An Investigation into the Adoption of Computer Assisted Audit Techniques in the Oil and Gas Industry. A case study of Tullow Ghana Limited

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Abstract - *As technology is being introduced by organizations in making work efficient and effective, the security of these technologies is of great importance as data from these organizations keeps expanding. It is, therefore, imperative to ensure these technologies are audited to ensure there are no glitches or vulnerabilities.*

The main objective of this study is to examine the Technology Acceptance Model and the Diffusion of Innovation Theory in the adoption of computer assisted audit techniques in the Oil and Gas industry in Ghana. The data collected from the questionnaire were analyzed using a mixed methodology that is quantitative and qualitative. Priority was given to the quantitative methodology in collecting and analyzing data for the study. A secondary survey was used to grab evidence for the analysis of the study. This helped to get opinions, attitudes and description for the study. Based on the key findings of the research, an organization in adopting a technology for its systems auditing is greatly influenced by the behavior of its employees in accepting technology use as explained by [1] in his Technology acceptance model.

Key Words: **Technology Acceptance Model, Adoption, CAATs, Oil and Gas**

1. INTRODUCTION

Today's organisations operate in a dynamic global-market environment with focus on operating in a collaborative and strict requirement in the telecommunications network notwithstanding the location of other branches of their organisation. These organisations irrespective of their size or scope of business have come to realise the importance of adopting technology to compete in the global market. They however, invest greatly in designing and implementing systems that are complex and sometimes challenging to manage.

With the advancement of technology, organisations are becoming more dependent on information systems to do their businesses. As they adopt these systems in service delivery, and engage in a paperless system or transaction these data collected keeps growing by the day. These data could either be financial or non-financial transactions as well as network logs. For this data to be effectively managed, it calls for the need to adopt the Computer Assisted Audit Tools (CAATs) in analysing data.

The process of auditing information systems is characterised by adopting tools and techniques in Computer Information Systems which is mostly referred to as Computer-Assisted Audit Tools and techniques (CAATs). CAATs is a means by which organisations adopt the use of technology for monitoring and compliance auditing [2]. CAATs provide an efficient and effective means for IT auditors to achieve their audit objective [3].

Computer Assisted Audit Techniques (CAATs) represents the usage of technology by an auditor to assist in the completion of an audit process [4][11]. CAATs are tools and techniques adopted by either internal or external auditors in the process of auditing an organisation with the purpose of collecting data from their systems [5].

The availability and usage of data is the most important aspect of business growth, as a result the confidentiality, integrity, reliability and availability of data and system processes are a major concern or influence of IT audit. The use of Computer-Assisted Audit tools and Techniques (CAATs) is often associated with data mining which extracts data for analysis.

Due to the enormous growth of data and transactional processing in today's economy, organisations can hardly function efficiently without the use of technology in their operations [6]. Information system audit ensures organisational data is confidentially stored, and data is always made available for authorised users always [7].

The adoption of CAAT's does not only apply to its usage in banks or financial institutions for detecting fraud but also by oil and gas exploration and production companies, especially in the deep-water where large amount of data and information systems is adopted, auditing manually would be tedious.

Anantha Sayana, in 2003 classified the use of CAATs into four broad categories;

- Data Analysis Software
- Network Security Evaluation
- Operating Systems (OS) and Database Management System (DBMS) Security Evaluation Software/Utilities Software and Code Testing Tools

This research seeks to explore the motivational factors in implementing or adopting CAATS in the oil and gas exploration and production industry in Ghana, using Tullow Ghana Limited as a case study.

As the oil wells in locations close to the ports and cities, (otherwise known as On-shore drilling) often dry-up, oil and gas exploration and production companies like Exxon, Total, Shell, Chevron and others have resorted to exploration and drilling in the deep waters offshore. These industries adapt the use of technologies like video conferencing and VSAT (Very-Small-Aperture-Terminal) in their operational mechanism for increasing growth and productivity in their operations. VSAT systems use commercial satellite connections as a high-speed digital link between locations, which are traditionally impossible to access. VSAT technology is mostly used by banks and oil companies in their operations because of its success in supplying connectivity to its remote locations.

2. LITERATURE REVIEW

2.1 Introduction

This chapter highlights various theories in adopting and accepting technology in auditing information systems by organizations. There have been many researches done in the past referring to Computer Assisted Audit Tools (CAATs). Researchers have also come up with their findings based on the importance of information systems in business operations. CAATs is a technique that involves the use of technology that is computer programs by auditors or system auditors during the process of audit to enable them to achieve the general objectives of auditing [8].

Researchers have carried out different studies on the adoption of technology by organizations and have examined theories like the diffusion of innovation, theory of reasoned action, and the theory of behavior to support their literature [9].

A study by [6] on using CAATs to support information systems classified CAATs into four categories; namely, Data Analysis Software, Network Security Evaluation, Operating System (OS) and Database Management Systems (DBMS) Security Evaluation Software, and Software and Code Testing Tools. [10] on referencing other researches in CAATs usage, stated that CAATs can be used or is mostly used by banks or financial institutions for investigating fraud and detecting anomalies in transactions. [4][11] conducted a survey on governmental auditors regarding their use of Audit Command Language (ACL) a commercially available CAAT. Participants perceived the potential benefits of ACL, but displayed a lower confidence in their technical abilities to use ACL.

Despite the benefits of the usage of CAATs in the auditing process and standards, audit technologies in the audit firms, previous studies show that auditors do not often use CAATs when auditing [12].

2.2 Theoretical Framework

The academic basis in the adoption of technology is known as Unified Theory of Acceptance and Use of Technology (UTAUT). UTAUT is a unified model developed by [13] who adopted, examined, compared and tested eight theories of competition in this area of research. Various researchers in the past have tried to find general factors that influence users when technology options were adopted for a variety of realms. These models have been adopted in Information Technology decisions from a psychological perspective from which it first originated. These models include the Technological Adoption Model (TAM), Innovation Diffusion Theory (IDT), Social Cognitive Theory (SCT), Theory of Reasoned Action (TRA), Theory of Planned Behavior (TPB), Motivation Model (MM), the Model of Personal Computation Utilization (MPCU) and a combination of Technology Acceptance/Adoption Model and Theory of Planned Behavior. [13] having reviewed all eight models, established a theoretical and experimental similarities across the eight models of the UTAUT.

A recent study also by [14], who adopt four hypothesis referencing [13] four construct of the UTAUT. In the hypothesis stated:

a. "H1: Performance Expectancy (PE) positively affects the behaviour intention in the adoption of CAATS i.e. performance expectancy would increase when technology is adopted in auditing".
b. "H2: Effort Expectancy (EE) positively affects behavioral intention in the adoption of CAATS i.e. if technology is easy to be used, then individuals would be willing to learn and adopt to the new features".
c. "H3: Social Influence (SI) positively affects behavioral intention to adopt CAATS".
d. "H4: Facilitating Conditions (FC) positively affects behavioral intention to adopt CAATS"
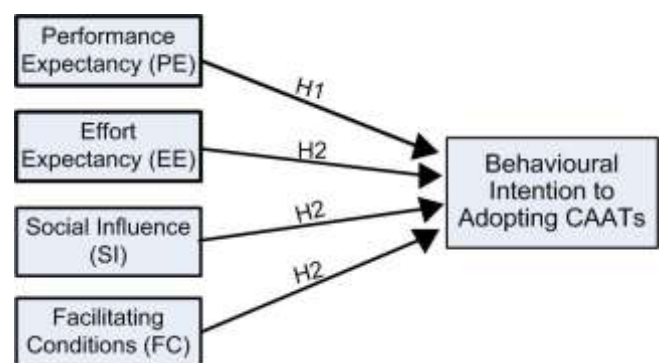

Fig -2.1: UTAUT as proposed by Venkatesh et al (2003)

The figure above shows the conceptual framework as proposed as "constructs" of the UTAUT by Venkatesh et al (2003). The four constructs are the Performance Expectancy, Social Influence, Facilitating Conditions and Effort Expectancy as illustrated in Fig-2.1 above.

2.3 THEORETICAL REVIEW

2.3.1 TECHNOLOGY ACCEPTANCE MODEL (TAM)

Technology Acceptance Model (TAM) is an information system theory that demonstrates how users accept and use a technology [15]. It suggests that when users are presented with a new technology, many factors influence their decision about how and when they will use it. TAM as introduce by [1] stated the influencing factors for accepting technology as;

1. Perceived usefulness (PU) "the degree to which a person believes that using a particular system would enhance his or her job performance".

2. Perceived Ease-Of-Use (PEOU) "the degree to which a person believes that using a particular system would be free from effort".

Davis, on relying on prior work by [16], who formulated the theory of Reasoned Action stated a conceptual model to propose the Technology Acceptance Model (TAM) as shown in Figure 2.2 below.
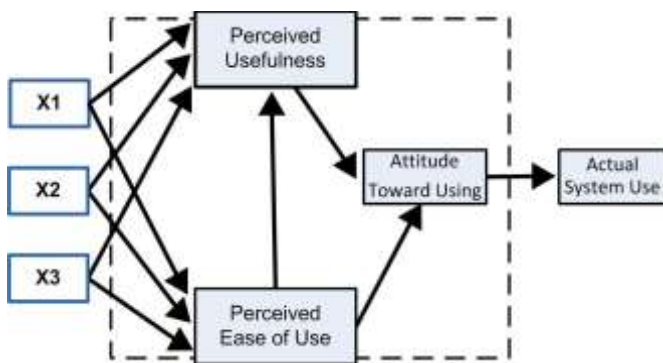

Fig -2.2: Original TAM (Davis 1986)

The TAM model as proposed by Davis, shown in Figure 2.2 above with arrows illustrates causal relationships. In this model, "a potential user's overall attitude toward using a given system is hypothesized to be a major determinant of whether he actually uses it. Attitude towards using, in turn, is a function of two major beliefs: perceived usefulness and perceived ease of use. Perceived ease of use has a causal effect on perceived usefulness. Design features directly influences perceived usefulness and perceived ease of use." Referencing [16] model, the relationship of the TAM model can be expressed in four equations:

1. $PEOU = \Sigma i = 1, n \; \beta i \, Xi + \varepsilon$

2. $USEF = \Sigma i = 1, n \; \beta i \, Xi + \beta n + 1 \, EOU + \varepsilon$

3. $ATT = \beta 1 \, EOU + \beta 2 USEF + \varepsilon$

4. $USE = \beta 1 \, ATT + \varepsilon$

$where$:

$Xi = the\ design\ feature\ i, i = 1, n$

$PEOU = Perceived\ Ease\ Of\ Use$

$USEF = perceived\ usefulness$

$ATT = attitude\ toward\ using$

$USE = actual\ use\ of\ the\ system$

$\beta i = standardized\ partial\ regression\ coefficient$

2.3.2   DIFFUSION OF INNOVATION THEORY

The Diffusion of Innovation (DOI) is a theory proposed by [17], to explain how, and why a technology can be adopted. Rogers defines diffusion as "the process in which an innovation is communicated through a certain channel over a period among the members of a social system".

According to his theory, the adoption of a new technology mostly undergoes a process of decision making amongst individuals or groups. He further explains that an innovation or technology may already be in existence but once a group or individual finds it to be new to them, then it can still be considered as an innovation for that group or individual.   For [17], an organization in making the decision to adopt an innovation or adopt a new technology they must undergo a five-step process of making an innovation-decision; Knowledge, Persuasion, Decision, Implementation and Confirmation. Once this process is assumed the organization or individual can finally make the decision to either implement or reject a technology or innovation.
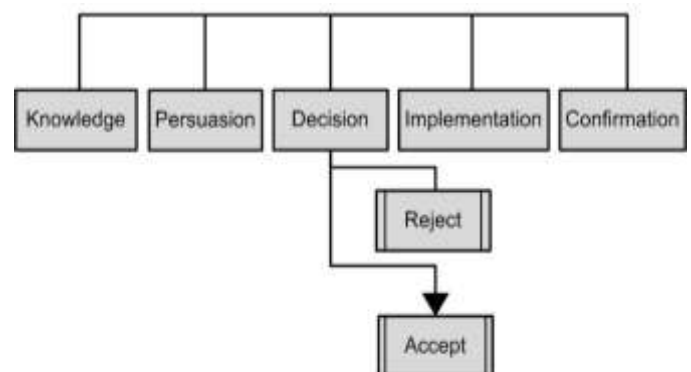

Fig -2.3: Five stages in the Decision Innovation Process as proposed by [17]

3.0 METHODOLOGY

The researchers in getting a better understanding of the research problems adopted the mixed methodology that is a combination of the quantitative and qualitative methodology of collecting and analyzing data for the study [18]. Priority was however, given to the quantitative methodology in collecting and analyzing the data. A secondary survey was used to grab evidence for the analysis of the study. This helped to get opinions, attitudes and description for the study. Some of the data collected were from interviews carried out on phone conversations and via face to face with selected infrastructure specialists of the case study company.

Tullow Ghana Limited was selected because it is a leading independent oil and gas, exploration and production company in Ghana and also adopts the use of technology in their day to day operations. A sample size of 50 respondents was selected from Tullow Ghana Limited for this study.

To ensure validity and reliability of the data collected for this study, the researchers exercise care to ensure that the responses are those that have been released by the respondents of the selected case study company. The data was collated from questionnaires that were given to respondents online (using: Google forms) to answer without any undue influence, link to the questionnaires were sent to some respondents on WhatsApp platform whiles some respondents were e-mailed the link to fill out the questionnaire online.

The data collected was analyzed quantitatively. They were first edited to ensure consistency, which would then be coded and analyzed by a combination of descriptive accounts and summary statistics in terms of frequencies and percentages.

4. DATA ANALYSIS

4.1 Demographic Background

Table 4.1 below gives the frequency distribution of respondents (in this case the staff of Tullow Ghana Limited); 24 of the respondents representing 48% who were presented with the questionnaire were in the age range of 31-40 years, 20 (40%) were in the 20-30 age group and 6 (12%) were in the 41-50 age group. The distribution shows that 88.0% of workers who answered the questionnaire were less than 40 years, suggesting a young workforce that should have a working knowledge of information technology.

Table -4.1: Age Group of Respondents

Age Distribution of Respondents		
Age group	Frequency	Percent (%)
20-30	20	40.0
31-40	24	48.0
41-50	6	12.0
Total	50	100.0

As indicated in Table 4.2 below, 34 (64%) of the respondents indicated that there are applications and processes implemented by the Information Systems Department in auditing company assets (systems and phones). Information Systems Assets and Procurement Administrator stated through an interview to confirm that when new users join the company they are taken through the new starter process and once a login credential is

created, a ticket is logged to the Asset team to issue out assets to the users.

Table -4.2: Are there any tools, applications or processes in recording assets issued out to staffs?

Availability of Means of Measure Analysis		
Response	Frequency	Percent (%)
Yes	34	68.0
No	10	20.0
Not Applicable	6	12.0
Total	50	100.0

All respondents representing 100% indicated that IT assets are audited periodically by the organization, however they could not state the exact period assets are audited as Table 4.3 depicts. Out of the 50 respondents, 26% responded asset audit was carried out as per the Auditors discretion, 32% responded quarterly, 30% responded annually whereas 12% responded audit was carried out monthly.

Table - 4.3: How often are IT assets audited?

Frequency of Auditing of IT Assets		
Response	Frequency	Percent (%)
Monthly	6	12.0
Annually	15	30.0
Quarterly	16	32.0
As per Auditors discretion	13	26.0
Total	50	100.0

As illustrated in Table 4.4 below, all respondents (100%) confirmed the organization uses security tools to scan all computers on the network, install patches and uninstall unauthorized applications or browsers by end-user systems. As confirmed by a Security Analyst in an interview over the telephone and asked how often this tool was run on systems he responded, "as and when it's needed, and the process is automated". He also stated that during the process when patches are running on the computers users are not given the option to cancel or close the patch installation and compliance check, but once the process has successfully been completed the application closes by itself. There is normally no exemption of user systems when the process/exercise is running or carried out.

Table 4.4: Does the company use technology for compliance checks on systems?

Response to Compliance Check		
Response	Frequency	Percent (%)
Yes	50	100.0

4.2 Attitudes towards the use of CAATs

Exactly 43 (86%) indicated that the company adopt computer assisted audit tools and techniques in systems auditing process, 7 (14%) said no, as indicated in Table 4.5 below. Generally, the company adopts computer assisted audit tools and techniques in systems auditing process.

Table 4.5: Does the company adopt Computer assisted audit tools and techniques in systems auditing process?

Response to Adoption of CAATs		
Response	Frequency	Percent (%)
Yes	43	86.0
No	7	14.0
Total	50	100.0

When finding out from respondents whether adopting CAATs in auditing information systems has come to replace the manual way of auditing the systems, 31(62%) of the respondents say "Yes", whereas 19(38%) said it is not the case as indicated in table 4.6 below.

Table 4.6: Has CAATs in auditing replace the manual way of auditing?

Response on Manual to CAATs Adoption		
Response	Frequency	Percent (%)
Yes	31	62.0
No	19	38.0
Total	50	100.0

From Table 4.7 below a greater percentage of the respondents 38 (76%) stated that employees believed that the introduction of IT has influenced their works by making it efficient and effective. The remaining 12 (24%) stated otherwise, by indicating that there is the need to continual updating themselves in the usage of IT to remain competitive in their profession.

Table 4.7: What is the attitude of employees towards the adoption of Computer Assisted Audit Tools and Techniques?

Response to Attitude of Employees to CAATs		
Description	Freq.	Percent (%)
Employees believe that the introduction of IT has an influence in making their work efficient and effective.	38	76.0
Employees believe in continually updating themselves in the use of IT to remain competitive in their profession.	12	24.0
Total	50	100.0

In knowing the opinion of the respondents on the effects of the adoption of IT tools and techniques in the company 43 (68%) stated that the introduction of IT serves as a tool for helping them work effectively, 10 (16%) indicated that IT tools serves as a tool for work. 6 (10%) indicated that it was difficult to ignore IT tools when working, the remaining 4 (6%) stated its introduction distracts their actual work. All the responses are depicted in Table 4.8 below.

Table 4.8: What is your opinion about the adoption of IT tools and techniques in the company? (Multiple responses, n = 63)

Responses to Opinions of employees on CAATs		
Opinion	Frequency	Percent (%)
Its introduction distracts the actual work	4	6.0
IT serves as a tool that helps in working	43	68.0
Serves as a tool for work	10	16.0
Difficult to ignore when working	6	10.0
Total	63	100.0

5.0 CONCLUSION

Based on the key findings of the research an organization in adopting a technology for its systems auditing is greatly influenced by the behavior of its employees in accepting technology use as explained by [1] in his Technology acceptance model.

Also, the behavior of personnel towards the introduction of new technologies is very important in an organization. Whiles some employees embrace new technologies and avail themselves to expand their knowledge to learn new technologies others are reluctant and fear the introduction and acceptance of these technologies in working.

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