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A business process gap detecting mechanism between information system process flow and internal control flow

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ABSTRACT

The information system (IS) has become an important backbone of the modern enterprise, which has caused electronic data generated by the IS to be more easily manipulated and destroyed than hardcopy data. It is therefore important for auditors to assure that the IS is well-controlled and secure. Auditors generally use Computer-Assisted Audit Techniques and Tools (CAATTs) to assist them in auditing the IS, though given the growing complexity of these systems, it is hard to completely perform a control test of the systems. This research aims to develop a mechanism, namely the Business Process Gap Detecting Mechanism (BPGAP-Detecting Mechanism), to automatically detect the business process gap between IS processes and internal control flows. This study also justifies the feasibility of BPGAP-Detecting Mechanism by providing a real case study. The result indicates that the BPGAP-Detecting Mechanism can assist the case company in resolving data quality problems that have occurred in its ERP (Enterprise Resource Planning) system and can also provide additional information for the company.

1. Introduction

During the last several decades, the information system (IS) has become the backbone of the modern enterprise because of its efficiency and effectiveness. However, electronic data generated by the IS have become easier to change, manipulate, or destroy. These aspects of IS have created an easier way for crime to take place [16]. This fact was quantified in the 2005 Computer Crime and Security Survey, which revealed that losses caused by computer crimes and computer security breaches were $130,104,542 for the 639 respondents in 2005 [17]. Hence, it is important for auditors to assure that ISs are adequately controlled, secured, and function as intended [39].

Reassuring IS security in the modern business environment requires a complete understanding of the continuous events that comprise the way businesses organize their activities. An important way to attain this understanding is to deconstruct a business into its underlying business processes [5]. It should be noted that the Sarbanes–Oxley (SOX) Act [44] requires both managers and auditors to force firms to follow their business activities more closely and verify controls over the firm's financial reporting processes [23]. To improve the performance and efficiency of business processes, IS activities should be recorded in a log that indicates when and who accesses what data [3]. These logs should be reviewed frequently to ensure that system activities parallel business activities [43].

However, the increasing complexity and variety of IS along with the need to uncover unrevealed information provides auditors with serious challenges. It is difficult to audit the IS if auditors do not know the data structure and process flow inside the system. When auditing the IS, either the control test or the substantive test is conventionally required. The control test indicates the illegal actions which have violated internal controls, while the substantive test is performed to test the material misstatements afterwards [40]. In general, auditors use the Computer-Assisted Audit Techniques and Tools (CAATTs) to support them in auditing these systems [11,36,43]. Most CAATTs provide the substantive test of the IS, but it is more effective to review the controls of the systems than to audit the output data [53]. In addition, the CAATTs which only provide the substantive test of the IS may fail to find the business process gap between IS process flow and internal control flow. The above phenomenon may lead to poor data quality, the mask-up effect, incorrect decision-making, or fraudulence.

Therefore, the control test is essential for the CAATTs to ensure that the business process gap does not exist between IS process flow and internal control flow. In specific, both the control test and substantive test should be included to complement each other in the CAATTs. In practice, auditors should not only audit the output data produced after

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the IS process flow, but audit the activities conducted during the IS process flow itself. For some complex information systems, they need to perform more control tests rather than only substantive tests or control tests in order to reduce the audit risk to an appropriate level [57].

It is doubtless that CAATTs can help auditors to audit the IS in either a static or dynamic way. Although many CAATTs were proposed in the past two decades, they are still in their infancy and possess some limitations and drawbacks. Generalized Audit Software (GAS), Parallel Simulation, Test Data, and Integrated Test Facility (ITF) focus on the output data produced by the IS. They provide the substantive test and risk assessment, and cannot detect the business process gap between the IS process flow and the internal control flow. Although the concept and execution of the control test are not difficult to realize, the prototype systems/commercial software which can perform the control test are limited.

An Embedded Audit Module can detect the business process gap between the IS process flow and the internal control flow by working with the IS. However, it is difficult to construct a general system which can combine with different IS. Additionally, client cooperation is also a disadvantage of Embedded Audit Module [20], as auditees are not always willing to be cooperative with auditors, whose applications affect their IS. In short, because of the complexity of the IS without combining the CAATTs with these systems, it is difficult to conduct the entire control test of the IS.

As a result, this paper aims to propose a mechanism to automatically perform a control test of the IS of firms. This prototype system is expected to achieve the following objectives:

- automatically identify the internal control for the audit objects;
- automatically identify the IS process flow for the audit objects;
- automatically compare the internal control flow with the IS flow to detect any differences between these two flows.

In addition to the aforementioned objectives, this study can also be recognized as an effective development practice which can provide the structured form, formal logic and mathematical algorithm for the whole auditing process and can be used as a reference for future researchers and practitioners.

2. Literature review

2.1. Computer-assisted audit techniques and tools

Over the past two decades, several CAATTs were proposed by prior studies of auditing [11,13,15,20,36,43], such as GAS, Parallel Simulation, Test data, ITF, the Embedded Audit Module, and so on. This study classifies them into three categories: Substantive Tests, Control Tests, and Hybrid Tests including both Substantive Tests and Control Tests. The classification of CAATTs is tabulated in Table 1.

Table 1
Classification of computer-assisted audit techniques and tools.

Test type	CAATTs	Estimated by	Degree of embedded on client's system	Software
Substantive test	Generalized Audit Software(GAS)	Output data	N/A	ACL/IDEA
	Parallel Simulation	Output data	N/A	N/A
Control test	Test data	Output data	N/A	N/A
	Integrated Test Facility (ITF)	Output data	Middle	N/A
Both	Embedded audit module	System processing/ output data	High	Oracle/SQL Server /IBM DB2

The purpose of the substantive test is to ensure the integrity and data quality of the output data produced by the IS. Both GAS and Parallel Simulation can perform the substantive test, though GAS is the most frequently used technique of CAATTs [11]. GAS software like Audit Command Language (ACL) and Interactive Data Extraction and Analysis (IDEA) are widely employed by firms. It has a friendly user interface to extract the data produced by the systems and analyzes the patterns of variables. By constructing another identical IS, Parallel Simulation will compare and verify the data produced by both systems to detect the gap/difference between two systems.

The control test, including risk assessment and compliance tests, is used to ensure IS process flows. Both Test Data and ITF can perform the control test. Test Data is a technique in which auditors prepare the input data for the auditee's IS and analyze the output results to assess the potential risk of the systems. The ITF is similar to the Test Data, as both ITF and Test Data employ some dummy data as test sets to help auditors analyze the output result of the dummy test data and to detect any potential risk.

The Hybrid Test, like the Embedded Audit Module, can perform both substantive tests and control tests. The Embedded Audit Module combines the audit module with the IS, and can therefore monitor the IS process flow and collect data. However, it is less popular due to its difficulty in getting cooperation of the auditee and in constructing a general system which can combine with different ISs.

2.2. Dynamic modeling tools for internal control flow

Internal control is a process that permeates an organization's activities and hence, provides reasonable assurance that the following control objectives are achieved [43]. To this end, internal control is critical to any business organization. Without the ability to ensure the accuracy and reliability of information produced by ISs, it is difficult for a business organization to survive in a competitive environment [8]. Furthermore, the implementation of ISs and other associated systems performed in business process is not straightforward [19]. For these reasons, it is necessary to assure that the IS process flow conforms to the planned control objective. The design and evaluation of systems of internal control also have become important tasks to auditors. This is because they are charged with responsibility of certifying to the reliability of information produced by ISs [8].

Auditors evaluate information reliability by assessing whether or not the appropriate system controls are in place and under operating effectively [18]. Almost all practicing auditors employ some sort of internal control system, such as questionnaires, narrative descriptions, and flowcharts, in their resulting evaluation process [8]. Utilizing the computer-assisted methods has the unique advantage of bringing the speed, accuracy, and great memory capacity of the computer to carry out the internal control evaluation problem [8,34]. The computer-assisted evaluation actually allows the utilization for larger and more complex models. Moreover, it can be much more rigorous than the using of manual methods [8,34].

To complete the assessments of the reliability of system controls, IS auditors firstly need to understand the IS processes information [18]. In order to realize the system and thus, conduct the control test for an IS, auditors rely heavily on an understanding of the internal control flow of the IS. Therefore, it is important to choose a suitable, computer-assisted dynamic modeling tool to keep track of the internal control flow of the IS. The most common tools are: Flowchart [21], Event-driven Process Chain (EPC) [56], extended Event-driven Process Chain (eEPC) [25,46], IDEF [7], Unified Modeling Language (UML) [10,45], Data Flow Diagram (DFD) [47,52], Business Process Modeling Notation (BPMN) [49], and Petri-Net [12]. Table 2 classifies them into three categories: workflow model, dataflow model, and mathematical model. The classification can focus the modeling tools on the usage.

The purpose of the workflow model is to depict the dynamic workflow which has the sequential, iterative, parallel, and conditional