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The Use of Generalized Audit Software by Egyptian External Auditors: The Effect of Audit Software Features

Kim, Hyo-Jeong; Kotb, Amr; Eldaly, Mohamed Khaled

Abstract

Purpose - This study aims to explore: the actual usage of GAS features among Egyptian external auditors, through the technology acceptance model (TAM); how the conceptual complexity of GAS features impact its actual usage; and what factors influencing the GAS use by Egyptian external auditors.

Design/methodology/approach - External audit professionals at twelve international audit firms, including the Big 4 and eight medium-sized firms, in Egypt were surveyed.

Findings - The results show that the basic features including database queries, ratio analysis, and audit sampling were higher in GAS use, perceived usefulness, and perceived ease of use among Egyptian external auditors than the advanced features: digital analysis, regression/ANOVA, and data mining classification. The SEM analysis by GAS features suggests that perceived ease of use has a stronger effect on GAS use when the conceptual complexity of GAS features is high. The analysis also support that the use of GAS by Egyptian external auditors is more affected by co-worker, supervisor, or organization through perceived usefulness, but not by job relevance, output quality, and result demonstration.

Research limitations/implications - Although Egyptian external auditors participated in this study may limit the extent to which the findings may be generalized, the responses provide an insight into the actual usage of GAS features by external auditors and the impact of conceptual complexity of GAS features, which is consistent with the literature concerning the relatively low level of utilizing the advanced features of GAS by internal auditors, suggesting that the issues revealed should be of concern.

Practical implications - The results reported in this paper are useful to audit software developers and audit firms in their understanding of factors influencing GAS usage in a different audit context.

Originality/value - The study adds value to prior research by providing context-contingent insight into the application of technology acceptance model in an unexplored audit context.

Keywords: GAS Acceptance, GAS Use, GAS Features, IT Audit, Egyptian External Audit.

1. Introduction

In today's global business environment, advances in client information technology (IT) are rapidly intensifying the need for audit firms to employ various computer-assisted auditing tools and techniques (CAATTs). One of the most commonly and widely used types of CAATTs, in recent years, is generalized audit software (GAS) such as: ACL, IDEA, CA's Easytrieve, Statistical Analysis System (SAS), and Statistical Package for Social Sciences (SPSS) (Debreceny *et al.*, 2005; Singleton, 2006). These software packages are employed by auditors to perform specific audit routines such as: browse, analyze, sort, summarize, stratify, sample, apply calculations, convert, and carry out other operations of data extraction and data analytics to audit a full set of client data, as opposed to relying on sampling (Ahmi and Kent, 2013). Despite the widely adopted IT applications in today's businesses; the functionality and benefits of GAS products; and the given support of audit standards to employ GAS, the relevant literature suggests that the extent to which external auditors utilize GAS still remains relatively low and under-investigated (Carmichael, 2004; Debreceny *et al.* 2005; Kim *et al.*, 2009; Payne and Curtis, 2010; Kotb and Roberts, 2011; Ahmi and Kent, 2013).

Prior information systems (IS) research indicates that technology cannot achieve its benefits if it is not accepted and frequently/systematically used by end-users (Davis *et al.*, 1989; Venkatesh *et al.*, 2003). As such, IS scholars have developed several theoretical models to predict and investigate users' acceptance and usage of IT developments (Davis, 1986; Davis *et al.*, 1989; Venkatesh and Davis, 2000; Venkates *et al.*, 2003). The Technology Acceptance Model (TAM), introduced by Davis (1986), provides an explanation of the determinants of end-user computing technology's acceptance. However, there is an apparent literature gap in using TAM to understand the acceptance enablers of GAS by external auditors. In particular, most prior TAM research investigates the end-users' acceptance of *non-auditing related technology* such as word-processing (Davis *et al.*, 1989; Adams *et al.*, 1992), personal computing (Igbaria *et al.*, 1997), data retrieval systems (Venkatesh and Morris, 2000), and accounting systems (Venkatesh and Morris, 2000; Venkatesh *et al.*, 2003). While some extant GAS acceptance research has been done, most of this research either focuses on the use of GAS for internal auditing (Kim *et al.*, 2009; Ahmi *et al.*, 2014), or on a mixture of internal and external auditing (Janvrin *et al.*, 2008; Ahmi and Kent, 2013). Also, this prior research does not give a weight to the factor of *technology features* and their possible impact on the acceptance enablers, with exception to Kim *et al.* (2009) that was also focusing on GAS acceptance by internal auditors. Moreover, most prior TAM and GAS research focuses on audit markets in developed economies, with very less attention being given to emerging auditing markets. Motivated by this existing literature gap, this study extends previous

research to empirically evaluating the behaviours of accepting/using GAS through the TAM in the Egyptian external audit profession as an example of emerging audit markets.

This study investigates the actual usage of GAS among external auditors in Egypt and the impact of GAS features on their usage behaviours and the factors influencing the use of GAS by Egyptian external auditors, using a sample of 118 external auditors from Egyptian international audit firms, representing the Big 4 and eight medium tier international firms. A comparison of previous study leads to a conclusion that the effect of GAS features is same within the Egyptian external audit context but factors influencing the use of GAS are different in this context. The use of basic features was higher than that of advanced features and perceived ease of use is more important when using advanced features in this professional group. The use of GAS is more affected by social factors through perceived usefulness in the Egyptian external audit profession.

This study substantially contributes to the IS and the auditing research in three ways. First, this study attempts to extend previous research as examining individual external auditors' behaviours of using GAS in Egypt and providing empirical evidence on the effect of GAS features on the use of GAS within the Egyptian external audit context. Second, findings of this study are beneficial to IT researchers and practitioners as expanding the overall understanding of the underutilization of GAS and factors influencing the GAS acceptance/usage by external audit professionals. Third, this type of research is necessary in IS and auditing research as investigating the behaviours of audit professionals from Big 4 and other international medium-tier firms and in underexplored audit context.

The remainder of this paper is organized as follows. The next section reviews the theoretical background to the research and develops the hypotheses and the research model. Following this, the research design section outlines the sample, the research instrument, and the research procedures. Section four presents empirical results of data analysis. The final section concludes the paper, discusses implications of the study, and offers additional research directions.

2. Background and Research Hypotheses Development

Over the last few decades, businesses have been transformed by advances in IT, moving to so-called 'now economy', which is characterized by real-time globalized business operations, interaction with customers, and management decision-making (Vasarhelyi *et al.,* 2010, p.7). This technological transformation in the business world has intensified the need for audit firms to employ several GAS products as part of their audit procedures that can provide users of auditing services with relevant,

reliable, and timely information (Elliott, 2002), as well as improve the efficiency (cost) and effectiveness (quality) of an audit service (Banker *et al.,* 2002; Debreceny *et al.,* 2005). Furthermore, the auditing standards issued by the American Institute of Certified Public Accountants (AICPA) and Auditing Practices Board (APB) encourage the utilization of CAATTs. Janvrin *et al.* (2009), Ahmi and Kent (2013), and Bierstaker *et al.* (2014) identified a number of different functions of CAATTs according to these auditing standards. These functions are: evaluate fraud risk, identify journal entries and other adjustments to be tested, evaluate inventory existence and completeness (AICPA, 2002; APB, 2004a, 2004b, 2004c), select sample transactions from key electronic files, sort transactions with specific characteristics, test an entire population instead of a sample, obtain evidence about control effectiveness (APB, 2004a, 2004e, 2006; PCAOB, 2010), check the accuracy of electronic files, and reperform procedures such as aging of accounts receivables (AICPA, 2001; APB, 2004a, 2004d, 2006). Despite the widely adopted IT applications in the business environment and the functionality and benefits of GAS products, audit literature indicates that auditors do not use GAS as expected (Carmichael, 2004; Debreceny *et al.,* 2005; Payne and Curtis, 2010; Ahmi and Kent, 2013). A number of theoretical models to explain the user acceptance and usage of IT developments were developed (Davis, 1986; Davis *et al.,* 1989; Venkatesh and Davis, 2000; Venkates *et al.,* 2003).

Following the theory of reasoned action (TRA) (Fishbein and Ajzen, 1975), the TAM (Davis, 1986) provides an explanation of the determinants of end-user computing technology's acceptance in general and a basis for tracing the impact of external factors on internal beliefs, attitudes, and intentions to use (Davis *et al.,* 1989). The TAM follows four stages in investigating the decision to accept and use a particular end-user computing technology. During the first stage, users consider external variables (e.g. individual abilities, the type of computing technology, the task, situational constrains) to evaluate the consequences of using a particular computing technology. Their evaluation is reflected in their internal beliefs about the usefulness (perceived usefulness) and the ease of use (perceived ease of use) of that computing technology. In the second stage, these two internal beliefs drive the users' attitude/affection toward behaviour, while their favorable or unfavorable attitude towards using the computing technology influences the extent to which they intend to use it (the third stage). Finally, users' intention to use the technology drives whether they will actually use it.

According to the TAM, the actual usage of the end-user computing technology is the primary indicator of the technology acceptance, and is measured by frequency and volume of the usage (Davis *et al.,* 1989). The two belief constructs - perceived usefulness and perceived ease of use - are fundamental

and distinct constructs that are influential in decisions to use computing technologies, fully mediating the influence of external variables of computer usage behaviour. Perceived usefulness was defined as 'the prospective user's subjective probability that using a specific application system will increase his or her job performance within an organizational context' (Davis *et al.,* 1989, p.985) and perceived ease of use was defined as 'the degree to which the prospective user expects the target system to be free of effort' (Davis *et al.*, 1989, p.985). Therefore, they have a positive association with technology acceptance (Davis *et al.,* 1989). Hence, we hypothesized the positive relationship between perceived usefulness and GAS use on one hand, and perceived ease of use and GAS use on the other hand, in the Egyptian external audit profession.

H1. Perceived usefulness has a positive effect on GAS use by Egyptian external auditors.

H2. Perceived ease of use has a positive effect on GAS use by Egyptian external auditors.

Within the TAM, perceived usefulness and perceived ease of use are two distinct constructs but empirical association between them has been observed (Davis *et al.,* 1989). Several studies have found a significant positive relationship between external variables (e.g. system characteristics) and measures similar to perceived usefulness (Miller, 1977; Benbasat and Dexter, 1986; Benbasat *et al.,* 1986). Thus, perceived usefulness can be affected by various external variables over and above perceived ease of use. Further, perceived ease of use not only has a direct effect on computing technology acceptance but also an indirect effect through perceived usefulness, as improvements in a technological application to make it more easier could contribute to improved performance. Therefore, we hypothesized this direct effect of perceived ease of use on perceived usefulness among Egyptian external auditors.

H3. Perceived ease of use has a positive effect on perceived usefulness of the GAS by Egyptian external auditors.

Prior IS research (Davis, 1989; Davis *et al.,* 1989; Thompson *et al.,* 1991; Igbaria *et al.,* 1997; Malhotra and Galletta, 1999; Venkatesh and Davis, 2000; Venkatesh *et al.,* 2003; Burton-Jones and Hubona, 2005) indicates that the original TAM (Davis, 1986) is incomplete as it does not account for the influence of external variables on the adoption and utilization of computing technology. To address this, Kim *et al.* (2009) has identified fifteen external variables from extended TAM research, and grouped them into three categories: organizational factors, social factors, and individual factors. However, it can be argued that, by its definition, organizational factors (i.e. training and support from organizations) can be viewed as part of social factors (i.e. influences from other people including coworkers, management, or the organization). So we only examine the effect of social factors (i.e. influences from co-workers, management, or organizations including training and support) and individual factors as external variables influencing the use of GAS by Egyptian external auditors.

Igbaria *et al.* (1997) extended the TAM to examine the effect of intra-organizational factors (i.e. internal support, internal training, and management support) and extra-organizational factors (i.e. external support and

external training) in promoting personal computing acceptance in small firms. The results demonstrate that both intra- and extra-organizational factors, particularly management support and external support, have positive effects on the acceptance of personal computing through perceived usefulness and perceived ease of use. Further, the effect of facilitating conditions (i.e. users' expectations regarding the existence of an organizational and technical infrastructure to support system use) on technology acceptance was also examined. Thompson *et al*. (1991) found a small negative effect of facilitating conditions on personal computing utilization. However, using unified theory of acceptance and use of technology (UTAUT), Venkatesh *et al.* (2003) and Bierstaker *et al.* (2014) found a positive effect of facilitating conditions on usage behaviours regarding to personal computing and CAATTs, which was moderated by gender, age, experience, and voluntariness. Further, Janvrin *et al.* (2009) found that developing training programs has a positive effect on behavioural usage through increasing the degree of ease. And, according to Global Audit Executives Survey Report (ACL 2006), auditors will be reluctantly use CAATTs if the firm lacks qualified technical staff familiar with the software

In contrast to Davis *et al.* (1989), Malhotra and Galletta (1999) have found that all three processes of social influence had direct effects on the user's attitude and indirect effects on their behavioural intention via attitude. It was found that identification and internalization had a strong positive effect on attitude, while compliance[1] [2] [3] has a weaker negative effect on attitude toward using technology. Additionally, subjective norm[4] was also considered an external social variable. However, its effect on the acceptance of computing technology had conflicting results. For example, while Davis *et al.* (1989) found that social norms had no effect on usage because of the weak psychometric properties, Venkatesh and Morris (2000) reported a strong relationship between subjective norm and technology usage decisions. Overall, Venkatesh and Davis (2000), through the TAM2, reported a significant effect of social factors on technology acceptance through perceived usefulness. Based on this relationship, we hypothesized a positive impact of social factors on perceived usefulness and perceived ease of use of GAS in the Egyptian external audit profession.

H4a. Social factors have a positive effect on perceived usefulness of GAS by Egyptian external auditors.

H4b. Social factors have a positive effect on perceived ease of use of GAS by Egyptian external auditors.

There is no common definition of individual factors as part of external variables in the extant IS literature. Individual factors have been known as cognitive factors (Venkatesh and Davis, 2000) while known as

[1] '... when an individual accepts influence because he wants to establish or maintain a satisfying self-defining relationship to another person or group' (Kelman, 1958, p.53).
[2] '. when an individual accepts influence because the content of the induced behaviour - the ideas and actions of which it is composed - is intrinsically rewarding' (Kelman, 1958, p.53).
[3] '... when an individual accepts influence because he hopes to achieve a favorable reaction from another person or group' (Kelman, 1958, p.53).
[4] '... degree to which an individual believes that people who are important to her/him think she/he should perform the behaviour in question' (Fishbein and Ajzen, 1975, p.302).

personal factors in social cognitive theory (Compeau and Higgins, 1995). However, through the TAM2, Venkatesh and Davis (2000) reported individual factors (i.e. job relevance, output quality, and result demonstrability) as significant determinants of technology acceptance through perceived usefulness. Building on this relationship, we hypothesized a positive effect of individual factors on GAS use through their perceived usefulness and perceived ease of use.

H5a. Individual factors have a positive effect on perceived usefulness of GAS by Egyptian external auditors.

H5b. Individual factors have a positive effect on perceived ease of use of GAS by Egyptian external auditors.

Following Kim *et al.* (2009), we also examine the effect that GAS features could have on the use of GAS in the Egyptian external audit profession. Any hardware and/or software is characterized by its features, which are notable properties resulting from choices during the design process and intended to improve the expected benefits of that device/application. For example, in the electronic communication media, Griffith and Northcraft (1994, 273) define features as the objective and psychosocial characteristics of a communication medium and provide the distinguishing (core) attributes of the medium. In this sense, technology features are the building blocks or components of the technology (Griffith and Northcraft, 1994). This was echoed by Griffith (1999, p.476), as defining technology as 'a combination (constellation) of features: distinct parts, and qualities.' Further, Harrison and Datta (2007, p. 300) define features as 'vendor-created software tools designed to complete tasks on behalf of the user.' They further add 'an application, in turn, is a bundle of features compiled to provide users with the ability to complete a set of specialized tasks' (Harrison and Datta, 2007, p.300). While this study is concerned with the influence of GAS features on GAS use, we adopt Harrison and Datta's (2007) definition of technology features as the definition of GAS features. GAS features are the software tools of GAS products created by GAS vendors to complete audit tasks on behalf of the auditors.

As noted earlier, external auditors are encouraged to use various features of GAS products to complete different audit tasks, such as data extraction, fraud detection, internal control evaluation, etc. However, there has been little research, (both in the IS literature and the auditing literature) examining the influence of technology features and their level of complexity on technology acceptance and usage. Kay and Thomas (1995) investigated the use of a system, Sam editor (a Unix-based text editor) in a longitudinal time frame, by over 2,000 users. They found that users adopted more commands when their experience increased, and the features adopted late tended to be more complex and powerful. Jasperson *et al.* (2005) indicated most users employ quite a narrow band of features of IT applications, operate at low levels of features use, and rarely initiate technology- or task-related extensions of the available features. Complexity[5] is an aspect of the technology feature that could also have an influence on the technology adoption and utilization. Tornatzky

[5] '... the degree to which an innovation is perceived as relatively difficult to understand and use' (Rogers and Shoemaker, 1971, p. 154).

and Klein (1982) reported a significant negative relationship between the innovation complexity and the innovation adoption. Similarly, Thompson *et al.* (1991) found a significant negative relationship between perceived complexity of use and the utilization of personal computing. More specifically, Kim *et al.* (2009) found that as complexity of technology features increased, internal auditors became less likely to use those complex features due to a decrease in the perceived ease of use; therefore system usage decreased. Thus, we hypothesized the negative relationship between the conceptual complexity of GAS features and GAS use by Egyptian external auditors.

H6. When the conceptual complexity of GAS features is high, perceived ease of use has a stronger effect on GAS use by Egyptian external auditors.

To sum it up, Figure 1 combines all the variables together showing the GAS acceptance model for Egyptian external auditors. The model incorporates GAS use, perceived usefulness, perceived ease of use, social factors, and individual factors. Social factors are defined as influence from other people, including co-workers, supervisors, or support from the organizations a user belongs to. Individual factors are defined as cognitive factors related to outcomes of audit software, including job relevance, output quality, and result demonstration.

Figure 1: GAS Acceptance Model for Egyptian External Auditors

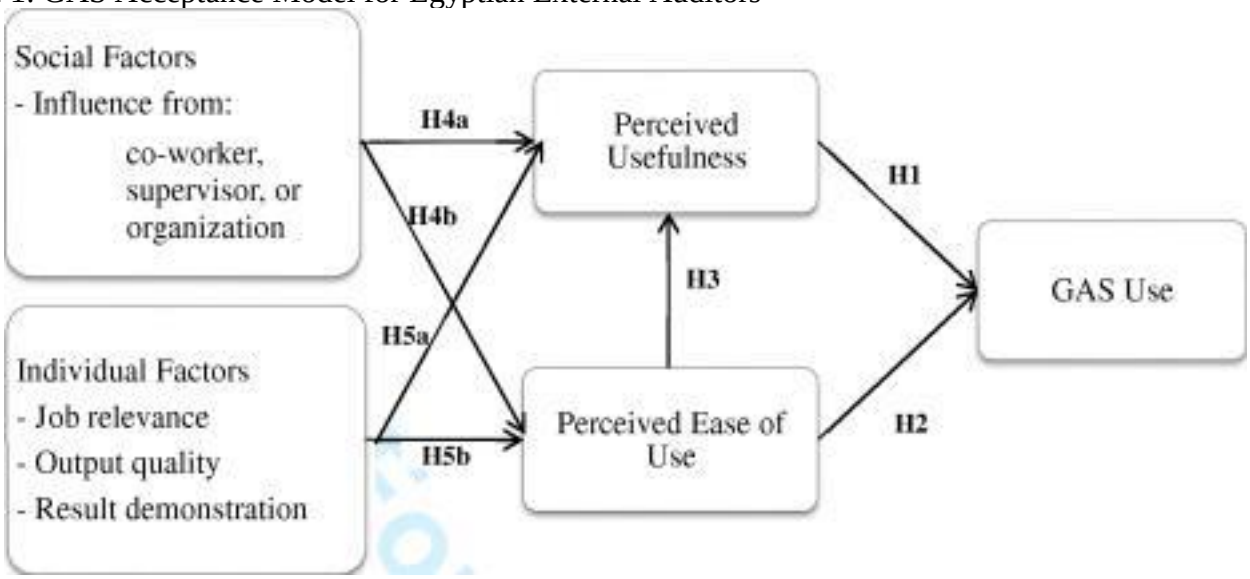
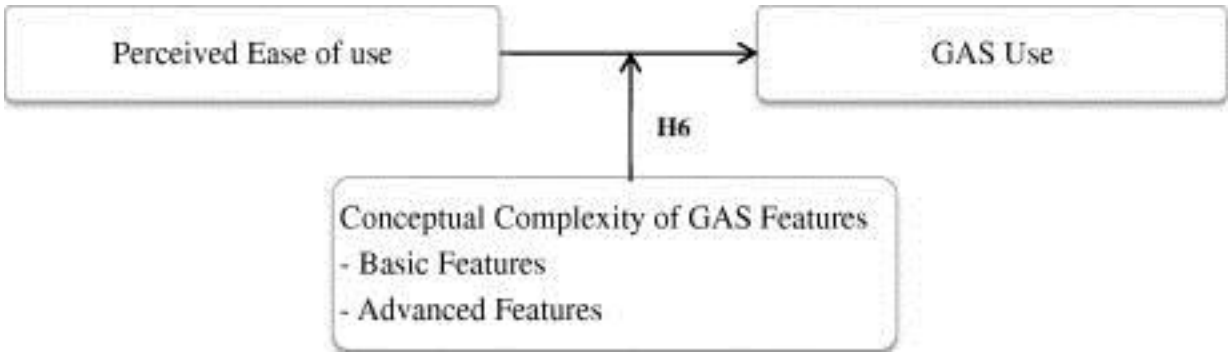


Figure 2 presents the effect of conceptual complexity of GAS features that is separately analyzed in the data analysis section. Six different GAS features were adopted from Kim *et al.* (2009) and categorized into two groups based on the conceptual complexity of GAS features, namely: basic features (i.e. database queries, ratio analysis, and audit sampling) and advanced features (i.e. digital analysis, regression/ANOVA, and data mining classification). While the basic features of GAS are mostly taught within the accounting curriculum in Egyptian business schools, the advanced features are not traditionally part of the external auditors' education and/or professional training requiring a mathematical background and prerequisite knowledge (e.g. information theories).

Figure 2: Conceptual Model for the Moderating Effect of Conceptual Complexity of GAS Features by Egyptian External Auditors



3. Research Design

3.1. Sample

We have gathered data through questionnaires. We delivered a total of 240 questionnaires to external audit professionals at twelve international audit firms including the Big 4[6] [7] and eight medium-sized international audit firms in Egypt, as twenty questionnaires per audit firm . After following up respondents with telephone calls, we had a final sample of 118 external auditors with a response rate of 49%. This sample size is more than five times the number of variables being analyzed in our structural equation model (Hatcher, 1994).

The demographic data shows that 62% of the respondents are experienced auditors with six or more years in their profession at varied levels, ranging from auditor, to partner, to junior auditor. Moreover, 46% of the respondents are employed by Big 4 audit firms and 54% work at medium-sized international audit firms. Almost all (98%) respondents have an accounting-major bachelor's degree as their highest educational level. The majority of respondents (61%) have indicated their IT expertise as intermediate, while 20% have stated they are IT experts.

[6] On the basis of pilot short telephone interviews with audit firms, we have come to the conclusion that there is very limited use of IT in audit work by smaller and/or local audit firms. Therefore, we have decided to exclude smaller/local audit firms that are unlikely to make significant use of GAS, and focus only on Big 4 and medium-sized international audit firms in Egypt, which account for auditing the majority of companies listed in the Egyptian Stock Exchange.

[7] Past experience proves that twenty is the maximum number of questionnaires to be distributed and/or likely collected.

3.2. Research Instrument and Procedures

The measurement of GAS use, perceived usefulness, and perceived ease of use were adopted from the original TAM (Davis *et al.*, 1989) and other extended TAMs (Taylor and Todd, 1995). GAS use is measured by two indicator variables: the frequency to use GAS and the actual time spent on GAS per day. The frequency to use GAS is measured with the seven-point Likert scale ranging from "not at all" to "several times each day." The actual amount of time spent on GAS per day is measured with the seven-point Likert scale ranging from "almost never" to "more than 4 hours." Both indicator variables include a N/A (not available) option for those who do not have an access to GAS. Perceived usefulness and perceived ease of use are measured by three indicator variables respectively with the seven-point Likert scale ranging from "strongly disagree" to "strongly agree".

The measurement items for external factors are adopted from Kim *et al.* (2009) and modified to meet the needs of this research. We grouped social and organizational factors under the social factors group, as social factors and organizational factors are highly correlated due to the influence from organizations in both factors. Thus, social factors are measured by four indicator variables: two from organizational factors (training and support)[8], and two from social factors (influences from co-workers, management, or the organization)[9]. Individual factors are measured by four indicator variables; one from job relevance, two from output quality, and one from result demonstration[10]. All variables are measured with the seven-point Likert scale ranging from "strongly disagree" to "strongly agree."

The list of GAS features was delivered with the questionnaires, including the description and the audit example for each feature. The questionnaire and the list of GAS features were produced in English with an Arabic translation for only those items/terms that seemed difficult to understand or likely to cause confusion. The authors double-checked the translation with audit professionals in the pilot phase. Participants were asked to answer GAS use, perceived usefulness, and perceived ease of use by GAS features and check social and individual factors that affect the use of GAS. The data collected was analyzed using a structural equation model, ANOVA, and regression analysis.

4. Results

4.1. Test of Measurement

As shown in Table 1, all measures have high Cronbach's Alpha coefficients, exceeding .70, which indicates reasonable internal consistency of measurement items (Fornell and Larcker, 1981).

[8] These organizational factor questions are originally from Igbaria *et al.* (1997).
[9] These social factor questions are originally from Thompson *et al.* (1991).
[10] These individual factors are originally from Venketash and Davis (2000).

Table 1: Reliability statistics of measurement

	Cronbach's Alpha	Cronbach's Alpha (Based on Standardized Items)	N of Items
GAS use	.779	.799	2
Perceived usefulness	.936	.936	3
Perceived ease of use	.908	.908	3
Social factors	.906	.907	4
Individual factors	.818	.825	4

The convergent and discriminant validity of the measurement items of GAS use, perceived usefulness, and perceived ease of use is tested using correlation matrix. The statistical results indicate that the correlation between frequency and time ($r_{FREQ, TIME}$=.638) is stronger than their correlations with perceived usefulness, ranging from .440 to .461, and perceived ease of use, ranging from .428 to .492. While the correlations among perceived usefulness ($r_{PU1, PU2}$=.797; $r_{PU1, PU3}$=.784; $r_{PU2, PU3}$=.908) are stronger than their correlations with GAS use, ranging from .440 to .477, the correlations among perceived ease of use ($r_{PEOUI, PEOU2}$=.797; $r_{PEOUI, PEOU3}$=.768; $r_{PEOU2, PEOU3}$=.731) are stronger than their correlations with GAS use, ranging from .428 to .492. GAS use and perceived usefulness, and GAS use and perceived ease of use are distinct due to strong correlations among associated items and weak correlations among unassociated items (Igbaria *et al.,* 1997). Although perceived usefulness and perceived ease of use are not distinct with high correlation (.678 to .840), we analyzed these constructs separately as often seen in prior TAM research.

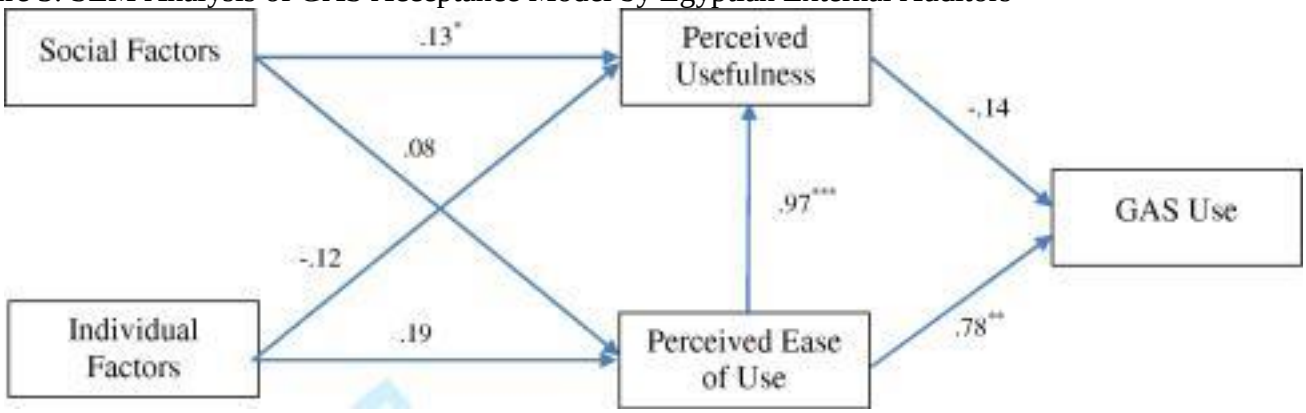
The convergent and discriminant validity of the measurement items of social factors and individual factors is also tested using principal component analysis with Varimax rotation. The statistical results show that the first factor is highly correlated to social factors and the second factor is highly correlated to individual factors.

4.2. Structural Equation Model

Figure 3 presents the structural relationships among social factors, individual factors, perceived usefulness, perceived ease of use, and GAS use. Inconsistent with Hypothesis 1, the relationship between perceived usefulness and GAS use (P=-.14, p=.582) is not significant in the Egyptian external audit profession[11]. However, consistent with Hypothesis 2, perceived ease of use is positively related to GAS use by Egyptian external auditors (P=-.78, p=.003), and consistent with Hypothesis 3, perceived ease of use is positively related to perceived usefulness of the GAS (P=.99, p=.000). Consistent with Hypothesis 4a, social factors have a positive influence on perceived usefulness of GAS by Egyptian external auditors (P=.141, p=.030). Inconsistent with Hypothesis 4b, social factors have no influence on perceived ease of use of GAS by Egyptian external auditors. Inconsistent with Hypothesis 5a and Hypothesis 5b, individual factors have no influence on perceived usefulness and perceived ease of use of GAS by Egyptian external auditors.

[11] The lack of clarity of the measurement has contributed to lack of support for the relationship between perceived usefulness and GAS use. The detailed reasons are explained in the limitation section of this study.

Figure 3: SEM Analysis of GAS Acceptance Model by Egyptian External Auditors



4.3. Generalized Audit Software Use by GAS Features

As can be seen from Table 2, based on the means of frequency to use GAS, audit sampling (m=4.43) was most frequently used, ratio analysis (m=3.82) and classification (m=3.25) are relatively more frequently used, and database queries (m=3.18), digital analysis (m=2.45) and regression/ANOVA (m=2.39) are relatively less frequently used by Egyptian external auditors. Consistently, Egyptian external auditors spend more time on audit sampling (m=3.96) and ratio analysis (m=3.47) while they spend relatively less time on classification (m=3.17), database queries (m=2.85), regression/ANOVA (m=2.71), and digital analysis (m=2.54).

Table 2: Descriptive statistics of frequency and time by GAS features

Software Features	Frequency			Time		
	Mean	Std. Deviation	N	Mean	Std. Deviation	N
Database Queries	3.18	2.084	115	2.85	1.827	115
Ratio Analysis	3.82	1.904	115	3.47	1.703	115
Audit Sampling	4.43	1.738	115	3.96	1.851	115
Digital Analysis	2.45	1.825	112	2.54	1.954	112
Regression/AN OVA	2.39	1.889	114	2.71	2.073	114
Classification	3.19	2.154	112	3.17	2.040	112
Total	3.25	2.061	683	3.12	1.965	683

Using ANOVA, as shown in Table 3, GAS use was significantly affected by GAS features in the Egyptian external audit profession. GAS features have a significant influence on the frequency to use GAS (F=18.973; p=.000) and the time spent on GAS (F=7.775; p=.000) among Egyptian external auditors.

Table 3: ANOVA results of GAS use by GAS features

Dependent Variables		Sum of	Df	Mean Square	F	Sig.
Frequency	Between Groups	355.681	5	71.136	18.973	.000
	Within Groups	2560.757	683	3.749		
	Total	2916.438	688			
Time	Between Groups	143.850	5	28.770	7.775	.000
	Within Groups	2560.759	692	3.701		
	Total	2704.609	697			

The means and standard deviations for perceived usefulness and perceived ease of use are presented in Table 4. Egyptian external auditors perceived that audit sampling (m=6.13) is most useful, ratio analysis (m=5.94) is more useful, while classification (m=5.03), database queries (m=4.99), regression/ANOVA (m=4.57), and digital analysis (m=4.47) are perceived relatively less useful. On the contrary, Egyptian external auditors perceived that audit sampling (m=5.89) and ratio analysis (m=5.75) are relatively easy to use, but they perceived classification (m=4.94), database queries (m=4.81), regression/ANOVA (m=4.52), and digital analysis (m=4.44) are relatively less easy to use.

Table 4: Descriptive statistics of perceived usefulness and perceived ease of use by GAS features

Software Features	Perceived Usefulness[6]			Perceived Ease of Use		
	Mean	Std. Deviation	N	Mean	Std. Deviation	N
Database Queries	4.99	2.249	118	4.81	1.958	118
Ratio Analysis	5.94	1.482	118	5.75	1.326	118
Audit Sampling	6.13	1.205	118	5.89	1.129	118
Digital Analysis	4.47	2.453	118	4.44	2.227	118
Regression/ANOVA	4.57	2.363	118	4.52	2.099	118
Classification	5.03	2.132	118	4.94	1.979	118
Total	5.19	2.125	708	5.06	1.911	708

[b] Perceived usefulness includes PU1, PU2, and PU3. [c] Perceived ease of use includes PEOU1, PEOU2, and PEOU3.

Further, Table 5 shows that GAS features have a significant influence on the perceived usefulness (F=13.703; p=.000), and the perceived ease of use (F=13.415; p=.000) among Egyptian external auditors.

Table 5: ANOVA results of perceived usefulness and perceived ease of use by GAS features[a]

Dependent Variables		Sum of Squares	Df	Mean Square	F	Sig.	
Perceived usefulness	Between Groups	283.799	5	56.760	13.70	.000	
	Within Groups	2907.88	702	4.142			
	Total	3191.67	707				
Perceived ease of use	Between Groups	225.217	5	45.043	13.41	.000	
	Within Groups	2357.09	702	3.358			
	Total	2582.30	707				

[a] The average of three measurement items is used for the ANOVA test

Table 6 summarizes the result of Structural Equation Modeling (SEM) analysis by GAS features. The use of digital analysis and regression/ANOVA is not influenced by perceived usefulness (P=.00, p=.999; P=-.02, p=.949) but significantly influenced by perceived ease of use (P=.71, p=.047, P=.66, p=.019) in the Egyptian external audit profession.

Table 6: SEM analysis of GAS features [a]

GAS Features	Perceived Usefulness ^ GAS Use	Perceived Ease of Use ^ GAS Use	Perceived Ease of Use ^ Perceived Usefulness
Database Queries	.47	.10	.98***
Ratio Analysis	-.59	.99	.94***
Audit Sampling	.14	.11	.92***
Digital Analysis	.00	.71*	ₜ" ***
Regression/AN OVA	-.02	.66*	.92***
Classification	-.33	1.01	.98***

P< .05; P< .01; P< .001

[a] The numbers shown in the table are beta weights after GAS use, perceived usefulness, and perceived ease of use are standardized.

4.4. Generalized Audit Software Use by Conceptual Complexity of GAS Features

The means and standard deviations for frequency and time by the conceptual complexity of GAS features are presented in Table 7. Results show that basic features (m=3.81) are more used, while advanced features (m=2.67) are less used by Egyptian external auditors. Consistent with this, Egyptian external auditors spend more time on basic features (m=3.43), while they spend less time on advanced features (m=2.80).

Table 7: Descriptive statistics of frequency and time by conceptual complexity of GAS features

Conceptual Complexity of GAS Features	Frequency			Time		
	Mean	Std. Deviation	N	Mean	Std. Deviation	N
Basic Features	3.81	1.976	345	3.43	1.846	345
Advanced Features	2.67	1.988	338	2.80	2.035	338
Total	3.25	2.061	683	3.12	1.965	683

The GAS use by the conceptual complexity of GAS features is examined using the regression analysis. As shown in Table 8, the conceptual complexity of GAS features is negatively related to the frequency (P=-1.113, p=.000) and the time (P=-.581, p=.000).

Table 8: Regression analysis of GAS use by conceptual complexity of GAS features

Dependent Variable	Parameter	B	Std. Error	t	Sig.
Frequency[a]	Intercept	4.900	.238	20.567	.000
	Conceptual Complexity	-1.113	.151	-7.363	.000
Time[b]	Intercept	4.004	.233	17.171	.000
	Conceptual Complexity	-.581	.148	-3.936	.000

[a] R squared = .073 (Adjusted R Squared=.072) [b] squared = .148 (Adjusted R Squared=.024)

Further, the means and standard deviations for perceived usefulness and perceived ease of use by the conceptual complexity of GAS features are presented in Table 9. Egyptian external auditors perceived that basic features (m=5.69) are more useful, while advanced features (m=4.69) are less useful. Also, they perceived basic features (m=5.48) as easier to use, but advanced features (m=4.63) as less easy to use.

Table 9: Descriptive statistics of perceived usefulness and ease of use by conceptual complexity of GAS features

Feature Complexity	Perceived Usefulness			Perceived Ease of Use		
	Mean	Std. Deviation	N	Mean	Std. Deviation	N
Basic Features	5.69	1.771	354	5.48	1.582	354
Advanced Features	4.69	2.326	354	4.63	2.109	354
Total	5.19	2.125	708	5.06	1.911	708

Perceived usefulness and perceived ease of use are also examined by the conceptual complexity of GAS features. Table 10 indicates that perceived usefulness and perceived ease of use are significantly affected by the conceptual complexity of GAS features. Further, the conceptual complexity of GAS features is negatively related to perceived usefulness (P=-.995, p=.000) and perceived ease of use (P=- .850, p=.000).

Table 10: Regression analysis of perceived usefulness and ease of use by conceptual complexity of GAS features

Dependent Variable	Parameter	B	Std. Error	t	Sig.
Perceived Usefulness[a]	Intercept	6.68	.246	27.204	.000
	Conceptual Complexity	-.995	.155	-6.406	.000
Perceived Ease of Use[b]	Intercept	6.33	.222	28.584	.000
	Conceptual Complexity	-.850	.140	-6.067	.000

[a] R squared = .055 (Adjusted R Squared=.054) [b] R squared = .050 (Adjusted R Squared=.048)

Table 11 summarizes the result of SEM analysis by the conceptual complexity of GAS features. The use of GAS use is significantly influenced by perceived ease of use (P=.95, p=.000), not by perceived usefulness (P=-.11, p=.645) when Egyptian external auditors use advanced features. However, the use of GAS is not influenced by perceived ease of use (P=.65, p=.333) and perceived usefulness (P=-.14, p=.836) when they use basic features. Consistent with Hypothesis 6, when the conceptual complexity of GAS features is high, perceived ease of use has a stronger effect on GAS use by Egyptian external auditors.

Table 11: SEM analysis of conceptual complexity of GAS features

Conceptual Complexity of GAS Features	Path	B	Std. Error	Critical Ratio	Sig.
Basic Features	Perceived usefulness ^ GAS use	-.14	.585	-.207	.836
	Perceived ease of use ^ GAS use	.65	.7	.969	.333
	Perceived ease of use ^ Perceived usefulness	.98	.048	24.175	.000
Advanced Features	Perceived usefulness ^ GAS use	-.11	.154	-.461	.645
	Perceived ease of use ^ GAS use	.79	.204	3.19	.001
	Perceived ease of use ^ Perceived usefulness	.95	.053	22.772	.000

5. Discussion, Implications, and Future Research

The results of our study lead to a conclusion that Egyptian external auditors have a different usage behaviour compared to internal auditors (Kim *et al.,* 2009). They are more influenced by perceived ease of use, not by perceived usefulness while both perceived usefulness and perceived ease of use are important in the context of internal auditors. Also the effect of external factors on perceived usefulness and perceived ease of use is different in the Egyptian external audit profession. They perceive that GAS is useful when influenced by co-worker, supervisor, or organization while internal auditors perceive that GAS is easy to use when influenced by support, training, or management support and useful when influenced by cognitive factors that related to outcomes of GAS. On the contrary, the impact of GAS features on the actual usage of GAS is similar in the Egyptian external audit profession. When they use the basic features of GAS which have low conceptual complexity, they more frequently use and spent more time on them. They perceive that those features are more useful and easier to use than GAS features with high conceptual complexity. As the conceptual complexity of GAS features increased, perceived ease of use has stronger effect on GAS use by Egyptian external auditors.

Findings reported in this study help to further understand the GAS usage behaviours by external audit professionals. The usage behaviours of GAS are different within the Egyptian external audit context. The core structure of the TAM (GAS use, perceived usefulness, and perceived ease of use) and the effect of external factors (social and individual factors) are influenced by this cross-context factor. Thus, the result of this research can help software developers or auditing companies to understand which factors are more important when Egyptian external auditors use the GAS products. This research also strengthens the result of previous research by empirically providing evidence that the impact of GAS features is consistent throughout different contexts and adds the value to previous research by providing context-contingent insight in the application of TAM. This research also provides useful insights into the actual usage of GAS as recruiting professional participants from Big 4 and other international medium-tier firms in Egypt.

The results of the current study contribute to a growing stream of research on the GAS acceptance by external auditors. This contribution stems from the applicability of its results to, relatively underexplored, an emerging market setting, unlike prior research that has been undertaken in developed audit markets. The results are particularly relevant, and may be of interest, to auditing professionals, regulators, audit software developers, and academia to enhancing the quality of financial statements audit using audit software. Although the study explores the acceptance of GAS by international auditing firms operating in a single setting - Egypt, the results can be generalized to similar markets, due to the inclusion of the international Big 4 and non-Big 4 affiliates. International audit firms adopt and apply an international audit approach, which refers to similar application of technical audit work (e.g. the use of GAS).

However, there might be some difference in perceptions of audit professionals with regard to factors enabling/inhibiting them from applying technical audit methods (e.g. GAS). However, collected responses provide an insight into the actual usage of GAS features by external auditors (working in international audit firms) and the impact of conceptual complexity of GAS features, which is applicable/generalizable in similar contexts and indicative to a boarder context, as a matter of concern to the macro audit market.

As with all research, our results must be interpreted in light of a number of limitations. First, all constructs are measured by self-report in a survey, so respondents' lack of understanding of GAS features or specific items could be of influence on the answers that respondents provided and the relations between the constructs that were measured. The construct validity of GAS use can be increased by monitoring the actual usage of GAS instead of using self-reported frequency and time. Second, we investigated the GAS usage behaviours within the Egyptian external audit context, so two cross-context factors (i.e. profession and country) are considered at the same time. Further examination with professions only or countries only is needed to clarify the effect of both factors. Third, organizations' audit methodology and practice are not taken into consideration in this study. GAS adoption is completely voluntary in Egyptian audit firms so the voluntary usage of GAS was examined, which is more likely to be different in mandatory settings. Also only international audit firms had to be selected since local audit firms did not apply GAS and mainly use basic tools such as Excel. And the extent to which the audit client's lack of willingness to cooperate with auditors may affect their GAS use in the case of embedded and integrated CAATTs. Fourth, six features of GAS were averaged to calculate the GAS use, perceived usefulness, and perceived ease of use in the structural equation model since we assumed that GAS features have no influence on social and individual factors. Hence, the complex structure to measure the GAS use, perceived usefulness, and perceived ease of use for six features may influence an insignificant relationship between perceived usefulness and GAS use. Finally, this study does not cover all features associated with GAS, but the common ones.

This research offers a number of opportunities for future research. By consolidating this result with prior studies, there is a possibility to develop a context-contingent theory with different software and software features, professional groups, and countries. The acceptance of GAS by external auditors can

be compared to internal auditors and the acceptance of GAS can be compared in developing countries to in developed countries. Also more cross-context extensions will be available with different software packages and software features. Further, general TAM can be theorized/tested in a software specific context with contextual factors (e.g. software use, software usefulness, and software ease of use) and mediating factors (e.g. software features, type of profession, and countries).

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