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Full Length Research Paper

IT auditing activities of public sector auditors in Malaysia

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Information technology (IT) has become an increasingly important tool for the Malaysian government to improve the delivery of its services. However, advances in information technology continuously render control procedures obsolete. Indispensably audit methodology has to evolve to keep abreast with the change in technology. This study investigates the IT practices of the public sector auditors in Malaysia. We examine IT evaluation based on IT audit objectives, organisational characteristics, competency of auditor and usage of Computer Assisted Audit Tools and techniques (CAATTs). Self-administered questionnaires were mailed to 400 public sector auditors providing a usable sample size of 73. The results show that application processing control and data integrity, privacy and security control were the most frequent evaluations performed by public sector auditors. The most frequent IT audit objective is the evaluation of compliance with policies, procedures and evaluation of internal control and these objectives are performed differently in different divisions. CAATTs have been used most frequently as a problem solving aid. Several appealing patterns emerged from the eight regression models. The findings provide important implications for research on IT and public sector auditing.

Key words: IT auditing, public sector auditing, public sector auditors.

INTRODUCTION

The impact of information technology (IT) in business has grown exponentially in recent years, changing the audit process and resulting in both opportunities and challenges for auditors. The audit profession is rapidly advancing in response to changes in its environment. It is also argued that auditors are struggling to maintain their identity and purpose as the organisations they audit undergo radical changes (Solomon and Trotman, 2003). Advances in IT continuously render control procedures obsolete, and the "value" of traditional audit has become seriously questioned (Tongren and Warigon, 1997). As IT changes occur more quickly, auditors must keep pace with emerging technological changes and their impact on their organisation's data processing system, as well as their own audit procedures (Rezaee and Reinstein, 1998).

IT is an increasingly powerful tool for improving the delivery of government services. IT and the Internet in particular have opened new possibilities for the govern-ment and the governed, just as it has for the businesses and its customers (Hazman and Maniam, 2004; Moon, 2002). Over the past decade, many governments including the Malaysian government have planned and implemented programmes projected to introduce the government into the digital land. The Malaysian government is transforming itself as it increasingly moves to delivering information and services electronically. The highly complex bureaucracies that grew to regulate the economy and society through the highly differentiated but usually lowly integrated machinery (Marche and McNiven, 2003; Davison et al., 2005) can eventually be reconstructed through IT. Governments of both developed and developing countries have embraced IT to improve the quality of public services, to increase public access to information and to energise more participation in public affairs (Becker, 1998; Moon, 2002). Therefore, public sector audit and accounting practices in Malaysia are experiencing focal reform aimed at escalating transparency, streamlining accountability and improving overall financial management in line with international standards and practices.

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Public sector auditors have a significant interest in these developments, especially in issues related to prudence and integrity, value for money, the stewardship of public assets and the quality of information used for decision making. As a result, IT audits need to provide assurance that systems are adequately controlled, secured and functioned as intended (Petterson, 2005). Among industries, there are different kinds of risks and therefore they require different control frameworks (Hunton et al., 2000). Traditional control frameworks, applicable to legacy environments, may not be applicable to current environment and may in fact subvert them (Nearon, 2000). New audit strategies must be developed for evaluating organisation functions that have begun to utilise e-business (Attaway, 2000). Now, auditors may decide it is not practical or possible to limit detection risk to an acceptable level by performing only substantive tests when most of the business information is in electronic form. In such cases, the auditors should gather evidence about the effectiveness of both the design and the operation of controls intended to reduce the assessed level of control risk (Tucker, 2001). Necessary assurance is achievable when the IT controls are properly directed on the risks they need to manage (Le Grand, 2005). In their effort to reduce the number of IT failures, auditors should also provide value-added services in areas that are often overlooked. Auditors can study processes concerned with systems validation, documentation and training. Such involvement could improve evaluation, quality and IT implementations (Rishel and Ivancevich, 2003). As information systems are so pervasive and fundamental to organisation performance, evaluation of IT risks and controls is crucial (Hermanson et al., 2000).

The general objectives of this research are to identify the IT control evaluations and the related activities of Malaysian public sector auditors. This study also aims to explore the following specific research objectives related to public sector auditors as per the following:

1. To investigate the different types of IT control evaluation activities.
2. To explore performance of the IT audit objectives.
3. To study the various usage of CAATTs during the audit process.
4. To examine whether the IT control evaluation activities performed by Malaysian public sector auditors vary according to organisational characteristics.
5. To investigate whether audit objectives, organisational characteristics, usage of CAATTs and competencies of auditors have different contribution to the IT evaluations performed by public sector auditors.

Although considerable research exists on IT control and IT auditing, there are limited studies that addresses IT evaluation control activities in the public sector auditing, particularly in Malaysia. As such, findings from this research would generate new conclusions to enrich the existing literatures on IT-related auditing. In addition, results of this study may help auditors in public sectors to address issues on efficiency and effectiveness of IT auditing for the government.

This paper is organised as follows: the next section reviews literature on IT auditing. Section three then discusses the research design and data collection methods. Next in section four we will present the results. Discussions are presented in section five and finally in section six we offer our conclusion.

LITERATURE REVIEW

The Malaysian government has recognised that IT serves as the underlying condition that would transform Malaysia from a P-based economy to a K-based economy. From the 6th Malaysian Plan (RMKe-6; 1991 - 1995) to the 9th Malaysian Plan (2005 - 2010), IT development is seen as an important strategic driver for positioning Malaysia in the global market. In summary, all past and present national plans were to provide a sound platform for Malaysia to transform into a knowledge-based society and value-driven economy (Hazman et al., 2004). In 1997, the Malaysian government launched the electronic government initiative, generally known as e-government, to reinvent itself to lead the country into the information age. The implementation of e-government in Malaysia heralds the beginning of a journey of reinventing the government by transforming the way it operates, modernising and enhancing its public service delivery.

As computer technology becomes more sophisticated, government organisations have become progressively more reliant on computerised information systems (CIS) to perform their operations and to process, maintain, and report essential information. Although the overall objective and scope of an audit do not change in a computerised environment, the use of IT has tremendously changed the mode and speed of processing, and storage media of financial data and records (Yang and Guan, 2004). These changes have significantly inflated the organisation and the procedures of the clients accounting and internal control systems. Consequently, the reliability of computerised data and of the systems that process, maintain and report these data are a major concern to audit. Auditors evaluate the reliability of computer generated data supporting financial statements and analyse specific programs and their outcomes. In addition, auditors examine the adequacy of controls in information system and related operations to ensure system effectiveness. Auditor must know the characteristics of users of the information system and the decision making environment in the client organisation while evaluating the effectiveness of any system[i].

Within a period of 100 years, public sector auditing profession has progressed excellently in response to the

i Retrieved January 28, 2009 from http://www.intosaiitaudit.org/India_GeneralPrinciples.pdf

current changes. The obvious developments are the changing role, responsibilities, scope, approach, technique and methodology in conducting the audits. The audits carried out earlier were of two types; financial statement audit and attestation/compliance audit. The shift to government accounting system in 1970's gave power to the department to carry out the performance audit[ii]. Further in 2000, the public sector accounting system has undergone tremendous transformation into e-business with resulting changes in the accounting system of the federal government, state governments, and statutory bodies. In line with the changes, the scope of audit has been extended to IT related audit[iii].

IT related auditing within the public sector encompasses the General IT Audit; System Development Audit; Performance Audit in IT environment; and lastly usage of CAATTs in auditing. The audit methodology adopted by the public sector require the auditors to evaluate the auditors CIS to determine whether the systems produce timely, complete, reliable information in conformity with their management goals and objectives. The IT related auditing includes techniques used for auditing around the computer, auditing through the computer and auditing with the computer[iv]. The majority of the auditors who are involved in the financial and attestation audits are performing the General IT Audit as stipulated in the IT Audit Manual which relates to the general controls and application controls of the accounting systems of the public sector organizations in federal government division, state government division, statutory bodies division and internal audit department of ministries. Besides, each divisions and internal audit department of ministries has its own IT audit team to perform auditing related to IT projects and system development and these teams mainly focusing on the system development audit and performance audit on IT projects. The auditing profession in both the private and public sectors needs to adapt both its techniques as well as its topics of concern as the world of the clients changes (Nikoloyuk et al., 2005). In the public sector, new models of governance and the privatisation of government services have created an explosive growth in the use of audit as a mechanism for control (Pentland, 2000). Remarkably, auditors are in a unique position to examine risks and its effects on the internal control of CIS (Pathak and Roberts, 2007).

IT often fundamentally changes the initiating, recording, processing and reporting of transactions. Similarly the organisation procedures change from paper-based documents to electronic records and the internal control of the organisation has a combination of both automated and manual (Ratcliffe and Munter, 2002; Tucker, 2001). Manual control may function independently of the IT system or use information produced by the IT system to monitor the automated controls. The appropriate mix of manual and automated controls varies with the nature and complexity of the IT system. IT controls can provide only reasonable assurance regarding the achievement of an entity's control objectives (Ratcliffe and Munter, 2002). All internal control systems, regardless of their design, face certain inherent limitation that makes absolute assurance impossible. In an IT system, errors can occur in designing, maintaining, or monitoring automated controls. Moreover, IT effectively extends the organisation, requiring the auditor to consider risks, controls and processes in a larger context (Helms, 2002). Auditors should check the automated controls implemented in the IT business environment to minimise the risk of unauthorised, invalid, incomplete, or inaccurate data and transactions, as well as to ensure timely processing. Controls should focus on information integrity at the point of entry. The auditor should have sufficient knowledge of the CIS to plan, direct, supervise and review the work performed (Burr et al., 2002). The higher the degree of the auditors' participation in system development, the more likely they will understand the system of internal control that should be in place (Pathak, 2003).

IT control evaluation activities

IT control evaluation activities are defined as control in computerised information system comprising policies, procedures, practices and organisational structures. They are designed to provide reasonable assurance that IT audit objectives will be achieved. The controls in a computer system ensure effectiveness and efficiency of operations, reliability of financial reporting and compliance with the rules and regulations. Hermanson et al. (2000) performs an exploratory research relating to how IT control activities are specific to internal auditors' evaluation efforts. He found that internal auditors consider more traditional IT control evaluation activities such as processing application, ensuring data integrity, privacy and security, and safeguarding IT assets as most important. On the other hand, system maintenance and program changes are non-traditional IT control and considered as less important by internal auditors in his study. However, disaster recovery planning has been considered vital by IT-dependent organisations. In term of specific organisational characteristics, some evidence indicates that larger internal audit departments, training of computer auditors and existence of new systems are associated with the internal auditor's IT control evaluations. The role of an internal auditor is important in identifying the amount of risk and assessing the impact of these risks on the overall IT related activities.

A study found that IT controls do improve operating performance, and some IT controls improve performance more than others do (Phelps and Milne, 2008). The extant study indicated that three controls related to data

ii Retrieved January 29, 2009 from http://www.audit.gov.my/xboer/upload/kertas01.pdf

iii Retrieved January 29, 2009 from http://www.audit.gov.my/xboer/upload/kertas02.pdf

iv National Audit Department of Malaysia. (2002). ICT Audit Manual.

integrity, security and privacy were able to predict 45 % of the performance difference across the organisations that have fewer controls in place and smaller in terms of size.

This study applies 36 specific tests outlined by IFAC which are categorised into eight types of IT evaluation control as per Table 1.

IT audit objectives

An IT audit objective is "a statement of the desired result or purpose to be achieved by implementing control procedures in a particular IT activity", (ISACA, 1998). Fundamental audit objective do not change because of the computerized accounting system. However, additional computer related considerations need to be incorporated into overall audit planning.

The advent of new technologies has caused changes in audit approaches and in some cases it may cause change in the audit objectives (Cooper and Vatanasakdakul, 2002). Based on IFAC (1995), IT audit objectives that relate to IT usage comprises:-

1. Evaluation of efficiency/effectiveness/economy of IT use (X_1).
2. Evaluation of compliance with policies, procedures, and regulations (X_2).
3. Evaluation of internal control in computer-based systems (X_3).
4. Evaluation of fairness of financial statement representations and the accuracy and completeness of computerized accounting records (X_4).

Apart from the above objectives related to IT usage, other variables relate to usage of CAATTs (X5) , auditors competencies (X6) and four organizational related variables that are type of auditor (X7), size of organization (X8), structure of computerized system (X9) and new computer system (X10).

Usage of CAATTs

With the expanding role of e-business in the economy, much of the traditional audit trail is disappearing. As standards and guidelines related to the impact of IT on internal control are issued, so they will signal diminished likelihood that a traditional 'audits around' the computer approach will be appropriate. As a result, auditors must begin to incorporate state-of-the-art auditing software applications into the auditing process. This will not only enable the auditor to perform traditional examinations in an increasingly paperless environment, but also enable audit processes to be more effective because the scope of transactions being analysed can be increased at a minimal marginal cost (Braun and Davis, 2003). In the modern audit environment, the information technologies are no longer luxury, but a necessity, as they promote continuous monitoring of risk in a cost-effective fashion (Hespenheide, 2006). During the IT control evaluation activities, auditors have to reevaluate the effectiveness of traditional audit procedures, and to explore the possibilities and opportunities by using IT and data analysis software (Abu-Musa, 2004). One of the most dynamic areas of audit processing is the use of Computer Assisted Auditing Tools and Techniques (CAATTs) (Gorham and Lamont, 1998). CAATTs can be portrayed as the tools and techniques used to examine directly the internal logic of an application as well as being used to draw indirectly inferences about application logic (Hall, 2000). The third hypothesis addresses the various usages of CAATTs by Malaysian public sector auditors in different organizations.

Auditors' competencies

Technique for testing automated control may differ from those for manual controls. Specialised computer tools and skills may be needed to design and perform the IT control evaluation activities (Ratcliffe and Munter, 2002). With the specialised knowledge, auditors will be equipped to assist organisation in eliminating control weaknesses and strengthening internal controls over information systems (Pathak and Roberts, 2007). The higher the level of skill, experience and attitudes towards e-business initiatives, the more likely auditors can and will participate in the e-business systems development (Pathak, 2003). Buckstein (2001), states ". . . public sector auditors, similar to their counterparts in the private sector, will have to undergo new skills training to ensure they are able to test systems to provide assurance that electronic processes are secure". A study by Viator and Curts (1998) suggests that in some cases, there appear to be an association between IT auditors' background and their evaluation of automated control procedures. There were several instances where higher weight were assigned to completely automated control procedures by computer auditors with Management Information System/Computer Science academic education and MIS work experience. Trainings also improve the system acceptance (Bedard et al., 2003). Higher-level skills in the e-business audit context are related to expertise/knowledge of organisational security vulnerabilities, intrusion protection management, system and network change management (Pathak and Baldwin, 2009).

Organisational characteristics

Organisational characteristics also influence the extent of IT auditing activities performed by public sector auditors. The main factors are discussed in extant literature as follows:

Types of auditor

Generally organizations classify the auditors as external, internal (business) and IT auditors. IT auditors usually recognise more types of security risks related to IT control evaluation activities than business auditors (Hunton and Wright, 2004). The presence of the IT specialist allows for more complex evaluations of technology (Hermanson et al., 2000). In the CIS setting, auditors reliance on IT specialists increases as the specialists competence increases, and the accuracy of auditors inherent and control risk assessments is affected more by IT expertise than by general audit experience (Brazel and Agoglia, 2005). However, business auditors who possessed a fundamental understanding of IT systems can successfully work in e-business environments as they can gain necessary support though collaboration with specialist auditors (Price, 2001). As an organization's reliance on technology increases, the differences in the role of IT auditor and business auditors/internal auditors are becoming less distinct (Pathak, 2003). It is anticipated that the types of auditors would vary by IT control evaluation activities.

Size of organization

Organization represented by number of auditors in the organizations who performed IT related auditing size can also influence IT audit activities. The availability of resources plays a part in determining the auditors' participation in e-business initiatives (Pathak, 2003). In larger audit department, as opposed to small ones, there is a greater tendency to participate in e-business system development process. Further, larger number of internal auditors may signal greater commitment to control, as well as greater resources available for IT auditing (Hermanson et al., 2000). Larger companies generally have larger internal audit staffs, and prior research has documented a positive relation between company size and control strength (Brans and Waterhouse, 1975; Ivancevich et al., 1998; Karnes et al., 1992; Snell, 1992). It is expected that the size of organizations would vary by IT control evaluation activities.

Structure of computerized information systems

Another organisational characteristic is whether the organisations computerised information systems are centralised or decentralised. Centralized systems consist of a central computer in one location that processes and stores all the company's data. Decentralized systems (also known as distributed systems) allow for more localized entry, processing, and storage of data (Hermanson et al., 2000). Decentralized systems present audit concern regarding the completeness, integrity, and security of the distributed data (Warren et al., 1998). It is forecasted that the structure of CIS would influence the variation of IT control evaluation activities.

New computer system

Finally, the organizational characteristic that can affect IT audit activities related to the percentage of new computer systems in the client organization. New systems are defined as those installed within the last three years. New systems can increase the level of risk in an organization (Hermanson et al., 2000). New systems are not implemented in a vacuum and many authors agree that the first step in developing a business continuation plan is to carry out a risk assessment (Maguire, 2002). Risk assessment should be used at the start of a project, and at least before system design, to determine the level of risk and identify the related controls to formulate plans for reducing that risk (Bocu et al., 1999; Curtis and Cobham, 2002). It is predicted that the percentage of new computer system would vary by IT control evaluation activities. The fifth hypothesis is to investigate whether there are any significant differences between IT Control evaluation activities in term of organisation characteristics.

In summary, this research addresses whether the performance of IT control evaluations activities by Malaysian public sector auditors are influenced by IT audit objectives, various usage of CAATTs, auditors competencies in IT and organizational characteristics. Considerable studies have been conducted in the area related to IT auditing in the developed countries but limited studies focused on Malaysia and none in the context of Malaysian public sector. Therefore, this paper contributes by bridging the gap in IT audit literature.

RESEARCH MODEL AND METHODOLOGY

The critical nature of IT control evaluation activities are evidenced by the recent focus placed on the topic by a variety of professional organisations. These organisations have placed emphasis on the importance of IT processes and controls in accessing the clients control environment and encourage the auditors to adopt IT in their auditing. These organisations mainly are the Information System Auditing Control Association (ISACA), the Internal Auditor Research Foundation (IIA), the Committee of Sponsoring Organisation (COSO), and American Institute of Certified Public Accountants (AICPA), The Public Company Accounting Oversight Board (PCAOB), and the International Federation of Accountants (IFAC) (Colbert and Bowen, 1996; O'Donnell and Rechtman, 2005). Each of these organizations has published a standard to assist with the definition of control objectives and the evaluation of internal control related to IT within an organization. Colbert and Bowen (1996) have compared 5 documents which are issued by ISACA, IIA, COSO, AICPA and IFAC with respect to audience, control objectives and focus. They found that the audience focus for internal control evaluation varies but the internal control objectives are similar across the documents. This study has chosen to use the objectives, evaluations and tests delineated by the IFAC in the statement of Information Technology in the Accounting Curriculum (IFAC 1995) which is a similar document used when the IT Audit Manual for

public sector audit was formulated by the National Audit Department of Malaysia. Other studies that used the same parameters are by Hermanson et al. (2000) and Abu-Musa (2008).

The development of the questions and scales of the questionnaires pertaining to each individual variable in this study is formulated based on the IFAC document and also by referring to instrument used in previous studies (Hermanson et al., 2000; Abu-Musa, 2008; Burton, 2000; Jackson, 2000). The questionnaire was further adapted to suit the public sector auditing environment and geographical region of Malaysia. 400 mail self-administered questionnaires were sent to National Audit Department of Malaysia (NAD) which was later distributed to its staff. Respondent of the questionnaires is limited to both the auditor from internal audit department of Ministries and auditors from National Audit Department who are involved in IT related auditing. A few interviews have also been conducted with the division's managers and auditors to discuss some aspects concerning the IT control evaluation activities in the Malaysian public sector. After excluding the incomplete and invalid questionnaires from 79 respondents, the research ended with 73 usable questionnaires which represent a response rate of 18.25%. A reliability test was carried out on the collected data using the Cronbach Alpha model, to explore the internal consistency of the questionnaire. IT evaluation control, audit objectives and usage of CAATTs show reliability scale of alpha level at 0.974, 0.834 and 0.777 respectively. The result of the overall reliability test shows that the questionnaire design is highly reliable, and the collected data are highly reliable and consistent ($\alpha = 0.966$).

The collected data were processed using SPSS version 17. Descriptive statistics of collected data were analysed for understanding the main characteristics of the research variables and to identify the frequency of internal control evaluation activities, audit objective, organisation characteristics and the usage of CAATTs across the Malaysian public sector organisation. The Kruskal Wallis test analyses the group difference on the organization structure. The correlation matrix was used to examine the relationship between IT evaluation control activities and auditors competency. Further, the relationship between factors that influence the different performance of IT control evaluation activities by public sector auditors were addressed through eight model of regression (one for each ITC described in Table 1).

The factors represented by independent variables labeled X_1 to X_{10} are described in section 2.2 to 2.5. Finally, an average score for the eight evaluation models (one for each ITC) was computed and labelled as "ITC_Overall". In the overall evaluation model, the dependent variable "ITC_Overall" was regressed on the ten independent variables(X_1 to X_{10}), using the regression equation:

$$ITC_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \varepsilon$$

Where

β_0 -constant (y intercept); β_j -regression confession, ε regression error and

X_1 - Audit Objective related to evaluation of efficiency, effectiveness and economy of IT use;

X_2 - Audit Objective related to evaluation of compliance with policies, procedures and regulation;

X_3 - Audit Objective related to evaluation of internal control computerised information system (CIS);

X_4 - Audir Objective related to evaluation of fairness of financial statement;

X_5 - Usage of CAATTs;

X_6 - Competencies of auditors.

X_7 - Types of auditor in performing IT related audit; X_8 - Size of the department;

X_9 - Structure of CIS in data processing;

X_{10} - Percentage of new system in the department.

FINDINGS AND DISCUSSION

Demographic analyses

The collected data showed that 31 respondents were from federal government division, 20 were from internal audit units of ministries and departments and 14 respondents were from ICT division, representing 42.5, 27.4 and 19.2% respectively (Table 2). Only 6 respondents belong to state government divisions and 2 from statutory body divisions. The statistics in Table 2 revealed that 59% of the respondents are IT auditors while the balance is general auditors. It is also observed that approximately one-half of respondents are performing audits with the computer using software, while 37% are conducting the audit through the computer and 11% are around the computer. Almost 58% of respondents are performing audits in decentralised data processing system. The responding auditor's organisations have an average of 2.27 numbers of auditors and median of two, indicating that majority of the respondent organisations have 10 to 29 staffs. The results also indicate that 70 % of the clients of these respondents have installed new CIS system in their organisation which is represented by the mean of 2.38 and the median of 2. On average, the respondents have experience in IT related auditing between 4 to 9 years and they have attended IT related training less than three times a year in past 3 years (mean of 1.60 and median of 1 time per year).

Descriptive analyses

Performance of IT control evaluation activities

From Table 3 it appears that the auditors in public sector place the greatest weight on application processing control (ITC_8) and data integrity, privacy and security control (ITC_5). The results are consistent with the Hermanson et al. (2000) and Abu-Musa (2008). The results exposed that moderate attention has been given to IT asset safeguarding control (ITC_4), operating system processing activity control (ITC_7) and system development and acquisition control (ITC_1). It also rendered that public sector auditors place least interest in data recovery plans (ITC_6), system maintenance and program changes control (ITC_3) and system implementation control (ITC_2). Through subsequent interviews with selected respondents, they highlighted that application processing control and data integrity, privacy and security control were given the highest priority due to the current transformation of Malaysian government into e-business. As such the internal control is one of the most important elements in ensuring the reliability of government financial statements and the protection of the government confidentiality.

The results of the Kruskal-Wallis test summary in Table 3 shows that IT control evaluation activities do not vary across the different organisation structure explained in Section 2 apart from system development and acquisition

Table 1. Types of IT evaluation controls.

IT evaluation control	Type of activity
ITC_1	New systems development and acquisition. The internal auditor evaluates the acquisition standards and methods that are used, whether the standards and methods are being used correctly, and whether system development technologies are being used correctly (Hermanson et al., 2000).
ITC_2	Examines systems under development to evaluate the quality of the testing, the accuracy of the data conversion, and the effectiveness of the post-implementation evaluations (Hermanson et al., 2000).
ITC_3	Considers revision to existing systems and evaluates the program-change controls, methods, and procedures, and whether these are operating properly (Hermanson et al., 2000).
ITC_4	Considers IT assets and facilities management. Ensuring IT assets are safeguarded is an important task for the auditor. The evaluation in this area also may include inspections of the actual computer locations and assessments of staffing practices, data centre access, and data libraries (Warren et al., 1998).
ITC_5	Encompasses data integrity, privacy, and security. As open systems, electronic data interchange (EDI), and internet communications become more prevalent, this evaluation will become even more important (Hermanson et al., 2000). Uncontrolled or loosely controlled networks increase business risk by enhancing the possibility of problems such as data tampering, destruction of data through infection with viruses, business interruption through loss of network communications, and legal liability through theft of personally confidential or firm confidential data (Warren et al., 1998).
ITC_6	Is concerned with continuity of processing/disaster-recovery planning. ITC_6 allow organisations to resume their systems operations as quickly as possible following a disaster (Ivancevich et al., 1998).
ITC_7	Considers control over operating systems and networks. Some of the tests considered in ITC_7 include evaluation of the cost effectiveness of the IT, evaluation of the procedures to manage the operating system and network, evaluation of the network reliability, evaluation of the sufficiency of the performance measures, and evaluation of compliance with the standards and procedures set for the operating system and network (Hermanson et al., 2000).
ITC_8	Deals with the traditional application-processing flows and controls. This evaluation includes determining whether the data for the application are processed correctly, preventing errors and omissions, ensuring the reliability of the data-processing outputs, and ensuring that only properly authorised transactions are processed (Hermanson et al., 2000).

control (ITC_1), system maintenance and program changes control (ITC_3) and IT asset safeguarding control (ITC_4) at the significance level p = 0.00625. Auditors in internal audit units of ministries place highest concern on the ITC_3 and ITC_4. Further analysis is conducted through short interviews with selected respondents and it shows that internal audit department of ministries has more IT auditors than in other divisions. It was argued in the literature that IT people place greater emphasis on the system whereas general auditor/financial auditors are more concerned with business process and accounting (Baker, 2007).

Performance of IT audit objectives

The statistical results in Table 4 show that evaluation of compliance with policies , procedures and regulation is the most common IT audit objective when evaluating CIS (X_2 , 4.37) and followed by evaluation of internal control in CIS (X_3, 4.16). Evaluating efficiency, effectiveness and economy of IT usage is given moderate attention by the public sector auditors (X_1, 3.95). Least attention is given to evaluation of the fairness of financial statements and to the accuracy and completeness of records (X_4, 3.6). Audit objective related to the evaluation of the compliance with policies, procedures and regulations is given high weight because all Malaysian public sector organisations are strictly subject to the government circulars and procedures on financial management of the government fund. The results of Kruskal-Wallis tests in Table 4 disclose no significant differences among different divisions in the government regarding the evaluation objectives except for evaluation of compliance with policies, procedures

Table 2. Demographic profile of respondent (N = 73).

Organisation characteristic		Frequency	%
Structure of organisations	Federal Government Division	31	42.47
	Internal Audit Department of Ministries	20	27.40
	ICT Audit Division	14	19.18
	State Government Division	6	8.22
	Statutory Bodies Division	2	2.74
Types of auditors	General auditor	30	41.1
	IT auditor	43	58.9
Style of auditing	Around the computer	8	11.0
	Through the computer	27	37.0
	With the computer	38	52.1
Structure of CIS in data processing	Centralised	31	42.5
	Decentralised	42	57.5

	Mean	Median	Std. deviation
Total number of auditor in the organisation	2.27	2.00	0.786
Percentage of new computer in the organisation for past 3 years	2.38	2.00	0.637
Auditors experience in IT related auditing	1.73	2.00	0.672

Table 3. Types of IT control evaluation (N = 73).

Type of IT control evaluation	Mean	Std. deviation	No. of test	K_W Government (Sig. value)
ITC_8 Application processing control	4.054795	0.89583	4	0.046
ITC_5Data integrity, privacy and security control	4.002283	0.903736	6	0.426
ITC_4 IT asset safeguarding control	3.794521	1.105025	1	0.005*
ITC_7 Operating system processing activity control	3.786693	0.818966	7	0.037
ITC_1 System development and acquisition control	3.462329	1.182681	4	0.006*
ITC_6 DRP	3.307241	1.168286	7	0.290
ITC_3System maintenance and program changes control	3.263699	1.174003	4	0.005*
ITC_2 System implementation control	3.246575	1.130426	3	0.060

*Significant with Bonferroni correction for multiple comparisons, p_{05} = 0.00625.

and regulations (X_2) at significance level p = 0.0125.

Performance of various usage of CAATTs

Table 5 shows that public sector auditors mostly use CAATTs as a problem solving aid (3.51) with data integrity tests (3.38) being the second most common use. Usage of CAATTs in system analysis and documentation is moderate (3.19). Least attention is given to CAATTs as program or system testing tool (3.05) and as an administrative tool (2.92). The results of Kruskal-Wallis tests summary in Table 5 reveal that the usage of CAATTs did not vary across the government audit structure at significance level p = 0.01.

In addition, the findings also show that all the public sector organisations (federal government division, state government division, statutory bodies division, ICT division and internal audit department of ministries) pay equal attention on the usage of CAATTs in their IT related auditing. This may be due to the expanding role of e-business in the Malaysian government; as such auditors begin to incorporate state-of-art auditing software application in the auditing process (Braun and Davis, 2003).

Table 4. IT audit objectives (N = 73).

IT audit objective		Mean	Std. deviation	K-W Government (Sig. value)
X_2	Evaluation of compliance with policies, procedures and regulations	4.37	.993	0.004*
X_3	Evaluation of internal control in CIS	4.16	.913	0.423
X_1	Evaluation of efficiency, effectiveness, and economy of IT usage	3.95	1.189	0.373
X_4	Evaluation of fairness of financial statement and the accuracy and completeness of record	3.60	1.115	0.156

*Significant with Bonferroni correction for multiple comparisons, p_{05}=0.0125.

Table 5. Usage of CAATTs (N = 73).

Usage of CAATTs	Mean	Std. deviation	K-W Government (Sig. value)
CAATTs as problem solving aids	3.5068	1.27064	0.128
CAATTs in data integrity testing	3.3836	1.32948	0.482
CAATTs use in system analysis and documentation	3.1918	1.37090	0.610
CAATTs use in system or program testing	3.0548	1.34258	0.758
CAATTs an administrative tool	2.9178	1.26659	0.480

*Significant with Bonferroni correction for multiple comparisons, p_{05} = 0.01.

Table 6. Comparison of Kruskal Wallis tests on IT control evaluation activities by organisation characteristics (N = 73).

Variable		Type of auditors*	Size**	Structure of CIS*	New system**
			Sig. value		
ITC_1	System development and acquisition control	.181	.505	.645	.249
ITC_2	System implementation control	.126	.386	.923	.556
ITC_3	System maintenance and program changes control	.098	.097	.114	.722
ITC_4	IT asset safeguarding control	.451	.143	.907	.061
ITC_5	Data integrity, privacy and security control	.281	.257	.210	.221
ITC_6	DRP control	.065	.093	.234	.390
ITC_7	Operating system processing control	.385	.066	.151	.339
ITC_8	Application processing control	.636	.451	.488	.007*

Significant with Bonferroni correction for multiple comparisons: *$p_{.05}$ = 0.025 ; **$p_{.05}$ = 0.0167.

Organizational characteristics and IT control evaluations

The Kruskal Wallis tests summary in Table 6 indicate that both general auditors and IT auditors gave an equal importance to all IT control evaluation activities at significance level p = 0.025. This may be due to the organisations' heavy emphasis on IT related auditing as a result of the e-government implementation. Besides, the accounting records and audit evidences which are in electronic form need to be verified and validated by all auditors.

The results also exposed that public sector auditors are giving equal attention when evaluating the IT control irrespective of the size (p = 0.0167), structure of CIS in data processing (p = 0.025) and the implementation of new system in the clients organizations (p = .0167) apart from evaluation of application processing (ITC_8) which indicates auditors place different emphasis when clients' organizations have implemented new system.

This may be due to auditors concern for the correctness and validity of the new transaction flow and to ensure all the general and application controls are tested accordingly.

Multiple regression analysis

Factors that contributed to the evaluations of IT control

Before conducting the regression analysis, the variables are analysed for their distribution. The purpose of the normality test is to determine the correct type of statistical

analysis to be employed in further examining the relationship of the variables. The normal plot of regression standardised residuals for dependent variables of the nine models indicated a relatively normal distribution and the scatterplot of residuals against predicted values for the entire nine models show that there is no clear relationship between the residual and the predicted value that is consistent with the assumption of linearity. The correlation matrix for the nine models confirms that there is no multicollinearity among variables since none of the variables correlates above 0.8. In addition, there are no predictor variables that produce variance inflation factor (VIF) greater than 10, confirming that multicollinearity is not a problem in this study. The results of the multiple regressions are presented in Table 7.

The results of the eight models (one for each ITC) give insight into the factors associated with differential performance of IT control evaluation activities by the Malaysian public sector auditors. The statistical results exposed that across the eight individual OLS regression models, the adjusted R^2 has varied from 16 to 53%, and all the eight models (one for each ITC) are significant at $p = 0.016$. The results proposed that the regression models appear to have important explanatory power and support the hypothesis that the evaluations of IT control activities performed by public sector auditors are connected to the IT audit objectives, organisational characteristics, usage of CAATTs and the competency of auditors.

From Table 7, we depicted the Overall multiple regression equation thus;

$ITC_{overall}$ = 16.621 + 11.424 Internal Control - 9.613 Financial Statement + 2.521 CAATTs

Several appealing patterns emerged from the eight regression models (one for each ITC). First, audit objectives related to fairness of financial statements and accuracy of accounting records appear to have the greatest association with the area of evaluation identified by IFAC. Public sector auditors with fairness of financial statement objectives are more likely to perform evaluation in five out of the eight control evaluations. Second, the usage of CAATTs appears to have the strongest association with the IT control evaluation activities.

Public sector auditors mostly used CAATTs in evaluating seven out of eight IT control evaluations. Third, the existence of new systems may play a role in public sector auditors' evaluations. There is some evidence in three out of eight IT control evaluation that testing is more extensive when new computerised systems are involved. Fourth, auditors' competencies and structure of CIS do not have any association with the IT control evaluation. Finally, audit objective related to efficiency, effectiveness and economy of IT use (X_1) and compliance (X_2) have minimal impact on the IT evaluations activities. These factors only appear to significantly affect one out of eight IT evaluation activities. These may be explained by the structure of the public sector organisation which majority of Malaysian public sector auditors are performing the General IT Audit as stipulated in the IT Audit Manual of the organization which relates to the general controls and application controls of the government accounting system. Only in 2008 after the restructuring of the public sector organisation, new division was created to perform more specific IT related auditing. The types of auditors (X_7) and the size of organizations (X_8) have least impact on the IT evaluations acti-vities possibly due to the lack of qualified IT audit staff and the small size of audit departments which are likely to restrict the range and scope of duties carried out by the audit departments in organizations.

The managers of those organizations might also be reluctant to be involved in such activities because they are busy with daily routine work activities or are utilizing them in other value added activities (Abu-Musa, 2008). As the samples for this study consist of IT auditors who are trained to be IT specialist and general auditors who have basic IT knowledge, there is a possibility that auditors do not see the necessity to develop comprehensive IT skills.

CONCLUSION AND RECOMMENDATIONS

It appears that the most frequently performed IT control evaluations are application processing control and data integrity, privacy and security control. System maintenance and program change control and system implementation control are given least attention. It is observed that public sector auditors in different divisions performed differently in evaluations of a) system development and acquisition control, b) system maintenance and program change control and c) IT asset safeguarding. IT audit objectives related to compliance with policies, procedures and regulation is given higher consideration while objectives related to fairness of financial statement and accuracy of accounting record are given lesser consideration during the IT control evaluations. Malaysian public sector auditors frequently used CAATTs as problem solving aids and infrequently used CAATTs as an administrative tool. Furthermore the usage of CAATTs did not vary across the divisions. The study also points out that IT control evaluations are not associated with public sector auditors' competencies. IT control evaluations performed by public sector auditors are not affected by organisation characteristics except for application processing controls which vary according to the new systems in the client organisation.

The study revealed that public sector auditors are currently concentrating on application processing and data integrity control when evaluating IT controls. This may be due to the small number of IT specialist in the public sectors organizations as the majority of the auditors are trained to be a general auditor. As such

Table 7. Summary of multiple regression analysis - Correlation coefficient and significant value of each independent variables (N = 73).

Dependent variable	Model			Independent variable										
				Sign of coefficient										
				Sig. value										
	Adj. R^2	Sig.		β_0	X_1 Efficiency, effective economy	X_2 Compliance	X_3 Internal control	X_4 Financial statement	X_5 CAATTs	X_6 Competency	X_7 Types of auditors	X_8 Size	X_9 Structure of CIS	X_{10} New system
ITC1 Sys. Development and acquisition	0.350	0.000	b_j	0.182	0.020	10.909	10.615	20.053	0.238	0.227	0. 808	0.538	0.928	0.909
			Sig.	0.964	0.975	0.052*	0.074	0.000*	0.021*	0.0561	0.428	0.441	0.390	0.280
ITC2 Sys. Implementation	0.166	0.016	b_j	0.769	0.175	0.878	0.732	0.871	0.242	0.021	10.138	0.177	0.209	0.208
			Sig.	0.815	0.737	0.266	0.315	0.038*	0.004*	0.947	0.171	0.755	0.812	0.760
ITC3 Sys. Maintenance and program Δ	0.281	0.000	b_j	0.444	0.942	0.654	10.469	20.192	0.195	0.442	10.59 1	0.610	0.023	0.312
			Sig.	0.916	0.163	0.518	0.119	0.000*	0.067	0.0278	0.137	0.403	0.984	0.721
ITC4 IT Safeguarding	0.201	0.006	b_j	10.477	0.200	0.292	0.616	0.314	0.067	0.005	0.64 1	0.375	0.241	0.095
			Sig.	0.163	0.231	0.246	0.010*	0.020*	0.013*	0.958	0.017*	0.041*	0.390	0.663
ITC5 Data integrity, privacy, security	0.318	0.000	b_j	20.597	0.947	0.799	10.459	0.521	0.423	0.022	20.32 4	0.994	10.246	20.011
			Sig.	0.586	0.211	0.483	0.167	0.385	0.001*	0.962	0.055	0.227	0.326	0.044*
ITC6 Disaster recovery plan	0.344	0.000	b_j	10.109	0.661	10.737	20.688	20.580	0.703	0.222	30. 695	0.169	30.557	10.149
			Sig.	0.875	0.554	0.304	0.087	0.005*	0.000*	0.742	0.040*	0.889	0.061	0.431
ITC7 Operating system	0.342	0.000	b_j	50.264	10.702	0.900	10.052	0.464	0.392	0.137	10. 022	10.816	0.723	20.030
			Sig.	0.289	0.033*	0.447	0.336	0.456	0.002*	0.773	0.411	0.036*	0.583	0.051*
ITC8 Application processing	0.533	0.000	b_j	50.143	0.350	0.809	10.794	0.619	0.261	0.298	0.451	0.389	0.554	20.092
			Sig.	0.052	0.397	0.196	0.003*	0.062	0.000*	0.236	0.490	0.385	0.424	0.000*
ITC Overall Overall ITC evaluation	0.415	0.000	b_j	160.621	40.997	70.394	110.424	90.613	20.521	0.636	110.669	30.965	30.016	60.986
			Sig.	0.507	0.209	0.218	0.041*	0.003*	0.000*	0.791	0.066	0.357	0.650	0.179

*Significant at the 0.05 level (2-tailed).

auditors did not have sufficiently detailed knowledge to perform system related controls. Thus, the public sector auditors tend to concentrate more on the traditional evaluation in respect of the internal control and the process flow of the transactions. The role of IT audit in the public sector organizations was largely just to add support to the financial and performance audit. Therefore, given the backdrop of intense development of e-government effort in Malaysia, it is suggested that public sector organizations should emphasize and develop a stronger IT audit teams. Perhaps, public sector organization should not only recruit more audit personnel with IT background in order to perform more evaluations on system related controls but to educate the so called business auditors to play a more important role in IT audit activities.

It is suggested that further studies of the Malaysian private sector auditors be conducted to investigate the current pattern of the IT control evaluation activities. Besides, future researchers should also further examine why public sector auditors seem to be performing less work relating to system implementation control, system maintenance and program changes control, and IT asset safeguarding. It is also recommended to investigate whether usages of CAATTs and auditor competency have acted as mediator or moderator in IT control evaluation activities.

This study is not without limitations. The responses from the respective samples were relatively small and we feel that a better empirical analysis can be done if the samples are larger and enhance the generalisability of the results. Despite the limitation, this study is pioneering the effort to contribute towards an understanding of the IT control evaluation activities of the Malaysian public sector auditors. This study offers the audit management an understanding of the internal controls evaluation activities performed by the public sector auditors. The results of the study will enable policy makers to enhance the role of the public sector auditors such as incorporating the audit in the implementation of the IT projects to ensure all related controls and risks are given adequate attention.

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