



**Audit sampling strategies and frauds: An Evidence from Africa**

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## Audit sampling strategies and frauds: An evidence from Africa

### Abstract:

**Purposes:** This research investigates how professionals such as accountants, auditors, senior civil servants and academics perceive the use of audit sampling strategies adopted by professionals to increase detection rates of frauds and corruption within the public sector in Africa. It also examines the respondents' perceived values regarding the reasons for committing frauds, types of frauds and corruption as well as the aspects of audit sampling strategies to tackle frauds.

**Design/methodology/approach:** This research employs non-parametric statistics and logistic regression to analyse the respondents' opinions regarding the state of frauds and corruption in Africa (particularly in Tunisia and non-Tunisia countries), the common factors behind people committing frauds, including the types of frauds and corruption and the respondents' opinions on the use of audit sampling strategies (non-random and random) to examine the instances of frauds and corruption.

**Findings:** The findings indicate that most respondents prefer to use non-probabilistic audit sampling rather than more robust sampling strategies such as random sampling and systematic random sampling to detect frauds and corruption. In addition, although there are some minor statistical differences between the countries in terms of the respondents' perceived values on skimming fraud and on the use of audit random sampling to tackle rampant corruption in Africa, the overall findings indicate that opinions do not significantly differ between the respondents from Tunisia and other countries in terms of the types of fraud, the reasons for committing fraud and the auditing sampling strategies used to investigate the frauds.

**Research Implications/limitations:** This research serves as an analytical exploratory study to instigate further audit sampling research to combat rampant fraud and corruption in the public sector in Africa.

**Originality/value:** There are few or non-existent studies investigating the application of audit sampling strategies in Africa countries, particularly to examine the application of audit random sampling and audit non-random sampling strategies to detect fraudulent activities and corruption. Correspondingly, this research carries strategic implications for accountants and auditors to successfully detect fraudulent activities and corruption in Africa.

### **Keywords:**

Logistic regression, Fraud triangle, Ch-square analysis, Logit model, Auditing  
Audit sampling, Random and non-random sampling, Africa

### 1. Introduction

Using correlation analysis of gross domestic product per capita, literacy, income inequality and freedom of the media, Warf (2017) indicates that many of the world's most corrupt governments are located in Africa. This severity of corruption relates to most of the fundamental issues in African countries, such as poverty, patrimonial cultures, nepotism, poorly developed civil societies and the lack of freedom of speech. This failure of combating fraudulent and corrupt activities within the African public sector has been due to ineffective corporate governance (Boly et al., 2020; Gustavson, 2014), which distorts the allocation of resources, minimises the benefits of foreign aid and discourages foreign investment. In fact, according to the Corruption Perception Index (CPI), Africa is the lowest performing region, and imminent action is needed in this area (Transparency International, 2020). Accordingly, the secondary data were extracted from Transparency International (2020) of the country ranking based on the Corruption Perception Index to evaluate the levels of corruption and fraud in Africa between 2015 and 2020. Table 1 below illustrates the secondary data extracted from Transparency International (2020). A ranking of 1 indicates a clean government, while a higher ranking implies higher corruption levels in the country.

**Table 1: Country Ranking Based on the Corruption Perception Index**

Country	Year					
	2015	2016	2017	2018	2019	2020
South Africa	61	64	71	73	70	69
Central Africa	145	159	156	149	153	146
Tunisia	76	75	74	73	74	69
Nigeria	136	136	148	144	146	149

Source: Transparency International (2020)

The data from Table 1 is portrayed graphically in Figure 1 and indicates that corruption levels in Africa have not yet declined substantially enough to warrant effective and clean corporate governance, as the corruption ranking trend remained relatively stable between 2015 and 2020. However, some slight ranking fluctuation is perceptible in the African countries, with Table 1 revealing that some countries, such as South Africa, Central Africa and Nigeria, have worsened in terms of corruption levels during recent years. For example, in 2015, South Africa ranked 61<sup>st</sup> (cleaner government), but in 2020, the country rank worsened to 69<sup>th</sup>. Conversely, Tunisia's ranking improved slightly from 76<sup>th</sup> in 2015 to 69<sup>th</sup> in 2020, implying corruption levels in the country have declined slightly.

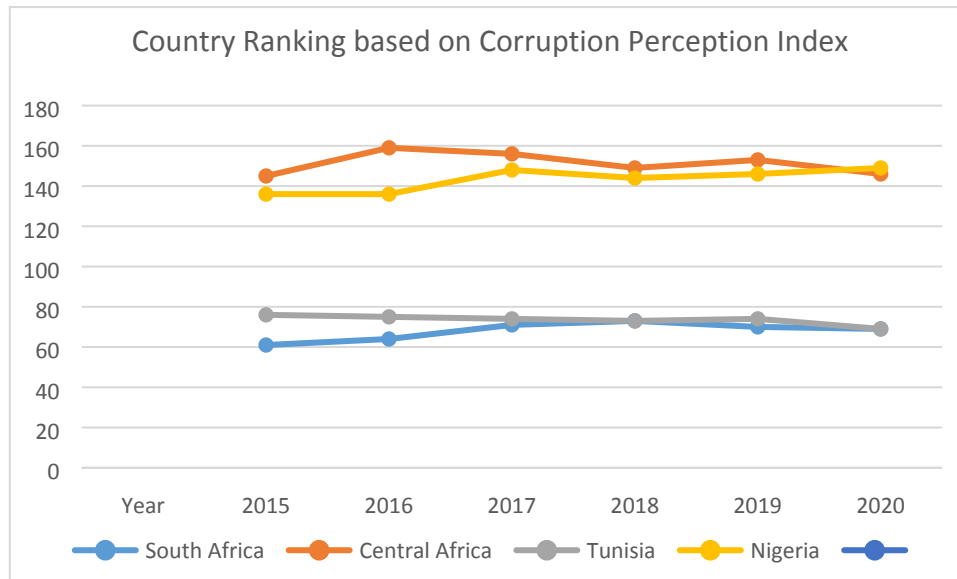


Figure 1: The Ranking Based on the Corruption Perception Index in Africa

The recent COVID-19 pandemic has led to a rise in costs of living and medical necessities, which are expected to raise the risks of corruption. Accordingly, this is one justification of this study stimulating further discussion towards cleaner government, increasing societal welfare, and reducing misappropriation of emergency funds.

Moreover, bribery continues to hinder the access to public services where the Global Corruption Barometer for Africa has revealed that approximately 130 million people in the 35 countries revealed they had paid a bribe to access essential public services such as health care (Transparency.org, 2019; Transparency International, 2020). Moreover, there are a variety of fraudulent activities and corruption (as indicated in Table 2) from expenses reimbursement schemes, asset misappropriation, skimming, corruption, shell companies, money laundering, espionage, and illegal insider trading and such sophisticated techniques make it difficult for auditors to detect fraudulent (Armah-Attoh, Gyimah-Boadi and Chikwanha, 2007; Heath, 2000; Pillay, 2014).

Table 2 – Fraudulent Activities in Africa

1	<b>Expense reimbursement schemes (ERS)</b>	Falsification of information about expenses that causes the government to overcompensate staff in the form of inflated expenses. For example, any governmental staff member who is in a position to incur travel expenses is potentially capable of committing this fraud.
2	<b>Asset misappropriation</b>	The theft of government assets (such as cash or inventory) and the misuse of government assets (such as using a government car for a personal trip).
3	<b>Skimming</b>	The process by which cash is removed from the government office before it enters the accounting system (for example, the receipt of the cash is never reported to the institution, unrecorded governmental revenues and understated government revenues).
4	<b>Corruption</b>	The wrongful use of influence in a governmental dealing to procure a personal benefit. Corruption occurs in various forms, including bribery, undisclosed payments, illegal gratuities and collusion.
5	<b>Shell companies</b>	Traders, vendors and suppliers who exist fictitiously only on paper. The purpose is to bill the government for services not rendered or products not delivered. The scheme involves an insider in the management and takes a variety of forms.

6	<b>Money laundering</b>	Disguising the origins of money obtained through illegal sources as if it was obtained from legal sources or transforming the proceeds of crime into legitimate assets. Otherwise, the fraudsters would be unable use the money as it would connect them to the illegal activity.
7	<b>Espionage</b>	Obtaining information that is not normally publicly available in return for monetary compensation. Espionage can be channelled by using a traditional way or more advanced IT hacking systems. It may also involve seeking to influence decision-makers for the benefit of an outside or foreign power. Espionage can be either governmental or industrial espionage.
8	<b>Illegal insider trading</b>	Buying or selling a security while in possession of non-public information about the security. It may also include tipping such information. Examples of illegal insider trading are friends, business associates and family members trading the securities after receiving confidential information and government employees, who learned of such information and take advantage of the confidential information.

Since fraud and corruption leads to negative impacts and corrodes the public's trust it could undermine the sector's effectiveness (Nyamori, Abdul-Rahaman and Grant, 2017; Pillay, 2014; Soobaroyen Tsamenyi, and Sapra, 2017; Yeboah-Assiamah, 2016). Hence, it is expected that the use of more robust sampling strategies will increase detection rates and reduce fraud in the public sector. This in turn will lead to stimulating economic growth in Africa since most African countries are characterised by a relatively high level of rampant fraudulent activities and corruption among officials within the public sector (Armah-Attoh, Gyimah-Boadi and Chikwanha, 2007; Nyamori, Abdul-Rahaman and Grant, 2017; Yeboah-Assiamah, 2016).

Correspondingly, the major aim of this study is to provide direction on audit sampling strategies to successfully combat fraud and corruption in Africa drawing on data collected from three African countries i.e. Tunisia, South Africa and Nigeria. The three countries are selected because they follow the Association of Chartered Certified Accountants (ACCA) and Chartered Financial Analyst (CFA) (Ngoc Huy, 2014). This study serves as a preliminary exploration in the application of audit sampling strategies to combat corruption in Africa's public sector.

The rest of the study is organized as follows. The next section shows the gap in the literature by presenting the literature on Auditing, Frauds and Corruption in Africa and literature on Audit-Sampling Strategies, followed by the methodology used. Section four reports the main empirical results, and section five of the article draws conclusions and provides elements for consideration in the public sector of Africa.

## 2. Literature Review

Public service organisations need to be more transparent and accountable in their operations while improving the policies and procedures to improve the accountability and access to public information. As such, improvements of audit quality procedures in Africa's public sector could be a solution to overcome these issues and improvements in accountability of public sector. In order to maintain

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3 better audit quality procedures, audit sampling techniques play a major role (Marazzi, 2016; Marazzi  
4 and Tille, 2017). However, the guidance for practitioners on how to use audit sampling methods has  
5 not appeared robustly in the auditing literature along with no validation of the guidance. In addition,  
6 evidence shows that the majority of auditors use non-statistical sampling techniques (Chen and Leitch,  
7 1999; Peek, Neter and Warren, 1991). Thus, the current research is considered paramount because a  
8 correct application of audit sampling strategies would lower non-detection risks in auditing. This  
9 research is considered vital for reducing fraudulent activities particularly within the public sector in  
10 Africa.

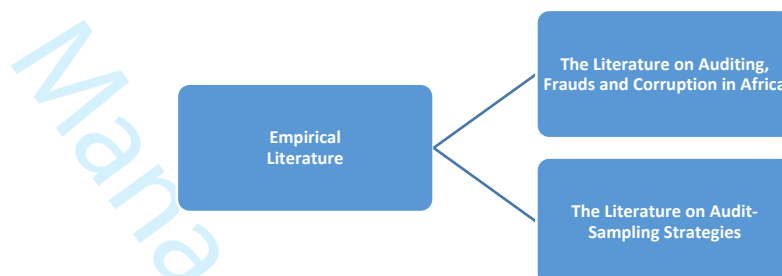
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18 Recent trends in auditing practices for multinational and larger corporations indicate the  
19 developmental use of big data and social media in audit sampling (Appelbaum, Kogan and Vasarhelyi  
20 (2017); Vasarhelyi, Kogan and Tuttle (2015), although in smaller companies and small to medium  
21 enterprises, auditors have to perform more traditional tasks of inspecting structured data such as  
22 10,000 conventional receipts a year, in which auditors need to perform audit sampling. Otherwise, it  
23 would not be possible to audit all receipts (census), which may take more than a year to audit  
24 individual receipts facing limited time and resource. This study applies to smaller firms and small to  
25 medium enterprises. However, as technology trends have developed, data for auditing can include  
26 exponentially growing online unstructured and machine-generated data. This has gradually  
27 transformed the work of auditors to audit unstructured and massive data particularly for  
28 multinationals and larger corporation in developed countries such as the UK, US, Germany, Japan and  
29 others. Accordingly, more auditors may employ big data and draw comparisons over larger  
30 populations. In addition, the methodology of automation and artificial intelligence (AI) are required  
31 by auditors to inspect a massive amount of big data. Nevertheless, this study focuses on audit sampling  
32 for structured or conventional data in emerging and developing economies in Africa.

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45 Although there have been abundant studies examining the application of audit sampling strategies  
46 within the auditing literature in general (Peek, Neter and Warren, 1991; Chen and Leitch, 1999;  
47 Beldona and Francis, 2007; Marazzi, 2016; Marazzi and Tille, 2017), there are very few studies  
48 investigating the application of audit sampling strategies in Africa, particularly to examine the  
49 application of audit random sampling and audit non-random sampling strategies to detect fraudulent  
50 activities and corruption. In addition, there has been little academic research on audit sampling and  
51 its strategic guidelines at institutional levels (Elder et al., 2013).

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This paper draws on studies developed in two areas of literature (Figure 2): studies pertaining to frauds, corruption, and auditing in Africa, and studies relating to general audit sampling techniques.

**Figure 2 – Relevant empirical literature**



The input–process–output (IPO) framework (Figure 3) can be used to illustrate the relevant literature pertaining to auditing, fraud, and corruption in Africa. The IPO framework is an extensively used approach in systems analysis for describing the structure and sequence of auditing (Johnstone, Gramling, and Rittenberg, 2015).

**Figure 3 – Input-Process-Output Framework**



Figure 3 illustrates the inputs of auditors are listed among other financial records, accounting transactions, complete ledger, and others. While the process of auditing (Figure 3) is robust sampling strategies to increase detection rates of frauds and corruption, audit engagement, substantive procedures and others. The process also includes regular training for auditors and continuous professional development (CPD) of auditors to lower non-detection risks. Lastly, the outputs of auditing comprise robust auditing reports to successfully detect fraud and corruption, which will subsequently lead to the country’s stability.

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5 Ngoepe and Ngulube (2016) indicated that poor record keeping was the main factor leading to the  
6 failure of auditing within the public sector in Africa and therefore, to a poor 'input' to be examined by  
7 the auditors as indicated in Figure 3. Hence, from an 'input' perspective, non-detection risks in  
8 auditing are still considered relatively high in Africa because of poor record keeping in the African  
9 public sector. Poor record keeping includes inadequate records of transactions, no itemisation of  
10 accounting transactions, etc. This phenomenon has also been echoed by recent research by Maroun  
11 and Atkins (2014). Maroun and Atkins' study (2014) indicated that in South Africa there is a need for  
12 institutions to improve audit quality ('process' – Figure 3) and the quality information made available  
13 to stakeholders ('input' – Figure 3). The authors focused on action-oriented research needed by  
14 auditors and emphasised the importance of regulations to enhance the quality of auditing in South  
15 Africa in general and the relevance of audit reports.  
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25 In addition, Pillay (2014) empirically examined a variety of development fraudulent activities and  
26 corruption, reported on an almost daily basis in South Africa. The author indicated that this rampant  
27 corruption has increased the country's economic, social, and political costs and that fraud and  
28 corruption takes place because of inadequate corporate governance to implement quality auditing.  
29 Pillay's approach focuses on an 'input' and 'process' within an IPO framework (Figure 3), namely  
30 gathering and analysing data.  
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37 In contrast, Ngoc Huy (2013) argued that abundant corporate scandals and bankruptcy happen in  
38 Africa because of three contributing factors, namely frail corporate governance, weak internal control  
39 systems, and fragile auditing quality. The author proposes strategic policy implications to improve  
40 auditing processes ('process – Figure 3) in Africa, particularly in South Africa and Ghana. In line with  
41 this study, Nieman and Fouché (2016) emphasised the importance of a regulatory framework in Africa  
42 because at present there is no robust framework prescribing requirements for financial reporting. In  
43 addition, the existing frameworks and practices do not meet the standard requirements of auditing.  
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50 Any regulatory framework is expected to concurrently enhance 'input', 'process', and 'output' of  
51 auditing. For example, by enhancing regulatory frameworks, public sector institutions will be able to  
52 provide adequate and detailed transaction records, which can be examined satisfactorily by the  
53 auditors. At the same time, the public sector institutions in Africa will be able to implement more  
54 rigorous processes in auditing the transaction in the public sector such as improve training and  
55 development for auditors as well as implementing robust sampling strategies. Lastly, this 'input' and  
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3 or 'process' is expected to enhance the 'output' of the auditing by reducing fraudulent activities and  
4 corruption in Africa's public sector. Similarly, Anders's study (2015) revealed that the Malawi  
5 government has emphasised the aspects of efficiency and transparency in the public sector through  
6 the implementation of technologies ('process' – Figure 3). In fact, the implementation of clean  
7 government in Africa in general has been hindered by bureaucratic practises and corruption (Anders,  
8 2015).

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15 An audit sampling strategy can be defined as a strategy to audit 'less than 100 percent' of the items  
16 within an account balance or 'less than 100 percent' of the financial transactions within an institution's  
17 financial statements in making a conclusion about either the account balance or the financial  
18 statement (Hayes, Wallage and Gortemaker, 2014; Johnstone, Gramling and Rittenberg, 2015). Audit  
19 sampling techniques are used because it is not practicable for the auditor to examine each single item  
20 within the population of an account balance. It is wasteful to investigate each transaction within the  
21 population of a financial statement, because of the time and resources involved. However, before  
22 selecting a sampling strategy, the auditor needs to define the population to be examined which can  
23 be the transactions or the items during the period under review.

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32 The basis for implementing audit sampling is to evaluate the list of items or transactions, which is  
33 known as a sampling frame. For example, if it is required to audit 'expense reimbursement schemes'  
34 (ERS) in a public-sector organisation, the auditor has to focus on the transactions relating to those  
35 staff who travel frequently. ERS can be defined as the falsification of expense information that results  
36 in the government overcompensating staff (in the form of inflated expense claims). Hence, any  
37 governmental staff member who can incur travel expenses is potentially capable of committing this  
38 type of fraud. To audit the possibility of fraud Anderson and Wolfe (2002), suggested that the auditor  
39 needs to reconcile all transactions that occurred during the period to the staff's Cash Receipts Journal  
40 and Cash Disbursements Journal, along with cross-verification with external parties such as flight or  
41 train companies. However, it may not be possible to check all transactions because of the time and  
42 resource constraints challenging the auditors. In practice, audit sampling is normally adopted to make  
43 a valid conclusion about the whole population. However, earlier research indicates a 20% rate of  
44 alleged failures to detect defalcation and fraudulent corruption in not-for-profit and government  
45 institutions (Anderson and Wolfe, 2002).

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57 The auditing theory (Pickett, 2005; Teitlebaum and Robinson, 1975) emphasise two types of audit  
58 sampling strategies, namely non-probabilistic (non-random) and probabilistic (random) audit  
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sampling. Non-probabilistic sampling includes purposive, convenience and quota audit sampling techniques, while probabilistic audit sampling includes simple random audit sampling, systematic random audit sampling, stratified random audit sampling and cluster random audit sampling.

This paper focuses on 'block selection audit (non-probabilistic) sampling' and 'monetary unit (non-probabilistic) sampling or MUS' (Questions 12 and 13 in the questionnaire) as well as 'simple random selection' and 'systematic random selection' (Questions 14 and 15 in the questionnaire). Hence, following relevant literature (Pickett, 2005; Teitlebaum and Robinson, 1975), audit sampling strategies used in this study are defined in detail in Table 3 below.

**Table 3 – Audit Sampling Strategies**

1	<b>Block selection audit non-random sampling (BLOCK)</b>	Selecting non-randomly a block of suspect records within the population of accounting records. In situations where the auditor uses block selection as a non-random sampling technique, many block samples should be selected to help minimise the non-detection risk, because the block samples may not be representative of all the records. An example of block selection is where the auditor examines some of the remittances relating to ERS that are suspected to relate to fraudulent activities, for example, selecting only records relating to travel expenses to a particular destination.
2	<b>Monetary unit non-random Sampling (MUS)</b>	Selecting samples based on monetary values to determine the accuracy of the financial accounts. Each individual pound sterling in an account balance is considered a sampling unit, thus accounts in the population with a higher balance have a higher chance of being selected. The steps involved in monetary unit sampling (MUS) are: determining the sample size; purposively selecting the sample; performing the audit procedures; evaluating the results; and arriving at a conclusion about the population. For example, by matching an inventory record with a receivable balance, the auditor will be able to detect misstatements relating to possible fraud and unrecorded government revenues.
3	<b>Simple audit random sampling (SIMPLE)</b>	Selecting samples to ensure that all items such as accounting records, sales invoices, account balances and financial information within a population of accounting records have an equal chance of selection, in which the samples are chosen randomly, for example, by using random number tables or a random number generator (RNG).
4	<b>Systematic audit random sampling (SYSTEM)</b>	Selecting (n) sample members randomly from the whole population (N) according to a random starting point with a fixed periodic interval (k). Imagine that an auditor wants to find out more about fraudulent activities in the public sector. Suppose that the government has approximately 1,000 transactional accounting records from Record 1 to Record 1,000. These 1,000 records are the population (N). To select systematic samples of (n) records from the population of 1,000 records, the auditor could use systematic random selection. For example, the auditor may decide that the desired sample size is 5%, and $5\% \times 1,000 = 50$ samples. Then k is estimated to be equal to $N/n = 1,000/50 = 20$ . The starting point for the sample can be generated randomly by RNG. Let us say that according to the RNG, the first number of the record that needs to be examined by the auditor is Record 14. Then, the second number that needs to be examined by the auditor is $14 + 20 = 34$ , or Record 34. The third is Record 54 ( $= 34 + 20$ ). The sample set of the accounting records is therefore 14, 34, 54, 74, 94, 114, 134, etc.

Audit sampling technique involve the application of audit procedures to less than 100% of items within an account balance (Oana and Tatiana, 2013). They authors discussed the origins of audit sampling techniques and provided a brief history of the techniques as well as different definitions from different theoretical perspectives. They concluded that audit sampling is appropriate for testing detailed items and identified the risks and factors affecting the selection of audit sampling procedures, such as non-detection risks, auditing objectives and population characteristics.

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3 From a non-probabilistic sampling perspective, Danescu and Chis (2012) revealed that audit non-  
4 probabilistic sampling procedures constitute a simple and practical situation, because auditors do not  
5 have to study the entire population of transactions within an account balance. Particularly, when the  
6 auditor needs to audit a large number of transactions, audit using non-random sampling techniques  
7 save considerable time and effort, resulting in lower costs of auditing by inspecting only a fraction of  
8 the transactions, or samples only. However, auditors need to use their professional judgement to  
9 avoid the risk of non-detection and ensure that the sample represents the population of all  
10 transactions to be audited. In the same vein, Burtescu and Grigore (2011) revealed that by selecting  
11 samples from the total transactions, the auditor aims to achieve time efficiency, and at the same time  
12 reach an efficient conclusion regarding the whole population of transactions. The authors  
13 recommended that auditors should use stratified random sampling to optimise the  
14 representativeness of the sample and achieve sampling diversity of transactions.  
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25 The auditing literature also discusses several aspects of both probabilistic and non-probabilistic audit  
26 sampling procedures. For instance, Sibelman (2014) discussed various audit random and non-random  
27 sampling techniques, their advantages and disadvantages, and highlighted the role 'practical or non-  
28 random' sampling techniques in balancing a concern for resource and efficiency. In contrast, Marazi  
29 (2016) employed Montecarlo simulation to conclude that by using random (probabilistic) audit  
30 sampling, the auditor could minimise financial misstatements. The author indicated that audit random  
31 sampling is more efficient than non-random audit sampling, such as monetary unit non-random  
32 sampling (MUS). In relation to random audit sampling, Bonnet and Clute (1990) also identified three  
33 types of non-sampling errors. They added that in the existence of non-sampling errors, standard audit  
34 (non-random) sampling procedures result in a negatively biased estimate of the true number of errors  
35 and dollar amounts associated with those errors. Correspondingly, they introduced a double audit  
36 sampling technique, such as non-random stratified audit sampling, which can be used to provide an  
37 unbiased estimate of the true number of errors and dollar amounts of those errors.  
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49 Lastly, Teitlebaum and Robinson's study (1975) indicated that the use of less robust audit sampling  
50 procedures results in audit risks such as non-detection, and the associated risks are more significant  
51 than predicted. They discussed several factors that affect audit risk, such as population characteristics,  
52 sampling design and auditing objectives e.g. problems related to non-random audit sampling in the  
53 case of heterogeneous populations i.e. transactions. While this non-random audit sampling can  
54 dramatically lower costs, it comes at the expense of introducing bias because the technique itself  
55 reduces the likelihood that the sample will represent a cross-section of the population. Hence, non-  
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random audit sampling can be an obvious source of sampling error and bias. If Mean Square Error (MSE) can be used as a measure of sampling error (Equation 1), the use of non-random audit sampling leads to higher sample error due to the increased variance (sampling error variability) and bias (systematic sampling error) (Lewis-Beck et al 2004, Rao, 2000) as follow:

$$\text{MSE}(x) = E[x - E(x)]^2 + E[x - X]^2 = \text{Var}(x) + \text{Bias}^2(x) \dots\dots\dots \text{Equation 1}$$

Where  $x$  is the sample statistic, which is employed to estimate the population parameter  $X$ ,  $E$  is expectation operator and MSE is the sum of the variance and the squared bias of the estimate.

In relation to audit non-detection risks, Sahnoun and Zarai's study (2009) used a sample of 200 Tunisian auditors to investigate the relationship between audit risk and auditee business risk and demonstrate that the auditors must devote more attention to auditing an institution's financial statements when the business risk is relatively high. This gives significant messages to the auditors to employ more robust sampling strategies, such as random or probabilistic audit sampling, when business risk is relatively high. A study of audit sampling strategies employed by national and international accounting firms revealed that choosing an audit sampling strategy is the most difficult barrier faced by auditors to identify financial misstatements and fraud, and, these firms use simpler audit sampling strategies because of nonexistence of guidelines on the relative efficiency of audit sampling strategies (Christensen, Elder and Glover, 2015). Because of the paucity of guidelines, the auditors underestimate the non-detection risks and fail to project sample errors when selecting audit sampling techniques and evaluating financial statements (Elder and Allen, 1998; 2003).

### 3. Methodology

This study employs a quantitative analysis based on a survey carried out to collect data to examine professionals' perception regarding the state of frauds and corruption in Tunisia and other countries such as South Africa and Nigeria and the reasons why people commit frauds, including the types of frauds and corruption. Additionally, the study investigates respondents' opinions (such as professionals, accountants, auditors, senior civil servants and academics) on the use of audit (non-random and random) sampling strategies to examine the instances of frauds and corruption.

The use of non-parametric (cross tabulation) statistics was employed, and the SPSS software package was used to carry out quantitative analyses such as descriptive statistics and cross tabulation statistics. The primary data (n=195) was analysed by using a non-parametric test of independence and by examining the closeness of the relationship between the respondents' demographic characteristics and their multiple-choice answers to the survey questions. The reasons for using the non-parametric test were as follows:

- Firstly, a non-parametric test is useful in analysing the categorical or qualitative data collected (Bryman and Bell, 2011), which was based on the multiple choices in the questionnaires.
- Secondly, this study employs a relatively small sample (n=195).
- Thirdly, it further analyses whether respondents' demographic characteristics are dependent or independent of their perception.
- Fourthly, the non-parametric test was also used to evaluate whether the respondents' perceptions (between Tunisia and other countries such as South Africa and Nigeria) differed statistically according to country of origin. This analysis is important since countries like South Africa and Nigeria employ auditing systems similar to that of the UK by following ACCA guidelines (Ngoc Huy, 2014), while Tunisia more closely follows French accounting systems (El Omari and Khlif, 2014); hence, the non-parametric test was used to evaluate the opinion differential between Tunisia, South Africa and Nigeria.

In general, a non-parametric (Chi-square) test of independence states that if the two variables are independent, the expected frequency (e) values of each cell can be determined by the equation below.

$$e = \frac{(n_i)(n_j)}{N} \dots\dots\dots \text{Equation 2}$$

where  $i$  is the row  $i$ ,  $j$  is the column  $j$ ,  $n_i$  is the total of row  $i$ ,  $n_j$  is the total of row  $j$ , and  $N$  is the grand total of all frequencies. Using these expected frequency values and the observed frequency values, a test of independence can be made using Equation 2 to determine whether the variables are independent:

$$\chi^2 = \sum \sum \left( \frac{f_o - f_e}{f_e} \right)^2 \dots\dots\dots \text{Equation 3}$$

The null hypothesis ( $H_0$ ) for a Chi-square test of independence is that the two variables are independent. The alternative hypothesis ( $H_a$ ) is that the variables are not independent. This test is one-tailed with the degrees of freedom of  $(r-1)(c-1)$ . The decision rule is to reject  $H_0$  if a computing Chi-square produces a critical value from a Chi-square table, otherwise do not reject  $H_0$ . Where  $df$  stands for degree of freedom,  $df=(r-1)(c-1)$ ,  $r$ =number of rows,  $c$ =number of columns,  $f_o$ =observed frequencies,  $f_e$ =expected frequencies and  $\Sigma$  stands for summation operation.

The survey questionnaires were distributed to more than 300 contacts from Tunisia and Nigeria and South Africa to obtain the perceived values of audit sampling techniques and frauds in the public sector in Africa. From 300 contacts, only 198 responses were received. After removing invalid and incomplete questionnaires, only 195 survey questionnaires fitted the criteria required for statistical analysis using SPSS. The respondents from Tunisia and non-Tunisia countries were purposefully obtained by using a chain-referral sampling technique, which is a non-random sampling technique to aim for heterogeneity of perception among homogenous groups of accountants, auditors, senior civil servants and academics teaching auditing and accounting. In a chain-referral sampling technique, existing respondents recruit future respondents from among their network (Lewis-Beck, Bryman and Liao, 2004; Sedgwick, 2013), in which the respondents are considered to have theoretical knowledge and familiarity in the area of public sector accounting as well as fraudulent and auditing practices in their own country of origin. They include professionals, accountants, bankers, auditors, auditing officers, public sector workers, senior civil servants, senior managers, and academics in auditing and business accounting. The respondents were contacted via LinkedIn and provided with a link to the survey questionnaire created on Google Forms.

The survey questionnaires included five and six scales ranging from 1 ('strongly disagree') to 5 ('strongly agree') or from 1 ('it happens all the time') to 6 ('it never happens'). The reliability of the measures is assessed using Cronbach's alpha statistics. The scales were empirically condensed into

two binary scales to employ binary logistic regression models through a stepwise regression procedure.

A logistic regression model will be employed to complement the descriptive statistics to predict the outcome of a categorical dependent variable based on one or more predictor variables. Algebraically, a Logit (log odds) model of  $p$  can be produced using the following equations:

$$\text{Odds} = \frac{\pi}{\pi-1} \dots\dots\dots \text{Equation 4}$$

$$\log \text{it} (\pi) = \log (\pi) - \log (1 - \pi) \dots\dots\dots \text{Equation 5}$$

The dependent variable in the logistic or logit model is dichotomous. It takes the value 1 with a probability of success  $p$ , or value 0 with a probability of failure of  $1 - p$ . In the above equations, the base of the logarithm model used is 10. However, the natural logarithm ( $\ln$ ) is the most frequently used in the empirical literature (Agresti, 1996; Kleinbaum, 1997). Accordingly, the logistic regression model of any number  $p$  can be provided algebraically by applying the following equations.

$$\log \text{it} (\pi) = \ln \left( \frac{\pi}{\pi-1} \right) \dots\dots\dots \text{Equation 6}$$

$$\ln \left( \frac{\pi}{\pi-1} \right) = \delta_0 + \delta_1 X_1 + \delta_2 X_2 \dots\dots\dots \text{Equation 7}$$

Following Equations 3 and 4, Hosmer and Lemeshow (2000), Menard (1995) and Kleinbaum (1997) reveals that a simple Logit model (with a single predictor variable) can take on Equation 7 for empirical investigation using SPSS.

#### 4. Findings and Discussion

##### 4.1 Descriptive statistics

The findings indicate that 63.1% of the respondents are male and 36.9% are female. Besides, 55.4% of the respondents are aged between 32 and 38, 18.5% are aged between 39 and 45, 12.3% are aged

between 46 and 52, 7.7% are aged between 25 and 31, and 6.2% are aged between 53 and 59. Tunisian respondents constitute 50.8% of the total respondents, whereas South African and Nigerian respondents represent respectively 29.1% and 20.1%.

In terms of the respondents' religions, the majority of respondents are Muslim; these respondents were of Tunisian origin. Christianity, as the religion of South Africa and Nigeria, was the second religion among respondents. The remaining respondents were atheists and those who prefer not to state their religion for personal reasons.

The findings also indicate 43.1% of the respondents have doctoral qualifications, 50.8% of the respondents have postgraduate qualifications, and 6.2% of the respondents are qualified to undergraduate degree level. It is, therefore, reasonable to indicate that the majority of respondents are knowledgeable enough to provide quality opinions on the state of auditing and fraud. Moreover, 55.4% of the respondents have teaching and research roles, while 15.4% of the respondents have managerial roles as professionals, accountants and auditors, 13.8% of the respondents have operational or secretarial roles, and 6.2% of them are in supervisory roles (Table 4).

**Table 4 - What is your role within your institution?**

	Frequency	%	Cumulative %
<b>Operational or secretarial role</b>	27	13.8	13.8
<b>Managerial role</b>	30	15.4	29.2
<b>Supervisory role</b>	12	6.2	35.4
<b>Teaching or research role</b>	108	55.4	90.8
<b>Advisory or consultancy role</b>	6	3.1	93.8
<b>Others</b>	12	6.2	100.0
<b>Total</b>	195	100.0	

The auditing literature (Murphy and Free, 2016; Roden, Cox and Kim, 2016; Shaio et al., 2017; Lokanan, 2018) identifies three common factors, known as the 'fraud triangle', that lead to fraud and economic crime in the public sector. The first is an incentive or pressure to engage in misconduct. The second is the presence of a bigger opportunity or fewer controls from the management. The third is rationalisation used to justify fraudulent actions, for example, because of their low salaries, managers may be tempted to justify fraud and economic crime.





<b>Mean</b>	1.985	1.785	2.292	1.692	2.431	2.723	3.108	2.738
<b>Std. Deviation</b>	0.8195	0.8925	1.0112	0.7890	1.1986	1.3976	1.4483	1.3261

When asked to suggest the most efficient audit sampling strategy for investigating fraudulent activities or economic crime within the public sector in Africa, the majority of the respondents chose 'block selection audit (non-random) sampling' (with a mean of 2.046), followed by 'monetary unit sampling (non-random)' (with a mean of 2.200). Although audit random sampling strategies, such as 'simple audit random sampling' and 'systematic audit random sampling', are considered as the most efficient sampling in auditing (Teitlebaum and Robinson, 1975), in this study, audit random sampling is found to be less important, with a mean of 2.754 (Table 6). Possible explanations for the phenomena are that the science of audit sampling was not widespread in the auditing community in Africa. In comparison, earlier studies in the application of audit sampling techniques (such as Elder and Allen, 1998, 2003; Marazzi, 2016; Marazzi and Tille, 2017) reveal that audit random sampling strategies were not widely used among practitioners.

The coefficient of skewness (Table 7) is a measure of the asymmetry of the probability distribution of the respondents' opinion, which can be positive or negative. The coefficients of skewness of block selection audit sampling, monetary unit sampling, simple audit random sampling and systematic audit random sampling are found to be 0.571, 0.836, -0.188 and -0.040 respectively. The findings indicate that the distribution of opinion preferring block selection audit sampling and monetary unit sampling is negatively skewed, while the opinion preferring simple audit random sampling and systematic audit random sampling is positively skewed. It is reasonable to expect that these types of skewness occur because most of the respondents prefer to use audit non-random sampling (block selection audit sampling and monetary unit sampling) rather than audit random sampling (simple audit random sampling and systematic audit random sampling). On average, most of the respondents who preferred to use non-probabilistic sampling share similar opinions, tending to agree with one other as indicated by relatively lower standard deviations of 0.8372 and 0.8874 respectively (Table 7).

**Table 7**

**To what extent do you agree that ..... is the most efficient methodology to detect fraudulent activities or economic crime within the public sector?**

	<b>Block selection audit sampling</b>	<b>Monetary unit sampling (MUS)</b>	<b>Simple audit random sampling</b>	<b>Systematic audit random sampling</b>
<b>Mean</b>	2.046	2.200	2.754	2.754
<b>Std. Deviation</b>	0.8372	0.8874	1.0312	0.9525
<b>Skewness</b>	0.571	0.836	-0.188	-0.040

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3 The findings showed that audit non-random sampling strategies are more preferred by the  
4 respondents than those of audit random sampling strategies. This is in line with the earlier studies of  
5 Elder and Allen (1998; 2003) who claimed that auditors do not consider sampling risks when  
6 identifying financial misstatements and fraud detection risks in general. Although earlier studies, such  
7 as Marazzi (2016) and Marazzi and Tille (2017), indicate that audit random sampling techniques are  
8 more efficient than audit non-random techniques such as block selection sampling and monetary unit  
9 sampling (MUS), most of the respondents consider the use of audit non-random sampling techniques  
10 as preferable.  
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### 17 **Reliability test**

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19 To assess the scales the scale reliability Cronbach's Alpha coefficients. A relatively high value of  
20 Cronbach's alpha is often used to prove that the items measure an underlying construct (Bonnent and  
21 Wright, 2014; Lewis-Beck, Bryman and Liao, 2004; Sijtsma, 2009; Vaske, Beaman and Sponarski, 2017).  
22 The closer the Cronbach Alpha is to 1, the greater the internal consistency of the scale is (Lewis-Beck,  
23 Bryman and Liao, 2004; Sijtsma, 2009; Vaske, Beaman and Sponarski, 2017). Overall, the findings  
24 reveal that the reliability is robust (CA=0.74), being higher than 0.7. That said, the questions are  
25 consistent and reliable enough to measure common factors (fraud, corruption and types of fraud, as  
26 well as the audit sampling strategy preference in detecting fraud).  
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33 Following the earlier discussion on descriptive statistics, this section offers inferential statistics of the  
34 findings. Inferential statistics enable the reader to analyse the data further by relating the  
35 respondents' demographics with their perceived values, in addition to proposing 'soft' generalisations  
36 about the populations from which the respondents come from; namely, Tunisia and non-Tunisia  
37 countries (South Africa and Nigeria). However, as discussed earlier, these findings offer valuable  
38 direction for future studies on audit sampling strategies that aim to tackle the rampant fraud and  
39 corruption in Africa. The discussions of inferential statistics include the estimation of parameters (of  
40 the non-parametric tests such as Chi Square test) and testing of possible hypotheses.  
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49 Following relevant methodical literature (Auerbach and Silverstein, 2003; Platt et al., 2006; Polit and  
50 Beck, 2007; Volz and Heckathorn, 2008), the respondents were selected by using a chain-referral  
51 sampling technique. The technique can be defined as special non-probability sampling used effectively  
52 when the sample characteristics are rare and difficult to contact, such as auditors, professional  
53 accountants, senior civil servants, and academics, who are knowledgeable in the areas of auditing in  
54 an Africa context. In chain-referral sampling, additional respondents were selected by initial  
55 respondents based on their network of contacts. This type of sampling, which is based on referrals  
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3 from the initial respondents, is very useful for this research because it is difficult nowadays to find  
4 people and potential respondents who are willing to fully answer survey questionnaires. Hence, such  
5 individuals and potential respondents within their own groups are difficult to identify because the  
6 target population is thinly dispersed among larger populations. Many companies and market research  
7 agencies are constantly researching people, at all times. Consequently, many people refuse to  
8 participate to surveys anymore, feeling they have been overly researched and believing that it wastes  
9 their valuable time (Agarwal et al., 2016; Phillips, Reddy and Durning, 2016).

### 16 **Relationship between demographics and respondents' opinions**

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18 In order to investigate the relationship between the respondents' demographics and their opinions,  
19 Spearman's rank correlation coefficient was computed. In line with previous literature, this study uses  
20 Spearman's coefficient instead of Pearson's, as the primary data was ordinal rather than ratio  
21 (Gibbons and Chakraborti, 2010; Lewis-Beck, Bryman and Liao, 2004). The Chi Square test was applied  
22 to understand whether there was a difference in opinion about the types of fraud in Tunisia and non-  
23 Tunisian countries, the common factors causing fraud and corruption, and the preferences of using  
24 audit random and non-random sampling between Tunisia and non-Tunisia countries. Initially, it was  
25 expected that the patterns (expected perceived values) would be different between the three selected  
26 countries because, South Africa and Nigeria predominantly follow the Association of Chartered  
27 Certified Accountants, or ACCA, as the global body for professional accountants, headquartered in  
28 London. Also, Tunisian respondents have different faith affiliation compared to the respondents from  
29 South Africa and Nigeria. This religious difference was expected to show different opinion regarding  
30 types of fraud, the common causes of frauds and preferred audit sampling strategies to detect the  
31 fraud. However, the findings indicate that there is no significant difference in respondents' opinion  
32 regarding the perceived values of audit sampling and people in different parts of Africa i.e. Tunisia,  
33 South Africa and Nigeria share a common opinion regarding the issues.

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46 Table 8 presents Spearman's rho between the respondents' preferred audit sampling strategies and  
47 their demographic characteristics. Interestingly, the findings indicate Spearman's rho values  
48 respectively -0.390 and -0.379. The coefficient correlation is statistically significant at the 0.01 level.  
49 Hence, it can be concluded that more educated respondents prefer to apply audit random sampling  
50 strategies to investigate fraud and corruption. Several cross-tabulations were also tried among the  
51 respondents' demographic status and their opinion, but the results were not statistically significant  
52 and was not reported.

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**Table 8 – Spearman rho (Refer to the note below)**

	To what extent do you agree that simple random selection auditing is the most efficient methodology to detect fraudulent activities or economic crime within the public sector?	To what extent do you agree that systematic random selection auditing is the most efficient methodology to detect fraudulent activities or economic crime within the public sector?
<b>Correlation Coefficient</b>	-0.390**	-0.379**
<b>Sig. (2-tailed)</b>	0.001	0.002

Note: The correlations are significant at the 0.01 level, 2-tailed (Two stars \*\*)

The cross-tabulation test of Chi Square (Table 9) was performed on Questions 22 (the respondents' country of origin) and 15 (the respondents' preference of audit sampling strategies to investigate fraud and corruption). The findings reveal a not statistically significant Chi square with a value of 2.896. This implies that the same preferences of the respondents from the three countries; the respondents from Tunisia, South Africa and Nigeria have similar preferential opinions regarding audit sampling strategies.

Similarly, the cross-tabulation test was implemented to investigate the relationship between the respondents' country of origin and the types of fraud and corruption activity that existed in their country. Overall, the findings, except the findings on 'skimming' fraud, indicate that the respondents from Tunisia, South Africa and Nigeria relatively share the same opinion regarding the types of fraud that occur in their countries. Besides, the findings related to skimming fraud indicate that the respondents from Tunisia believe that this activity occurs less frequently than in South Africa and Nigeria, while the respondents from South Africa and Nigeria indicate that skimming fraud takes place more frequently. A possible explanation for this divergence is, although South Africa's and Nigeria's accounting systems follow International Standards on Auditing (ISA) (Charlton, 2009; Wisdom and Oyebisi, 2017), there are more opportunity to commit this fraud, in which cash is removed from the government office before it enters the accounting system.

**Table 9 - Chi-Square Tests (Refer to the note below)**

	Value	Df	Asymptotic Significance (2-sided)
<b>Pearson Chi-Square</b>	2.896	3	0.408
<b>Likelihood Ratio</b>	3.031	3	0.387
<b>Linear-by-Linear Association</b>	1.614	1	0.204
<b>N of Valid Cases</b>	195		

Note: The tests are not significant (Column 4) implying relatively similar preferential opinions regarding audit sampling strategies between the countries.

**4.2 Regression Analysis**

A simple logistic regression model was employed in order to identify the relationship between the respondents’ country of origin and the respondents’ perception on the efficiency of audit sampling techniques. The results from the simple logistic model with the respondents’ country of origin as the independent variable (1=non-Tunisia; 2=Tunisia) reveal that the independent variable is a significant predictor with  $p < 0.05$  ( $=0.047$ ), which is indicated by the “Sig.” column in Table 10.

**Table 10 – A logistic regression model (SPSS output) (Refer to the note below)**

Dependent variable (Y): The perceived efficiency of block selection sampling  
(0=inefficient; 1=efficient)

	B	S.E.	Wald	df	Sig.	Exp (B)
Constant	0.974	0.399	5.959	1	0.015	2.650
Block (X <sub>1</sub> )	-0.305	0.172	3.135	1	0.047	0.737

Note: The coefficients are significant at the 1% and 5% levels respectively (Column 6 - Sig.)

The simple logistic regression model can be stated in either additive or multiplicative form. Based on Table 10, the additive and multiplicative forms of the simple logistic regression model can be written consecutively as follows:

$$\ln \frac{\pi}{1-\pi} = \beta_0 + \beta_1 X_1 \dots\dots\dots \text{Equation 8}$$

$$\ln \frac{\pi}{1-\pi} = 0.974 + 0.305 X_1 \dots\dots\dots \text{Equation 9}$$

$$\frac{\pi}{1-\pi} = e^{0.974 - 0.305 X_1} \dots\dots\dots \text{Equation 10}$$

Ln ( $\pi/1-\pi$ ) is known in the literature (Hoetker, 2007; Pampel, 2000; Agresti, 1996; Zaloumis, 2015) as the log-odds and ( $\pi/1-\pi$ ) as the odds, while e is exponential functions, as they are the odds multipliers. Accordingly, by using the simple logistic regression model, with one explanatory variable of the usage of block selection audit non-random sampling, the odds that a subject of given classification can be predicted accordingly, whether or not a respondent from a particular country will employ block selection audit sampling because of the perceived efficiency of block selection audit sampling.

Block selection audit non-random sampling involves selecting *non-randomly* a block of suspected accounting records or samples within the population of all accounting records. In situations when the auditor uses only block selection as a non-random sampling technique, many block samples should be selected to help minimise the *non-detection risk* because the block samples may not represent the whole accounting records.

Correspondingly, the respondents, professional and auditors from South Africa and Nigeria ( $X_1=1$ ) is 1.952 times more likely to utilise block selection sampling because they consider block selection sampling is an efficient auditing tool. Whilst, the professionals and accountants from Tunisia ( $X_1=2$ ) is only 1.439 times more likely to employ block audit sampling. Hence, compared to the professionals and accountants from Tunisia, the professionals and auditors from South Africa and Nigeria examine carefully more of the accounting remittances, which are suspected of fraudulent activities having happened. Possible explanations for the phenomena are that South Africa's and Nigeria's legal, accounting and regulatory systems are more consistent with international standards (Charlton, 2009; Wisdom and Oyebisi, 2017).

By converting the odds to probabilities of Equations 8 to 10, it yields Equation 11 as follows:

$$\pi = \frac{e^{0.974-0.305X_1}}{1+e^{0.974-0.305X_1}} \dots\dots\dots \text{Equation 11}$$

The simple logistic regression model predicts that 66% of the professionals, accountants and auditors from South Africa and Nigeria ( $X_1=1$ ) will employ block selection (non-random) sampling, whilst the model forecasts that only 59% of the respondents, accountants and auditors from Tunisia ( $X_1=2$ ) will utilise block selection (non-random) sampling to audit fraudulent records.

A stepwise regression procedure was implemented by adding other explanatory and interactive variables (interaction effects) as well as incorporating other dependent variables such as the perceived efficiency of monetary unit sampling (Question 13), simple random selection auditing (Question 14) and systematic random selection auditing (Question 15). However, the results are not significant, the finding of the simple logistic regression model is in line with the statistics provided in Table 7 that the majority of the respondents chose 'block selection audit sampling' with a mean of 2.046. which is in line with previous findings showing that auditors prefer to employ non-random audit sampling in practice (Elder and Allen, 1998; 2003)

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3 Lastly, multinomial logistic regression models using more than two categories are also implemented  
4 following Garson (2012) but the results were not acceptable. This result could be explained by the  
5 small sample size (195) which could hinder sophisticated multinomial logistic regression models and  
6 the degree of freedom was lost.  
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### 10 11 12 **5. Conclusion and Policy Implications** 13

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16 This study investigates how people in Tunisia, South Africa and Nigeria perceive the types of fraud in  
17 Africa, the causes of such fraud, and the audit sampling strategies used to investigate the frauds.  
18 Although there are some minor statistical differences between the countries in terms of the  
19 respondents' perceived values on skimming fraud and the use of audit random sampling to tackle  
20 rampant corruption in Africa, the overall findings indicate that opinions do not significantly differ  
21 between the respondents from Tunisia, South Africa and Nigeria in terms of the types of fraud, the  
22 reasons for committing fraud and the auditing sampling strategies used to investigate the frauds.  
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29 This study could assist governments, policy makers and academia to improve the country's audit  
30 sampling strategy to combat fraud and corruption using audit random sampling rather than audit non-  
31 random sampling. Moreover, audit firms and policy makers need to be vigilant to apply audit sampling  
32 techniques in order to improve the countries' performances and minimise the fraud level.  
33 Nevertheless, it is suggested that future studies on audit sampling strategies aiming to minimise  
34 fraudulent activities and corruption within the public sector in Africa could be enhanced by  
35 undertaking the following aspects:  
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43 • Since Africa has suffered from fraudulent practices and corruption in recent decades, future  
44 studies may utilise larger sample sizes among several African countries so that a  
45 comprehensive generalisation can be made. In addition, by employing larger datasets, a more  
46 robust analysis can be performed.  
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49 • Future studies can use actual values instead of perceived values of the respondents' opinions.  
50 For example, real audit data could be obtained from any public sector office in Africa, meaning  
51 various hypothetical audit sampling strategies can be performed in relation to the potential  
52 errors generated within the accounting population. This type of study could be analysed by  
53 using Monte Carlo simulations. Then, a relationship could be established between audit  
54 sampling strategies and their efficiency or effective detection rates so the efficiency of audit  
55 sampling strategies can be estimated according to an Africa context.  
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- To complement the quantitative analysis conducted, a qualitative analysis using interviews and observations could be conducted to evaluate the effectiveness of various audit sampling strategies in relation to the fraudulent and corruptive activities in the public sector in Africa.
- The findings indicate that audit non-random sampling techniques are more preferred by the respondents than those of audit random sampling technique. However, this non-random technique increases fraud and corruption. Accordingly, the government should develop strategic policies and facilitate training and workshops on audit random sampling to educate accountants, auditors and financial advisors since audit random sampling techniques are more efficient than audit non-random techniques to detect fraudulent activities.
- Since big data is increasingly playing a significant role in the auditing practice, further investigations into the application of audit sampling techniques appropriate to handle big data are recommended. For example, the methodology of automation and artificial intelligence are required by auditors to inspect a massive amount of big data on the Internet. The findings of this study could be applied to big data and more efficient audit random sampling strategies could be employed to lower the non-detection risks and detect fraud and corruption.
- This study carries limitations. This research analyses a limited number of countries: Tunisia and other countries such as South Africa and Nigeria. Correspondingly, the findings may not represent the perceived values and opinions of the whole populations of African countries; however, the findings are valuable as an analytical exploration to instigate the potential application of audit sampling strategies for detecting fraudulent activities and corruption in Africa by researching several African countries to achieve stronger generalisation.

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