Sample Frame and Size

The study sample was drawn from a pool of employees from ZETDC who are in Engineering, Commercial, Risk Management and Transmission departments. The population comprised of 780 employees. A sampling frame was designed to assist the researcher to collect data that was representative of the views of management and staff at the various levels of management or hierarchy from the above mentioned departments. More focus was given to middle management and line management as they have insight on the variables under review. The sampling frame that was used for this study is as highlighted in the table below

Table 3:2 Sampling frame

Population		**Sample**
Strata	Population Size	Sample size
Executive Management	6	6
Senior Management	64	50
Middle management	128	55
Line Management	223	105
Junior Staff	259	48
Total	**780**	**264**

From this population, the researcher randomly selected 264 employees to participate in the study. The sample size and method used are both influenced by constraints like financial

support, availability of resources and time available to select the sample, collect and analyze the data. The researcher adopted the formula developed by Yamane in 1967 to determining the sample size of the study. Yamane`s method indicate that a ±5% accuracy level and 95% confidence level should be accepted for study.

Yamane`s formula is presented as follows:

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

Where: n = sample size
N = Population size
e = Level of precision

The population for this study comprised of 780 employees and the researcher assumed a 5% accuracy level, therefore the computed sample size was 264 employees.

3.6.3 Sampling Techniques

According to Coldwell and Herbst (2011) there are two main sampling techniques which are probability and non-probability sampling. Taherdoost (2016) asserted that in probability sampling every item in the population has equal chance of being included in a sample. In other words, probability sampling method is when the probability of selection from the entire population is equal and known for all the cases. The probability sampling methods can be considered as simple random, systematic, stratified and cluster. According to Taherdoost (2016) non probability sampling is often associated with case study research design and qualitative research. Non-probability sampling procedures include convenience sampling, purposive sampling and quota sampling (Locke, Silverman and Spirduso, 2010). For this research, the probability sampling was adopted because of its representative nature of the sample population to the target population which increases reliability of the outcomes and eases bias of outcomes because of its randomness. A stratified simple random sampling method was used by the researcher to select so as to give each employee in strata equal chance of being selected hence eliminating bias. According to Taherdoost (2016) stratified sampling is where the population is divided into strata (or subgroups) and a random sample is taken from each subgroup. This technique may also allow the use of inferential statistics that permits generalizability of outcomes to a larger population.

3.7 Questionnaire Administration

The researcher used emails and self-administered structured survey questionnaires to gather data from targeted respondents. These methods of collecting data were appropriate for this study because they permit collection of large amounts of data at low cost and also they convenient to participants. Emails were sent to respondents whose emails were found online and the researcher was continuously making follow ups to ensure that the questionnaires were completed and emailed back

3.7.1 Research Instrument Piloting

The researcher pilot tested the questionnaire on a small proportion (ten respondents) of the sample. According to Johnson and Christensen (2012) pilot testing means testing the research instrument on a miniature portion of the sample in order to detect and correct flaws and limitations in the instrument. Pre-test was done to test the wording sequence, layout of questions as well time required to complete the instrument. Specific problems that were faced with questions content included misinterpretation of the terms, concepts and the meaning of the phrases for example, revenue assurance strategies, revenue leakages, revenue protection, technical and non-technical losses, efficacy, and smart metering. To alleviate these problems, the researcher had to clarify the meanings to the respondents and sometimes had to be present while the respondent was completing the questionnaire clarifying some questions which they could not understand. Visagie (2010) posit that questionnaire should be checked for some formatting problems because they result in loss of important information. As such, pilot study was conducted to improve validity of the instrument.

3.7.2 Data analysis techniques, and presentation

Data received from respondents was coded first. A data entry template was designed and subsequently all the data was captured and cleaned to remove inconsistent responses. The questionnaires were initially given codes for all responses and all poorly answered questionnaires would not be considered for analysis. Data entry was done using the Statistical Package for Social Sciences (SPSS) and analysed using descriptive statistics and

regression analysis. The information obtained from the data was presented using tables, graphs, and charts for the easy comparison and clear projection of the situation. These findings will be presented in chapter four, together with detailed discussions.

3.8 Ethical Considerations

The researcher maintained confidentiality and consent of the respondents. This was done by relaying all the necessary important details of the study, including study and therefore not being forced to participate in the research. The names of the participants were not disclosed including any other personal information in the research and the researcher ensured that only those details that help in answering the research questions were included in the questionnaire.

3.9 Chapter Summary

Literature and the underlying concepts for selection of the research methods, research population, the sampling techniques and research instruments were discussed. This chapter presented the research design and approach that were considered most appropriate for this study and their selection was justified. The target population was outlined and sampling frame was also well-defined. The research philosophy, assumptions, research strategy, quantitative research methodology, data collection method, data presentation and analysis procedures used in the study were outlined. This chapter also discussed validity and reliability issues as well as ethical considerations. The next chapter presents the findings based on evidence from data collected using research design and methodologies that were described in this chapter.

CHAPTER FOUR

RESEARCH FINDINGS, ANALYSIS AND DISCUSSION

4.0 Introduction

This chapter presents the findings of the research and discussion that are born from such findings. These findings will as a result form a basis for either rejecting or accepting the research hypothesis. The results from the study are based on objectives of the study. This chapter forms the foundation for the research conclusions and recommendations of the study. These findings will also be discussed in relation to the findings in the literature review.

4.1 Response Rate

In this research a questionnaire was used as a research instrument for the study. A total of 264 questionnaires were personally administered to management and staff in four departments of Zimbabwe Electricity Transmission and Distribution Company (ZETDC) and a total of 238 were successfully completed and returned, yielding a response rate of 91%. The table 4.1 summarises the response rate for the questionnaire.

Table 4:3 Response Rate of the Sample

Questionnaires sent	Response	% Response
264	239	91%

The researcher had left room for errors and non-response hence the disregarded questionnaires did not affect the study expectations. The 91% response rate was satisfactory to provide the researcher with an adequate sample to carry out the study. According to Baruch and Holtom, 2008 cited by Saunders, Lewis and Thornhill, 2015, response rates of about 55 per cent and above is considered to be realistic.

4.2 Reliability Testing

The researcher used Cronbach's alpha coefficient to test reliability in the survey. The coefficient measures the level of internal consistency or how strongly associated a set of objects are as a group. Nunnally (1978) suggests that a 0.7 Cronbach alpha coefficient is accepted to signify reliability in a research. According to principle, the more the value is closer to 1 the higher the reliability.

Table 4:4 Reliability

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.845	.848	63

Table above (4.2) illustrates that the overall coefficient achieved in this survey was 0.845 and after the standardising of the items it was 0.848 which is above 0.7 and also close to 1. This indicates that internal consistency was high and this was gained through pretesting of the questionnaire as anomalies noted during this phase were modified for clarity.

4.3 Demographic Data

This section looks at the demographic information of respondents in the following order; sex, level of education, functional department, experience with ZETDC and position level in ZETDC.

4.3.1 Sex distribution

As illustrated below, the gender distribution of participants was uneven, male respondents has 67% and female respondents has 33%. The rationale for this composition is that in the Zimbabwean set up there is a gender disparity in terms of employment. Males who are formally employed are more than females.

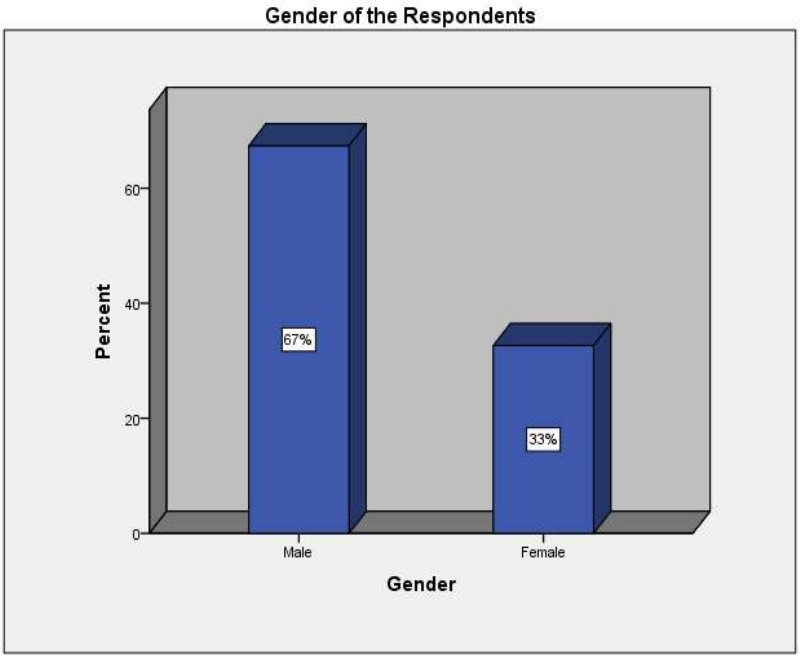


Figure 4:9*: Sex of the respondents*

4.3.2 Respondents' level of education

Table 4:5 Level of education

Level of Education					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Degree	65	27.2	27.2	27.2
	Diploma	99	41.4	41.4	68.6
	Certificate	69	28.9	28.9	97.5
	O level	6	2.5	2.5	100.0
	Total	239	100.0	100.0	

Table above shows that the respondents who have 'O' Level constitute 2.5% of the total respondents while the holders of national certificates and diplomas constitute 28.9% and 41.4% respectively. Holders of all types of degrees constitute 27.2%. The distribution shows a normal distribution skewed to learned personnel. From the above table, it can be concluded that majority of respondents who participate in this study are learned enough to understand the concepts under review.

4.3.3 Functional Departments

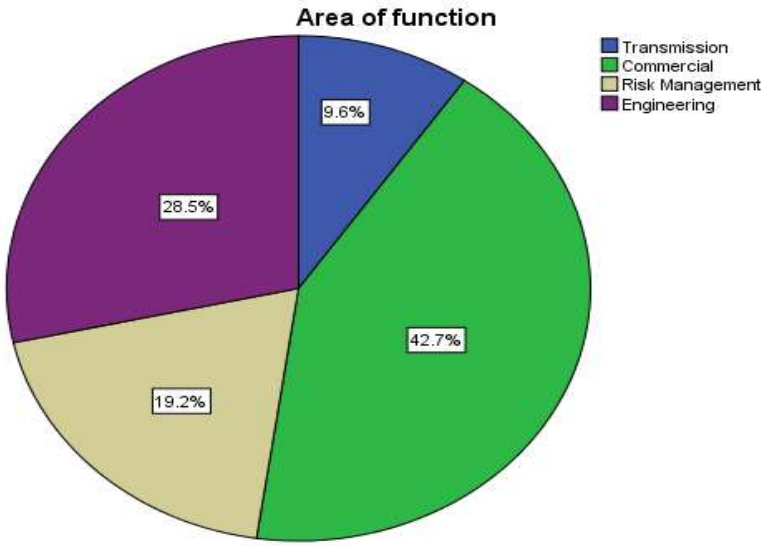


Figure 4:10*: Functional Departments of the respondents*

Figure 4.2 above presents the functional departments of the respondents. The majority (42.7%) of the respondents were from the Commercial Department followed by Engineering department (28.5%), and risk management department (19.2%). The Transmission Department had the least number of respondents of about 9.6%. The implication of the results is that Commercial has high representation of the sample followed by Engineering, Risk Management departments and Transmission department respectively.

4.3.4 Respondents' year of serving ZETDC

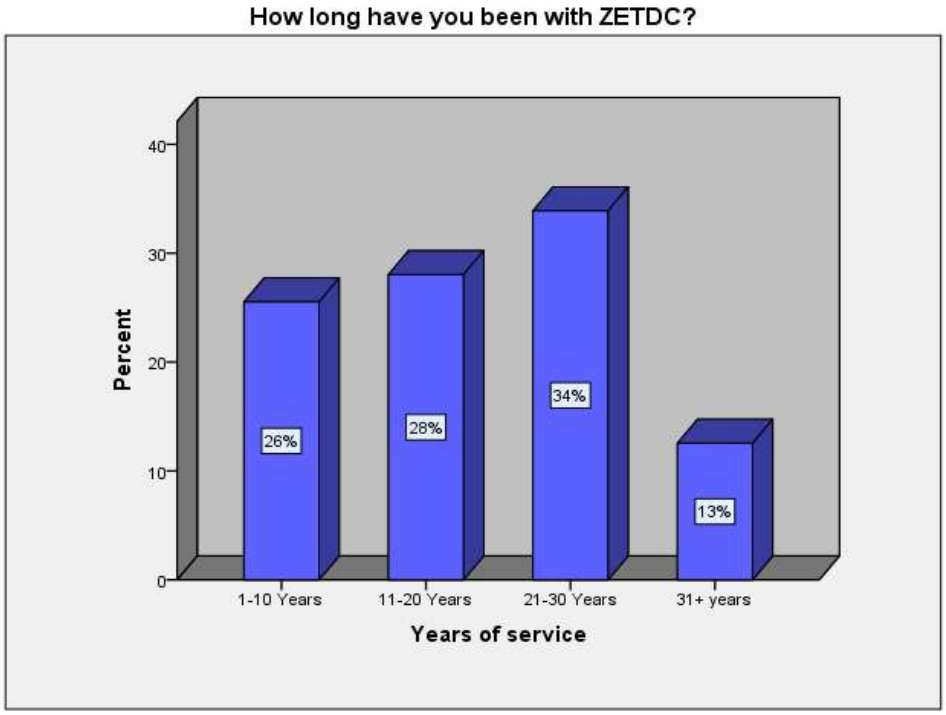


Figure 4.11*: Years of service in ZETDC*

Figure 4.3 above shows that majority 34% of the sample spent 21 to 30 years serving Zimbabwe Electricity Distribution Company (ZETDC). This is followed by a significant number of 28% who served for a period of 11 to 20 years in the organisation. About 26% of the respondents served 1 to 10 years in ZETDC and a fewer number of respondents, 13% served for more than 31 years. The sample shows a normal distribution of experience of the ZETDC workforce. Therefore, it shows that the participants have a considerable working experience with ZETDC to give valid responses for the research.

4.3.5 Position in the Organisation

Table 4:6 Positions of Respondents in the Organisation

Company Position					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Executive	6	2.5	2.5	2.5
	Senior Management	48	20.1	20.1	22.6
	Middle Management	46	19.2	19.2	41.8
	Line Supervisor	98	41.0	41.0	82.8
	Junior Staff	41	17.2	17.2	100.0
	Total	239	100.0	100.0	

The table above shows that the majority of the respondents (41.0%) are line supervisors, followed by the senior management and middle management with 20.1% and 19.2% respectively. Junior staff constitutes 17.2% while the executive staff has the least number of respondents (2.5%). The representation of the sample deviated from the pyramid shape of the normal organisation since the study was more inclined to management than junior staff. This distribution was a result of the sample frame which targeted management personnel than junior staff. However, on management level the sample showed a pyramid distribution which is quite normal for a health organisation. Since the majority of the respondents are from the managerial positions, this gives the research a positive dimension as they have in-depth knowledge on all point of revenue losses in ZETDC.

4.4 Research Objectives

In order to proffer answers to research questions of this study, the researcher employed descriptive statistics and inferential statistics. Descriptive statistics is concerned with the development of certain indices from the raw data whilst inferential statistics is concerned with inferring more information from the sample data. For this study the researcher chose mean as a measure of central tendency and standard deviation as a measure is dispersion or variation. Mean is the average and standard deviation shows how dispersed are the responses from the central value - mean. These measures have been calculated based on

SPSS coding of responses. Responses were based on a 5 point modern Likert-scale ranging from 1 to represent strongly disagree, 2- disagree, 3- neutral, 4- agree, and 5- strongly agree.

4.4.1 Causes of revenue losses in ZETDC

In order to ascertain causes of revenue losses in ZETDC revenue chain, respondents were asked various questions to give their views and perceptions on the causes of revenue in their organisations. Analysis of the findings was made using mean as a measure of central tendency and standard deviation as measure of variability. Further analysis was done using regression analysis. Responses of the respondents and analyses are illustrated by tables below.

Table 4:7 Mean and standard deviation on revenue losses in ZETDC's revenue chain

Descriptive Statistics			
	N	Mean	Std. Deviation
In your opinion are there revenue losses in ZETDC's revenue chain?	239	4.14	.473
Revenue loss in ZETDC's revenue chain are due to technical losses only	239	2.06	.591
Revenue loss in ZETDC's revenue chain are due to technical losses only	239	2.04	.631
Revenue loss in ZETDC's revenue chain are due to both technical and non-technical	239	4.06	.873
Valid N (listwise)	239		

M = Mean, SD = Standard Deviation

Table 4.5, above shows that the respondents strongly agree that there is revenue losses in ZETDC's revenue chain shown by (M=4.14, SD=0.473). It is revealed that the respondents are indifferent on the statement that revenue loss in ZETDC's revenue chain are due to technical losses only or non-technical losses only this was shown by (M=2.06, SD=0.591) and (M=2.04, SD=0.631) respectively. Findings shows that the respondents agree that revenue loss in ZETDC's revenue chain are due to both technical and non-technical

captured in (M=4.06, SD=0.873). In all aspects, variations of their views are below 1 meaning to say they are having same point of elevation.

4.4.1.1 Responses on the causes of technical losses

Analysis of the findings on the causes of technical losses was made using mean and standard deviation. Responses are illustrated below.

Table 4:8 Mean and standard deviation on the causes of technical losses

Descriptive Statistics			
	N	Mean	Std. Deviation
Line Loss	239	4.01	.996
Losses in mid-span Joints at termination	239	3.71	.942
Losses in transformer	239	4.40	.929
Losses in service cables and connections	239	3.95	.836
Loss due to impedance	239	3.86	.949
Losses in re-wired fuses/jumpers	239	3.98	.830
Valid N (listwise)	239		

Table 4.6, above shows that the respondents agree and strongly agree that the technical causes of revenue losses in ZETDC's revenue chain are line loss, loss in mid-span joints at termination, losses in transformer, losses in service cables and connections, loss due to impedance and losses in re-wired fuses/jumpers as indicated by (M=4.01, SD=0.996), (M=3.71, SD=0.942), (M=4.40, SD=0.929), (M=3.95, SD=0.836), (M=3.86, SD=0.949) and (M=3.98, SD=0.830). The variation of their responses shows that the majority holds the same viewpoints.

4.4.1.2 Regression analysis

Regression analysis was done to determine the significance and order of the above said contributors of the technical revenue losses so as to know the factors which may deserve priority. The analysis is tabulated below.

Table 4:9 Model Summary

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.501[a]	.251	.231	.414
a. Predictors: (Constant),				

The r square value is high enough to warrant significance of the model which is 25%. This means that technical losses contribute 25% of the data in the model. This suggests that 25% of the revenue losses in ZETDC revenue chain are technically driven and this means that there are other non-technical factors that can cause revenue losses.

Table 4:10 ANOVA Table

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	13.336	6	2.223	12.947	.000[b]
	Residual	39.828	232	.172		
	Total	53.163	238			
a. Dependent Variable: In your opinion is there revenue loss in ZETDC's revenue chain?						
b. Predictors: (Constant), Losses in re-wired fuses/jumpers, Line Loss, Loss due to impedance, Losses in service cables and connections, Losses in mid-span Joints at termination, Losses in transformer						

The ANOVA table denotes that the model is significant since the p value 0.00 is less than 0.05. Again the F statistic (12.947) is highly significant, which provides evidence for the presence of a linear relationship between all 6 variables. This suggests that using the model is better than guessing the mean. This makes the model significant meaning to say part of the revenue losses are as a result of technical factors.

Table 4:11 Coefficients

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.837	.177		27.398	.000
	Line Loss	.153	.042	.321	3.647	.000
	Losses in mid-span Joints at termination	-.214	.041	-.426	-5.283	.000
	Losses in transformer	-.309	.052	-.608	-5.922	.000
	Losses in service cables and connections	.084	.051	.148	1.657	.099
	Loss due to impedance	.144	.041	.288	3.488	.001
	Losses in re-wired fuses/jumpers	-.009	.048	-.016	-.185	.853
a. Dependent Variable: In your opinion are there revenue losses in ZETDC's revenue chain?						

The table denotes that there are non-significant coefficients, submits that Losses in re-wired fuses/jumpers and Losses in service cables and connections do not contribute much to the revenue losses since their p value are above 0.05. The variable that contributes much to revenue losses in their order of contribution are Line loss, Loss due to impedance, Losses in mid-span Joints at termination and Losses in transformer.

Table 4:12 Mean and standard deviation on the causes of non-technical losses

Descriptive Statistics			
	N	Mean	Std. Deviation
Meter Tempering	239	4.35	.831
Unregistered connection	239	4.00	1.065
Unpaid Bills	239	4.00	.733
Direct hooking	239	3.70	.904
Meter Modification	239	4.23	.967
Inverse (error) meter reading	239	3.91	1.043
Directional changes-Meter bypass	239	4.36	.876
Wires Tapping	239	4.03	.654
Pilferage of energy	239	4.13	.943
Energy Accounting Systems	239	3.83	.818
Receipt of payment	239	3.62	1.013
Error in meter reading	239	4.02	1.174
Error in Bills	239	3.99	1.117
Valid N (listwise)	239		

Table 4.9, above shows that the respondents agree and strongly agree that the non-technical causes of revenue losses in ZETDC's revenue chain are Meter Tempering, Unregistered connection, Unpaid Bills, Direct hooking, Meter Modification, Inverse (error) meter reading, Directional changes-Meter bypass, Wires Tapping, Pilferage of energy, Energy Accounting Systems, Receipt of payment, Error in meter reading, and Error in Bills. This is indicated by (M=4.35, SD=0.831), (M=4.00, SD=1.065), (M=4.00, SD=.733), (M=3.70, SD=0.904), (M=4.23, SD=0.987), (M=3.91, SD=1.043), (M=4.36, SD=0876), (M=4.03, SD=0.654), (M=4.13, SD=0.943), (M=3.83, SD=0.818), (M=3.62, SD=1.013), (M=4.02, SD=1.174), (M=3.99, SD=1.117). The variation of their responses shows that the majority holds the same line of view and perception save for the factors such as Error in bills, Error in meter reading, Receipt of payment, Inverse (error) meter reading and Unregistered connection.

4.4.1.3 Regression analysis

Regression analysis was done to determine the significance and order of the above said contributors of the non-technical revenue losses so as to know which variables could deserve priority. The analysis is tabulated below.

Table 4:13 Model Summary

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.629[a]	.395	.361	.378

a. Predictors: (Constant), Error in Bills, Unpaid Bills, Meter Tempering, Direct hooking, Pilferage of energy, Energy Accounting Systems, Meter Modification, Wires Tapping, Directional changes-Meter bypass, Error in meter reading, Unregistered connection , Receipt of payment, Inverse (error) meter reading

The r square value is high enough to warrant significance of the model which is 40%. This means that technical losses contribute 40% of the non-technical losses of revenues in ZETDC. This suggests that 40% of the revenue losses in ZETDC revenue chain are non-technically driven. It also means that apart from technical factors and non-technical factors mentioned here, there are other factors that contribute to revenue losses at ZETDC.

Table 4:14 ANOVA Table

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	21.024	13	1.617	11.322	.000[b]
	Residual	32.139	225	.143		
	Total	53.163	238			

a. Dependent Variable: In your opinion are there revenue losses in ZETDC's revenue chain?

b. Predictors: (Constant), Error in Bills, Unpaid Bills, Meter Tempering, Direct hooking, Pilferage of energy, Energy Accounting Systems, Meter Modification, Wires Tapping, Directional changes-Meter bypass, Error in meter reading, Unregistered connection , Receipt of payment, Inverse (error) meter reading

The ANOVA table denotes that the model is significant since the p value 0.00 which is less than 0.05. Again the F statistic (11.322) is highly significant, to provide evidence for the presence of a linear relationship between all 13 variables. This suggests that using the model is better than guessing the mean. Therefore, it is meaningful to say part of the revenue losses are as a result of non-technical factors.

Table 4:15 Coefficients Analysis

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.836	.267		14.374	.000
	Meter Tempering	.038	.043	.067	.892	.373
	Unregistered connection	.124	.042	.281	2.946	.004
	Unpaid Bills	.174	.041	.270	4.250	.000
	Direct hooking	-.280	.045	-.535	-6.175	.000
	Meter Modification	-.066	.038	-.135	-1.745	.082
	Inverse (error) meter reading	-.136	.049	-.301	-2.777	.006
	Directional changes-Meter bypass	.137	.052	.254	2.653	.009
	Wires Tapping	-.184	.056	-.255	-3.310	.001
	Pilferage of energy	.046	.036	.092	1.270	.205
	Energy Accounting Systems	.232	.046	.401	5.081	.000
	Receipt of payment	-.086	.044	-.185	-1.952	.052
	Error in meter reading	.109	.036	.271	3.038	.003
	Error in Bills	-.066	.040	-.157	-1.653	.100

a. Dependent Variable: In your opinion are there revenue losses in ZETDC's revenue chain?

The above table denotes that the revenue losses through Error in Bills, Receipt of payment, Pilferage of energy, Meter Modification and Meter Tempering are not statistically significant since their p value are above 0.05. All other variables with p value that are less than 0.05 have significant contribution to revenue losses. The variable that contributes much to revenue losses in their order of contribution are Energy Accounting Systems, Unpaid Bills, Error in meter reading, Unregistered connection, Directional changes-Meter bypass, Inverse (error) meter reading, Wires Tapping, and Direct hooking.

4.4.1.4 Discussion of the findings

The findings of this study revealed that within the revenue chain of ZETDC there is a lot of revenue leakages evidenced by (M=4.14, SD=0.473). This suggests that Zimbabwe is in a similar catastrophe with India, which is said to have more than 40% of electricity loss according to World Resources Institute (2008). The study reveals that the revenue losses in

ZETDC's revenue chain are due to both technical and non-technical captured in (M=4.06, SD=0.873). This supports the argument by Hussain et al (2017) which points out that there are two types of electrical power losses namely technical and non-technical losses. However, results from the regression analysis shows that technical and non-technical variable under review contributes 65% of the revenue losses in ZETDC meaning to say there are other variable, either technical or non-technical, not mention here that contributes to revenue losses. This is in line with Cabral, Pinto, Gontijo and Fihlo (2004) noted it is difficult to quantify non-technical losses due to the lack of information and insufficient inputs in order to carry out meaningful loss calculations.

It was also noted that the contribution of some of the variables which were under investigation, both technical and non-technical, are insignificant. This is due to the fact that some are positively correlated to each other such that if one variable is addressed, the other would be alleviated also. Those variables which have significant contribution towards revenue losses have a varied impact. For technical losses, the variable that contributes much to revenue losses in descending order of significance are Line loss, Loss due to impedance, Losses in mid-span Joints at termination and Losses in transformer. For non-technical losses, the variable that contributes much to revenue losses in descending order of significance are Energy Accounting Systems, Unpaid Bills, Error in meter reading, Unregistered connection, Directional changes-Meter bypass, Inverse (error) meter reading, Wires Tapping, and Direct hooking. These results support the work by Dike et al (2015), Hussain et al, (2017) and Selvam, et al., (2016) which purports that occurring losses consist mainly of power dissipation in electrical system mechanisms such as measurement systems, transmission lines, power transformers, meter tempering, unregistered connection, direct hooking system, and meter connection bypassing and meter modifications among other things.

4.4.2 The extent to which revenue losses are affecting ZETDC's growth.

The study sought to establish the extent to which revenue loss is affecting ZETDC's growth. In order to accomplish that, respondents were asked various questions to give their views and perceptions on whether revenue losses have an impact on the determinants of ZETDC business growth. Responses are illustrated by tables below.

Table 4:16 Means and standard deviations on whether revenue losses have impact on the determinants of ZETDC business growth.

Descriptive Statistics			
	N	Mean	Std. Deviation
Revenue losses is causing the dwindling of profitability	239	4.23	.762
Revenues losses is causing a decline in Electricity Sales	239	4.16	.886
Revenue loss is affecting Cash flow	239	4.05	.754
Revenue loss is hindering introduction of new product and services	239	3.98	.983
Revenue loss is hindering customer base growth	239	4.09	1.180
Revenue is leading to poor infrastructure development & maintenance	239	4.57	.694
Valid N (listwise)	239		

Table 4.13, above shows that the respondents agree and strongly agree that revenue losses in ZETDC has negative impact on; profits, electricity sales, cash flows, the introduction of new products and services, customer base growth, infrastructure development and maintenance. This is indicated by (M=4.23 SD=0.762), (M=4.16, SD=0.886), (M=4.05, SD=0.754), (M=3.98, SD=0.983), (M=4.09, SD=1.180) and (M=4.57, SD=0.694). The variation of their responses shows that the majority holds the same line of view and perception save for the customer base growth variable which has a greater variation of respondents' views (SD = 1.180).

4.4.2.1 Cross tabulation and Chi square Analysis

After a cross tabulation of respondents' view against their departments, it was observed that larger percentage of the respondents who disagree that revenue losses in ZETDC have a negative impact on customer base growth are from commercial department. Further analysis was done using chi-square to establish whether the relation of disagreement of the commercial department respondents is statistical significant. Below is the chi-square test showing the association.

Table 4:17 Chi-Square Tests Analysis

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	64.432[a]	12	.000
Likelihood Ratio	72.116	12	.000
Linear-by-Linear Association	.050	1	.824
N of Valid Cases	239		

a. 8 cells (40.0%) have expected count less than 5. The minimum expected count is 1.06.

Pearson's Chi Square two-sided asymptotic shows a p value of 0.000 which is less than 0.05, and r value of 64.432. This means there is statistical evidence to say there is an association between the respondents' argument and the department they are working in. Their views vary among the departments. Commercial, followed by Risk Management department has a large number of the respondents, though minority, who disagree that revenue losses in ZETDC have a negative impact on customer base growth. These two departments have a minority group which attributes the shrinkage of customer base to other variables apart from revenue loss.

4.4.2.2 Discussion of the findings

Information gathered from this study gave the researcher an insight that revenue losses in ZETDC's revenue chain have the following effects on ZETDC as company; dwindle in profits, decline in electricity sales, shrink in cash flows, impeding the introduction of new products and services, shrink on the customer base growth, daunt in the infrastructure development and maintenance. These findings are in congruent with the work by Jamil (2013); and (Saini, 2017) who pointed out that, electricity losses result in economic losses to the power utility. Also, it affects consumers being billed for accurately measured consumption and regularly paying their bills are subsidizing those users who do not pay for electricity consumption.

The study findings also concurred to Winther (2012) who purports that revenue losses adversely affects re-investment and employment that can take place in the electricity sector by curtailing potential revenue that can be collected by utility companies. It negatively affects the amount of funds available to finance expansion of generating capacity, and therefore contribute to load-shedding i.e. cutting power to selected customers when there

is shortage of electricity relative to demand. Findings also supports the views put forth by Navani, Sharma and Sornal (2011) who alluded that the Indian power system was in a devastating state and has been on the verge of financial collapse.

The findings revealed that views of the respondents varied with departments. There exist outliers from the Commercial and Risk Management departments, though insignificant, they deserve attention. The respondents attribute the shrinkage of customer base to other variables apart from revenue loss. This findings support the idea that there are other variables worth research that are not mentioned in this study.

4.4.3 Efficacy of existing revenue assurance strategies and their application to ZETDC

The study sought to assess efficacy of existing revenue assurance strategies and their application to ZETDC. The views of the respondents are presented and analysed below.

Table 4:18 Means and standard deviations on effectiveness of revenue assurance strategies

Descriptive Statistics			
	N	Mean	Std. Deviation
Are ZETDC revenue assurance strategies are effective?	239	2.92	1.364
Audit all CT metered points	239	2.76	1.169
Use of statistical meters	239	4.12	.627
Installation of statistical meters for substation	239	3.24	1.028
Installation of statistical meters on customers service point	239	2.31	1.258
Carry out meter verification on bulk supply points	239	3.85	.873
Meter Sample to come up with a data base of actual losses of substation and lines	239	3.52	.965
Use of software to analyse statistical data	239	3.72	1.049
Come up with a meter audit policy	239	3.88	.842
Sample and investigate low purchase points with capacity 100 Amps and below	239	3.42	.821
Inspection and sealing of all meters, prepaid and post-paid	239	3.61	1.071
Introduce new sealing technology that is tamper evident and difficult to defeat	239	2.67	1.225
Promptly replacement of faulty Post-paid and Prepaid meters still at site	239	3.08	1.467
Valid N (listwise)	239		

Table 4.14, above shows that the respondents are indifferent that ZETDC revenue assurance strategies are effective indicated by (M=2.92, SD=1.364). The variation of their responses shows that there is a diversified view towards the statement. The table also shows that respondents agrees and strongly agrees that there are only 9 revenue assurance strategies which are being applied effectively in ZETDC namely; Use of statistical meters, Installation of statistical meters for substation, Carry out meter verification on bulk supply points, Meter Sample to come up with a data base of actual losses of substation and lines, Use of software to analyse statistical data, Sample and investigate low purchase points with capacity 100 Amps and below, Come up with a meter audit policy, Inspection and sealing of all meters - prepaid and post-paid and Promptly replacement of faulty Post-paid and

Prepaid meters still at site. This is indicated by (M = 4.12, SD=0.627); (M =3.24, SD=1.028); (M =3.85, SD=0.873); (M= 3.52, SD=0.965); (M= 3.72, SD=1.049); (M= 3.88, SD=0.842); (M= 3.42, SD=0.821); (M= 3.61, SD=1.071) and (M= 3.08, SD=1.467) respectively. It is also emerged that the respondents were neutral on the existence and applicability of all other strategies.

4.4.3.1 Regression analysis

Regression analysis was done to determine the significance and order of importance of existing revenue assurance strategies as they are applied to ZETDC so as to know the strategies which may deserve priority. The analysis is tabulated below.

Table 4:19 Model Summary

Model Summary[b]				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.800[a]	.640	.620	.840

a. Predictors: (Constant), Promptly replacement of faulty Post-paid and Prepaid meters still at site, Installation of statistical meters for substation, Audit all CT metered points, Carry out meter verification on bulk supply points, Sample and investigate low purchase points with capacity 100 Amps and below, Come up with a meter audit policy, Introduce new sealing technology that is tamper evident and difficult to defeat, Use of software to analyse statistical data, Use of statistical meters, Installation of statistical meters on customers service point, Inspection and sealing of all meters, prepaid and post-paid, Meter Sample to come up with a data base of actual losses of substation and lines

b. Dependent Variable: ZETDC revenue assurance strategies are effective

The r square (R^2) value is higher enough to warrant significance of the model which is 64%. This means that the existing revenue assurance strategies only contribute 64% in curbing both non-technical and technical losses of revenues in ZETDC. It means that the existing revenue assurance strategies have a shortfall of 36% to absolutely curb the revenue losses in ZETDC.

Table 4:20 ANOVA Table

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	283.089	12	23.591	33.415	.000[b]
	Residual	159.555	226	.706		
	Total	442.644	238			

a. Dependent Variable: ZETDC revenue assurance strategies are effective

b. Predictors: (Constant), Promptly replacement of faulty Post-paid and Prepaid meters still at site, Installation of statistical meters for substation, Audit all CT metered points, Carry out meter verification on bulk supply points, Sample and investigate low purchase points with capacity 100 Amps and below, Come up with a meter audit policy, Introduce new sealing technology that is tamper evident and difficult to defeat, Use of software to analyse statistical data, Use of statistical meters, Installation of statistical meters on customers service point, Inspection and sealing of all meters, prepaid and post-paid, Meter Sample to come up with a data base of actual losses of substation and lines

The ANOVA table above represents that the model is significant since the p value 0.00 is less than 0.05. Again the F statistic (33.415) is highly significant, and which provides evidence for the presence of a linear relationship among all 12 variables. The table indicates that using the model is better than guessing the mean. Therefore it is meaningful to say the existing revenue assurance strategies are not strong enough to curb the revenue losses in ZETDC revenue chain.

Table 4:21 Coefficients

Coefficients[a]					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1	(Constant)	.968	.458	2.113	.036
	Audit all CT metered points	-.133	.054	-.114	-2.462	.015
	Use of statistical meters	.197	.113	.090	1.740	.083
	Installation of statistical meters for substation	.176	.063	.132	2.796	.006
	Installation of statistical meters on customers service point	.059	.059	.054	1.002	.318
	Carry out meter verification on bulk supply points	-.339	.085	-.217	-3.993	.000
	Meter Sample to come up with a data base of actual losses of substation and lines	.305	.088	.216	3.456	.001
	Use of software to analyse statistical data	-.468	.076	-.360	-6.175	.000
	Come up with a meter audit policy	-.011	.088	-.007	-.122	.903
	Sample and investigate low purchase points with capacity 100 Amps and below	.497	.081	.299	6.131	.000
	Inspection and sealing of all meters, prepaid and post-paid	-.075	.078	-.059	-.956	.340
	Introduce new sealing technology that is tamper evident and difficult to defeat	.068	.055	.061	1.235	.218
	Promptly replacement of faulty Post-paid and Prepaid meters still at site	.394	.070	.423	5.615	.000

a. Dependent Variable: ZETDC revenue assurance strategies are effective

The above table denotes that some of the revenue assurance strategies are not significant since their p values are above 0.05. All other variables with p value that are less than 0.05 have significant contribution in curbing revenue losses in ZETDC. This suggests that there are only six strategies which significantly contribute towards the curbing of revenue losses in ZETDC revenue chain. According to their descending order of importance, the strategies

are; Sample and investigate low purchase points with capacity 100 Amps and below, Promptly replacement of faulty Post-paid and Prepaid meters still at site, Meter Sample to come up with a data base of actual losses of substation and lines, Installation of statistical meters for substation, Carry out meter verification on bulk supply points and Use of software to analyse statistical data

4.4.3.1 Discussion of Findings

Information gathered from this study shows that the respondents are indifferent that all ZETDC revenue assurance strategies are effective indicated by (M=2.92, SD=1.364). The variation of their responses shows that there is a diversified view towards the statement. This outcome suggests that not all ZETDC revenue assurance strategies that are being practiced effectively and efficiently. This finding supports the idea by Bandyopadhyay (2008) who points out that there are not all strategies that can complement each other. Some can be used at the expense of the other depending on the main objective of the company.

The study revealed that there are only 9 revenue assurance strategies which are being applied in ZETDC. The strategies include; Use of statistical meters, Installation of statistical meters for substation, Carry out meter verification on bulk supply points, Meter Sample to come up with a data base of actual losses of substation and lines, Use of software to analyse statistical data, Sample and investigate low purchase points with capacity 100 Amps and below, Come up with a meter audit policy, Inspection and sealing of all meters (prepaid and post-paid), Promptly replacement of faulty Post-paid and Prepaid meters still at site indicated. The findings suggests that though being practiced they are not effective and efficient enough to get rid of revenue loss within the transmission and distribution process.

4.4.4 Recommendation on revenue assurance strategies that ZETDC can adopt

The study sought to recommend revenue assurance strategies that ZETDC can adopt to achieve growth. Springing from the literature, a list of revenue assurance strategies was drawn and respondents were asked to give their views on their feasibility in ZETDC set up. The views of the respondents are presented and analysed below.

Table 4:22 Means and standard deviations for non-technical revenue assurance strategy

Descriptive Statistics			
	N	Mean	Std. Deviation
Frequently conduct accuracy check of the meter at consumer to avoid tempering	239	4.33	.637
Use of Arial bundled or amoured LT cable in place bare conductor to avoid hooking	239	3.90	.857
Meter should be housed in a separate box sealed and made inaccessible to consumer and fuse cutouts should be provided for the meter	239	4.23	.812
Multi-core PVC cables should be used as service mains instead of single core wires	239	3.70	.889
Correct billing & timely delivery of bills improves revenue collections	239	4.35	.815
Severe penalties may be imposed for tampering with meter seals	239	4.67	.552
Progressive checks on disconnected services	239	4.56	.590
Correct point with wrong multiplication factors (MF) in the billing system	239	4.15	.542
Prompt investigation of billing exception	239	4.44	.713
Smart Metering	239	4.78	.452
Valid N (listwise)	239		

Table 4.19 above shows that the respondents agree and strongly agree that all non-technical revenue assurance strategies are feasible. The variation of their responses shows that the majority holds the same line of view and perception on the feasibility of the revenue assurance strategies.

Table 4:23 Means and standard deviations for technical revenue assurance strategy

Descriptive Statistics			
	N	Mean	Std. Deviation

Network Reconfiguration	239	3.92	.709
Regular preventive condition based (maintenance) of equipment and network	239	4.51	.647
Automatic Voltage booster	239	4.02	.651
Load Balancing and Load Management	239	4.42	.574
Capacitor Installation	239	4.21	.618
Improving joint and connections	239	4.41	.640
Maintain voltage within operational	239	4.33	.539
Valid N (listwise)	239		

Table 4.19 above shows that the respondents agree and strongly agree to recommend all non-technical revenue assurance strategies. The variation of their responses shows that the majority holds the same line of view and perception on the feasibility of the revenue assurance strategies.

Table 4:24 Means and standard deviations for non-technical losses

Descriptive Statistics			
	N	Mean	Std. Deviation
Do you think the recommended strategies on revenue assurance mentioned herein will curb revenue loss in ZETDC if implemented	239	3.57	1.013
Valid N (listwise)	239		

Table 4.21, above shows that the respondents agree that the recommended strategies on revenue assurance mentioned herein will curb revenue loss in ZETDC, if implemented effectively, indicated by (M=2.92, SD=1.364). However, the variation of their responses shows that there is a diversified view towards the statement.

4.4.4.1 Regression analysis

Regression analysis was done to determine the significance and order of importance of recommended revenue assurance strategies so as to screen the most feasible ones considering the ZETDC environment. The analysis is tabulated below.

Table 4:25 Model Summary

Model Summary[b]				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.633[a]	.400	.345	.820

a. Predictors: (Constant)

b. Dependent Variable:

The r square value is higher enough to warrant significance of the model which is 40%. This means that the recommended revenue assurance strategies could only contribute 40% in curbing both non-technical and technical losses of revenues in ZETDC. It means that if the recommended strategies are implemented, it could go a mile stone to cover the shortfall of 32% of the existing strategies.

Table 4:26 ANOVA Table

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	97.888	20	4.894	7.279	.000[b]
	Residual	146.581	218	.672		
	Total	244.469	238			

Since the p value 0.00 is less than 0.05, the model is significant. F statistic (7.379) indicates that using the model is better than guessing the mean.

4.4.4.2 Analysis of the Coefficient table

The regression analysis results showed that of all the recommended strategies, only seven strategies are of significant value in curbing revenue losses in ZETDC revenue chain. According to their descending order of importance, the strategies are; Automatic Voltage booster (t = 3.753, p = 000), Progressive checks on disconnected services (t = 2.512, p = 0.013), Frequently conduct accuracy check of the meter at consumer to avoid tempering (t = 2.242, p =0.026), Relocate energy meters outside premises (t =2.165, p =0.032), Regular preventive condition based (maintenance) (t = -2.417, p = 0.016), Multi-core PVC cables should be used as service mains instead of single core wires (t = -2.544, p = 0.012) and Correct point with wrong multiplication factors (MF) in the billing system (t = -3.062, 0.002)

4.4.4.3 Discussion of the findings

The study revealed that respondents agree that all revenue assurance strategies, technical and non-technical, are feasible to be implemented in ZETDC. The smaller the variations on their responses reflect that all the respondents are upholding the feasibility of revenue assurance strategies. However, respondents are indifferent on whether if the strategies are implemented will absolutely curb the revenue losses in the ZETDC. This argument was supported by the regression summary model which revealed that the recommended revenue assurance strategies could only contribute 40% in curbing both non-technical and technical losses of revenues in ZETDC. Some gave a clue that the watch dogs of the systems are also the first infringers of the same system. Their arguments points that revenue losses will not absolutely alleviated as long there is human input.

It emerged that only seven strategies are of significant value in curbing revenue losses in ZETDC revenue chain. With their descending order of importance, the strategies are; Automatic Voltage booster, Progressive checks on disconnected services, Frequently conduct accuracy check of the meter at consumer to avoid tempering, Relocate energy meters outside premises, Regular preventive condition based (maintenance) Use of Multi-core PVC cables as service mains instead of single core wires and Correct point with wrong multiplication factors (MF) in the billing system.

4.4.5 Hypothesis Test

The study sought to test the following hypothesis;

H_0: Revenue loss in the ZETDC revenue chain is affecting its business growth

H_1: Revenue loss in the ZETDC revenue chain is not affecting its business growth

A hypothesis testing procedure was carried out in line with the proposed Null and Alternative hypothesis as highlighted in Chapter one. Rationale of the test was based on the views' scoring. Three represents average (Indifferent/ Neutral) One t test was carried out and the results are explained below.

Table 4:27 One Sample Test

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
Revenue losses is affecting ZETDC's growth	239	4.23	.762	.049

The table above denotes that mean views (4.23 ± 0.762) was higher than the sample 'normal' view of 3.0.

A one-sample t-test was run to determine whether view score was higher than the normal, defined by Likert scale of 3.0. The table below shows the results.

Table 4:28 One Sample Test

One-Sample Test						
	Test Value = 3					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Revenue losses is affecting ZETDC's growth	24.944	238	.000	1.230	1.13	1.33

The test statistic table shows the results of the one-sample *t* test. The *t* column displays the observed *t* statistic for each sample, calculated as the ratio of the mean difference divided

by the standard error of the sample mean. The results show that views were normally distributed, as assessed by Shapiro-Wilk's test ($p > .05$) and there were no outliers in the data, as assessed by inspection of a boxplot. Mean views (4.23± 0.762) was higher than the normal view of 3.0. Also shows a statistical significant difference of 1.23 (95% CI, 1.13 to 1.33), t (238) = -24.944, p = 0.000.

There was a statistically significant difference between means ($p < .05$) and, therefore, we can accept the null hypothesis and reject the alternative hypothesis and conclude that revenue loss in the ZETDC revenue chain is affecting its business growth.

4.5 Chapter Summary

This chapter presented the findings of the research. It commenced by illustrating the response rates, reliability test and the demographic information of the participants. Survey data was then presented and analysed using SPSS software package version 23.0. Findings on all objectives were presented in the form of descriptive statistics. Inferential statistics were used for further analysis. The next chapter will focus on outlining the major research conclusions and suggested recommendations as well as the limitations and the direction for future research.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0. Introduction

This chapter presents a summary of this study, starting with the background to the findings of the study. It also sets out the relevant conclusions and makes recommendations for practice and suggestions for further research based on the findings of the study.

5.1 Summary

The power utility revenue inflow for the past five years has been dwindling at an alarming rate due to loss of revenue within the power value chain; as a result, this impacted negatively to the company. Reviewed literature points out the future of the company lies on its ability to adopt and implement revenue assurance strategies effectively and efficiently. It is against this background that the study sought to explore revenue assurance strategies that leverage business growth of State Owned Enterprises a case of ZETDC.

The main objective of the study was to explore revenue assurance strategies that leverage business growth of ZETDC. In order to accomplish the above mentioned research objective, this study adopted a quantitative approach where much emphasis is place on numerical analysis, objectivity, reliability and replication of findings. This approach helped the researcher to have an opportunity to retain control of the whole study and compare the data easily as well.

The study contributed to shape the understanding on the influence of current revenue assurance strategies of ZETDC on its business growth. The study set out to answer the following specific research questions:

(i) What are the causes of revenue losses in ZETDC?

(ii) To what extent do revenue losses affect ZETDC's business growth?

(iii) Are the revenue assurance strategies in ZETDC applied effectively and efficiently?

(iv) What are revenue assurance strategies that ZETDC can adopt to achieve growth?

5.1.1 Causes of revenue losses in ZETDC

Information gathered from the respondents gave the researcher an insight that there are revenue leakages in ZETDC which are due to both technical and non-technical variables. The variables are yet exhaustive and this deserves further research to explore other variable that are contributing to revenue leakages. The percentage of contribution varies from one variable to another. On technical losses, the variable that contributes much to revenue losses in descending order of significance are Line loss, Loss due to impedance, Losses in mid-span Joints at termination and Losses in transformer. On non-technical losses, the variable that contributes much to revenue losses in descending order of significance are Energy Accounting Systems, Unpaid Bills, Error in meter reading, Unregistered connection, Directional changes-Meter bypass, Inverse (error) meter reading, Wires Tapping, and Direct hooking.

5.1.2. The extent in which revenue losses affecting ZETDC's business growth

Deducing from the information gathered from the respondents, it was revealed that revenue losses in ZETDC's revenue chain have the following effects on ZETDC as company; dwindling of profits, declining of electricity sales, shrinking of cash flows, impeding the introduction of new products and services, shrinking of the customer base growth, daunting of the infrastructure development and maintenance.

5.1.3. Revenue assurance strategies in ZETDC.

Based on the findings from this study ZETDC has adopted various revenue assurance strategies, however, most of them are not being practiced effectively and efficiently. The study revealed that there are only 9 revenue assurance strategies which are being applied in ZETDC. The strategies include; Use of statistical meters, Installation of statistical meters for substation, Carry out meter verification on bulk supply points, Meter Sample to come up with a data base of actual losses of substation and lines, Use of software to analyse statistical data, Sample and investigate low purchase points with capacity 100 Amps and

below, Come up with a meter audit policy, Inspection and sealing of all meters, prepaid and post-paid, Promptly replacement of faulty Post-paid and Prepaid meters still at site indicated. Though being practiced they are not effective and efficient enough to get rid of revenue loss within the transmission and distribution process.

5.1.4. Revenue assurance strategies that ZETDC can adopt to achieve growth

The following revenue assurance strategies were proposed;

- Automatic Voltage booster,
- Progressive checks on disconnected services,
- Frequently conduct accuracy check of the meter at consumer to avoid tempering,
- Relocate energy meters outside premises, Regular preventive condition based (maintenance)
- Multi-core PVC cables should be used as service mains instead of single core wires
- Correct point with wrong multiplication factors (MF) in the billing system.
- Smart metering

5.1.5. Hypothesis Test

One T Test results revealed that there is a statistically significant difference between means ($p < .05$) and, therefore, we can accept the null hypothesis and reject the alternative hypothesis and conclude that revenue loss in the ZETDC revenue chain is affecting its business growth.

5.2 Conclusions Drawn From the Study

The obtained results of research on the exploration of revenue assurance strategies that leverage business growth in State Owned Enterprises, case study of ZETDC concluded that; there are revenue leakages in ZETDC which are due to both technical and non-technical variables. Revenue losses in ZETDC's revenue chain have the following effects; dwindling of profits, declining of electricity sales, shrinking of cash flows, impeding the introduction

of new products and services, shrinking of the customer base growth, daunting of the infrastructure development and maintenance. All these have a negative impact on ZETDC growth. However, the Company has adopted various revenue assurance strategies, but most of them are not being practiced effectively and efficiently so as to curb revenue losses. It was discovered that there are vibrant revenue assurance strategies that can help the company to grow if adopted and implemented effectively and efficiently. This leads to a conclusion that revenue assurance strategies in the ZETDC revenue chain are not supporting its business growth since they are failing to curb the revenue loss. Therefore the hypothesis that revenue loss in the ZETDC revenue chain is affecting its business growth is supported.

5.3 Recommendations

The recommendations are being made on the understanding that the current revenue assurance strategies adopted by ZETDC are not being practiced effectively and efficiently so as to curb revenue losses. Also on the understating that there are other vibrant revenue assurance strategies that can help the company to grow if adopted and implemented effectively and efficiently.

It is therefore recommended that:

Policy makers should come up with a law that puts heavy penalties to individuals that contributes to loss of revenue within ZETDC revenue chain.

Top management should consider the following revenue assurance strategies;

(i) Automatic Voltage booster, Progressive checks on disconnected services,
(ii) Frequently conduct accuracy check of the meter at consumer to avoid tempering,
(iii) Relocate energy meters outside premises, Regular preventive condition based (maintenance)
(iv) Multi-core PVC cables should be used as service mains instead of single core wires
(v) Correct point with wrong multiplication factors (MF) in the billing system.
(vi) Smart metering

Top management should ensure the efficacy implementation of the above revenue assurance strategies in three main areas: cultivating the efficiency of the employees, cultivating the company's efficiency when dealing with clients, and improving the efficiency of the company as a whole.

Top management should invest in research and development so as to find and adopt new technologies of dealing with revenue losses during the transmission and distribution of electricity. Also to investigate new technologies that is being used in electricity theft so as to curb them on their inception stages.

5.4 Limitations

The information given by the respondents was uncontrollable and not sure if it was true of false. However, the respondents were explained that the information would only be used for education purpose and this allowed them to be confident that they would not be persecuted of the information they supplied.

The research was conducted using a limited theory about revenue assurance strategies. The area is still a new phenomenon which still requires deserve board of knowledge.

It was hard to collect data from the respondents since they were busy during the day. The researcher had to drop the questionnaires and picked them at a later date and time and this allowed the respondents to fill in the questionnaires at their own time. Some questionnaires were sent through e-mails.

5.6 Areas for Further Study

From the insights drawn from this research there are several additional areas that could be concluded for research; first, a comparative research can be conducted by comparing the exploring the revenue losses that affects business growth between public and private sector or between manufacturing and service sector.

The study exploring the revenue losses that affects business growth in State Owned Enterprises, case study of ZETDC a similar study could be conducted taking a survey

design rather a case study to have a broader picture. There is need again to take pure qualitative approach so as to have an in-depth evaluation on the revenue losses that affects business growth in State Owned Enterprises.

Again, study can be conducted on how Information Communication Technology (ICT) can leverage on business growth within State Owned Enterprises.

5.11 Chapter Summary

This chapter concluded by providing the key findings of the research on the inquiry revenue losses that affects business growth in State Owned Enterprises. The chapter also ended by recommending strategies that are critical in curbing revenue losses that affects business growth in State Owned Enterprises. Recommendations for areas for further studies were highlighted at the end of this chapter.

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APPENDIX A: SURVEY QUESTIONNAIRE

QUESTIONNAIRE NO.....

Dear Respondent

My name is Charlton Fambisayi a Master of Business Administration (MBA) student with the University of Zimbabwe, Graduate School of Management (GSM) researching on to

Exploring revenue assurance strategies that leverage business growth of State Owned Enterprises and Parastatals: The Case of Zimbabwe Electricity Transmission and Distribution Company (ZETDC).

The aim of the study is to explore revenue assurance strategies that leverage business growth of ZETDC, to ascertain the causes of revenue losses within the company's revenue chain, extent to which revenue losses are affecting ZETDC's growth, assessment of efficacy of the existing revenue assurance strategies and their application in curbing loss of revenue. Lastly, to recommend revenue assurance strategies that ZETDC can adopt to achieve growth.

The following questionnaires are for collecting the information and data related to explore revenue assurance strategies to curb revenue losses within ZETDC revenue chain. Please kindly assist by completing the Questionnaire. The data collected will be treated as confidential and used specifically for the purpose of this study. Your cooperation in this regard will be greatly appreciated. For further information, you are free to the researcher on 0775 863 836 or email- fambisaic2015@gmail.com

Instructions:

1. The questionnaire contains 61 questions and takes about 15 minutes to complete.
2. Provide your best guesses if information is not available
3. Please provide responses to all questions by either ticking the appropriate box or typing in spaces provided.

Section A: Demographic information

This section captures demographic information. Please complete the blank space in the right hand column by ticking the appropriate option

Questions		Code	Option	Tick
A1	Please indicate your gender.	**1**	Male	
		2	Female	
A2	Indicate your highest level of education.	**1**	College	
		2	University	
		3	Professional	
		4	Post Graduate	
A3	In which area of function are you in? Please tick appropriate.	**1**	Transmission	
		2	Commercial	
		3	Risk Management	
		4	Engineering	
A4	How long have been with ZETDC? Please tick appropriate.	**1**	1-10 years	
		2	11-20 years	
		3	21-30 years	
		4	31+ years	
A5	What is your level? Please tick appropriate.	**1**	Executive	
		2	Senior Management	
		3	Middle Management	
		4	Line Supervisor	
		5	Junior Staff	

Section B: In your opinion are there revenue losses in ZETDC's revenue chain?

To what extent do you agree or disagree on a scale of 1 to 5 to the following statements.

1= strongly disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= strongly agree

Item	Causes of Non -Technical losses	1	2	3	4	5
C7	In your opinion are there revenue losses in ZETDC's revenue chain?					
C8	Revenue loss in ZETDC's revenue chain are due to technical losses only					
C9	Revenue loss in ZETDC's revenue chain are due to non-technical losses only					
C10	Revenue loss in ZETDC's revenue chain are due to both technical and non-technical					

Types of revenue losses within ZETDC's Revenue Chain

Questions		Code	Option	Tick
B1	Please indicate common type of losses in ZETDC.	**1**	Technical losses	
		2	Non-Technical losses	
		3	Both	

SECTION C1: What are the causes of revenue losses at ZETDC?

To what extent do you agree or disagree on a scale of 1 to 5 the following causes the loss of revenue within ZETDC revenue chain?

1= strongly disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= strongly agree

Item	Causes of Technical losses	1	2	3	4	5
C1	Line Loss					
C2	Losses in mid-span Joints at termination					
C3	Losses in transformer					
C4	Losses in service cables and connections					
C5	Loss due to high impedance faults					
C6	Losses in re-wired fuses/jumpers					

Item	Causes of Non -Technical losses	1	2	3	4	5
C7	Meter tempering					
C8	Un-registered connection					
C9	Unpaid bills					
C10	Direct hooking					
C11	Meter Modification					
C12	Inverse (error) meter Reading					
C13	Directional Changes-Meter bypass					
C15	Wires Tapping					
C17	Pilferage of energy					
C18	Energy accounting systems					
C19	Receipt of payment					
C20	Error in meter reading					
C21	Error in bills					

In your own opinion, from the above causes of loss of revenue which ones are the major causes of revenue losses in ZETDC?

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SECTION D: Effects of revenue losses affecting ZETDC's Growth?

To what extent do you agree or disagree on a scale of 1 to 5 that revenue loss is affecting ZETDC's Growth.

1= strongly disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= strongly agree

Item	To what extent do revenue losses affecting ZETDC's Growth	1	2	3	4	5
D1	Revenue losses affecting dwindling profitability					
D2	Revenues losses is a decline in Electricity Sales					
D3	Revenue loss is affecting Cash flow					
D4	Revenue loss is hindering introduction of new product and services					
D5	Revenue loss is affecting customer base growth					
D6	Revenue is leading to poor infrastructure development & maintenance					

SECTION E: What is the efficacy of the existing revenue assurance strategies and their application to ZETDC?

To what extent do you agree or disagree on a scale of 1 to 5 that the following assurance strategies exist and being applied to accelerate ZETDC's Growth.

1= strongly disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= strongly agree

Item	Revenue assurance strategies	1	2	3	4	5
E1	Audit all CT metered points to confirm correct connection take corrective measures where there are anomalies					
E2	Use of statistical exceptions to Identify zero, never, low purchase prepaid.					
E3	Installation of statistical meters for substations with substation auxiliaries					
E4	Installation of statistical meters customer service point (meter).					
E5	Carry out meter verification on bulk supply points (imports and local generation)					
E6	Meter sample representative circuits to come up with a database of actual losses of substations and lines in ZETDC					
E7	Use of software to analyse statistical data to come up with Energy Balance and Energy Accounting models to be able to identify High Loss Areas (HLA), Medium Loss Areas (MLA) and Low Loss Areas (LLA)					
E8	Come up with a meter audit policy that compels all points to be audited once in a year to avoid					

	issues/anomalies that go beyond three years. Amendment of SI 142 of 2004					
		1	**2**	**3**	**4**	**5**
E9	Sample and investigate low purchase points with capacity 100Amps and below (Direct Connected or whole current metered point)					
E10	Inspection and sealing of all meters, prepaid and post - paid.					
E11	Introduce new sealing technology that is tamper evident and difficult to defeat.					
E12	Promptly replacement of faulty Post-paid and Pre-paid meters still at site.					

SECTION F: In your own opinion, are these strategies being implemented are effective or not effective in curbing loss of revenue within the ZETDC revenue chain?

To what extent do you agree or disagree on a scale of 1 to 5 on the effectives of revenue assurance strategies?

1= strongly disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= strongly agree

Item	**Revenue assurance strategies**	**1**	**2**	**3**	**4**	**5**
F1	ZETDC Revenue assurance strategies are effective					

SECTION G: Which revenue assurance strategies would you recommend for ZETDC to adopt in order to accelerate growth?

To what extent do you agree or disagree on a scale of 1 to 5 that the following assurance strategies accelerate ZETDC's Growth.

1= strongly disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= strongly agree

Item	**Revenue assurance strategies for Non-Technical Losses**	**1**	**2**	**3**	**4**	**5**
G1	Enforcement team conduct frequent raids at high loss points to avoid direct theft in the early morning and late nights including day time.					
G2	Relocate energy meters outside premises					

G3	Replace or recalibrate old meters those warranty discarded by the manufacturer					
G4	Frequently conduct accuracy check of the meter at the consumer end to avoid any type of tempering					
G5	Use of Arial bundled or armoured LT cable in place of bare conductor to avoid direct hooking					
		1	**2**	**3**	**4**	**5**
G6	Meter should be housed in a separate box sealed and made inaccessible to consumer. The fuse cut-outs should be provided for the meter.					
G7	Multi-core PVC cables should be used as service mains instead of single core wires					
G8	Correct billing & timely delivery of bills improves revenue collections					
G9	Severe penalties may be imposed for tampering with metering seals.					
G10	Progressive checks on disconnected services					
G11	Correct point with wrong multiplication factors (MF) in the billing system.					
G12	Prompt investigation of billing exception.					
G13	Smart Metering					

Item	**Revenue assurance strategies for Technical losses**	**1**	**2**	**3**	**4**	**5**
G13	Network Reconfiguration					
G14	Regular preventive condition based (maintenance) of equipment and network					
G15	Automatic Voltage booster					
G16	Load Balancing and Load Management					
G17	Capacitor Installation					
G18	Improving joints and connections					
G19	Maintain voltage within operational limits					
G20	Do you think the recommended strategies on revenue assurance mentioned herein will curb revenue loss in ZETDC if implemented					

In your own opinion, which revenue assurance strategies would you recommend to ZETDC in order to curb loss of revenue within its revenue chain?

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End of Questionnaire

Thank you for your cooperation