

# Audit Decisions: The Impact of Interactive Reviews with Group Support System on Information Ambiguity

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## ABSTRACT

**Manuscript type:** Research paper

**Research aims:** This paper examines the impact of interactive reviews and the effectiveness of group support system (GSS) in mitigating information ambiguity in audit decisions.

**Design/ Methodology/ Approach:** The research employed a laboratory experiment, with 74 students serving as subjects. In this study, the following information ambiguity were manipulated: (1) insufficient and complex data, (2) sufficient and complex data, or (3) sufficient and non-complex data. The decision-making process (individually and through GSS interaction) was also manipulated. In this research, audit decisions made of the client's internal control system served as the dependent variable.

**Research findings:** Analysis shows that ambiguity level has a negative effect on the accuracy of audit decisions. The empirical evidence acquired suggests that GSS-based interactive review increases the accuracy of audit decisions. It further shows that the GSS-based interactive review can be effective and practical as a strategy to mitigate information ambiguity in the audit decision making process during the planning stage.

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**Theoretical contribution/ Originality:** By investigating the benefits of information technology as a control mechanism for the auditing process and by looking at how it alters auditors' behaviour and how it enables the auditing team to behave in reviewing their work, this study contributes to extant literature. This research fills in the theoretical gap by using GSS to mitigate the ambiguity of information.

**Practitioner/ Policy implication:** The result of this study will encourage auditor to use GSS as a means of communication between the audit team leader and members.

**Research limitation/ Implications:** The limitation of this study lies in its using a single leader and not other members of the audit team to do the GSS in the experimental manipulation.

**Keywords:** Audit Decisions, Experimental Research, Group Support System, Information Ambiguity

**JEL Classification:** M42

## 1. Introduction

Literature published in the last two decades focussing on analytical procedure (Ameen & Strawser, 1994; Hirst & Koonce, 1996; O'Donnell & Schultz, 2005; Trompeter & Wright, 2010) highlights the importance of accurate professional judgement when determining the initial expectation of clients in auditing. This finding is supported by Messier, Simon, and Smith (2013) who conclude that analytical procedure research in the past two decades has provided a number of important findings about the significant difference between the auditor's expectation and the client's reported results.

According to Trompeter and Wright (2010), analytical procedure practice has undergone changes and the two main causes can be traced to technological progress and audit approach. This is so because technological progress can provide tools to support the decision making process in the analytical procedure. In addition, the auditing method developed over the last two decades is risk-based auditing, an approach which relies on an analytical procedure as its basis for evaluating clients' operation and potential risk of material misstatements (Curtis & Turley, 2007). Moreno, Bhattacharjee, and Brandon (2007) confirm that the risk-based audit approach which uses technology tends to provide better audit evidence data in the analytical procedure.

Regulations emphasising compliance with audit standards imply the importance of an audit firm that can enforce a more effective control

system. This is important because it helps to ensure audit quality (DeFond & Lennox, 2011) which tend to depend on auditors who should make accurate decisions while performing audit procedures. Luippold and Kida (2012) provide empirical evidence which shows that the main cause of inaccurate determination of initial hypotheses is information ambiguity. They say that ambiguity is any set of information that can cause various interpretations. They further add that data sufficiency and data complexity are the main causes of information ambiguity.

However, the effect of information ambiguity on the accuracy of auditors' decision may be mediated by the use of information technology (IT) which, according to Dowling and Leech (2014), enables auditors to make more accurate decisions. This is because the use of IT not only causes the control of the audit process to be more effective but also alters auditors' behaviour (Dowling & Leech, 2014). In their research, Dowling and Leech find that the presentation of information using IT affects reviewers' judgement which appears to be more effective. This finding is in contrast to previous researches asserting that electronic reviews are ineffective (Bible, Graham & Rosman, 2005; Bedard, Ettredge & Johnstone, 2007; Rosman, Biggs, Graham, & Bible, 2007).

The current study employs a laboratory experimental design to examine the impact of information ambiguity on audit decision during the audit planning stage. It uses IT as a tool to help mitigate information ambiguity. The use of IT in the review process is indicated by the interaction between team members and their audit team leaders in a group support system (GSS). Adding a GSS as a means to mitigate information ambiguity could fill the research gap because this issue has not been raised by previous research. The current study adopts three levels of ambiguity that are based on Luippold and Kida (2012), namely (1) insufficient and complex data; (2) sufficient and complex data; and (3) sufficient and non-complex data.

The findings of this research will contribute to behavioural research, specifically in auditing. Firstly, there is empirical evidence to show that information ambiguity in the analytical procedure reduces the accuracy level of professional judgement during the planning stage. Secondly, the findings indicate that IT-based interaction in audit teams increases the accuracy level of judgement. Thirdly, this research also has a professional implication in that audit firms can use the results as a learning method for auditors to enhance the quality of their work.

The rest of this paper is organised as follows: Section 2 explains the audit environment in Indonesia. Section 3 reviews the prior literature

and develops the hypotheses. This is followed by an explanation on the methodology employed to conduct this study. Sections 5 and 6 present and discuss the findings. Section 7 concludes.

## **2. Audit Environment in Indonesia**

Indonesian public accountants are supervised by the Ministry of Finance but they retain their professional independence by organising themselves to become what is known as the Indonesian Institute of Certified Public Accountants (IICPA) or Institut Akuntan Publik Indonesia (IAPI) in Indonesian. As a professional organisation of public accountants, IAPI administers public accountant certification test, codifies and publishes professional standards and ethics of public accountants, and administers continuing educational programmes for all public accountants in Indonesia. In exercising their professional practice, Indonesian public accountants have to comply with Act No. 5 Year 2011. This Act specifies that only public accountants could offer "Assurance Service", i.e. provide assurance on measurement of financial and non-financial information to users based on specific criteria. Thus, the role played by public accountants is important as the financial statements of corporations in Indonesia are mandated to be audited by these accountants. Despite their crucial role, the number of accountants in Indonesia is relatively low compared to that of other ASEAN countries. According to the World Bank, the approximate number of accountants in Indonesia as at 2014 was 20,735, whereas the Philippines, Malaysia, Singapore, and Thailand have 21,586, 32,750, 28,869 and 57,467 accountants respectively (The World Bank Report, 2014). The Indonesian Ministry of Finance stated that in 2014, there were only 1,054 public accountants in 110 Certified Public Accountants firms. In addition, majority (333 person) of the public accountants were 59 years old and above and only 10 public accountants were under 30 years of age. Due to this wide gap, there is an urgent need to increase the number of accountants in Indonesia. In 2014, the Indonesian Ministry of Finance also issued a blueprint (The Regulation of the Minister of Finance of Republic Indonesia Number. 25/PMK.01/2014) to regulate the certification pathway towards becoming public accountants.

## **3. Literature Review and Hypotheses Development**

In practice, an auditing team consists of junior auditors, senior auditors, audit managers and partners. Fieldwork is mostly done by

junior auditors who are under the supervision of the more senior and experienced members of the team. This phenomenon is even more prevalent as the shortage of public accountants in Indonesia is escalating. This makes the need for efficient communication between team members even more necessary. Nonetheless, one possible electronic tool that can be used for communication purposes can be traced to the internet or group support system (GSS).

Auditing goes through stages. During the planning stage, information about a client's condition is received by the auditors. This information helps them to understand the nature of the client's business and industry. It also helps them to assess the client's internal control system. Researchers in the areas of medicine, auditing and psychology suggest that the decision-making process starts with the determination of an initial hypothesis which guides the subsequent data collection process (Koonce, 1993). Any inaccuracy of the final decision is therefore, the consequence of any inaccuracy that occurred at the initial hypothesis stage (Bedard & Biggs, 1991; Luippold & Kida, 2012). Empirical evidence provided by Luippold and Kida (2012) shows that data insufficiency and complexity can cause information ambiguity which, in turn, might lead to the auditors' failure to determine the initial hypothesis with accuracy. In this regard, it is crucial that the audit team leaders review their junior auditors' output and provide feedback as a way to increase the accuracy of their professional judgement. These leaders can use technology-based communication methods such as emails (Brazel, Agoglia, & Hatfield, 2004), telephones (Schultz & Reckers, 1981; Reckers & Schultz, 1982) or computer technology (Arnold et al., 2000; Murthy & Kerr, 2004) to inform the junior auditors of the reviewing results.

### ***3.1 Information Ambiguity and Audit Decision Making during the Audit Planning Stage***

During the planning stage, the audit decision making process consists of a preliminary analytical procedure which conducts a test of the internal control system. The analytical procedure involves four stages namely (1) diagnostic processes that form a mental representation; (2) hypothesis formulation; (3) information search; and (4) hypothesis evaluation (Koonce, 1992; 1993). These four stages are interactive thus, the decisions made in the first stage can affect the analytical procedure in the subsequent stages. Therefore, should any inaccuracy occur, auditors must perform the first stage all over again. According to the

AICPA (2008), the first stage is the most important stage in the analytical procedure. It has the highest risk of errors (Bedard & Biggs, 1991). This means that an accurate hypothesis formulation can enable auditors to detect any financial statement misrepresentation during the analytical procedure (Asare & Wright, 2003).

Various biases can also lead to inaccurate auditor decision making. For instance, auditors' judgement bias may be affected by the strategic assessment and impact to halo effect bias (Bell, Marrs, Solomon, & Thomas, 1997; Bell, Peecher, & Solomon, 2002; O'Donnell & Schultz, 2005). Confirmation biases also may be affected by the instructions received by auditors (McDaniel & Kinney, 1995; Yip-Ow & Tan, 2000; Peecher, Piercey, Rich, & Tubbs, 2010). Recency biases or primacy biases are impacted by the modes of information presentation (Hogarth & Einhorn, 1992) or even the media of information (Ricchiute, 1984; Boritz, 1985). The main cause of inaccurate judgment is the ambiguity of the data (Luippold & Kida, 2012).

Research has been conducted to investigate information bias. Hsee (1995; 1996) and Russo, Meloy, and Wilks (2000) investigated the role of self-serving bias and judgement bias, respectively, in individual decision making. They find that information ambiguity is a general condition in an organisation and has a significant influence on managerial decision making (Ho, Keller, & Keltyka, 2005). In the budgeting context, Ho, Keller, and Keltyka (2002) demonstrated that majority of the managers are ambiguity averse in the profit condition and ambiguity seeking in the loss condition. Hogarth (1989) explains that information ambiguity occurs during uncertainty.

In the auditing context, information ambiguity may emerge when auditors attempt to understand their clients' business and industry. Initial information of clients is beneficial in determining misstatement risk during the planning stage. It also helps to determine the nature, extent and scope of the subsequent test (Arens, Elder, & Beasley, 2012). Initial information can take the form of quantitative and qualitative data based on clients' internal sources or from industries. Luippold and Kida (2012) have evidence to show that data sufficiency and complexity can affect auditors' decision-making process at the initial analytical procedure. Data are sufficient when they are comprehensive (Luippold & Kida, 2012). Information complexity refers to the amount of audit evidence or the length of the presented evidence (Hogarth & Einhorn, 1992). In the investment context, Pinsker (2007) tested 20 units of positive evidence followed by negative evidence while Pinsker (2011) tested 40

units of positive evidence followed by negative evidence. The results of both tests show that the more complex the information presented, the more likely it is that information ambiguity and biased decision making will emerge.

From this, it therefore follows that the more information auditors receive, the more hypotheses related to data can be developed. Thus, information is likely to be more ambiguous and so auditors will require a more cognitive information processing climate to eliminate inaccurate hypotheses (Luippold & Kida, 2012). Based on previous research and arguments, this research hypothesises the following:

- H<sub>1</sub>: Ambiguous information reduces the accuracy of decision-making.
- H<sub>1a</sub>: An audit decision based on sufficient and complex data is more accurate than an audit decision based on insufficient and complex data.
- H<sub>1b</sub>: An audit decision based on sufficient and non-complex data is more accurate than an audit decision based on sufficient and complex data.
- H<sub>1c</sub>: An audit decision based on sufficient and non-complex data is more accurate than an audit decision based on insufficient and complex data.

### 3.2 *Mitigating Effect of Supervisor Reviews in a Group Support System*

Janvrin, Bierstaker, and Lowe (2008) and Bedard, Deis, Curtis, and Jenkins (2008) suggest that an electronic workpaper system is an information technology tool that can mitigate the risk management process of a public accounting firm. Where audit members are not stationed in one location, audit team leaders can rely on information technology to supervise and conduct reviews on their members' work. The reviews are a means of mitigating inaccuracies otherwise information ambiguity causes audit decisions to be inaccurate. However, reliance on information technology can affect auditors' behaviour (Dowling & Leech, 2014).

In the budgeting context, Chalos and Poon (2000) argue that in-group performance is better because group members have opportunities to share information. Using manufacturing firms as their research context, Banker, Field, Schroeder, and Sinha (1996) demonstrate that sharing information within a team significantly increases the outcome

quality or labour productivity. Therefore, it can be concluded that interaction within a group potentially increases the quality of decision making.

The audit task is a hierarchically structured one and this implies that junior auditors' work is always reviewed by auditors at a higher level. This practice helps to increase the quality of the audit judgement. The audit review process is an essential part of an audit task (Trotman, 1985; Libby & Trotman, 1993; Tan, 1995). Reviewers tend to search for evidence that is not consistent with the information provided by junior auditors (Libby & Trotman, 1993). Supervisors, as reviewers, do not accept junior auditors' judgement in determining the preliminary misstatement risk at face value. Supervisors' reviews are a form of knowledge sharing – from superiors to junior auditors. Vera-Munoz, Ho, and Chow (2006) suggest that three factors affect the success of the knowledge-sharing process: information technology, formal and informal interaction in the audit team, and the incentive system.

Information technology enables auditors to access materials and important documents outside firms thereby, increasing the efficiency and quality of decision making. Jessup, Connelly, and Tansik (1990) provide an example of computer-mediated communication tools such as a web-based decision support system that combines communication, computer and decision technology to support group decision making and related tasks. In the auditing context, group interaction takes the form of brainstorming (Carpenter, 2007; Hoffman & Zimbelman, 2009; Brazel, Carpenter, & Jenkins, 2010). The modes of interaction are face-to-face, telephone communication, electronic mail and computer interaction.

An experimental research to investigate the effect of a brainstorming session on the relationship between fraud risk and the audit procedure chosen was performed by Carpenter (2007) and Hoffman and Zimbelman (2009). Carpenter (2007) tested brainstorming in a hierarchical team. His study came to the conclusion that teams produce more lists of fraud risk than individuals. In contrast, Hoffman and Zimbelman (2009) investigated the role of brainstorming in the audit planning procedure. Their results show that, in the case of a high level of fraud risk, documents prepared by the brainstorming process are more effective in modifying the audit standard procedure than documents prepared without a brainstorming session. Brazel et al. (2010) conducted a survey on auditors. They find sufficient evidence to imply that high-quality

brainstorming increases the relationship between the fraud risk and the assessment of fraud risk.

Prior researches show that electronic-based communication can be influential in decision making during group interactions. However, researches looking at the use of a GSS and its effect on group members' performance and satisfaction show conflicting results. An experimental study conducted by Arnold et al. (2000) shows that the decisions produced by a GSS are better than individual decisions. Kerr and Murthy (1994) also find that individuals working in GSS have greater learning than those working in non-GSS environment.

On the other hand, Adler and Borys (1996) find that auditors may respond negatively to the system if they perceive the task as merely for formalisation and compliance with firm policies. They may also perceive the 'task' as routine (Bamber & Snowball 1988). Adler and Borys (1996) argue that top management regulatory laws are imposed to discourage enabler orientation which is to the benefit of the coercive orientation. They also note that formalisation undermines employees' commitment as well as fosters dissatisfaction. As a result, the auditor will reject the system and attempt to work around it (Bedard et al., 2007; Bedard, Jackson, Ettredge, & Johnstone, 2003). Conversely, Dowling and Leech (2014) find that electronic-based communication makes auditor reviews more effective. If the auditors perceive the system to clarify his task and responsibility, he will then respond positively to the system (Adler & Borys, 1996; Bamber & Snowball, 1988).

Brazel et al. (2004) suggest that interactions using electronic mails tend to be passive and is one-way, thereby, negating the two-way communication between reviewers and junior auditors. Arnold et al. (2000) acknowledge that their research has a low level external validity because it does not successfully create an experimental setting that reflects an electronic-based discussion in the auditing practice. Previous research had used computers for intrateam interaction when discussing certain problems and when making decisions (Arnold et al., 2000; Brazel et al., 2004). Team members at the same level would communicate so that convergence which can change the initial decision can be achieved. Communication can also be carried out between team members and team leaders as a form of superiors' reviews of their subordinates. Such reviews tend to increase the quality of individually produced decisions. A GSS enables the reviewers to give feedback to the junior auditors so that junior auditors' consideration in identifying

misstatement risk is more accurate. Thus, it is hypothesised that group interaction is important in decision making.

Studies looking at the review process of working papers have emphasised on the importance of reviews and feedback to share knowledge (Gibbins & Trotman, 2002; Brazel et al., 2004; Fargher, Mayorga, & Trotman, 2005). In the reviewing process, reviewers and reviewees can engage in face-to-face interaction to discuss their interests (Vera-Munoz et al., 2006). According to Dowling and Leech (2014), information technology acts as a control mechanism in the audit process. Hence, the use of an IT-based audit system can offer competitive advantages to auditors (Carson & Dowling, 2012) and improve their efficacy (Banker, Chang, & Kao, 2002). Thorough emphasis from regulators on compliance with audit standards highlights the importance of the effectiveness of a control system in ensuring audit quality (Bedard, Deis, Curtis, & Jenkins, 2008; DeFond & Lennox, 2011). Technological advancement enables reviewers to review working papers electronically and to send their notes to junior auditors who prepare reports through electronic mails. Because supervisors' reviews potentially generate bias in reviewees, this study proposes the use of interactive reviews based on a GSS as an approach to generate reviews. Based on the arguments above, this study proposes the following hypotheses:

- H<sub>2</sub>: A GSS-based interactive review increases the accuracy of audit decisions.
- H<sub>2a</sub>: Under the condition of insufficient and complex data, the audit decision after the GSS-based interactive review is more accurate than before a GSS-based interactive review.
- H<sub>2b</sub>: Under the condition of sufficient and complex data, the audit decision after a GSS-based interactive review is more accurate than before a GSS-based interactive review.
- H<sub>2c</sub>: Under the condition of sufficient and non-complex data, the audit decision after a GSS-based interactive review is more accurate than before a GSS-based interactive review.

#### **4. Methodology**

In this study, a number of variables are involved. The first independent or manipulated variable is data ambiguity. Following Luippold and Kida (2012), data ambiguity is deemed to exist on three levels: insufficient and complex data, sufficient and complex data, and sufficient and non-

complex data. The second independent variable is whether subjects interact with or without a GSS. The dependent variable or measured variable comprises the audit decision, that is, the assessment of the internal control system which is measured on a scale from 10 to 100. A higher score indicates that the subjects perceive the client to have a reliable internal control system. A low score implies the opposite.

This study employed an experimental research method. Students as proxy for auditors were asked to assess the internal control system of the sales cycle of a company based on the information provided to them. There were weaknesses in the internal control which were only revealed during the interaction between members of the audit team.

The research instrument used in this study was adapted from Luippold and Kida (2012). It was pilot tested with some auditing lecturers and public accountants in Central Java Province, Indonesia. Additionally, a discussion of the validity of the instrument was made with a partner of a public accounting firm in Central Java Province. Following a series of pilot tests, the instrument was modified and refined before it was used in the experiment.

#### **4.1 Selection of Subjects**

This research used students as a proxy for auditors. This is because the analytical procedure assignment is a general one which can be performed by junior auditors (Bonner & Walker, 1994; Moreno et al., 2007). The task did not require any experience. The basis for using students as proxy was supported by previous GSS-based research which also used students as subjects (Reckers & Schultz, 1982; Kerr & Murthy, 1994; Arnold et al., 2000; Murthy & Kerr, 2003; Kerr & Murthy, 2004). In this study, the subjects are undergraduate students who have passed their auditing courses and completed their auditing practices, thus, they can be assumed to have an understanding of the internal control tests.

Eighty four (84) students who have passed the auditing courses and auditing practices at two universities (private and state) in Central Java and Yogyakarta province in Indonesia were selected to participate in this experimental research. The mean Cumulative Grade Point Average (CGPA) of the subjects is 3.23 and their mean age is 21.25 years. They were each randomly assigned to one of three groups as can be seen in Table 1 below. A randomisation procedure is used because it increases the likelihood of having similarity of variation of audit knowledge for the individuals in each group.

One client profile test and two manipulation check tests were conducted throughout the experiment. Subjects who could not answer at least two questions in the profile test or manipulation check test correctly were excluded from the experiment. Upon screening, the final sample consists of 74 subject (38 males and 36 females) with 26 subjects in Group 1 (Insufficient and Complex data), 25 subjects in Group 2 (Sufficient and Complex Data), and 23 subjects in Group 3 (Sufficient and Non-Complex Data).

Table 1: Experimental Matrix

Group	Data Ambiguity	Communication Method	
		(Before GSS)	(After GSS)
1	Insufficient and complex data	Cell 1	Cell 2
2	Sufficient and complex data	Cell 3	Cell 4
3	Sufficient and non-complex data	Cell 5	Cell 6

## 4.2 The Experiment

The experiment consists of eight stages or steps which are explained below. The flow of the experimental research is shown in Table 2.

### 4.2.1 Step 1

In step 1 of the experiment, subjects were informed that they were acting as junior auditors working for a certain audit firm. They then opened the website of the experiment module and filled in their assigned ID number. Thereupon, they were shown the client's company profile which belonged to an international manufacturing firm. Subjects were then asked three questions about the client's profile in order to assess their understanding of the case given. The given questions are listed in Appendix 1. Subjects who answered at least two questions correctly were considered to have passed the test of understanding of the client's profile. They then moved on to step 2 of the experiment.

### 4.2.2 Step 2

In step 2, subjects received information according to the treatment in each group. A sample of the information received by subjects in Group 1 is provided in Appendix 2.

The auditing standard stipulates that an audit process has to obtain sufficient and competent evidence. Sufficiency of evidence refers to data quantity while the competence of evidence is associated with data quality. High-quality data have to be relevant to decision making. According to Luippold and Kida (2012), sufficiency is related to the notion of information completeness and it refers to whether or not an information set contains the necessary evidence for auditors to arrive at a correct solution. The second factor of ambiguity is complexity which refers to the amount of information (Hogarth & Einhorn, 1992). Data are said to be sufficient when they are comprehensive (Luippold & Kida, 2012), and data are said to be complex when they are lengthy (Hogarth & Einhorn, 1992). Presentation of complex information may result in more ambiguity (Pinsker, 2007; 2011; Luippold & Kida, 2012). In this study, insufficient data are deemed to be irrelevant while sufficient data are deemed to be relevant to decision making. Non-complex data refer to those data considered small whereas complex data refer to data that are lengthy.

Since the auditing standard stipulates the need to have sufficient and competent data, this study adopts the concept of sufficient data and non-complex data. Consequently, sufficient and non-complex data are expected to possess a high sufficiency-to-complexity ratio (approaching 1). This study employs the approach proposed by Luippold and Kida (2012) which classifies data sufficiency and complexity into three levels namely insufficient and complex data, sufficient and complex data, and sufficient and non-complex data.

In this study, subjects in Group 1 (Insufficient and Complex data) received lengthy but irrelevant data about the internal control system for the sales cycle. More specifically, the data consist of: (a) the time the company started its operation; (b) the product order system; (c) the high-quality woods chosen by the company for its production; (d) the use of foreign experts to maintain product quality; (e) the storing of finished goods in a warehouse; (f) the use of only experienced staff to perform sales activities; (g) the routine check of the inventory card by warehouse staff; and (h) the company's active participation in trade exhibitions overseas. From the data provided, only three are relevant information items (items (e), (f) and (g)). The other items are irrelevant to the sales cycle. In this regard, the data received by subjects in Group 1 are considered to be insufficient and complex.

Subjects in Group 2 (Sufficient and Complex data) received lengthy data which are quite relevant to the internal control system

for the sales cycle, namely, (a) the company's operation in 1990; (b) the company's furniture production which is based on job orders; (c) the selection of high-quality woods by the company for its production; (d) the hiring of foreign quality control expert to test the product quality; (e) the storing of the company's finished goods in a warehouse; (f) the selection of only experienced staff to perform sales activities; (g) the full computerisation of sales; (h) the authorisation of sales by the sales manager; (i) the computerised sales invoices are pre-numbered; (j) the routine check of warehouse inventory cards by staff; and (j) the company's active participation in trade exhibitions overseas. Of the 11 information items provided, only 6 (items (e), (f), (g), (h), (i) and (j)) are relevant. Thus, data received by subjects in Group 2 are considered to be sufficient and complex.

Lastly, subjects in Group 3 (Sufficient and Non-Complex data) were given short information which are relevant to the sales cycle. Specifically they are (a) the selection of only experienced staff to perform sales activities; (b) the full computerisation of sales; (c) the authorisation of sales by the sales manager; and (d) the computerised sales invoices are pre-numbered. Although the number of information items is small, all of them are relevant to determine the effectiveness of the internal control of the sales cycles. Hence, data received by the subjects in Group 3 are considered to be sufficient and non-complex.

#### 4.2.3 Step 3

After receiving the information, subjects were requested to score the client's internal control system (10 to 100). Subjects assessed and gave the score of the client's internal control system based on the information received. They would give a high score (50 to 100) when they considered the internal control system to provide a reasonable assurance, and low score when the internal control was bad (10 to 49).

#### 4.2.4 Step 4

In step 4, subjects sat for the Manipulation Test 1. They received three questions on information about the firm's internal control system on sales. Subjects who answered at least two questions correctly were considered to have passed the manipulation check and thus, they qualified to move to the next step. A sample of the questions is attached in Appendix 3.

#### 4.2.5 *Step 5*

Subsequently, the computers displayed information about a review from the audit team leader. This review comprises a short analysis of the assessment of the client's business risk and internal control. In this study, the client's business risk was considered high. All the three groups received the same information.

#### 4.2.6 *Step 6*

In step 6, subjects were given an opportunity to interact (via chatting) with their audit team leaders while discussing the results of the review. For ease of reference, subjects in Groups 1, 2 and 3, before they chatted with their audit team leaders, were identified as subjects in Cells 1, 3 and 5 respectively. Subsequent to the interaction with the leaders, they were known as subjects in Cells 2, 4 and 6 respectively.

The role of the audit team leader was played by a computerised system. This consists of computerised chatting that automatically displayed sentences thereby, enabling the subjects to interact with their audit team leaders. The programme presented sentences which emphasised that the subjects should consider some important information gleaned from the interim audit. This information, namely the client's business risk, the client's business continuity in the future and sales documents that cannot adequately support sales transactions, is necessary in order to determine the audit decision. A sample of the chat between a subject in Group 1 (Insufficient and Complex data) and his audit team leader is provided in Appendix 4.

#### 4.2.7 *Step 7*

In step 7, subjects sat for Manipulation Test 2. The subjects received three manipulation check questions regarding the audit team leader's review. Subjects passed the manipulation check when they answered at least two questions correctly. The questions are provided in Appendix 5.

#### 4.2.8 *Step 8*

After chatting with their respective team leaders, the subjects re-assessed the internal control system. The experiment ended with a debriefing to explain the previous audit simulation.

Table 2: Flow of the Experiment

Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7	Step 8
Subjects in Cell 1 receive instructions and answer client profile check questions.	Subjects in Cell 1 who passed the client profile test, receive insufficient and complex data.	Subjects in Cell 1 assess and gave the score of client's internal control.	Subjects in Cell 1 answer manipulation check questions (Manipulation test 1).	Subjects in Cell 1 who passed the manipulation test 1, receive additional data on client.	Subjects in Cell 1 who passed the manipulation test 1, interact with the audit team leader (after the GSS, known as Cell 2).	Subjects in Cell 2 answer manipulation check questions (Manipulation test 2).	Subjects in Cell 2 determine the final judgement.
Subjects in Cell 3 receive instructions and answer client profile check questions.	Subjects in Cell 3 who passed the client profile test, receive sufficient and complex data.	Subjects in Cell 3 assess and gave the score of client's internal control.	Subjects in Cell 3 answer manipulation check questions (Manipulation test 1).	Subjects in Cell 3 who passed the manipulation test 1, receive additional data on client.	Subjects in Cell 3 who passed the manipulation test 1, interact with the audit team leader (after the GSS, known as Cell 4).	Subjects in Cell 4 answer manipulation check questions (Manipulation test 2).	Subjects in Cell 4 determine the final judgement.
Subjects in Cell 5 receive instructions and answer client profile check questions.	Subjects in Cell 5 who passed the client profile test, receive sufficient and non-complex data.	Subjects in Cell 5 assess and gave the score of client's internal control.	Subjects in Cell 5 answer manipulation check questions (Manipulation test 1).	Subjects in Cell 5 who passed the manipulation test 1, receive additional data on client.	Subjects in Cell 5 who passed the manipulation test 1, interact with the audit team leader (after the GSS, known as Cell 6).	Subjects in Cell 6 answer manipulation check questions (Manipulation test 2).	Subjects in Cell 6 determine the final judgement.

## 5. Findings

To ensure that the randomisation is effective, a one-way ANOVA test was conducted to eliminate inter-group differences in individual characteristics with the risk of material misstatement and demographic characteristics (gender, age and CGPA). ANCOVA test was also done to check whether the research is confounded by subjects' differences in accounting or auditing skills and to verify that only the manipulation affects the dependent variable. In the ANCOVA test, the dependent variable is the audit decision on the internal control system, the independent variable is the data presentation and the covariate variable is the score of basic accounting and auditing knowledge. The ANCOVA result indicates that this research is not confounded by subjects' differences in accounting or auditing skills and that only the manipulation affects the dependent variable. The first hypothesis was tested using ANOVA and the second hypothesis was tested with a paired *t*-test.

### 5.1 Test of Hypothesis 1

This study hypothesises that the level of information ambiguity reduces the accuracy of audit decisions in the analytical procedure. Table 3 displays the results of the independent *t*-test for hypotheses  $H_{1a}$ ,  $H_{1b}$  and  $H_{1c}$ . Hypothesis  $H_{1a}$  compares the audit decision based on sufficient and complex data with the audit decision based on insufficient and complex data. The results indicate that the audit decision score based on sufficient and complex data is 74.40 while the audit decision score based on insufficient and complex data is 67.31. In this context, the audit decision refers to the internal control of the sales cycle. Where the subjects perceived that the information is not ambiguous, they will make audit decision more accurately. The higher the score before GSS, the more accurate is the audit decision based on the analysis of the data available to the subjects. After GSS, subjects were aware of the high business risk of the client thus, they reassessed their decisions. The lower the score after GSS, the more accurate is the audit decision based on the analysis of the data. In sum, hypothesis  $H_{1a}$  is supported with a significance value of 0.05.

Hypothesis  $H_{1b}$  compares subjects' audit decision based on sufficient and complex data (mean=74.40) with subjects' audit decision based on sufficient and non-complex data (mean=79.13). The independent *t*-test shows that there is no significant difference between the two subject groups, implying that  $H_{1b}$  is not supported.

Table 3: Descriptive Statistics

Ambiguity Level	Average Score	Std Deviation	Minimum	Maximum	F	Sign
PANEL A Hypothesis 1a						
Insufficient and Complex data (N=26)	67.31	14.29	30	80	1.269	0.05*
Sufficient and Complex data (N=25)	74.40	11.56	40	90		
PANEL B Hypothesis 1b						
Sufficient and Complex data (N=25)	74.40	11.56	40	90	0.017	0.21
Sufficient and Non-Complex data (N=23)	79.13	14.11	30	100		
PANEL C Hypothesis 1c						
Sufficient and Non-Complex data (N=23)	79.13	14.11	30	100	1.038	0.01*
Insufficient and Complex data (N=26)	67.31	14.29	30	80		

Note: \* indicates significance at 5% level (2-tailed).

Hypothesis  $H_{1c}$  compares subjects' audit decision based on sufficient and non-complex data (mean=79.13) with subjects' audit decision based on insufficient and complex data (mean=67.31). The independent *t*-test shows that there is a significant difference (sig.=0.01) between the two groups, implying that  $H_{1c}$  is supported.

The first hypothesis was further tested on a more aggregate level by using ANOVA to compare the audit decision based on three levels of ambiguity. The independent variable is the three levels of data ambiguity (Insufficient and Complex data; Sufficient and Complex data; and Sufficient and Non-Complex data) while the dependent variable is the score of the internal control system of the sales cycle (before chatting). Tables 4a and 4b display the descriptive statistics of the internal control system score of the three levels of ambiguity.

The ANOVA test demonstrates the significant effect (at the 0.01 level) of information ambiguity on the accuracy of the audit decision. The post-hoc test results indicate that the groups that exhibit a difference in the internal control assessment mean are Cell 1 (Insufficient and Complex data) and Cell 5 (Sufficient and Non-Complex data). This is indicated by the mean difference of -11.83 between the two groups (sig.=0.05). The results imply that data ambiguity is represented by Insufficient and Complex data, and Sufficient and Complex data, and not by Sufficient and Non-Complex data. Overall, the research result is consistent with Luippold and Kida (2012) who suggest that data sufficiency and complexity have a significant effect on audit decision making.

Table 4a: ANOVA Results of Hypothesis 1

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	1,745.258	2	872.629	4.875	0.010
Intercept	399,947.176	1	399,947.176	2.234E3	0.000
Ambiguity Level	1,745.258	2	872.629	4.875	0.010**
Error	12,710.147		179.016		

Note: \*\* indicates significance at 5% level.

Table 4b: Post-Hoc Test Bonferroni

Cel	Cell	Mean Difference	Std Error	Sig.	95% Confidence Level	
					Lower Bound	Upper Bound
Cell 1	Cell 3	-7.09	3.74	0.19	-16.28	2.09
	Cell 5	-11.83*	3.83	0.01	121.21	-2.43
Cell 3	Cell 1	7.09	3.74	0.19	-2.09	16.28
	Cell 5	-4.73	3.86	0.68	-14.20	4.74
Cell 5	Cell 1	11.83*	3.83	0.01	2.43	21.21
	Cell 3	4.73	3.86	0.68	-4.74	14.21

Note: \* indicates significance at 5% level.

## 5.2 Test of Hypothesis 2

The second hypothesis predicts that a GSS-based interactive review improves the accuracy of the audit decision. Previous researches (Arnold et al., 2000; Chalos & Poon, 2000) provide empirical evidence to suggest

that discussions within a group improve the decision quality. In this study, the subjects used web-based chatting facilities to discuss their matters with their audit team leaders.

In chatting, the supervisors emphasised the importance of paying more attention to information that was presented at the beginning. They also informed the subjects of the interim audit findings that is, the client suffered a high level of business risk and that there were some incomplete sales documents. After chatting, the subjects were requested to provide reasons for their previous decision to score the client's internal control system and to re-score it after the discussion with their supervisor.

A paired t-test was conducted on all three groups of information ambiguity to test hypothesis 2. This was done by comparing the audit decision of the internal control system before using the GSS and the audit decision after using the GSS. Table 5 shows the mean scores of the audit decisions before and after using the GSS.

Table 5: Mean Scores of the Audit Decisions on the Internal Control System (ICS) Before GSS and After GSS (High Business Risk Scenario)

Group	Mean (Std Dev.) ICS		Paired-Samples Test Sig.
	Before GSS	After GSS	
Insufficient and complex (N=26)	67.31 (14.29)	59.23 (13.83)	0.021
Sufficient and complex (N=25)	74.40 (11.56)	62.80 (16.21)	0.007
Sufficient and non-complex (N=23)	79.13 (14.11)	63.91 (16.16)	0.000
Average group (N=74)	73.38 (14.07)	61.89 (15.32)	0.000

The test of  $H_{2a}$  compares the audit decisions based on Insufficient and Complex data before and after using the GSS. Table 5 tabulates the results. The average value of the audit decision before using the GSS is 73.38, implying a moderate level of assessment. Through the GSS, the subjects received reviews from their audit team leaders who suggested that they should pay special attention to information on the client's internal control weakness and to make their audit decision accordingly.

The mean of the audit decision after using the GSS is 61.89. For  $H_{2b}$ , the average score of the audit decision when the subjects received Sufficient and Complex data is 74.40. After using the GSS with the audit team leader, the score is 62.80. Similarly, for  $H_{2c}$ , the audit decision under the condition of Sufficient and Non-Complex data shows a score of 79.13, and after using the GSS the score decreases to 63.91. In sum, the scores given by Groups 1, 2 and 3 before GSS are 67.31, 74.40 and 79.13, whereas after GSS, the scores are 59.23, 62.80 and 63.91. The range is narrower after GSS.

Table 6 shows that overall, the average value of the audit decision before using the GSS is 73.38 while after using the GSS, the mean is 61.89 (sig.). The results show that the GSS, as an interactive mechanism between subjects and audit team leaders, caused subjects to consider some important aspects of the client and then revised their decisions. The accurate score is low because in fact, the client has weaknesses in its internal control. The audit team leader reminded the subjects of the importance of internal control weakness. The subjects then gave their audit decision after communication with the team leaders.

Table 6: Result of Paired t-Test Score of the Audit Decision on the Internal Control System Before GSS and After GSS in High Business Risk

	Mean	Std Dev.	Paired-Samples Correlation (Sig.)	Paired-Samples Test (Sig.)
Audit Decision before GSS (N=74)	73.38	14.07	0.307	5.70
Audit Decision after GSS(N=74)	61.89	15.32	(0.008)	(0.000)

The above results demonstrate that interaction among members of the audit team even during the early stage of the audit assignment is vital for the audit team to arrive at a better or more accurate audit decision. Such a decision has a significant effect on the quality of the subsequent audit test.

### 5.3 Supplementary Analysis

This study also performed an additional test to provide a robust result. A similar experiment was conducted on different sets of information

using different subjects. In the second test, the client has a relatively low level business risk but had some sales documents that were incomplete. After the subjects had discussed the matter with their audit team leaders through an electronic-based chatting platform, they scored their client's internal control system lower than before chatting with their superiors. This is because the interactive discussion provided the initial data which they used when making the initial judgement. Thus it enabled the subjects to rethink and consequently, they revised their initial judgement. From this, it can be concluded that the GSS has a positive effect on the accuracy of the audit judgement. The mean scores of the audit decision on the internal control system before GSS and after GSS are tabulated in Table 7 below.<sup>1</sup>

Table 7: Result of Paired t-Test: Score of the Audit Decision on the Internal Control System Before GSS and After GSS (Low Business Risk Scenario)

#### PANEL A

Group	Mean of Internal Control Assessment (Std Dev.)	
	Before GSS	After GSS
Insufficient/complex	68.08 (14.43)	61.92 (14.15)
Sufficient/complex	77.04 (12.03)	70.74 (10.72)
Sufficient/non-complex	82.00 (9.57)	71.60 (13.13)
Average	75.70 (12.01)	68.08 (12.67)

#### PANEL B

	Mean	Std Dev.	Paired-Samples Correlation (Sign)	Paired-Samples Test (Sign)
Judgement before GSS	75.64	13.35	0.611 (0.000)	5.684 (0.000)
Judgement after GSS	68.07	13.30		

## 6. Discussion and Implication

The findings of this study suggest that the level of information ambiguity, namely (i) insufficient and complex data; (ii) sufficient and

<sup>1</sup> Due to constraint to space, the details of this test will not be discussed here, but available from authors upon request.

complex data; and (iii) sufficient and non-complex data, can potentially lead to inaccuracy in decision making. There is empirical evidence which shows that audit decisions made with insufficient and complex data differ significantly from audit decisions made with sufficient and complex data. Further, it is noted that the score of the audit decisions of subjects in Cell 1 with insufficient and complex data (67.31) is lower than the score of the audit decisions of subjects in Cell 5 who were given sufficient and non-complex data (79.13). The subjects in Cell 1 had considered the client's internal control to be weak based on the available data, thus implying that the information does not provide reasonable assurance. Also, the score of Cell 5 indicates that subjects rely on the information that was not ambiguous for them to make audit decisions.

Other findings from this study show that the audit decisions of the subjects in Cell 3 (Sufficient and Complex data) are no different from those of the subjects in Cell 5 (Sufficient and Non-Complex data). The scores of the audit decisions of the two groups do not differ significantly. These results show that the subjects are not affected by the information presented (Sufficient and Complex data, or Sufficient and Non-Complex data).

Further, this study also indicated that the audit decisions of subjects provided with insufficient and complex data (Cell 1) differ significantly from the audit decisions of subjects provided with sufficient and complex data (Cell 3). Sufficiency and complexity refer to the comprehensiveness and length of the data provided. Where the data were insufficient and complex, the information was lengthy but not comprehensive. This occurrence affected the quality of the decision making as indicated by the score of 67.31. Meanwhile, sufficient and complex data provided information which was relevant to decision making (score=74.40). The higher score of the decision indicates that the subjects perceived the reliability of internal control although there was weakness in the internal control system. The importance of the GSS in the subject's audit decision making was tested in hypothesis 2 which will be discussed below.

Based on the findings of the test of the first hypothesis, it can be ascertained that the level of information ambiguity affects decision-making. When performing the analytical procedure, auditors often have difficulties in connecting one set of data with another one. Similarly, when receiving information about the client, the subjects potentially suffered from ambiguity. The determinant of ambiguity is data complexity which refers to the amount of information contained in

each set of data (Hogarth & Einhorn, 1992). When data are presented in some sets of information, the fluctuation in data requires a more complex analysis and a deeper cognitive process to determine the cause of the fluctuation. This occurrence increases decision inaccuracy.

In the tests for hypothesis 2 which were decomposed into  $H_{2a}$ ,  $H_{2b}$  and  $H_{2c}$ , it was shown that the GSS process can alter subjects' decision. The GSS, a computer-mediated form of communication, facilitates subjects' simultaneous interaction with audit team leaders to solve their problems. Audit team leaders' review emphasised the importance of subjects considering other factors that can potentially affect the internal control assessment and this includes the client's business risk. The findings of this study therefore, support Arnold et al. (2000), Adler and Borys (1996), Bamber and Snowball (1988), Brazel et al. (2004), and Dowling and Leech (2014) which suggest that electronic-based interaction between team members produces more accurate decisions. Further, the GSS will increase the competitive advantage for auditors because the review process will be more effective. Carson and Dowling (2012) assert that the use of information technology in auditing improves the competitive advantage.

## 7. Conclusion

The findings of this study contribute to current literature in several ways. Firstly, the results provide empirical evidence to suggest that the more ambiguous a set of information presented is, the more inaccurate the audit decision tends to be. The results of this study also support the findings in Hogarth and Einhorn (1992), Pinsker (2007; 2011) and Luippold and Kida (2012). Secondly, this study finds that GSS-based interactive reviews increase the accuracy of audit decisions. This result supports Chalos and Poon (2000) who suggest that performance within a group is better because the group interaction enables individuals to share information. Banker et al. (1996) also show that sharing information has a significant role in improving the outcome quality or labour productivity.

The results of this study also corroborate Dowling and Leech (2014) who argue that information technology in auditing is a control mechanism of the audit process and it can alter auditors' behaviour. Their finding also implies that public accounting firms should utilise the GSS to review audit teams' work. With the GSS, audit team leaders are better able to communicate with their team members so that the audit decisions are made more accurate.

This study had examined the impact of the GSS by manipulating the communication with a single leader. In practice, however, auditors are likely to communicate with other members in the audit team too. Thus, future research can be conducted in a context where the subjects communicate not only with the audit leader but also with other team members. In addition, this study had focused on audit decision which used internal control evaluation with analytical procedure during the planning stage. Future research may be conducted to investigate the impact of information ambiguity on audit decision during other stages such as the testing and evaluating stages.

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## Appendix 1

Profile of Client and Question to check of understanding the information (for all Cells)

<b>YOUR ROLE</b>	Senior auditor of audit firm of <b>ABC &amp; Partners</b> which is located in <b>Jakarta</b> .
<b>NEW CLIENT</b>	<b>PT XYZ INDONESIA FURNITURE</b> which is located in Jakarta.
<b>TASK</b>	Determining the value of internal control system of sales system based on available information.

### Achievement Test 1

**Please answer correctly.**

1. You are now .....

  - a. The director of PT XYZ Indonesia Furniture.
  - b. Partner of audit firm of ABC & Partners.
  - c. Senior auditor of audit firm of ABC & Partners.

2. Your client's main activity is .....

  - a. Furniture.
  - b. Fashion.
  - c. Logistic.

3. Your task in this audit assignment is .....

  - a. Determining risk of material misstatement of sales account balance.
  - b. Evaluating client's internal control system.
  - c. Preparing client's financial statements.

## Appendix 2

The manipulation and the manipulation test of Cell 1 (Insufficient and Complex Data)

The following are information related to PT XYZ Indonesia Furniture:

- The company began its operation in 1990.
- The company produces furniture on a job-order basis.
- The company only chooses high-quality woods for its production.
- The company hires foreign quality control expert to test product quality.
- The company stores its finished goods at the warehouse.
- Only experienced staff perform sales activities.
- Warehouse staff routinely checks inventory card.
- The company actively participates in overseas exhibitions.

You are required to assess the values of internal control system of sales cycle based on the existing information.

How sufficient is the availability of information to determine the value of internal control system of sales cycle?

Sufficient									Very Sufficient	
10	20	30	40	50	60	70	80	90	100	

Based on the available information, please **determine the value of internal control system for client's sales cycle.**

Very poor									Very good	
10	20	30	40	50	60	70	80	90	100	

Please explain your reasons:

### Appendix 3

#### Manipulation Test 1 for Cell 1 (Step 4)

Please answer the following questions with answers that you consider most appropriate.

1. Information that you receive to determine the value of internal control system of sales system is:
  - a. Purchase
  - b. The company stores finished goods at the warehouse
  - c. Solvability ratio
  
2. Product quality is checked by:
  - a. Marketing manager
  - b. Production manager
  - c. Quality Control
  
3. Information presented to determine the value of internal control system of sales system but IRRELEVANT is:
  - a. Ratio information
  - b. The company actively participates in overseas exhibition.
  - c. Organizational structure information.

## Appendix 4

Chat Session between A Subject in Group 1 (insufficient and complex data) and the Audit Team Leader

< AUDIT TEAM LEADER>	: You and your team are assigned to assess internal control system of Internal Control System from PT XYZ Indonesia Furniture
<SUPERVISOR>	: Yes sir.
< AUDIT TEAM LEADER>	: I and the manager have assessed client's business risk. Our conclusion is that client's business risk is HIGH. We doubt the client's continuity in the future.
<SUPERVISOR>	: I and <participant's name>' team have determined the value of client's internal control system of sales cycle, Sir.
<AUDIT TEAM LEADER>	: What value did you assign to the client's internal control system?

Please offer your argument in the box provided and subsequently SEND

<Partisipant>	:
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## CHATTING 2

< AUDIT TEAM LEADER>	: Which information do you use to assess internal control system of sales system?
<SUPERVISOR>	: <ul style="list-style-type: none"> <li>• PT XYZ Indonesia Furniture began its operation in 1990.</li> <li>• The company produces furniture on a job-order basis.</li> <li>• The company only chooses high-quality woods for its production.</li> <li>• The company owns foreign quality control expert to test product quality.</li> <li>• The company stores its finished goods at the warehouse.</li> <li>• Only experienced staff perform sales activities.</li> <li>• Warehouse staff routinely checks inventory card.</li> <li>• The company actively participates in exhibition overseas</li> </ul>
<AUDIT TEAM LEADER>	: Is the information already complete to assess internal control system of sales system? Based on our assessment, our client's business risk is HIGH The client has uncertain business continuity in the future. We also found that some sales are not supported by sufficient document.

<SUPERVISOR> : Let me check my team's reasons.
<AUDIT TEAM LEADER> : Ok

Please offer your argument in the box provided and subsequently SEND

<Participant> :
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Based on the discussion with the partner, please determine **the final value** of Internal Control System of PT XYZ Indonesia Furniture

Very Poor									Very Good	
10	20	30	40	50	60	70	80	90	100	

Please explain your reason:

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How sufficient is the information from audit team leader to be used to determine the value of internal control system of sales cycle?

Inadequate									Very adequate	
10	20	30	40	50	60	70	80	90	100	

## Appendix 5

### Manipulation Test 2 for Cell 1 (Step 7)

Please answer the following questions with answers that you consider most appropriate.

1. You have made discussion via chatting with ....
  - a. Marketing manager
  - b. Audit team leader
  - c. Accounting manager
  
2. The level of client's business risk assessed by audit team leader is:
  - a. High
  - b. Low
  - c. Medium
  
3. Audit team leader provides results of review that ....
  - a. Information that is used to assess internal control system is sufficient.
  - b. Information that is used to assess internal control system is not sufficient
  - c. Information that is used to assess internal control system is very sufficient.

