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EFFECTIVENESS OF TECHNICAL AUDIT IN THE POWER SECTOR: A CASE FROM A DEVELOPING COUNTRY

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Original Scientific Paper

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The paper examines the level and the factors that influence the effectiveness of technical audit in the power sector of Malawi from the perspective of auditors and auditees. Data was collected through a questionnaire that was analyzed using bivariate and multivariate statistics. Further to that, complementary data to measure the level of effectiveness was also collected and analyzed using the effectiveness calculator. Results show that the level of effectiveness of technical audit is low. Bivariate and multivariate analyses suggest that management support, organizational independence, and audit quality individually and collectively significantly influence the level of technical audit effectiveness.

Keywords: Effectiveness; Internal audit; Malawi; Power sector; Technical audit.

INTRODUCTION

Internal audit is defined as an "independent, objective assurance and consulting activity designed to add value and improve an organization's operations" (Institute of Internal Auditors-Global, 2020a). Unlike external audit which is annual and undertaken by auditors from outside of the organization and focuses on the fairness of the financial statements, internal audit is continuous, carried out by auditors who are the employees of the organization, and their work embraces all organizational operations (Cohen & Sayag, 2010; Saputra & Yusuf, 2019). The primary purpose of an internal audit is to help "an organization accomplish its objectives by bringing a systematic, disciplined approach to evaluate and improve the effectiveness of risk management, control, and governance processes" (Institute of Internal Auditors-Global, 2020b). The output of internal audit work is a set of recommendations for the improvement of organizational operations. The recommendations are made based on a critical review of organizational policies and procedures, and how the internal controls effectively mitigate associated risks. Internal audit enhances organizational efficiency and effectiveness through constructive criticism that is provided on a regular basis (Cohen & Sayag, 2010).

In the power sector, internal audit is divided into two: financial (or management) audit and technical audit. Financial audit appraises all organizational administrative operations such as human resources, finance, procurement, legal, and administration, while technical audit appraises engineering operations. Accordingly, internal audit functions in power organizations tend to have a financial audit and technical audit sections.

In the power sector, engineering operations are critically important to organizational effectiveness, hence, the effectiveness of the technical audit deserves considerable emphasis. Moreover, in developing countries like Malawi, whose power sectors are faced with significant technical and operational challenges, the role of technical audit and hence its effectiveness needed greater attention as one of the means for improvement. However, in developing countries, the technical component of internal audit is a new phenomenon that is still in its infancy. Furthermore, empirically, little is

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known about its development and effectiveness. Basically, the existing literature focuses on examining the effectiveness of the entire internal audit function. It is against this background that this paper examines the effectiveness of technical audit as an integral part of the internal audit in the power sector in the developing country context of Malawi. It measures the level of effectiveness of technical audit and evaluates the factors that affect the same from the perspective of the auditors and auditees.

The remainder of the paper is arranged as follows: the second section discusses the composition of the power sector of Malawi. The third section reviews the extant literature regarding the effectiveness of internal audit function generally as there is hardly any literature on the effectiveness of the technical audit. The fourth section presents the methodology that was used while the fifth section presents the results and the ensuing discussion. Finally, the sixth section provides the concluding remarks.

POWER SECTOR IN MALAWI

Composition

Electricity is a crucial variable in the drive to reduce poverty, promote economic growth, and enhance living standards. Ritchie and Roser (2020) estimated that about 87% of the world's population (that is about 6.3 billion people) has access to electricity. However, in Malawi, which is an African country in the southern part of the continent, access to electricity is about 10%, making it the fourth lowest worldwide and the lowest in the Southern Africa Development Community region (JICA, 2019). The country has a total installed generation capacity of about 582.16MW. Presently, the main source of electricity is hydropower which contributes about 90% of the power (JICA, 2019). The power sector has two public companies: the Electricity Generation Company (EGENCO) and the Electricity Supply Corporation of Malawi (ESCOM). The former is only responsible for a generation while the latter is responsible for transmission and distribution.

As of December 2020, EGENCO was generating 73% of the total installed capacity and the remainder was generated by private producers. EGENCO was established as a company in September 2016 after being carved out of ESCOM in the process of unbundling that was aimed at improving efficiency (EGENCO, 2021). Before its establishment, ESCOM used to be responsible for the generation as well as transmission and distribution of power. With the unbundling, ESCOM only transmits and distributes the power (ESCOM, 2018).

Other generators of power include Aggreko, a privately owned international company, which uses diesel generators. Aggreko has an installed capacity of 78MW. Numerous other private players generate power from bagasse (18.5MW), diesel (61.5MW), hydro (0.84MW), solar and wind hybrid (0.075MW), and Solar PV (0.87MW) (Taulo et al., 2015). Besides, ESCOM imports power from neighboring countries as follows: Mozambique (2MW) and Zambia (10MW) (ESCOM, 2020). All the other power companies are licensed only to generate power while ESCOM has the license to transmit and distribute power. The generated power is sold to ESCOM to transmit and distribute to the customers. Presently, the major players in the power sector of Malawi are ESCOM, EGENCO, and Aggreko.

Technical audit functions in the power sector of Malawi

Technical audit is a new phenomenon in the power sector of Malawi. Presently, it is only ESCOM and EGENCO that have technical audit units. However, it is only in ESCOM that the unit is fully-fledged. EGENCO, being a new company, its unit is in the process of being set up. Thus, the paper focused on the technical audit unit of ESCOM. ESCOM is mandated to transmit and distribute electricity in Malawi (ESCOM, 2018). It has about 2500 employees with an electricity network in all 28 districts of the country. As is exhibited in Figure 1, ESCOM has three technical (engineering) directorates namely: transmission (also called system and market operations), distribution, and planning and development; and four administrative directorates namely: Human Resources and administration, finance, legal, and procurement. In addition, it has an internal audit section.

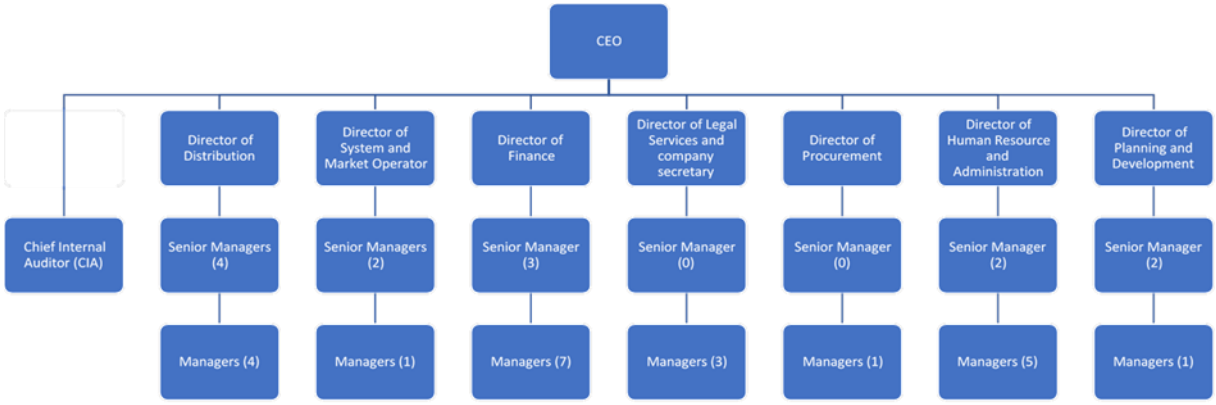

Figure 1: Organogram of ESCOM

The company has four management tiers. The first tier is the executive management tier which comprises the Chief Executive Officer (CEO) and seven directors. This is followed by the management tier, which is made up of senior managers and managers. Below is the professional tier consisting of senior officers/engineers, officers/engineers, and assistant officers/engineers. The fourth and final tier is the supervisory tier made up of artisans and ground workers. The company is overseen by the board of directors. As can also be observed in Figure 1, the highest position in the internal audit section is that of the Chief Internal Auditor at the senior management level.

Figure 2. (next page) provides the organogram for the internal audit section. The Chief Internal Auditor reports administratively to the CEO but functionally to the finance and audit committee of the board. At the management level, the internal audit section has the Chief Technical Audit Engineer responsible for managing the technical audit unit and the Finance Audit Manager responsible for managing the financial audit unit. The technical audit unit is staffed by engineers by profession. As can be noted in Figure 2, the Chief Technical Audit Engineer reports administratively to the Chief Internal Auditor but functionally directly to the Projects and Technical Committee of the board of directors.

In spite of the existence of technical audit in ESCOM, its engineering operations continue to experience significant technical challenges. The Malawi Energy Regulatory Authority (MERA), which is the regulator of the energy sector of Malawi, observed that the performance of ESCOM was below standard in terms of both transmission and distribution functions (MERA, 2018). As a result, it is estimated that the total power losses were 23.5% when calculated using the power sold against power bought from generation companies. The losses comprise 13.5% as technical losses and 10% as non-technical losses. Basically, the non-technical losses occur due to theft, accounting errors, metering inaccuracies, and unmetered power. Power losses cause ESCOM to lose about USD 43.59 million annually (AZOROM, 2015).

INTERNAL AUDITING EFFECTIVENESS

Scholars have conducted research on the effectiveness of internal audit focusing on internal audit function as a whole; however, this paper focuses only on its technical audit component. Further, the extant literature either evaluates the level of internal audit effectiveness or the factors that affect the effectiveness of internal audit, however, this paper combines the two strands.

Measuring the level of internal audit effectiveness

Cristina and Cristina (2009) classified methods of measuring internal audit effectiveness into three: quantitative method, qualitative method, and qualitative and quantitative method. The quantitative method involves, among other things, numerical ascertainment of the extent to which audit plans are executed; determination of the time taken from ending audit work to the issuance of the final audit report; monitoring the number of findings cleared and time taken to clear them; verifying auditors' qualifications; and determination of how time available has been used in administering audit and other activities. The qualitative method measures effectiveness from the qualitative point of view that emphasizes carrying out surveys (through questionnaires or interviews)

soon after finishing internal audit assignments, where the respondents are the organizational managers (Weldu, 2017). The third method (qualitative and quantitative) is a combination of the two methods as such it is also called the mixed method. This method is considered robust and balanced as it combines the strengths of both methods. It is practically involving but rigorous hence it is popularly used in assessing effectiveness. Under this method, several approaches are used to measure internal auditing effectiveness, these include total quality management; performance measurement matrix; balanced scorecard (BSC); SMART performance pyramid; performance prism; value-based management; and SWOT Analysis (Hijarunguru, 2017). Among these approaches, the studies of Boguslauskas and Rupšys (2007); B. A. Cristina and P. Cristina (2009); Baiden et al., (2016); and Hijarunguru (2017) established that the balanced scorecard is the one that is well known and frequently used.

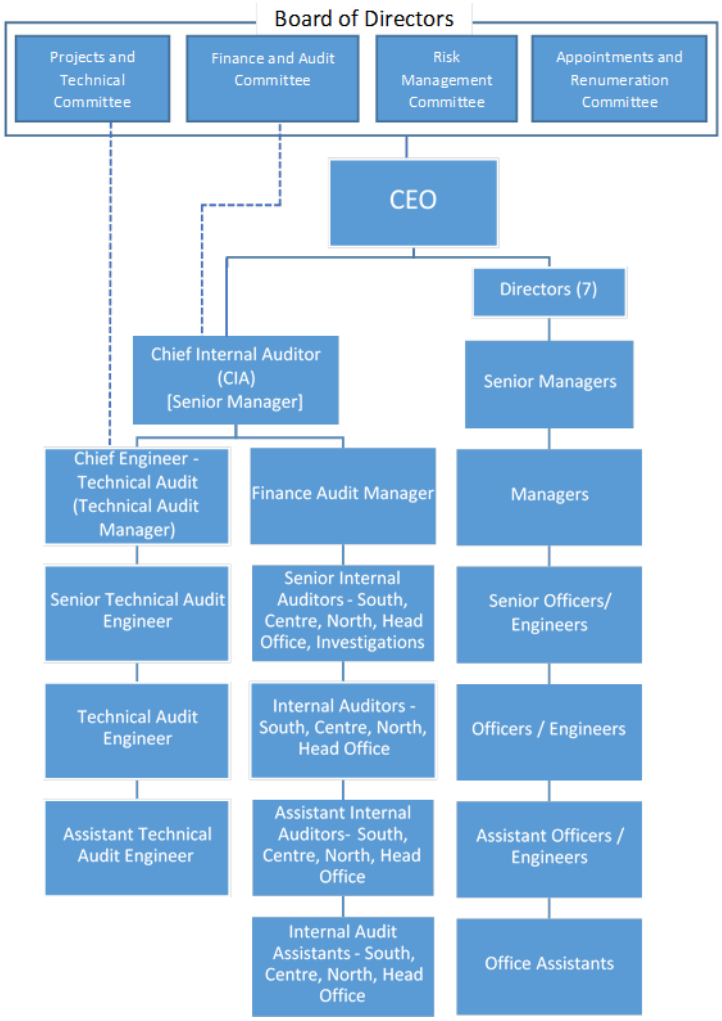

Figure 2: Organogram of the Internal Audit Section

The BSC is applauded for providing a flexible, multi-dimensional, and usable framework that allows critical evaluation of internal audit effectiveness from four key perspectives: financial or stewardship perspective; customer or stakeholder perspective; internal process and innovation perspective; and capabilities perspective to come up with a meaningful performance outcome (Graybeal et al., 2019). Further to that, it balances between short and long-term measures, internal and external business processes, leading and lagging indicators, but also objective and subjective measures (Martin, 2004; Koutoupis et al., 2018). Besides, it is integrative in its orientation, in that, it links the organization's vision and strategy to its targets and initiatives. Accordingly, it is regarded as a management and measurement tool, an improvement and learning tool; a motivation and implementation tool, as well as a control and evaluation tool (Baiden et al.,

2016). In harmony with existing studies (Baiden et al., 2016; Filos et al., 2017; Boguslauskas & Rupšys, 2007), this paper utilized the BSC in determining the level of effectiveness of technical audit which is a key component of internal audit in the power sector. The level of effectiveness was determined quantitatively using the questionnaire. And further to that, the quantitative measurements were complemented by additional qualitative assessments using a tool developed by the Institute of Internal Auditors – Netherlands, which this paper is referred to as the "effectiveness calculator".

The Institute of Internal Auditors – Netherlands developed a step-by-step tool that is used to calculate the level of effectiveness of the internal audit function. The tool is made up of effectiveness indicators in all four perspectives of the BSC (Institute of Internal Auditors - Netherlands, 2016). It provides twenty-four key performance indicators (KPIs) (Institute of Internal Auditors - Netherlands, 2016). It assigns to each KPI a norm as the expected level of performance and that represents the standard pass mark. The actual score on each KPI is compared to the standard pass mark in ascertaining the level of effectiveness. Information for determining the actual score is sourced from the audit reports, audit work plans, and other relevant data for the function. The overall score on the effectiveness of the internal audit function is determined by a percentage of the total number of items that exceed the standard pass mark to the total number of items tested on the effectiveness calculator (Institute of Internal Auditors - Netherlands, 2016). 50% is considered the standard pass mark for an effective internal audit function.

All in all, based on the four BSC perspectives, the level of internal audit effectiveness can be measured by the composite score of financial, customer, internal business, and growth and innovative perspectives as presented in Figure 3. The composite score was used in this paper to measure the level of effectiveness of the technical audit.

Figure 3: BSC-based measure of the level of technical audit effectiveness

Factors influencing internal audit effectiveness

Management Support

The internal audit function works hand in hand with the executive arm of the organization in its day-to-day work. Accordingly, Marks (2013) argues that the function requires full management support for it to be effective. Fundamentally, management support is demonstrated through the provision of necessary resources, like finances or transport if required, providing training, introducing auditors to new technology and procedures, budgeting funds for certification, and other facilities that facilitate internal auditing works (Hailemariam, 2014). Besides, the rate at which management responds to audit recommendations is also a key indicator of management support and determines the impact of the audit function (Ahmad et al., 2009; Marks, 2013).

Marks (2013) found that where management support for audit function is inadequate, it renders the audit working environment to be hostile, which affects the effectiveness of the audit. On the other hand, the internal audit function gets motivated when it receives adequate management support (Ahmad et al., 2009). Impliedly, an excellent internal audit team, with the ability to come up with brilliant audit recommendations, would be rendered ineffective if there is no management support for the audit function. Based on the forgoing the paper hypothesized that:

H1: There is a significant effect of the level of management support on the effectiveness of the technical audit function.

Independence of Internal Audit

Internal audit independence is "the freedom from conditions that threaten the ability of the internal audit function to carry out internal audit

responsibilities in an unbiased manner" (Institute of Internal Auditors - North America, 2019). Without independence, the internal audit function loses its ability to offer fresh perspectives and eventually becomes part of management (Yee et al., 2008). Hailemariam (2014) argues that independence is achieved when auditors are able to do their job with objectivity, integrity, impartiality, and without any conflict of interest. IIA-North America (2019) suggests that one way to achieve the degree of independence necessary to effectively carry out the responsibilities of the internal audit activity is to have a chief audit executive that has direct and unrestricted access to senior management and the board, which can be achieved through a dual reporting relationship.

George et al., (2015) found that the independence of internal audit is the most important factor that affects internal audit effectiveness. Similarly, Cohen and Sayag (2010) observed that organizational independence enhances the internal auditor's effectiveness because it gives auditors a conducive working environment in which they can conduct their tasks objectively and without pressure. However, Hailemariam (2014) found that the independence of internal auditors was not significantly correlated to internal audit effectiveness. The negative results suggest inconclusiveness concerning the effect of the independence of the internal auditors on audit effectiveness. Hence indicating the need for further studies. This paper hypothesized that:

H2: There is a significant effect of the level of independence of the technical auditors on the effectiveness of the technical audit function.

Audit Quality

The quality of an internal audit is determined by the internal audit department's ability to provide useful findings and recommendations (Sawyer, 1995). Audit quality thus, hinges on the ability of the auditors to plan and carry out the audit work so that substantial findings are arrived at and workable recommendations for improvement are made (Mihre, & Yismaw, 2007). Mihret and Yismaw (2007) further argued that audit quality is contingent on the audit staff's competence or expertise; reasonableness of the scope of service; effective planning, execution, and communication of internal audits. Auditors' competence can be determined by academic level, experience, and the efforts of staff for continuous professional development and compliance with audit standards (Hailemariam, 2014).

Mihret and Yismaw (2007) found that there was a positive correlation between audit quality and internal audit effectiveness. In harmony, George et al., (2015) also found that audit quality is significantly and positively associated with audit effectiveness. Generally, if internal audit quality is improved, it contributes to the appropriateness of procedures and operations of the auditee thereby contributing to the effectiveness of the auditee and the organization as a whole (Dittenhofer, 2001). Accordingly, the paper hypothesized that:

H3: There is a significant effect of the level of audit quality on the effectiveness of the technical audit function.

METHODOLOGY

Data collection

The study was conducted in the technical audit unit and all the audited technical units of ESCOM. As already discussed, in the power sector of Malawi, it is only ESCOM and EGENCO that have technical audit units. However, EGENCO is a relatively new company whose operational structures (including the technical audit unit) are in the process of being developed. As such, it is only ESCOM that has all its structures in place from which informative insights can be generated. Thus, the paper focused on audited engineering sections and the technical audit unit. The population for the study was ninety-two (92) making up of personnel acquainted with technical audit activities that included 79 supervisors, assistant engineers, engineers, senior engineers, 4 technical audit engineers, 5 managers, 3 senior managers, and 1 director (see Table 1). The chairperson of the Projects and Technical Committee of the Board was also included as is directly responsible for overseeing technical operations and technical audit activities at the board level. Considering the manageable size of the population, all the members of the population were sampled (Saunders et al., 2009).

Data were collected using a structured questionnaire that was adapted from Baiden et al., (2016) and Hailemariam (2014). Measurements regarding the level of effectiveness were adapted from the former and measurements of the factors affecting effectiveness were adapted from the latter. The questionnaire used a five-point Likert scale. Respondents were required to express their level of

agreement with the statements (questions) where the lowest score (1) represented strong disagreement and the highest score represented strong agreement (Brown, 2010). The questionnaire was organized into three parts: the first part comprised questions on the demography of respondents, while the second and the third parts contained items measuring the three influential factors and the BSC-based composite level of technical audit effectiveness respectively.

Table 1: Details of the study population

Category of respondents	Number
Engineers and supervisors	79
Technical audit engineers	4
Managers	5
Executive managers	3
Board member	1
Total	**92**

A pilot test was conducted on 10 respondents. According to Saunders et al., (2009), 10 is ideal for piloting a questionnaire for a sample with up to 200 respondents. Cronbach's Alpha was used as a measure of the reliability of the questionnaire. An Alpha score of greater than 0.7 is considered as an indication of high reliability (Ursachi et al., 2015). Table 2 shows the resultant values of Cronbach's Alpha for each variable. The lowest Alpha was 0.773 for the internal business perspective and the highest was 0.957 for audit quality. The scores indicated that the questionnaire was highly reliable.

Table 2: Reliability test results

Variable	Alpha
Management support	0.817
Organization independence	0.945
Audit quality	0.957
Financial perspective	0.821
Customer perspective	0.842
Internal business perspective	0.773
Growth and innovative perspective	0.790

Data collected using the questionnaire was complemented by the data that were collected from audit reports, audit work plans, and other relevant data for the technical audit function using the effectiveness calculator to measure the level of effectiveness.

Data Analysis

Descriptive statistical analysis was used to summarise the results while inferential statistics was used to test the relationships between dependent and independent variables. The level of technical audit effectiveness (TAE) was measured as a composite mean score of the four BSC perspectives. The TAE composite mean score from the questionnaire was complemented by TAE score based on the effectiveness calculator, which was determined by a percentage of the total number of items that exceed the standard pass mark to the total number of items tested on the effectiveness calculator (Institute of Internal Auditors - Netherlands, 2016).

In terms of inferential analysis, regression analysis was used. The multivariate regression model was used to examine the collective effect of three factors (management support, organizational independence, and audit quality) on the level of technical audit effectiveness. The model was specified as follows:

$$TAE_i = \beta_0 + \beta_1 MS_i + \beta_2 QA_i + \beta_2 OI_i + \varepsilon_i \qquad (1)$$

Where: TAE is technical audit effectiveness; MS is management support; AQ is audit quality; OI is organizational independence; β_0 is a constant representing the effectiveness of technical audit when every independent variable is zero; β_{1-3} are coefficients, in which every marginal change in variables on technical audit effectiveness correspondingly affects; and is the error term

Besides, bivariate analysis was conducted using chi-square and Cramer's V tests to examine the effect of an individual factor on the level of technical audit effectiveness. Each independent variable was tested against the dependent variable to check the extent of association with the dependent variable. Basically, the Chi-square test determines whether there is an association between categorical variables while Cramer's V test measures the strength of the association between the variables (Akoglu, 2018). Akoglu (2018) provides a guide to the interpretation of Cramer's V results as follows: 0 indicates no relationship; greater than 0 to 0.05 indicates a very weak relationship; greater than 0.05 to 0.10 indicates a weak relationship; greater than 0.10 to 0.15 indicates a moderate relationship; greater than 0.15 to 0.25 indicates a strong relationship, and greater than 0.25 indicates a very strong relationship.

RESULTS AND DISCUSSION

Profile of the respondents

The questionnaires were distributed to all ninety-two (92) respondents, out of which, sixty-five (65) responded representing a response rate of 73%. The respondents comprised 63 males and 2 females. The small number of female respondents was because of the small number of female engineers in ESCOM. 3 female engineers were given the questionnaire out of which 2 responded. Concerning work experience, the highest was in the range of 6-10 years (29.2%) followed by those with more than 20 years of experience (27.7%) and then those within the 15-20 years range (24.6%). Below these were those within the ranges of 11-15 years (13.8%) and 0 – 5 years (4.6%). This indicates that the majority of the respondents had considerable work experience to be able to provide a well-informed assessment of technical audit effectiveness. In terms of departments, 70.8% of the respondents were from distribution, which is the largest directorate in ESCOM, while 20% were from the transmission and 9.2% were from the head office. The majority of the respondents (64.6%) were bachelor's degrees holders, 23.1% were diploma holders, 7.7% were master's degree holders and 4.3% had other qualifications. Concerning positional categories, 84.6% of the respondents were from the professional category, 12.3% were supervisory category and 3.1% were managerial category.

Preliminary reliability analysis

The Jarque Bera test was conducted for all the variables in the data combined. The p-value was found to be 0.4231, which was greater than the threshold value of 0.05. This means that data were normal hence normality was accepted at 0.05. Furthermore, the Shapiro-Wilk skewness and Kurtosis tests were conducted for individual variables, the results of which are shown in Table 3.

Table 3: Results for Shapiro-Wilk, Skewness, and Kurtosis

Variable	Shapiro-Wilk (sig)	Skewness Z-Value	Kurtosis Z-Value
MS	0.357	- 0.32997	- 0.38567
OI	0.125	- 0.00673	- 0.73208
AQ	0.063	+ 0.36364	- 1.2116
TAE	0.226	- 0.23569	- 1.3976

Shapiro-Wilk test results in Table 3 show that the p-values for all the variables were above 0.05, which attested for normality. Besides, the skewness and kurtosis' Z-value for all variables is within the allowable limits of between -1.96 and +1.96 (Pett, 2015) indicating that the collected data were normally distributed.

The heteroscedasticity test was conducted using the Breusch-Pagan test. The p-value for the regression was found to be 0.1017, which is greater than the critical value of 0.05. This indicated that the model was homoscedastic. Furthermore, a pairwise correlation was conducted and tolerance and variance inflation factor (VIF) was calculated to test for multi-collinearity in the model.

Table 4: Pairwise correlation of variables

	TAE	MS	OI	AQ
TAE	1.0000			
MS	0.6547 0.0000	1.0000		
OI	0.6332 0.0000	0.5625 0.0000	1.0000	
AQ	0.5779 0.0000	0.4255 0.0004	0.3506 0.0042	1.0000

As shown in Table 4, all the correlations between variables were less than 0.8. Further to that, tolerance for all the variables was well above the threshold of 0.10 threshold and VIF values were below 10 (see Table 5). The results indicated that there were no multi-collinearity problems in the regression model (Gujarati, 2004).

Table 5: Tolerance and Variance Inflation Factor (VIF)

Variables	Tolerance	VIF
MS	0.62418	1.60
OI	0.66852	1.50
AQ	0.80083	1.25

Autocorrelation assessment was conducted using the Durbin-Watson test. A t-statistic of 2.006787 was found, which indicated that there was no autocorrelation in the model (Field, 2009). Finally, a RESET test was also conducted to detect whether there were omitted variables and incorrect functional forms in the regression model (Sapra, 2018). Ramsey's test was used which gave a p-value for the F-statistic of 12.44%. Thus, at a 5% significance level, the results indicated that the functional form was correct, and the model did not suffer from omitted variables.

Level of technical audit effectiveness

The four perspectives of the BSC were evaluated on a five-point Likert scale. The lowest score was 1 expressing strong disagreement and the highest score was 5 expressing strong agreement. A score of 3 indicated neutrality. Table 6 presents the individual mean scores for the four perspectives and the composite mean score representing the overall level of technical audit effectiveness. As can be observed in the Table, mean scores for all four perspectives and the composite mean score were below 3. The individual perspective scores were 2.6462 for the financial perspective, 2.7169 for the customer perspective, 1.9744 for the internal business perspective, and 2.6974 for the growth and innovation perspective, whereas, the composite mean score was 2.5087.

Table 6: Level of effectiveness: individual scores and composite mean Score

BSC elements	N	Mean	Std. deviation
Financial Perspective	65	2.6462	0.92163
Customer Perspective	65	2.7169	0.62239
Internal Business Perspective	65	1.9744	0.65962
Growth and Innovation Perspective	65	2.6974	0.65543
Technical Audit Effectiveness	65	2.5087	0.56107

Table 7: Results of qualitative assessment of effectiveness using effectiveness Calculator

Items	Actual Mark	Standard Pass Mark	Pass (1) or fail (0)
1. Number of management requests (# fulfilled/# request) (#) YTD (not in Year Plan)	100%	100%	1
2. Number/Percentage of audits realized within agreed assignment letter deadline per quarter	59%	70%	0
3. Hours of training per auditor YTD (hrs)	0	2 per year	0
4. Average audit client satisfaction p/Q, scale" Good=3, Satisfactory=2, Unsatisfactory=1 per quarter	1.25	2	0
5. Client score on 'audit added value', scale: Strongly Disagree=5, Strongly agree=1	4	1 or 2	0
6. At least **70%** of the original year plan is achieved in the relevant year.	50%	70%	0
7. All staff members have a tasking.	50%	100%	0
8. Auditors have at least a degree or are studying towards such a degree. **90%**	100%	90%	1
9. The average level of working experience among staff members is at least **10 years**.	37.5%	50%	0
10. Maximum of **5%** staff departures per year	0%	5% or less	1
11. Maximum average sickness absenteeism among audit staff members of **5%**.	0	5% or less	0
12. The financial budget is adequate for the continuing professional education and insourcing of external experts.	0	1	0
13. All audit staff members fulfill their annual CPE requirement. **100%**	0%	100%	0
14. All staff members have a personal development plan. **100%**	100%	100%	1
15. Meetings on technical audit matters are held at least twice per year. **100%**	100%	100%	1
16. All findings are included in Action Tracking. **100%**	100%	100%	1
17. 100% of the mandatory annual audits are performed in the relevant year. **100%**	64%	100%	0
18. The audit manager and the chair of the Technical Committee meet at least once every a quarter	1	1	1
19. A review is conducted for at least **25%** of audits (in writing or verbally)	23.35%	50%	0
20. Technical audit reports to Executive Board once per quarter. **(once per quarter)**	1	1	1
21. The average number of recommendations per audit	7	7	1
22. Percentage of recommendations implemented by corrective action date	35.05%	70%	0
23. How many changes to the process	25%	70%	0
24. Actual(A) vs planned(P) costs (if A<P:100%; A>P: (1 - % of the excess))	100%	100%	1
		Overall Score	**41.67%**

The score suggests that the respondents perceived the level of technical audit effectiveness as low on all four perspectives with the internal business perspective scoring the lowest at 1.9744 and the customer perspective scoring the highest 2.7169. A consistent result was also found from the

effectiveness calculator. As exhibited in Table 7, the overall score was 41.67%. The technical audit unit passed ten KPIs while fourteen were below the standard level. Since 50% is the standard pass level (Institute of Internal Auditors - Netherlands, 2016); the overall score indicated that technical audit effectiveness was below the standard.

As can be observed in Table 7, the results on the effectiveness calculator indicated that technical audit was doing well, among other areas, in the handling of special management requests, qualification of technical auditors, staff departures, the inclusion of all findings in the action tacking, number of recommendations per audit, and cost of conducting the audit. On the other hand, the effectiveness calculator showed that technical audit performance was below the standard in areas such as the number of audit assignments achieved from the annual work plan, training of audit engineers, clients' satisfaction, the experience of audit engineers, an achievement on mandatory audits, implementation of recommendations by corrective action date, and a number of changes to the processes.

The results suggest that technical audit is not perceived as doing well in all four perspectives of the BSC. This is a matter of concern because an audit function that is not effective can hardly add value to the organization (Baiden et al., 2016). The results may to some extent explain the reasons that ESCOM continues to face operational challenges in spite of having a technical audit unit.

Factors affecting technical audit effectiveness

Table 8. provides the descriptive statistics of the independent variables. As can be seen, all the mean scores were below 3. Management support scored 2.7323, organizational independence 2.2354, and audit quality 2.8454. The results indicate that the respondents were generally in agreement that management supports the function, and organizational independence of the unit and audit quality is unsatisfactory.

Table 8: Descriptive statistics of independent variables

Variables	N	Mean	Std. Deviation
Management Support	65	2.7323	0.70492
Organizational Independence	65	2.2354	0.64546
Audit Quality	65	2.8454	0.54727

The collective effect of the factors on technical audit effectiveness

The regression results were obtained by regressing the dependent variable – technical audit effectiveness on the independent variables – management support, organizational independence, and audit quality. Table 9 provides the results of the regression analysis. The adjusted R^2 value was 0.5942, indicating that approximately 59.4% of the total variations in the effectiveness of the technical audit function could be explained by the predictor variables – management support, organizational independence, and audit quality. Further to that, the results indicated that the predictor variables have a significant effect on the effectiveness of the technical audit function (F = 32.24, p = 0.0000).

Table 9: Results of multivariate regression analysis

Variable	Coef.	t-stat.	P > t	[95% Conf. Interval]
MS	0.2626	3.27	0.002	0.1022 - 0.4230
OI	0.2916	3.44	0.001	0.1223 - 0.4609
AQ	0.3280	3.60	0.001	0.1456 - 0.5104
Cons.	0.2062	0.81	0.420	- 0.3020 - 0.7143
R^2	*0.6133*	**F(2,61)**	*32.24*	
Adj. R^2	*0.5942*	**Prob > F**	*0.0000*	

Besides, results in Table 9 show that management support ($\hat{\beta}$ = 0.2626, p < 0.05), organizational independence ($\hat{\beta}$ = 0.2916, p < 0.05), as well as audit quality ($\hat{\beta}$ = 0.328, p < 0.05), have positive significant values. The results indicated that all the predictor variables had a positive and significant contribution to the effectiveness of the technical audit. Based on the model specification, the regression equation expressing the relationships between the dependent variable (technical audit effectiveness – TAE) and the predictor variables (management support – MS; organizational

independence – OI and audit quality – AQ) can be expressed as follows:

$$TAE = 0.2062 + 0.2626MS + \\ + 0.2916OI + 0.3280AQ + \varepsilon \quad (2)$$

Thus, holding all the other variables constant, the equation indicates that for every unit increase in management support, technical audit effectiveness increases on average by 0.2626 units; for every unit increase in organizational independence, technical audit effectiveness increases on average by 0.2916, and for every unit increase in audit quality, technical audit effectiveness increases on average by 0.3280.

The individual effect of the factors on technical audit effectiveness

Table 10 provides the results of the tests of association between the dependent variable and independent variable's management support individually using chi-square and Cramer's V tests.

Table 10: Test of association - Chi-square and Cramer's V

Variables	Chi-square	Pr	Cramer's V
TAE and MS	28.4630	0.000	0.4679
TAE and OI	23.9538	0.000	0.4293
TAE and AQ	18.9893	0.001	0.3822

As seen in Table 10, Chi-square p-values for all variables were less than 0.05, thus indicating that there is a relationship between the independent variables (MS, OI, and AQ) and the dependent variables (TAE). Similarly, Cramer's V results indicate that there is a strong relationship between the dependent variable – technical audit effectiveness and all three independent variables. This is the case because Cramer's V values are all greater than 0.25 (Akoglu, 2018). Thus, the tests of association reveal significant relationships between individual predictor factors – management support, organization independence, and audit quality – and the dependent variable – technical audit effectiveness.

The results of both multivariate and bivariate analyses showed that the three factors have significant positive effects on the effectiveness of technical audit both collectively and individually. Thus, the results support the three study hypotheses, suggesting that technical audit effectiveness can be enhanced by improving management support, organizational independence, and audit quality among other factors.

CONCLUSION

The results from the analysis of data collected by the questionnaire and the effectiveness calculator consistently showed that the level of technical audit effectiveness was low. In relation to the factors, the multivariate regression analysis indicated that approximately 59.4% of the total variations in the effectiveness of the technical audit can be explained by the three predictor variables – management support, organizational independence, and audit quality. Besides, a bivariate analysis indicates significant and strong relationships existing between technical audit effectiveness with management support, organizational independence, and audit quality.

Thus, in order to improve the effectiveness of technical audit, improvements need to be undertaken on all three factors. Management support can be improved by, among other means, providing adequate resources to the technical audit unit which will among others, enhance productivity, improve output quality, and reduced burnout in employees. Management support can further be improved by promptly responding to audit recommendations. Organizational independence of technical audit can be improved by not only creating dual reporting lines, where the head of technical audit reports directly to the board but more importantly by the management not interfering with the work of the technical auditors. This would enable auditors to provide audit opinions without any influence on the relationship with the clients. Audit quality can be improved by the enhancing academic qualifications of auditors, work experience, continuous professional development, and the auditor's ensuring compliance with audit standards.

The results of the study need to be applied cautiously because they are based on a single company. To ensure generalisability, further studies need to be conducted. Since presently there is only one company in Malawi with a fully-fledged technical audit in the power sector, the paper recommends cross-country studies. All in all, the study is unique and important because, to the best knowledge of the researchers, it is the first to evaluate the effectiveness of technical audit in the power sector. Thus, it extends the academic debate on internal audit practice generally and specifically in the power sector, moreover, in a developing country context.

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EFIKASNOST TEHNIČKE REVIZIJE U ENERGETIKOM SEKTORU: SLUČAJ IZ ZEMLJE U RAZVOJU

U radu se ispituje nivo i faktori koji utiču na efikasnost tehničke revizije u elektroenergetskom sektoru Malavija iz ugla revizora i subjekata revizije. Podaci su prikupljeni putem upitnika koji su analizirani korišćenjem bivarijatnih i multivarijantnih statistika. Dalje, komplementarni podaci za merenje nivoa efektivnosti takođe su prikupljeni i analizirani korišćenjem proračuna efektivnosti. Rezultati pokazuju da je nivo efektivnosti tehničke revizije nizak. Bivarijantne i multivarijantne analize sugerišu da podrška menadžmenta, organizaciona nezavisnost i kvalitet revizije pojedinačno i zajedno značajno utiču na nivo efektivnosti tehničke revizije.

Ključne reči: Efektivnost; Interna revizija; Malavi; Energetski sektor; Tehnička revizija.