UNIVERSITY OF TURKU

ABSTRACT

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Title	Order, Counter-order, Disorder – The role of the IT auditor in the financial statements audit.		
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Abstract

This thesis investigates the role of an IT auditor within a financial statements audit engagement. As the company's information system environment evolves in tandem with the emergence of disrupting technologies, financial auditors cannot adapt their audit to suit these ever-more complex environments. Financial auditors increasingly resort to the employment of IT auditors to certify the integrity and reliability of the financial information emitted by information systems. It thus becomes pertinent to study the role adopted by an IT auditor during these engagements and to explore the dynamics of a working relationship.

Therefore, this thesis seeks to define the role, duties and responsibility to IT auditors working with Financial auditors. In addition, the place of the IT auditor within the team and within the audit was inspected. For that purpose, a mixed-method case study was conducted via participant observation in a Big Four Audit Firm wherein the researcher took the role of an IT auditor-in-training. A process mining analysis on the formalization of the Planning and Conclusion workpapers of the IT audit complemented the research.

The analyses contribute to a clearer understanding of the role and duties of the IT auditor during a financial statements audit. In addition, they uncover and seek to explain the dynamics between IT and Financial auditors. An established hierarchical team structure was highlighted throughout the results of the process mining analysis. The main conclusion reached by this thesis established the IT auditor as subservient to the Financial auditors with complex team dynamics. Within itself, the role of the auditor is flexible and adjustable to the different audit engagements, but the comprehension of the IT environment of the client and the applicable controls, IT general and IT applications controls, are as mandatory as the presentation of the conclusions to the Financial auditors.

Key words	Auditing, Accounting, Big-4, Information System, IT Audit

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ORDER, COUNTER-ORDER, DISORDER – THE ROLE OF THE IT AUDITOR IN THE FINANCIAL STATEMENTS AUDIT

Master's Thesis
in Information System Science

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The originality of this thesis has been checked in accordance with the University of Turku quality assurance system using the Turnitin Originality Check service.

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LIST OF ABBREVIATIONS

AQ – Audit Quality

BP – Business Process

GAAP – Generally accepted accounting principles

GAAS – Generally accepted accounting standards

IS – Information Systems

ISA – International Standards on Auditing

ISO – International Organization for Standardization

IT – Information Technology

ITA – Information Technology Audit

ITAC – Information Technology Application Control

ITGC – Information Technology General Control

PCAOB – Public Company Accounting Oversight Board

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1 INTRODUCTION

The increasing ubiquity of Information Technology (IT) in companies transforms the landscape of their information system. Let us forgo the numerous emails to the IT department and open an automatically transmitted ticket to the helpdesk; let us forgo the manual transfer of journal entries in favour of a gradual and incremental automatic transfer. The purpose of those changes is, in the long term, to minimize the human component and focus the freed brain power on more advantageous endeavours.

Nonetheless, the repercussions brought by these trends affect all service providers of a company, and especially the auditors investigating the financial statements of said company. Hence, the reliance on IT results in financial statements depends on the maturity and control of the applications involved in the process. Financial auditors must have the knowledge and capacity to assess the IT environment. In addition, they must call upon specialists, IT auditors, to measure and certify the newly emerged risks. IT and Financial auditors must then work together to ensure the fairness and truth of the financial statements. However, the steep learning curve of working together remains incommodious for both IT and Financial auditors.

The contrast of a very regulated financial audit with the flexibility of an IT audit appears to be based on a non-organic and forced cooperation. The IT and Financial auditors are not forming a single team with a simple and clearly defined purpose, namely certifying the financial statements. On the contrary, the IT auditors have their own audit to conduct, consequently the certification of the financial statements may seem like a collateral of their own audit. This results in the information system accounting field and the accounting field working as two separate entities on different puzzles.

This behaviour is then reflected in practice where IT auditors works on their engagement independently from the Financial auditors, who in their turn are more concerned with the financial reporting. This issue has oft been addressed from a financial auditor or firm perspective. In such instances, the research focuses on making the IT auditor work seamlessly with the financial auditors. However, the separate elements defining a proper working relationship have not been studied as such. Indeed, communication, collaboration and cooperation in the IT audit and financial domain have seldomly been researched conjointly. Yet, the particular study of those parameters as a single issue, and not of three separate problems, may bring into light the elements necessary to create a team spirit amongst the auditors and the experts, thus enhancing subsequently audit quality.

1.1 Research Questions

This study seeks to understand the IT auditor and their duties within a financial statements audit. This understanding is only achievable through the exhaustive comprehension of the statutory place given to the IT auditor and its subsequent application in practice. As such, this study endeavours to answer the following questions:

(1) What is the role of the IT auditor within a financial statements audit?

a) What is the purpose of the IT auditor involvement in financial statements audits?
b) How is this purpose translated through the tasks effected by the IT auditor?
c) What are the responsibilities of the IT auditor relative to the financial statements?

Nonetheless, those questions alone are not sufficient to shed light on the place of the IT auditor within financial statements audits. Intrinsically, IT auditors share the financial statements audits with financial auditors who are ultimately responsible for the certification of the statements. The following questions must therefore be answered:

(2) How is the working relationship between IT and Financial auditors construed within the framework of a financial statements audit construed?

a) At which stages do IT and Financial auditors most communicate?

b) How is the cooperation between IT and Financial auditors illustrated through the audit formalization and documentation?

c) Where lies the responsibility of the planning and scope of the IT intervention on a financial statements audit?

1.2 Scope

This study focuses on uncovering the working conditions shared by IT and Financial auditors within a financial statements audit. For this purpose, the scope comprises all the components in which the IT auditors take part, namely the IT audit itself and the liaison with Financial auditors. As such, the parameters studied are the standards framing the IT

audit, and the duties given to the IT auditors in practice. Furthermore, as the relationships between auditors are a subject of interest, the communication means, and their formalized interactions are investigated.

1.3 Setting

The study takes place within the confines of the end-of-studies internship of the author at a Big-4 auditing firm in France. The internship was mainly conducted on-premises and lasted 6 months. Due to the COVID-19 pandemic, remote working was highly encouraged, when not mandatory. This situation influenced the present research in regard to the availability and accessibility of the resources needed. The focus of interest is the IT audit team of the branch and its interactions with the in-house Financial audit team. The author joined as an IT auditor-in-training and had the opportunity to simultaneously observe and integrate the team studied.

1.4 Method

A literature review highlighting the theory framing this cooperation is performed. This review has two objectives: discovering the place of IT audit within the financial statements and defining the parameters allowing an effective working relationship and especially effective communication amongst auditors.

A mixed-methods approach is taken, combining qualitative and quantitative methods. Via the qualitative method, the author endeavours to explore the context of the IT auditor's intervention and the resulting teamworking conditions with Financial Auditors. In addition, participant observation, as the qualitative method, completes and enhances the conduction of the quantitative method, therefore construing an embedded mixed-methods design. Via the quantitative method, Process Mining, the author seeks to provide answers concerning the formalization of the relationship between IT and Financial auditors.

2 BACKGROUND

2.1 Introduction

Stakeholders possess a vested interest in the financial health of an entity, and more particularly, in the management of its resources. As the latter has the potential to make the difference between wealth and poverty, it is essential for all involved parties to have a thorough understanding of the entity's inner workings. However, cases such as the Enron scandal and Waste Management Inc, have eroded the trust between an entity and its stakeholders. Those accounting scandals shed light into the auditing firms of those entities and their supposed role of trust-dealer between entities and their stakeholders (Li, 2011). Auditors failed at their duties, in part, because they could not detect fraud or expose it. This has highlighted the need for IT auditors, who have both the time and the means to inspect the entity's systems more precisely. They serve as middleman between financial auditors and the entities, their sole raison d'etre being to repair and reinforce the trust in auditing. To better understand the role of IT auditors within the financial statements cycle and their duties, the following sub-chapter focuses on understanding this intermediary role and on placing financial and IT auditors in their context.

2.2 Financial Audit

2.2.1 Definition

The Public Company Accounting Oversight Board (PCAOB) is an organization specializing in defining Auditing Standards (AS). In the norm AS1001, PCAOB (2020) describes an audit of financial statements, here referred to as financial audit, as the expression of the opinion of an external auditor on the fairness of an entity's financial statements. Those statements are previously prepared by entities and abide by the Generally Accepted Accounting Principles (GAAP). The purpose of these is to reassure and inform interested parties and stakeholders, for example investors, on the entity financial matters. These include, but are not limited to, the entity's assets and liabilities. As such, the financial statements' raison d'être is to help interested parties to assess the entity and its resources truly and fairly (ISAC, 2018).

The first part of the true and fair term, mainly used in conjunction with an audit report of financial statements, refers to the fact that the financial statements are prepared according to applicable reporting frameworks, such as the GAAP, and are free of any material

misstatements. The second part refers to the fact that the financial statements represent the financial performance of the entity audited faithfully, objectively, and without biases. Whilst this definition is implicitly shared amongst auditors, this paper notes that no legal nor practical definition of the term has been agreed upon (Kirk, 2006). As such, the true and fair view is used to ensure of an essential quality of the financial statements.

Hereby the role of the external auditor, also known as independent auditor, is to emit a report through which they summarize their professional and critical opinion on a company's financial health, and specifically on the financial statements (PCAOB, 2020; PwC, 2013). This opinion is built upon the audit work done by the auditor, as planned, and defined by the generally accepted accounting standards (GAAS), namely International Standards on Auditing (ISA), International Organization for Standardization (ISO) and country- or region-specific GAAS.

2.2.2 Audit procedure

A financial audit is strictly regulated and supervised. Indeed, every step of an audit engagement is outlined and described in AS2001 (PCAOB, 2020), on which external auditors base their own audit processes. Engagements generally follow the workflow illustrated in Figure 1, below. Whilst bearing different names in different auditing firms and standards, the workflow of an audit engagement, whether IT or Financial, maintains a similar structure. Indeed, for instance, in Figure 1, the workflow comes from Cooke (2019), who created it based on the recommendations of COBIT, therefore applicable for an IT audit. Conversely, the workflow in Figure 2 is the one applied in Financial audits in one of the Big Four accounting firm, namely PwC (2013).

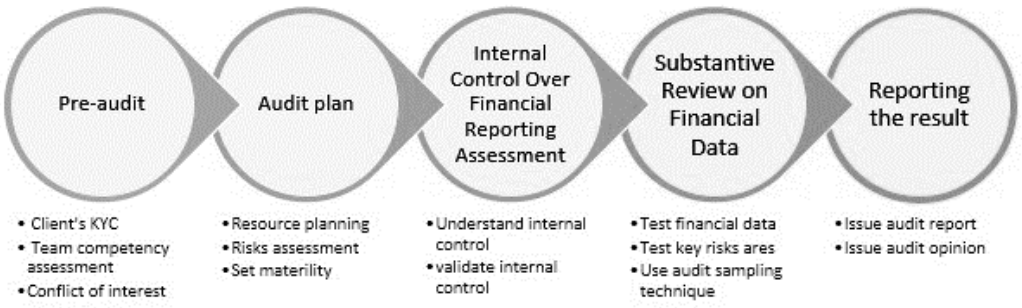

Figure 1 IT Audit Engagement Flowchart from COBIT (Cooke, 2019)

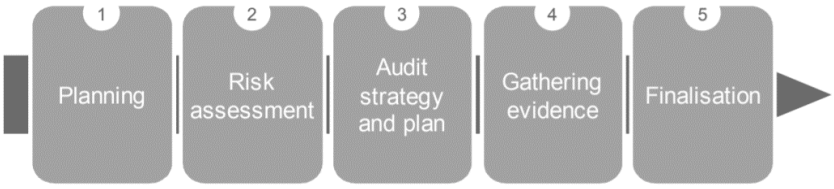

Figure 2 Financial Audit Engagement Flowchart from PwC (2013)

An engagement can be divided into three main parts: pre-audit, audit, and post-audit. Each of those parts are in turn comprised of several steps (Gantz, 2013). This reconstruction of the necessary steps of every audit engagement is illustrated in Figure 3, below.

(1) During the pre-audit phase, the first step revolves around the planning of the engagement itself. This includes its formal acceptance and matters of administrative logistics, such as building the audit team and deciding on the extents and nature of the procedures necessary to the audit. The second step (Figure 1) involves the execution of a risk analysis. This is based on the industry's knowledge of the audit team and the understanding of the audited entity. As such, it is essential for properly evaluating the risk of misstatements and comprehending the risks specific to the entity. In the third step, the audit team build a plan and draft their strategy, basing it on the information gathered thus far. This includes deciding on a testing approach, the extent of the tests being performed, or even whether to trust the internal control of the entity.

(2) The next part of the engagement (step four in Figure 1) is the execution of the audit plan. The audit team assess the statements made by the entity through different methods: reperforming selected calculations, inquiring and inspecting the processes, or targeted observation. For instance, one way to test the inventories' assumption is to attend and observe the process. Therefore, the different testing methods require auditors to intervene throughout the entirety of the fiscal year, and not only when the statement is emitted at the end of a fiscal period.

(3) The engagement ends when the auditors conclude and emit their professional and critical opinion on the fairness of the financial statements presented by the entity.

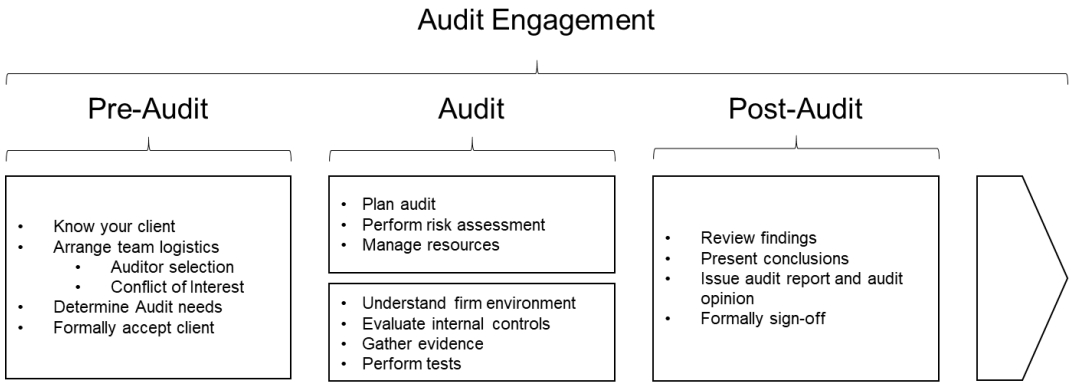

Figure 3 Reconstitution of the steps of an Audit Engagement (Financial / IT)

An important aspect of a financial audit, shared by other types of audits, is the need for formalized documentation of the audit work done. Indeed, from this documentation of the work and the conclusions drawn from it, a reviewer should be able to reperform or even test the reasoning behind the audit to reach the same conclusions as the ones written in the auditor's report. Therefore, the audit team must record their audit trace during an engagement. This must also include the documents provided by the client that were used during the testing phase. Both the audit traces and documents provided by the clients are mandatory audit elements as per the standard ISA 230 pertaining to audit documentation.

2.3 IT Audit

Amongst the several types of audit that are performed in the auditing field, this paper is focuses on Information Technology (IT) audits, also known as Information Systems Audit. IT audits' (henceforth abbreviated as ITA in this paper) purpose is to measure and evaluate the reliability of the IT infrastructure and environment from a firm, including its information systems (IS) (Gantz, 2013). An ITA consists of gathering and evaluating evidence to ensure that an information system complies to the necessary standards that guarantee the safeguarding of its assets and data integrity, and that it manages resources effectively and efficiently (Sayana, 2002). As such, during an ITA, auditors test the internal controls related to the IS environment of an entity to ensure that both the design and application of a control are satisfactory (Moeller, 2010). Most of the tests performed by auditors can be regrouped under two areas: Information Technology General Controls (ITGC) and Information Technology Application controls (ITAC). The topics of ITGC and ITAC, specifically their definitions, use and related procedures, are discussed within the context of the Financial IT Audit below.

2.3.1 IT Audit: one for every need

The concept of IT audit (ITA) does not simply allude to one kind of audit. Indeed, ITA can be divided into two main branches: core IT audits and specialized IT audits. The first branch, relative to core IT audit, refers to the fact that IT audits are conducted within their own cycle. Furthermore, unlike specialized IT audit, core IT audit brings direct value to the company and is conducted as a main audit. Whilst most core IT audit does share the same process as specialized IT audit, i.e., test the effectiveness of internal controls and IT dependencies; it can also be performed to certify a service provider, measure the maturity of the IS/IT environment, and evaluate the IS security management. In addition, the two types of IT audit share a standardized common structure, as depicted by Figure 4**.** Those aforementioned audits may be driven either by the need to be certified or by the company's own interest (Gantz, 2013).

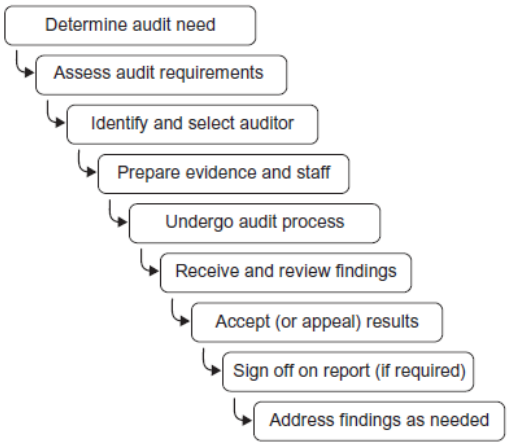

Figure 4: External Audit Workflow (Gantz, 2013)

The second branch, specialized IT audit, refers to the auditing of information systems within another audit cycle. The ITA's main purpose is then to test specific controls in order to either enable another audit's work or support its conclusions. This branch involves a change in perspective when envisioning information systems in ITA. Indeed, whereas in a core IT audit, information systems are at the centre of the audit team's focus, in a specialized audit, ISs are considered a tool or a process to be used by the entity. This point of view recognises the information technology environment as a potential source of weaknesses and deficiencies. The different IT audits are presented in Table 1, below. Whilst the objectives of those audits differ, the purpose of the specialized IT audit remains the same. As it then becomes dependent on what is considered the main audit, the depth and extent of the work needed may vary.

Table 1 Typology of audits engagement within the auditing field (Gantz, 2013)

Audit	Focus	Objectives	Auditors
Financial	Accounting practices, financial reporting	Confirm appropriate practices and internal control effectiveness	*External auditors*
Operational	Management practices, processes, and procedures	Review operational efficiency and effectiveness in meeting objectives	*Internal or External auditors*
Certification	Industry, quality or management standards or other certification requirements	Judge compliance to certification criteria; grant (or refuse) certification	*External auditors (accredited to certify others)*
Compliance	Legal, regulatory, or contractual requirements	Verify adherence to requirements and fulfilments of obligations	*Internal or External auditors*
IT/IS	Controls for systems or IT development, operations and maintenance, security, and privacy	Validate control, configuration, sufficiency, and effectiveness	*Internal or External auditors*

2.3.2 IT audit as an in-house Audit as a Service

Audits can be initiated, organized, and executed both internally and externally. A sequence of internal audits, whether IT audit or any other type of audit, will be regularly performed by stakeholders belonging to the audited company or internal auditors (Goodwin, 2004). Internal controls are created and curated by internal controllers, such as, but not exclusively, auditors. Those controls regulate and protect the company from unintentional and intentional mistakes (Goodwin, 2004). Thus, the necessity for an entity and its internal auditors to maintain the processes and improve the controls throughout the entirety of the year. While it is possible for an external auditor to act as an internal control for an entity, that is not the main purpose of an external audit engagement (Gantz, 2013). Indeed, external audits are punctual, but oft yearly, engagements with the vocation to submit an annual report of their opinion. Contrary to internal auditors who work for the entity itself, external auditors are “hired” for an audit engagement in which they audit a specific entity. As such, auditors, and specifically the firms for which they are working, can be considered as service providers, while the auditees are the clients. Whilst it is noteworthy to mention internal audit as a crucial part of the auditing field, the scope of this paper is hereby limited to external audits, namely the role of an external IT auditor within a financial audit. This limitation of the scope is due to the fact that the certification of financial statements can only occur to through the employment of external Financial and IT auditors, who are the focus of this study.

2.4 Financial IT Audit

2.4.1 Actual financial IT audit

The dependency on the IT environment of the auditee has led financial auditors to either gain a deeper understanding of fully-fledged industry- and firm-specific systems, or to resort to hiring experts to do so in their stead (Curtis et al., 2009; Griffin & Wright, 2015). The latter may conduct an IT audit in the IT environment of the auditee in order to certify that its information systems are dependable and may be relied upon when financial auditors perform their testing. For instance, IT auditors may measure the logical security of an ERP as SAP or verify that the data flow between two interfaces is untouched and complete. That is, they perform a Financial IT audit, an integrated external audit engagement which consists of performing an IT audit within a financial audit cycle (Barta, 2018). The main components of a Financial IT audit are information technology general controls, information technology application controls, and entity-level controls (Gantz, 2013).

Information Technology General Controls (ITGCs) are controls which aim to measure the efficiency and effective use of the internal control set up and maintained by the auditee (Richards et al., 2005). They evaluate several aspects of the information system environment, including the logical and physical security of the IS environment, changes and project managements, and computer operations. Each of these aspects comprises several tests which cover for a specific risk to ensure that the IS environment does not threaten the integrity and fairness of the financial statements presented by the auditee (Barta, 2018). To evaluate this assumption, the IT auditor undertakes the role of an investigator, systematically following three steps for each control. They start by interviewing the people responsible for said control, thus creating an understanding of the control design and its practical application. Thereafter, IT auditors develop a testing strategy to accurately test the proper execution of the control. The last step is the collection of the required evidence and the testing itself. Finally, after those steps, the auditor can assert whether the control is effective and cover the risk it was designed for (Coronado, 2014).

Whilst ITGCs consider the risk posed by an uncontrolled information system manned by humans, IT dependencies controls consider the risk brought on by the use of this information system and its necessary applications. Indeed, the smooth running of a company relies heavily on information and proper data distribution amongst the systems (Barta, 2018). Therefore, the information flowing through the IS environment needs to remain whole and un-modified, whether by human hands or by bugs in the matrix.

Consequently, the department responsible for internal controls conceives tests allowing the company to be reinsured of the quality of its information flow. The role of the external IT auditor is then to test these controls to measure their efficiency. The IT auditor is going to reperform the controls or the interactions between two applications, hereby called interfaces. For instance, one common IT dependency tested is comparing the accounting records and the entries transmitted from the accounting system to the treasury IS.

Finally, the last component of a financial IT audit is the entity level controls, which are used to evaluate the maturity of the IT governance (ITG) of the auditee. Entity-level controls are not set in stone and their nature is dependent on the auditee's IT environment and organization (Coronado, 2014). They are considered as internal controls, applied throughout the company to ensure the proper application of the entity's IT vision and policy. Coronado posits a simple review of the entity's Information System's department to evaluate whether the chain of accountability and authority is clearly established. An example of entity-level controls is the evaluation of the information system landscape of the entity. Here, the auditor reaches an understanding of the IS environment, its associated risks and is able to measure the entity's own understanding of its systems (Arson, 2005). Thus, entity-level controls provide a way to measure the ITG of the entity and allow the auditors to identity risks and orient their ITGC and ITAC strategy to cover those risks (Coronado, 2014), thereby conducting a risked-based IT Audit (Bowlin, 2011).

2.4.2 Definition and influence

The consequences of the use of an IT audit during a financial statement of an entity are manifold. The more obvious among them is the certification of the information systems, i.e., its maturity and preparedness against external and internal risks and potential materiality misstatements. A less obvious influence concerns the financial auditor and the remaining work to be done in the financial audit (Mazza & Azzali, 2018). Indeed, when the IS environment of the firm is reliable and its associated risks are covered, the IT auditor opinion provide financial auditors assurance that the auditee is in control of its IT environment and therefore, of the evidence that underlies the financial reports. Consequently, this reliability attests to the mitigation of the risks brought on by automated IS (Stoel et al., 2012). Through that assurance, the financial auditor may reduce the audit work to be done related to semi- and automated-controls and focus on more risk-based scoped out areas, namely manual controls.

3 LITERATURE REVIEW

3.1 Conducting an IT Financial Audit – In practice

The previous chapter concerned itself with the definition of the auditing field and practice *as it should-be.* The following chapter focuses on the applications on the aforementioned standards and the observation of practice *as-is.* In consequence, this chapter reviews two factors allowing practice to be measured against theory, i.e., auditing standards: audit quality, and the cooperation between IT and financial auditors.

3.1.1 The question of audit quality

3.1.1.1 Towards a consensual definition of Audit Quality

In information system security, it is often said that the human element is the weakest link, or as Debra Murphy phrased it, the 'leaky faucet' (Linberry, 2007). No matter how well refined, high-tech, or supervised a system is, it can fail due to a simple and oft preventable human mistake (Beynon-Davies, 1999). The Enron case, and more recently the William Saurin fraud in France, proved that this is also relevant to audit (Li, 2010). Indeed, the credibility and usefulness of an audit depend highly on its quality.

Indeed, the quality of an audit is a widely researched topic, as can attest the almost 3 million of results brought up when looking for the key words 'audit quality' in Google Scholar. Nevertheless, the literature admits a lack of consensus on the very definition of audit quality (Watkins et al., 2004; Francis, 2011; Knechel et al., 2013). Consequently, trends regarding the definition of audit quality (AQ) have emerged to fill this gap. For example, practitioners take a regulationist stance by measuring the audit quality through the auditor's ability to conform to applicable auditing standards (Watkins et al., 2004). Conversely, researchers often cite DeAngelo's (1981) definition, in which he states that AQ represents the joint probability that an auditor will discover a misstatement and report it (Knechel et al., 2013). Both Knechel et al. (2013) and Francis (2011) attribute those preferences in definitions to the different perspectives, and consequently the worries of the practitioners and researchers. Indeed, practitioners are concerned with compliance, whilst researchers focus on independence and professional scepticism (Rajgopal et al., 2021).

Rather than deciding on one definition alone and excluding the others, the field would benefit from using the views of practitioners and researchers in a complementary manner

to arrive to a well-rounded understanding of audit quality (Aobdia, 2019). Through complementary definitions, different factors, and assumptions that impact audit quality can be considered (Knechel et al., 2013). Therefore, this sub-chapter seeks to measure how compliance, independence, and professional scepticism can affect the quality of an audit engagement.

3.1.1.2 Failing at being accountable: independence and ethics

DeAngelo (1981) described audit quality as the joint probability of an auditor discovering a misstatement and reporting it. While discovering the misstatement pertains to professional scepticism and the competence of an auditor, reporting the event is a matter of independence. Indeed, the independence of an auditor during an engagement has a positive effect on the quality of the audit, and therefore on the auditor's opinion (Suyono, 2012; Haeridistia & Fadjarenie, 2019; Lamba et al., 2020). Furthermore, the respect of the independence is a mandatory factor in the acceptance of the engagement, if not respected, the engagement should be returned. Thus, myriads of standards as the one below, as well as the ISA 200 and the GAAS, were established to outline the requirements for an auditor to be independent. For instance, the auditing standard AS1005 focuses on the sole notion of independence, as the second paragraph of the standard states:

> *The statement in the preceding paragraph requires that the auditor be independent; aside from being in public practice (as distinct from being in private practice), he must be without bias with respect to the client since otherwise he would lack that impartiality necessary for the dependability of his findings, however excellent his technical proficiency may be. However, independence does not imply the attitude of a prosecutor but rather a judicial impartiality that recognizes an obligation for fairness not only to management and owners of a business but also to creditors and those who may otherwise rely (in part, at least) upon the independent auditor's report, as in the case of prospective owners or creditors. (PCAOB, 2020, AS1005)*

As such, these auditing standards require the auditor to be both without a bias and aware of the potential pitfalls that would lead them to a conflict of interest. In other words, regulators need auditors to be aware of their own independence and, specifically, to be able to measure it (Moore et al., 2006). Whilst the auditor may have the willingness to avoid or report conflicts of interest, the problem stems from auditors being psychologically unable to recognize situations wherein they may have lost their impartiality (Bazerman et al., 1997; Moore et al., 2006; Guénin-Paracini et al., 2015). Indeed, the client-auditor relationship imposes a certain level of trust and cooperation between the two

parties for an audit to be conducted (Ball et al., 2015). At any point, keeping an unbiased mind and a deep awareness of any arising conflict of interest whilst committing to the engagement and the client is an equilibrist's act for the auditor. As such, applying the standards may prove difficult to put into practice, and instead they may be simply regarded as best practices (Bazerman et al., 1997; Church et al., 2018).

Standards notwithstanding, it is the auditor's due diligence to apply the ethics and morals necessary to avoid or report conflicts of interest, or biases that may occur during an engagement. Gendron et al. (2006), in their study on the commitment of auditors to their independence, define ethics as the level to which an auditor adopts and respects ideal moral values, as well as their enforcement within the auditing field. This commitment may lead to a higher level of audit quality (Siriwardane et al., 2014). Indeed, Haeridistia and Fadjarenie (2019) as well as Ardelean (2015) have found a positive relation between ethical commitment and the quality of an audit. While mandatory, the proactive upkeeping of the independence of the auditor enhance the quality of an audit. Therefore, ethics can compensate, to some degree, for a lack of independence within the engagement and consequently maintain the audit quality.

3.1.1.3 An equilibrist's act: professional scepticism

Auditors follow and comply to standards, and therefore, when those standards require auditors to show professional scepticism, auditors must do so. However, the definition of the expression is as vague as its application. Namely, it depends on the chosen perspective. Nelson (2009) describes professional scepticism as the ability to critically assess and question evidence. Nonetheless, it is important to distinguish professional scepticism from a forensic mindset, the latter representing the perennial doubt present in an auditor's mind (Glover & Prawitt, 2014). Indeed, as per the standard AS1500 on an auditor's independence above, an auditor must not be biased, including against the client (PCAOB, 2020).

Therein lies the difficulty: an auditor must maintain a professional scepticism balance regarding their attitude and approach to the audit engagement (Glover & Prawitt, 2014). This balance rests upon the experience acquired by the auditor, as it is with experience and peer knowledge that an auditor can assess whether an element is coherent or not. The experience acquired by the auditor may thus be measured by the number of audit engagements they performed. Indeed, these appear to be positively correlated with an auditor's higher decision-making capability (Suyono, 2012). Furthermore, auditors with more

engagement-experience also gain technical knowledge, such as, but not exclusively, specific information systems know-how or industry- or client-specific information (Bonner et al., 1997). Those acquired decision-making skills and technical knowledge enhance the audit quality (Ernstberger et al., 2015).

Nevertheless, it is of note that this knowledge does not come without a price. Indeed, audit experience acquired through long audit tenure may also negatively impact the audit quality (Al-Thuneibat et al., 2011; Suyono, 2012). Whilst a long tenure positively affects the knowledge acquired by the auditor, it may negatively impact the professional scepticism and independence of the auditor. Through the years and engagements, auditors build a relationship with the client, and as such, develop some level bias (Ball et al., 2015; Suyono, 2012). This auditee-client relationship lowers the audit quality (Carey & Simnett, 2006).

3.1.1.4 Generalization of Audit Quality

This literature review on audit quality has insofar focused on the auditing field in general, and not solely on IT audit (ITA). This deliberate choice can be explained by the consensus of the literature on audit quality indicating how many determinants of AQ are shared by ITA and financial audit (Nguyen et al., 2020). Nonetheless, the degree to which the factors affect audit quality differs according to the kind of audit performed.

Stoel et al. (2012) perform a comparative analysis of the perceptions of the different determinants of IT audit quality between financial and IT auditors. In this study, the authors collected data through a survey composed of 54 questions, each representing an audit quality factor. Financial and IT auditors ranked a list of all the factors from the most important (1) to the least important (54). Whilst divergences emerged from the relative importance given to the determinants, their ranking reflected the same trend. Indeed, as shown in Table 2 below, planning and methodology, independence, auditee relationship, and auditability were amongst the highest factors moderating IT audit quality. Those determinants are also highlighted within the aforementioned definitions of audit quality: independence, professional scepticism, and compliance (PCAOB, 2020). Indeed, the audit quality factors mentioned earlier mirror those of IT audit quality in key areas (i.e., independence, professional scepticism, and compliance). Thus, they are indicative of both financial and IT auditors' overall perception.

Table 2 IT Audit quality determinants from an IT and a financial perspective (Stoel et al., 2012, p.66)

Factor (number)	Overall mean	Fin Rank	IT Rank
Planning and methodology (10)	4.121	2	1
Independence (1)	4.038	4	2
Business process knowledge and experience (3)	4.017	1	6
Auditability (7)	4.002	3	4
Auditee relationship (12)	3.972	6	3
Responsiveness (4)	3.893	5	7
Business environment (13)	3.694	8	8
Auditor experience with auditee (8)	3.681	7	9
IT and controls knowledge (9)	3.602	12	5
Field work and audit procedures (5)	3.457	11	10
Resource availability (11)	3.456	10	11
Accounting knowledge and audit skills (2)	3.267	9	13
Business scale and audit scope (6)	3.201	13	12

The Fin Rank and the IT Rank indicate the ranking of the specific attribute out of the 13 factors identified by the factor analysis. The ranking is based on the mean score of the factor within the subgroup (financial auditor or IT auditor) compared to all other factors within the same subgroup.

3.1.2 Working together: a tale of two auditors

3.1.2.1 Apprehension of technology

The ever-growing complexity and automation of the information technology environment of an auditee requires auditors to understand the systems therein and to be able to evaluate their relevant internal controls. Yet, technology adoption amongst financial auditors is not homogenous (Curtis & Payne, 2008). Here, technology adoption refers the willingness to use or understand technology employed by the auditee.

This heterogenous technology adoption may in part be explained by the requirements of an auditor job posting, whilst the job offer does acknowledge the advantage of technology-adopter candidates, being technology-adverse is not a deal breaker (Ham et al., 2020). Another possible explanation are the characteristics of the auditor as an individual: risk takers were reported to have a more open view to new technologies, whereas the risk-adverse shied away from them (Vasarhelyi & Romero, 2014). However, the literature points to the firm and environment of the auditor as the main culprits in the differences in technology adoption (Curtis & Payne, 2008; Bierstaker et al., 2014; Vasarhelyi & Romero, 2014). Indeed, organizational pressure, and hereby the stance of the auditor's management toward technology adoption or the firm policy, results in auditors accepting and using technology (Curtis & Payne, 2008). This structure effect is further enhanced when the firm is encouraging and offering training to the auditor (Bierstaker et al., 2014; Vasarhelyi & Romero 2014). Nonetheless, should all the aforementioned factors be reunited, it does not automatically translate into a complete adherence to technology. Arbitration comes into play through the theory of the Iron Triangle (Oisen, 1971, in Bierstaker et al., 2014).

In Oisen (1971)'s theory, reprised for the auditing field, the audit quality is influenced by the time spent on the audit itself, the cost, and the scope of the audit work. Figure 5, below, represents the elements influencing audit quality. For auditors, the learning curve for new technologies and their implications for the subsequent audit work done are costly in time (Curtis & Payne, 2008). Furthermore, technology adverse auditors do not fully trust CAATs or technology as a replacement for 'pen and paper' audit. These auditors consider technology a cost, especially timewise, which does not result in an improved audit quality (Vasarhelyi & Romero, 2014).

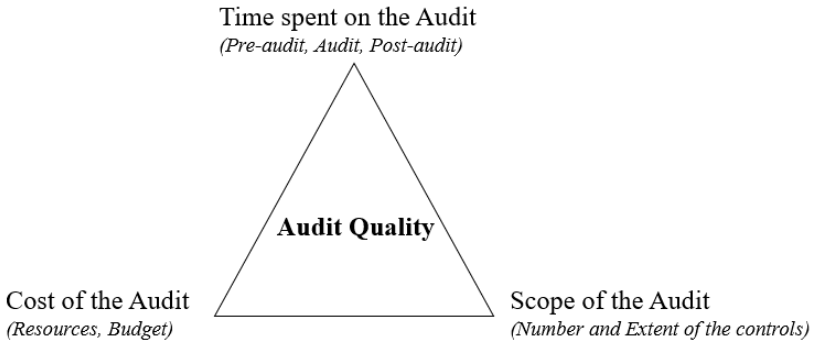

Figure 5 Reprisal of the Iron Triangle for Audit Quality

For technology-oriented auditors, the problem may be that the operational costs associated with training and learning about the new tools or the different applications of the IS environment of an auditee might be too high. Indeed, keeping up with new technologies and how to use them in audit, or *a contrario*, how to audit them, signifies that the auditor-in-training is not working on audits and therefore not bringing money to the firm. At the same time, firms would be billed for those training sessions. As such, audit firms and auditors must arbitrate the cost of the training and its possible influence on audit quality before adopting the technology (Vasarhelyi & Romero, 2014).

A solution to this arbitration started with the creation of support IT teams, and in the last two decades, the emergence of IT auditors **(**Aditya et al., 2018**)**. When asking for an IT audit, the financial auditors displace technology adoption onto the IT audit team: the financial auditors reap the benefits by getting experts whose sole purpose is to adopt technology (Vasarhelyi & Romero, 2014). Nevertheless, the financial auditors may still have to evaluate the technology used and proceed to a new arbitration: whether to bring in a specialist audit team on an engagement or not, as represented by Figure 6 below.

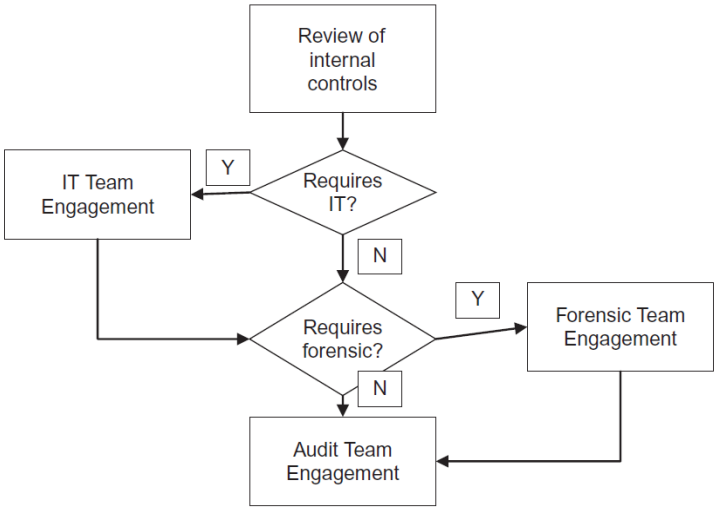

Figure 6 An auditor's thought path into involving Specialist Auditors (Vsarhelyi & Romero, 2014)

3.1.2.2 Time to get some team spirit

The decision to consult and bring a specialist team on the engagement ultimately rests in the hands of the financial audit team. Indeed, while the auditors can support their decision on the audit firm policies and the accounting and auditing standards, their main decision-making tool is their professional judgment (Boritz et al., 2020). As stated previously in Chapter 3.1, professional judgement builds itself through the different experiences and engagements of an auditor (Suyono 2012); in most cases, the auditor improves their decision-making ability throughout their career (Ernstberger et al., 2015). Thus, the more auditors have consulted with specialists, the more objectively they are able to evaluate the need for their involvement in the audit (Boritz et al., 2020).

The input of specialist teams may be underestimated and undervalued by auditors, due to their ego, sentiments, or past experiences with specialists (Boritz et al., 2020). In such cases, the root of the issue varies: auditors may feel overconfident in their own ability to understand IS risks or abilities of their subordinates (Boritz et al., 2020), or that specialist auditors are not knowledgeable enough on financial audit matters to mitigate risks (Griffith, 2020). Therefore, the financial auditors tend to view specialist auditors as consultants whose sole purpose is to assess the relatability of the controls and the maturity of the IS environment of the auditee, i.e., a 'necessary evil' (Bauer et al., 2019). Furthermore, primary findings from Hirsch (2020) support the implication that financial auditors view specialist auditors as competition. Indeed, financial auditors reported relying more on the findings of the specialists when those did not have a similar knowledge base as financial auditors and were not on premise. From these studies and their respective

findings, it can therefore be inferred that specialist auditors are considered as consultants brought along with an "Audit as a Service" offer.

3.1.2.3 There is no IT in team

Financial auditors and specialist auditors form two distinct entities which are ultimately forced to interact and cooperate in order to perform the audit. This raises the question of whether financial auditors and specialists work together or work alongside each other. This paper makes the distinction between the two via the following nuance: working together involves communication and collaboration between specialists and financial auditors. Conversely, working alongside one another refers to a sort of parallelism of the two audits being conducted, following the same steps without any interaction necessarily taking place.

Surprisingly, however, financial and specialist auditors unanimously agree that difficult relationships and misalignments between the two audits teams are detrimental to the general audit quality of the engagement (Bauer et al., 2019; Boritz et al., 2020). Indeed, the lack of good working relationships, i.e., respect, effective communication, or knowledge sharing may lead to critical components of the auditee not being controlled, and as such, potentially not identifying weaknesses (Vsarhelyi & Romero, 2014; Boritz et al., 2020). This implication is supported by the auditors in Bauer et al. (2019)'s study, reporting that they feel like the other team (either financial or specialist) is "just throwing things over the fence". In such cases, the two teams are disconnected. Thus, they cannot properly interpret and measure the findings of the audit work done by the other team nor its implication for their own audit.

This disconnection between financial and specialist auditors takes its roots in the pre-audit phase of the engagement. Indeed, specialist auditors are not involved, or scarcely, in the planning and risk assessment of the financial audit (Boritz et al., 2020).

Specialist auditors therefore encounter several problems when intervening during, and not at the planning stage of the financial audit cycle. Firstly, they lose the opportunity to discuss and comprehend the stakes and risks for the financial auditor scoped during the audit (Estep, 2019). Secondly, specialist auditors do not discuss the IT environment of the firm and its critical component with the financial lead auditors during the planning phase. This may lead to unnecessary work being done by the specialists, or to important elements not being scoped during pre-audit phase, thus negatively affecting the audit.

Lastly, the financial auditors establish a 'grocery list', which is then given to the specialist for them to base their audit on (Estep, 2019; Bauer et al. 2019).

The aforementioned issues could be summarized with the simple assumption that, since the final goal of this cooperation is to certify financial statements, the financial auditors are the ones ultimately responsible and accountable for the audit (Estep, 2019; Boritz et al., 2020). As such, instead of working together, or alongside each other, the specialist auditors feel like they are working for the financial auditors instead of a common goal. The side audit performed by specialist auditors thus becomes secondary, and the logistic surrounding the engagement revolves around the financial audit. This instigates a hierarchy in which specialist auditors are subordinated to financial auditors (Boritz et al., 2020). Indeed, specialist auditors report with frustration in Bauer et al. (2019)'s study that they feel like they 'are being told what to do'.

This hierarchical structure created during a joint audit is detrimental to the audit quality of the engagement as it questions the legitimacy of the specialist auditors (Bauer et al., 2019). Indeed, as subordinates and under the responsibility of the financial auditors, the work of specialists is thus devalued, and they are considered less crucial to the audit. In contrast, financial auditors enjoy and endeavour to reinforce their higher status. This treatment of specialists brings credibility to the theory of the 'Audit as a service' with specialists working as consultants (Bauer et al., 2019).

Griffin and Wight (2015) propose an explanation of the depreciation of the input of specialist auditors: as IT becomes more important and especially more complex, the importance of specialist auditors grows. The environment of the auditee is not the only subject undergoing changes due to new technologies, indeed, with the democratization and development of continuous auditing, the role of specialists is becoming crucial to measuring the efficiency of those controls. In other words, the *status quo* between financial and specialist auditors is becoming upset, as the work of specialist auditors gains in importance and the financial work remains at the same level or lessens due the relegation of the auditor in a role of certifier only. Indeed, financial and specialist auditors may be put in competition with one another for a status struggle (Griffin & Wright, 2015; Bauer et al., 2019).

In order to avoid toxicity within an engagement, which would negatively affect the outcomes of the audit, teams composed of both specialists and financial auditors must have *at minima,* effective communication to take the first step of working together, namely cooperation (Estep, 2019; Joe et al., 2020). This effective communication enables

the second, and most crucial step: coordination on audit engagements. These two steps lead to the effective collaboration of specialist and financial auditors in the audit engagement.

However, it is not necessary for them to merge into one single team to create effective communication. Indeed, teams with weak ties but efficient communication are linked to an enhanced understanding and a fairer evaluation of the information transmitted between auditors (Estep, 2019). This theory is coherent with Joe et al. (2020)'s findings that the nature of communication complexity, namely the presentation of technical information, is at the root of misinterpretation and undervaluation between financial and specialist auditors. Therefore, the problem lies not with the structure of the team, which is ultimately meant to be comprised of both financial and specialist auditors (Bauer et al., 2019), but rather with the disrupted communication in between the teams.

3.2 The nuances of working together

3.2.1 Audit's conundrum

Two audit teams, two audits to be conducted; this equation may not be solved by a simple repartition of one audit, one team. Dividing the tasks equally to each team will not solve the equation either. A financial statements audit comprising of an IT audit involves *at minima* IT and Financial auditors. Those teams ought to work together towards the same purpose, namely the certification of the financial statements. However, for this goal to be reached, financial auditors and IT auditors must each conduct their own audit.

As such, one issue remains with regards to the way IT and Financial auditors must work together. The responsibilities and subsequent duties must be defined in accordance with the desired level of involvement of each auditors' team. Divergent degrees of involvement all come with advantages and disadvantages; it is therefore crucial to understand the typology behind working together as it leads to an enlightened arbitration.

3.2.2 From solitary individuality to cooperation

Coordination, cooperation, and collaboration are amongst the words used interchangeably when a group of actors or agents work together. However, these words do not share the same definition. The difference in their nuances may reflect a different ideology on group work, which may in turn influence a 'working together' experience (McNamara, 2012; Castañer & Oliveira, 2020).

Cooperation is oft defined as a joint action with a joint intent (Tuomela, 1993; Fantasia et al., 2014). Namely, different actors perform individual acts in order to reach an agreed-upon goal. Tuomela (1993) contrasts cooperation with co-action. The definition of the latter relies on the performance joint action without a joint intent. As such, the defining element of cooperation is the intent behind the actions. Nonetheless, the intent must be known and accepted by the different agents intervening in this joint endeavour (Tuomela, 1993). Hence, an instantiation of cooperation implies both the existence of a foreplan and an established communication to inform the actors involved in the process.

3.2.3 Creating a shared order

Successful cooperation pre-supposes then a defined and mature coordination of the actions of the agents. Indeed, coordination rests upon the alignment and organization of actions in time and place, including communication, of both the actions performed by the agents and of the shared goal pursued (Gulati et al., 2012). In other words, where cooperation focuses on the actions performed by the agents, coordination concentrates on the determination of the action plan.

As such, specific attention is given to the elements happening pre-implementation, namely the organization of the tasks and the planning. In this phase, coordination focuses on establishing a definition of the tasks, of the resources needed, and of the repartition amongst agents of the tasks and resources. Nonetheless, the proper execution of this task may only be guaranteed via a constant communication plan through the project. Indeed, coordination rests upon an alignment between actors in regard to resources and goals to be achieved. Once the project progresses or an event upsets the status quo, a newly adjusted coordination plan needs to be shared and acknowledged by the different actors.

In contrast, while cooperation happens at a fixed point in time, coordination is an ongoing effort. It requires actors to be actively engaged and committed to conscious information sharing.

3.2.4 Establishing a collaboration mindset

Castañer and Oliveira (2020)’s reflection and literature review support the idea of coordination and cooperation being the cornerstone of collaboration. Nonetheless, it is shortsighted to envision collaboration as the simple sum of cooperation and coordination. Cooperation, in contrast to cooperation and coordination, postulates that the aggregation of

the actors to work conjointly on a task results in value creation (Thomson & Perry, 2006; Kozar, 2010; Castañer & Oliveira, 2020).

However, value creation can only occur if two criteria are met, namely, availability and an active mindset (Mishra & Mishra, 2009). Creating organic opportunities for actors to learn from one another or to consult each other on both their individual and group task enhances the chance of the actors collaborating on such a task. Instead of the final product resulting in being the sum of its individually crafted parts, there will be the added value of the brainstorming realized conjointly. Ergo, value is created. Nevertheless, such an event pre-supposes that the actors are willing to engage with one another to perform more than their required parts.

Consequently, although it can only occur if cooperation and coordination are enabled, collaboration must simultaneously enable value creation to create a veritable working together environment. The typology of 'working together', in Figure 7, illustrates the absence of graduation or hierarchical ranking between the different types of working together (McNamara, 2012; Castañer and Oliveira, 2020). Indeed, the differences stem from a more or less integrated version of what constitutes a team. Therefore, arbitrating between cooperation, coordination, and collaboration does not equate to deciding on whether to choose the best option, but to choosing the one most aligned with the needs of the project (McNamara, 2012). Conversely, some costs may incur as the team becomes more integrated (Thomson & Perry, 2006; McNamara, 2012). For instance, establishing a collaborative mindset may result in a human cost, namely the time spent encouraging and training the team to work in such a way (Thomson & Perry, 2006).

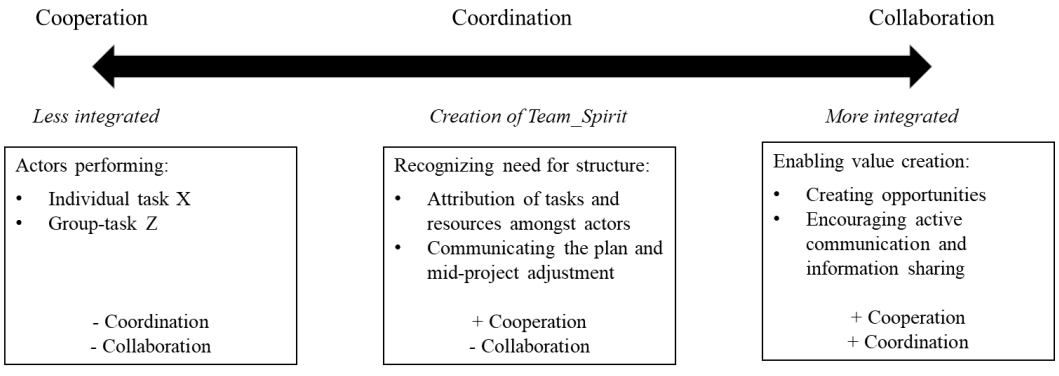

Figure 7 Working Together Continuum

4 METHOD

In the previous chapter, the literature review highlighted gaps in the information system auditing research field, specifically with regards to the lack of research on the cooperation of IT and financial auditors during a financial IT audit. In order to bridge the gap highlighted by the literature review and articulated by the research questions, a conceptual model was created around the central actor of this thesis, the IT auditor, is represented in Figure 8 below. This conceptual model is situated within the context of an IT audit conducted along a financial statements audit. The IT auditor is hereby defined according to three main concepts, namely the What, the How, and the Who. The first two constitute the main focus of the present research. Sub-themes were derived from the themes addressed in the research questions and are used to guide the analyses.

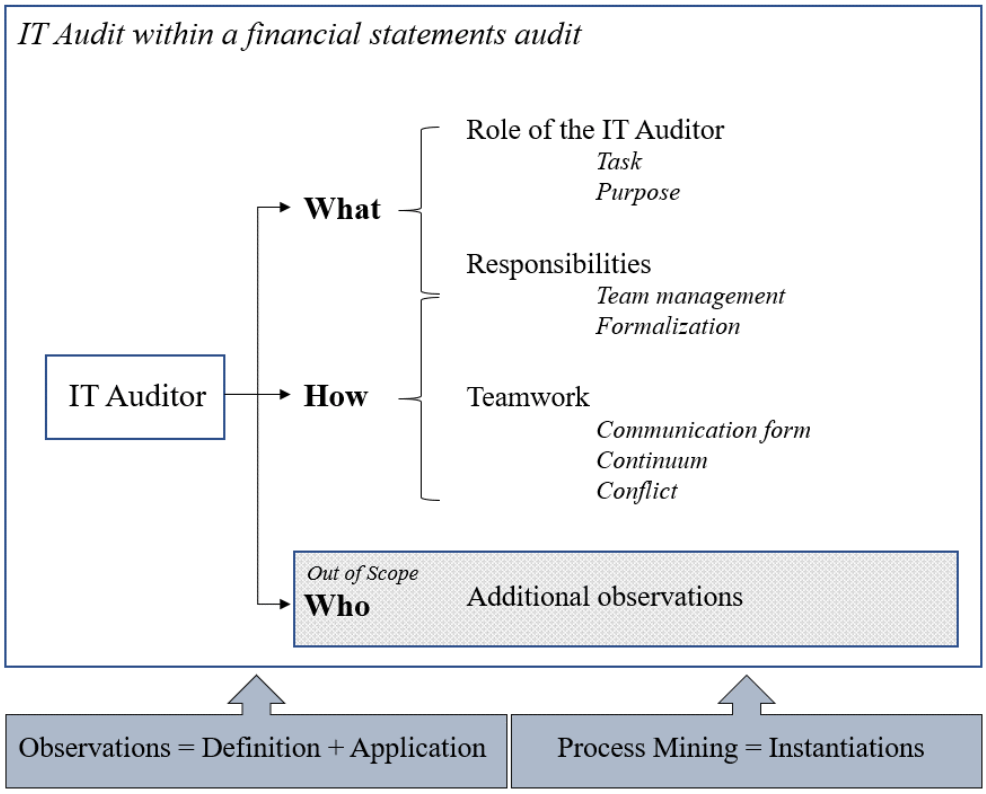

Figure 8 Conceptualization of the IT Auditor

4.1 Motivate

The principal aim of this paper is to discover at which steps the IT auditor gets involved in the financial IT audit and how this involvement is transcribed in the audit trail or dossier of the engagement, including any issues or bottlenecks encountered along the

way. This paper seeks to explore and identify these instances. Traditionally in academia, it is agreed upon that a qualitative methodology is more suited to exploratory research questions and problems. Nonetheless, it is not uncommon for exploratory papers to use a quantitative approach (Abramova & Böhme, 2016) or, more commonly, a mixed-method approach (Chakrabarty & Chuan, 2009).

A mixed-method approach involves a combination of, *at minima*, the use of two different methods in a study, in order to answer its research interests (Venkatesh, Brown & Bala, 2013). This approach is used vastly across fields, whether in education (Martinez et al., 2003), auditing (Vinson, Robertson, & Curtis, 2020), or information systems (Mikalef et al., 2019). The importance and relevance of this approach lies not with a potential 2-in-1 study effect, but with a new dimension added to the data or the findings through the inclusion of a supplementary method (Venkatesh et al., 2013). In other words, a mixed-method approach proves itself valuable when it comes to, for instance, interpreting the findings of one method (Mikalef et al., 2019) or complementing a dataset (Yousefi Nooraie et al., 2020). Consequently, mixed methods may be used both in explanatory and exploratory research, using quantitative and qualitive methods, for different fields and purposes (Venkatesh et al., 2013). This paper is resorting to exploratory research.

An embedded experimental mixed-method design is followed. That is, the combination of quantitative and qualitative methods, with quantitative as the main method (Creswell & Plano Clark, 2011). The quantitative approach is used to explore the field and discover the steps at which an IT auditor gets involved in the financial audit, as well as, whether there is any formalized interaction of IT auditors and financial auditors. Throughout the process, a qualitative method is used to confirm the data and add context to the findings and validate the interpretation. The approach is illustrated in Figure 9.

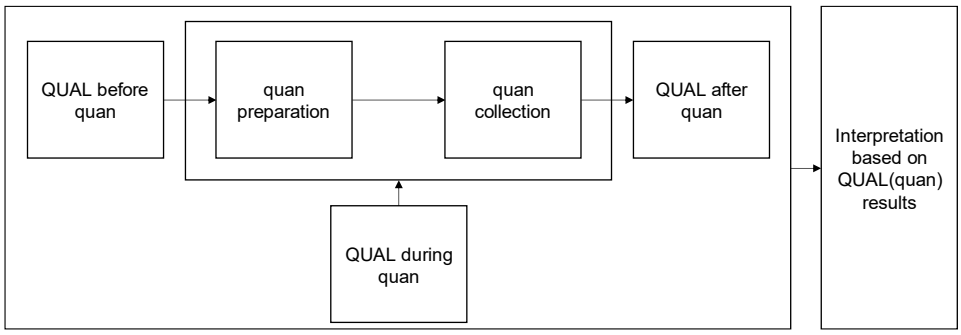

Figure 9 Embedded mixed-method design used

4.1.1 Quantitative

As the topic of the interests of this paper are the actors and interactions, or lack thereof, within an audit cycle, process mining is conducted. Process Mining, as explored in Chapter 6, is used in exploratory research to discover patterns and models emerging from mined event logs (van der Aalst & Song, 2004). This method was selected as the audit software allows for a manual extraction of the event logs. Through the listing and mining of the actors involved within a process, this paper seeks to study the relationship and cooperation between IT and Financial auditors. Process mining grants the researcher the means to study the tangible connection and official interactions between the experts and the auditors.

4.1.2 Qualitative

The author of the present paper was an intern at one of the Big 4 in France. They were working at the branch of the Big 4 in the role of an IT Auditor during 6 months from January until June 2021. As such, they were privy to the inner workings of the field and the firm, as well as taking part in the audit as a legitimate IT auditor-in-training. This context is best explored via a qualitative approach. Indeed, participant observation has been proven to be useful in obtaining information that would not be elicited by using exclusively one form of investigation, such as interviews, surveys, or process mining (Scott & Silbey, 2000).

Participant observation is a form of ethnographical research, which refers to the integration of the researcher into the group they wish to study (Spradley, 2016). In the present paper, the context of the internship is a prime opportunity for the use of participant observation. Indeed, the researcher, as an intern, has legitimacy within the audit team and within the firm. They are therefore granted access that an outsider or fully-fledged researcher would not have been given (Spradley, 2016). This unique position allows the author of the paper to be presented with the training of the auditor and the ability to ask any kind of questions without suspicion (Scott & Silbey, 2000) or reluctance to answer. As the intern is here to integrate into the firm and learn the implicit and explicit auditing codes, the auditors with more seniority, whether financial or specialist, are more inclined to provide knowledge. Indeed, this specific situation allows for the creation of a mentor-mentee bond. In addition to knowledge gain, participant observation in this context

equates to illimited and legitimate access to the observation of the interactions between the different audit teams.

4.1.3 Triangulation method

Through mixed-method approaches, and more specifically the use of qualitative methods, the researcher's bias becomes an issue. This issue is a burden borne by the entire community of researchers. Whenever qualitative research is conducted, the researcher thus becomes the pillar on which the analysis rests (Denzin, 1978). Therefore, triangulation must come into play. This technique posits that multiplying the sources of data, at the risk of data saturation, enhances the quality of the study and mitigates the risk of bias (Fusch, Fusch & Ness, 2018). In other words, triangulation enriches the data and subsequently the related research.

Amongst the four triangulation techniques developed by Denzin (1978), this paper resorts to method triangulation via both qualitative (participant observation) and quantitative analyses (process mining); thusly deciding to focus on the reliability and validity of the data (Fusch, Fusch & Ness, 2018). Hence, this paper collects two different types of data to perform a mixed method analysis: qualitative through observation and qualitative through the resulting process maps. Recouping those data ensures that the data collected is coherent and accurate. Furthermore, this proceeding mitigates the possible influence of the researcher's bias on the subsequent discussion. An additional benefit from between-method triangulation is the gain of an in-depth understanding of the subject study (Denzin, 1978).

4.2 Data collection method

4.2.1 Nature of the data selected

The mixed-method approach of quantitative and qualitative methods elicited two primary sources of data. The first is the dataset collected from the event log of the auditing software used by the firm. The second comprises the observations and fieldnotes collected by the participant observer, i.e., the author. The data and insight gathered through participant observation are presented in Chapter 7. This subchapter is centred on the dataset used in the quantitative analysis.

In order to conduct a process mining analysis, this paper must start with gathering the necessary data about the processes. This data, at its core, takes the form of event logs

of a specific audit trace file. The firm uses an in-house reporting software which is used by auditors, specialists, and support functions to report on the audit work done during an engagement. A deep awareness of the importance of a properly kept audit trail comes with the territory of being an auditor within an audit firm. Indeed, this comes with the auditor's requirements, as per ISA 230, keep an audit trail of the work performed, namely, to enable an audit trail. In this auditing firm, the reporting software, henceforward referred to via the pseudonym Pandora, as it withholds information of a very sensitive nature, contains the documented audit trail.

4.2.2 Pandora: auditors' secret box of evidence

Pandora, the auditing software used in the studied Big 4 audit firm, comprises of a single base, i.e., an audit dossier, per engagement. It classifies the bases into two categories: in-going and archived. It is of note that only the necessary auditors, namely auditors taking part in the audit, may ask and be granted access to them. Bases are archived after the end of an engagement and only the necessary information for the audit trail remains. Furthermore, an archived base only allows a 'read' right, forbidding users to write or delete the trail. In contrast, the rights allocated to the users in in-going bases can vary according to their role within the engagement and their position within the firm.

In Pandora, every step of the audit engagement is represented: the scoping of the audit, the risk assessment, the substantive testing plan, and control testing plan. As such, the software presents a complete overview of all the acts performed during the audit. This vision encompasses all the results, but not necessarily the work accomplished: oft, only the reporting of the audit work done, and its conclusions are logged into the software. Nonetheless, this is not an obstacle to the proper observation of the audit engagement. Indeed, every test, recalculation, and control are logged in their related sheet. For instance, a test on the access controls of a specific application has its own filled-up control sheet with its assorted conclusion of the control within; another sheet will be filled for a different application or a different control. An interesting feature of this software relates to the aforementioned audit trail, each sheet's properties indicate the users modifying it, who reviewed it, and the timeframe of those actions. Therefore, this paper seeks to use this feature to process mine the relevant controls sheets.

4.2.3 Vague descriptions of abstruse engagements

A sample of audit bases was gathered to process mine the control sheets. The selected sample was composed of 11 audit engagements corresponding to 11 bases on Pandora, roughly corresponding to 10% of a season, the testing of the interim period notwithstanding. The sample was created through a simple, but not random, selection: through the active participant observation situation of the internship, the author, an IT auditor-in-training, had access to 6 bases. The sample was further completed with additional bases (5) to which access was granted after the author's presentation of the project. The resulting sample can be summarized in the table below:

Table 3 Description of the Sample studied

#	Fiscal Year Audited	Type	Sector
1	2019	Insurance	*Financial Services*
2	2019	Retail	*Industry/Services*
3	2020	Debt	*Financial Services*
4	2020	Bank	*Financial Services*
5	2019	Agri-food	*Industry/Services*
6	2020	Health	*Public Sector*
7	2020	Services	*Industry/Services*
8	2020	Bank B	*Financial Services*
9	2020	Services	*Industry/Services*
10	2020	Retail	*Industry/Services*
11	2020	Insurance	*Industry/Services*

The names of the engagement and related companies will remain anonymous, and any further information will be anonymized and pseudonymised. Furthermore, only the necessary data for this project will be collected, it will be secured on the firm cloud environment and will not be used in any other setting. The size of the sample is deliberate. It grants the researcher the need and the ability to understand the cases above in-depth and to verify their validity with experimented auditors.

4.2.4 Data collection method

4.2.4.1 Identified Pandora workpapers

One obstacle the author of the study had to overcome was the selection of audit sheets which would be the most relevant to the formalization of the IT auditor's work during a financial statements audit. That is, the event logs on which the process mining analysis rests. Indeed, Pandora is an auditable software, and as such, possesses an abundance of information and audit sheets. Whilst they are interesting, their relevance and importance may vary. The author chose to focus specially on two audit workpapers, which were deemed most in line with the research objective. This choice was made based on two factors. First, the author, as an active observer, took part in IT audits. Therefore, they were able to gather which audit sheets would yield the most results when it came to representing the interaction between IT and financial auditors through the formalization of the audit work. Second, through informal conversations and unstructured interviews, the author was able to gather advice on which audit workpapers would potentially hold both IT and financial auditors' inputs.

Consequently, the audit workpapers selected for this study are the workpapers referred to as Planning and Conclude. Interestingly, those papers are the alpha and the omega of the IT audit. Indeed, the Planning workpaper scopes the IT environment of the auditee and determines the extent and subjects of the work conducted by the IT auditors. This workpaper yields information concerning the processed audited by financial auditors and the IT components intervening in this process. It contains, as well, the understanding grasped by the IT auditors of the maturity and state of the IT and IS systems of the auditee. Therefore, it requires both the input of financial and IT auditors.

Table 4 Intervention of the different teams on the workpaper studied

Workpaper	IT auditors	Financial auditors
Planning	Evaluation of the IT environment and maturity of the auditee.	Additional information on the scoping
Conclude	Report of the audit work done in the ITGCs and the conclusions of said work, including identified weaknesses	Evaluating the impact of the conclusions of the IT audit on the financial statements audit

The second paper whose logs are studied in depth is the Conclude workpaper. This paper, as may be guessed by its name, reports on the conclusions emitted by the IT auditors. As such, it contains the state of the IS landscape and the results in the IT applications controls performed. In addition, in the Conclude workpaper, the IT auditors lists the weaknesses, in the ITGCs, found throughout their work. They also include the tests used to mitigate the risks those controls cannot cover. Financial auditors, for their part, must evaluate and note the impact of the reported weaknesses on their work and the method through which they are mitigating it on the financial statements. The role and responsibilities that lie with IT and financial auditors for the two aforementioned workpapers are summarized in Table 4 and Figure 12.

4.2.4.2 Collecting the data

The data collection takes place on Pandora, the audit software presented previously. The author oversees the collection of the data and its anonymization. The process used for data collection is as follows:

(1) Author logs in Pandora;
(2) Selects the relevant engagement base;
(3) Selects the audit sheet and enables its properties;
(4) Manually types the Edit History within an Excel sheet;
(5) Anonymizes the different auditors through their rank and team.

The event logs are stored in excel sheets, each engagement is stored within a single excel file, the different audit sheets being separated in different sheets. The author will keep a list of the auditors. This list is used during the analysis and discussion phases to create a better overview of the process mined.

The event logs extracted from Pandora will be represented as shown in Table 5, which illustrates the type and model of event log that will be exploited in the course of this study. Event logs, while they may have different presentations and content, possess *at minima* the following information: the actor, the activity, and the date of the activity. The name of the actor has been removed in favour of highlighting the rank of the actor and the team they belong to. Oft, in audits engagement, only one person per rank is responsible for the sheet of a specific control and test. However, it may happen that, for instance, several associates worked on the same sheet. In such cases, a letter may be added

to properly differentiate all the actors involved. As the author does not have the possibility to automatically extract the relevant logs, the collection is done manually.

Table 5 Example of an Event Log for an Audit Work Done Sheet

case_id,activity,case_id:actor,timestamp,team
1,Reviewed-final,Manager,14/04/2020 09:00,IT
1,Reviewed ,Manager,14/04/2020 08:00,IT
1,Prepared,Associate,11/04/2020 08:00,IT
1,Edited,Associate,11/04/2020 07:00,IT
1,Edited,Associate,18/02/2020 07:00,IT
1,Edited,Associate,17/02/2020 10:00,IT
1,Reviewed-final,Manager,13/02/2020 09:00,IT

4.3 Case description

4.3.1 Process Mining Methodology

The quantitative method chosen to answer the questions posited in the Literature Review relies on the extraction of the event logs. Through them a process mining analysis will be performed, allowing information to be extracted from the logs. This information will be presented through the lenses of two software tools: ProM (TU/e) and Disco (Fluxicon). The purpose of process mining defines the specific techniques used. Therefore, as the objectives of this paper are exploratory, namely, to investigate the formalization of the communication between IT and financial auditors through the workpaper of the audit file, the most suitable type of process mining is the discovery model (Mans et al., 2008).

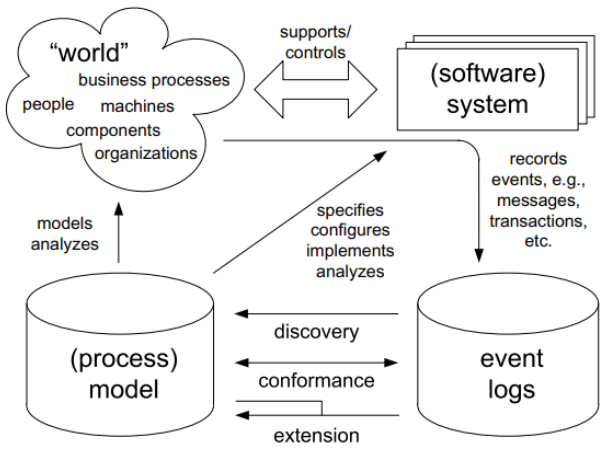

Figure 10 Typology and purpose of Process Mining (Mans et al., 2008)

The discovery model endeavours to reveal patterns and subsequently establish a model from logs. The event logs dispose of three vital pieces of information that answer

three questions: who, what, and when. We refer to this information as the actor, the activity, and the timestamp, respectively. Additional information may help answer the why or the where, those resources are not used to mine specifically, but to enrich the process.

4.3.2 Analysis background information

4.3.2.1 Recurring roles in the data

Table 6 summarizes the roles relevant to a financial statements' audit in France. The names of the roles were standardized. Understanding the responsibilities given to those roles during the formalization process of the audit trail provides vital input when interpreting the process mined in Chapter 7. This table represents the ideal repartition and distribution of tasks within the documentation of the audit trail within the software Pandora. Nonetheless, due to staffing reasons or time constraints, it may happen that this order of the cosmos is not completely in adequation with reality.

Table 6 Distribution of the responsibilities in the formalization of the audit work

Rank IT	Experience	Overview of responsibilities in the formalization
Intern	Pre-Diploma	Performing audit controls and documentation.
Associate	0 to 2 years	Performing audit controls and documentation.
Senior Associate	3 to 5 years	Performing audit controls and reporting on the Entity-level controls and conclusions of the audit.
(Senior) Manager	6-12 years	Reporting on the Entity-Level controls and reviewing the audit work documented. May participate in the documentation of the conclusions of the audit.
Director	12-14 years	Reviewing and correcting the Entity-Level controls and may review the audit documentation.
Partner	+14 years	Reviewing the Entity-Level controls, acknowledging the conclusions and validating the audit workpaper.

4.3.2.2 Interpretation of the activities performed

The range of actions performed on any workpaper on Pandora is limited. It involves 4 activities, as shown in Table 7**.** The process of formalizing the audit work done in Pandora can be divided in two subprocesses: completing and reviewing. The completion represents the first part of the documentation: creating and documenting the workpaper. For that purpose, each workpaper in Pandora is assigned to an auditor whose responsibility is

to test the control and document it. This step is commonly referred to as ‘Editing’. Once the workpaper is ready to be reviewed, the auditor sets the workpaper to ‘Prepared’. This specific status initiates a change of responsibility in the properties of the paper; the assignee is now the auditor in charge of reviewing the paper. This step marks the end of the completion process and starts the reviewing process.

Table 7 Description of the activities performed on a workpaper in Pandora

Activity	Meaning	Order	Expectation
Created	*Workpaper is initiated.* *Assignee designated.*	1	Once per workpaper
Edited	*Workpaper is modified.*	2	At least once
Prepared	*Workpaper is ready to be reviewed.* *Change of assignee.*	3	Only after ‘Edited’
Reviewed	*Workpaper is read and ready to be reviewed by another auditor.* *Change of assignee*	4	At least once, after ‘Prepared’
Reviewed-final	*Workpaper is read and ready for the sign-off.*	5	Only once after ‘Review’

In order to respect the segregation of tasks and duties, an auditor whose responsibility lies with the competition of the tests cannot review their own work. The reviewing process involves at least two different actors to create a four-eyes process. Once the first reviewer finishes correcting and reading the workpaper, they set it to ‘Reviewed’ and thus engage the last round of reviewing with a change in assignee. This round involves two actions for the auditor. They successively perform the activities ‘Reviewed’ and then ‘Reviewed-final’ to signal that the workpaper is ready for the sign-off of the audit.

In this process, there are two noteworthy events. Firstly, when a reviewer modifies the workpaper, it logs a new entry in the event logs: Edited by XXX on DD/MM/YYYY. If the reviewer considers the workpaper to be lacking, they can send the paper back to the previous owner. In this specific case, the event log records a ‘Sent Back’ activity and changes the assignee. The previous owner must go through the normal process again. Another interesting event is the noticeable increase in ranks and responsibility as the process progresses. Indeed, the process starts with the lower ranks (Intern, Associate, Senior Associate) and moves across the hierarchical ladder until the ‘Reviewed-final’ activity, which is to be conducted by the Partner, or at minima, the Director.

5 PARTICIPANT OBSERVATION

5.1 Insight into the observer's mind

5.1.1 Theoretical foundation

This chapter follows the guidelines and theories of Howell (1972) and the four phases defined: establishing rapport with the subjects, immersing oneself within the field studied, logging data through journal and fieldnotes, and analysing through a thematic perspective. For that purpose, the author decided to conduct a study by means of active participation in the auditing firm. An active participation is defined as the researcher becoming a part of the group they study, through embracing the customs and the culture (Spradley, 2016). As an intern, the author respects this criterion through immersion as a new hire.

5.1.2 Fieldnotes

The notes taken by the observer filled two complete notebooks. They were written in both English and French. French was used due being the working language. However, it was supplemented with numerous English concepts and standards. The notes were therefore translated by the observer, a native French and certified C2 English speaker. The notes were taken following the flow notes method. Invented by Scott Young, this method rests upon three principles: simplifying, visualizing, and making connections (University of Hawaii, 2021). This method was used in this case to shorten the notes taken and organize them in such a way that they would trigger the memory of the observer upon reviewing them at a later stage. The outlining method was also used to establish priority and to understand the relationships between concepts during informal interviews and training. By contrast to the flow method of notetaking, this outlining method focuses on giving structure and a linear timeline.

The notes consisted of to do lists, summaries, and explanations of the tasks given to the observer. The observer also recorded several anecdotes from other auditors, as well as any recurrent vocabulary that echoed the literature review, such as, for instance, 'grocery list' and 'service provider'. The notes were taken instantly and revised later during the day in order to further precise the context and ensure that they were understandable enough for an ex-post review by the observer. The notes were anonymised to be respectful of the auditors' right to privacy. As they were taken in a linear fashion, the observer was able to place them into context and understand their meaning. The notes are to be

destroyed at the end of this internship or the end of this thesis, whichever arrives sooner. This deliberate choice in destroying the evidence collected is due to the wish of the author to be GDRP compliant and respect the firm's privacy concerns.

5.1.3 Objectives

The ethnographic method of participant observation brings additional value to the process mining and social network analysis used in this thesis. The present chapter seeks to illustrate the most relevant findings encountered throughout the observation period. First, participant observation allows the observer to witness and then comprehend and reconcile first-hand practice with theory relative to the role of the IT auditor within a financial cycle. In addition, the observer is able to report on the roles and duties expected of an IT auditor. Second, the observations may bring context to the point of interests brought out in Chapter 4, and therefore enrich the discussion in Chapter 7 with meaning and implications for practice. Last, from those observation, the author gathers the insight required to pursue the chosen methodology and more specifically, accesses the information necessary to select and prepare the data analysed in Chapter 6.

5.1.4 Intervention of the author

5.1.4.1 Context

The observer was hired in the company as an end-of-studies intern for a duration of 6 months, from January 2021 to June 2021. This internship followed the standard conditions imposed by French legislation relative to 6-month internships. As such, whilst the existence end-of-studies thesis is known and accepted, the topic is not mandated by the company, nor it is part of a project. The intern, in conjunction with the university and thesis supervisor, is at liberty to elect the topic of the thesis. As such, the intern, referred to as the observer in this chapter, and the thesis supervisor convened of the following method.

The observation coincides with the busiest season of IT auditing, and as such the high season of financial auditing. Indeed, for most of the auditees, their accounting exercise starts in January and ends in December. For business reasons or contextual reasons, the exercise might finish in other dates. For instance, most audit firms' exercises finish in June, after the end of the busy season.

5.1.4.2 Mission

The role and responsibilities attributed to the observer varied during the internship. The observer was able to divide the work done in three themes. In the first theme, the observer worked on internal and team development projects. The internal work was both related and not related to IT auditing. Indeed, some of the tasks they were involved in were encouraging a team mentality and more communication in a remote working and COVID-19 context. Other tasks were more closely related with IT auditing, for instance, an internal project of the team was to create an explanation of the ITGCs on the intranet website of the team and update ITGCs, IT Dependencies templates, among others, to reconcile with the evolution of the brand of the firm.

The second theme worked upon was Risk Management and Compliance consulting. In this specific branch, an IT auditor has the possibility to conduct missions relating to compliance and risk management, as well as the traditional conduction of IT audits. The observer, here, only took the role of a researcher and an informer, as the tasks given required expertise and knowledge. Yet, those tasks allowed the observer to interact with the other auditors more closely, and as such, it enabled practical knowledge transfer on specific legislations, such as the GDPR and the French anti-corruption law.

The last theme was IT audit, on which the observer spent the majority of their time. The observer worked on conducting IT Audit and performing both ITGCs and ITAC controls. Here, the observer was more than an observer and was considered as an auditor-in-training. This theme will be discussed in detail in Section 5.3.1.2.

5.2 Presentation of the firm

5.2.1 The context of the firm

The topic of this thesis, and specifically of this chapter, is the way of working in a Big 4 Auditing Firm. The specific entity of the auditing firm that is studied, is situated in France, specifically in a provincial branch working with primarily local clients. The firm operates as several different partnerships reunited under the umbrella of one global firm that only manages the brand and its governance. Like the other Big-4 auditing firms, this firm possesses offices and entities across the world and amongst them, multiple offices in France. The audit firm has several divided lines of business: assurance, advisory, tax and legal, digital, and internal services. Within those lines of businesses, there are sub-categories.

The observer joined the Assurance lines of service in charge of Risk Assurance. Amongst the activities of this line of business, IT auditors conduct IT audits within financial statements audits. This observation period was impacted by the COVID-19 pandemic. Indeed, remote working was encouraged, when not mandatory, and strict social distancing guidelines were defined and then applied. Furthermore, during the entirety of the observation period, a curfew was enforced, from 6pm to 6am. This measure was accompanied by a lockdown during April and May. This context impacted the observation period. The limitations and impacts caused by the pandemic are discussed in Chapter 5.6.

5.2.2 Risk Assurance Team

The observer joined a provincial office of the audit firm. The office is divided in three lines of services and support services for a total of 150 collaborators. The lines of services are Tax and Legal, Assurance line composed of the classical Assurance, which performs financial audits and Risk Assurance, and an Advisory line. The Risk Assurance team, to which the observer belongs, shares a space with Advisory. The Tax and Legal, Advisory, and financial Assurance lines of business will not be described here, as they do not intervene into the observations reported upon by the observer.

5.2.2.1 Composition of the team

The Risk Assurance team itself comprises thirteen auditors whose ranks vary from Intern, here the observer, to Partner. The proportion of women in the office is of 27%, none of them belonging to management. Within the team, all the ranks were represented: Associates, Senior Associates, Managers, Directors and Partner. 27% of the team had 2 years or less of experience, 45% of the team had between 2 and 6 years of experience and 27% had more than 6 years of experience. The background of the Risk Assurance team is fairly homogenous, outliers excepted. Indeed, 81% of the team studied financial auditing. Furthermore, amongst them 89% had experience working as a financial auditor, in another auditing firm or in this firm. The remaining 19% percent had a background in Management Control and the observer herself had a background in Information Systems. This fairly homogenous cohort may result in a different approach taken to IT auditing, as they have the knowledge to understand financial auditing and its purposes.

5.2.2.2 Governance

The management part of the team comprises 27% of the team. This number translates to 1 Partner, 1 Senior Manager and 1 Director. They have established an open-door policy within the office. This governance policy implies, for the management, to maintain the door of their office open, when not in meetings, and their communications channels open to receive questions, comments, and all necessary communication from the staff team. Additionally, informality is well tolerated, the management and members of the staff preferring civility and politeness over formality. Indeed, the formal address pronoun, 'vous'-form in French, is particularly unadvised.

The staff must therefore act in accordance with these policies. The ranks, whilst respected, do not create any communication or interaction barrier within the team. As long as someone is available, i.e., not in meetings, they may be interacted with or contacted for a question. The observer, for instance, has oft gone to an experienced staff member to ask them a question, whether they were working together or not. This freedom of interaction, whether in person or online due to COVID-19 regulations, goes both ways.

Indeed, one recurrent observation and happenstance in the office is the Partner coming out of his office to share wins, frustrations, or even to ask whether anyone wanted him to bring them a coffee. This event may also involve asks for help, or pleas for someone to help him with the newly implemented auditing software. When it comes to working together, this office seldom uses ranks as an excuse or as privilege.

The following example illustrate this fact: the observer was studying for their mandatory training dispensed by the firm. The Partner comes into the open space to ask the observer, one of the only C2 English speakers of the team, to translate a document from French to English for them. One senior auditor persuaded the Partner to call the other fluent English speaker, who was available at that time, and not the observer, in order to respect the observer's time spent in training. Simultaneously, another senior auditor rose their voice to catch the Partner's attention and proceeded to tell the Partner to 'leave the observer alone' as they were doing their methodology training. The Partner listened to his team and contacted the other English speaker who then translated the document. This situation is a common happenstance and may include requests for anything, from IT-based expertise to data analytics.

However, this freedom of speech does not equate to a disregard for the hierarchy or disrespect towards the managers. Staff members recognize the experience and knowledge

brought on by management, and the former stress the importance of hearing and enabling everyone. Thus, the hierarchy does not resemble the cliché of audit firm in which the lower ranks do not have their say about their involvement in audits or cannot express their opinion. The organizational structure of the team is flatter than most audit firms, yet it remains structured along the lines of the audit structures with defined and precise ranks.

5.2.2.3 A word on knowledge transmission: expert knowledge management

The structural organization of this specific branch, as the observer can only attest and report on the happenstances of this office, seems to encourage peer-learning and formal training. Knowledge transmission can only occur if the learner of the learner-teacher bond acknowledges his or her ignorance, accepts it, and initiates actions for remediation. The observer has noted that admitting one's inexperience is widely accepted in the office. For instance, the Partner of the office recognized that Data cubes were not something he could comprehend at the moment and asked a Senior Auditor and the observer if they could explain the concept to him. The behaviour of the Partner is humbly reproduced by other staff members. One occurrence was a Senior Associate asking for help with the Visio software, as they were generalizing its use. Similarly, when the observer did not know how to audit an AS400, from IBM, they asked an Associate, who unfortunately could not answer the question. Nonetheless, the Associate did not hesitate to reach out to the office expert on the AS400 to ask them to explain the parameters of the audit.

Indeed, the office has informal knowledge experts who are encouraged to share their experience both by teaching and building tools. For instance, the observer was tasked with creating a template for mapping IT environments with Visio, an Associate was put in charge of the reporting of the planning, and the Partner coached a senior auditor through business developments. This widely accepted peer-learning was actively furthered throughout the observation period through the elaboration of an exhaustive list of knowledge experts within the team.

5.3 Role of the IT Auditor

In this subchapter, the observer reports on the observations made during their time as an IT auditor-in-training concerning the place of the IT auditor within the firm, and more specifically, within a financial statements audit cycle. To that purpose, the observation will be divided in two parts: in the first, the role and duties asked of the IT auditor will be

reported; in the second, the responsibilities linked to their involvement within the financial audit will be explored.

5.3.1 Knowledge and Compliance

5.3.1.1 Standardized work life

The first morning of the observer's life as an IT auditor-in-training consisted of two things: memorizing every name of every masked face, concordant with COVID-19 regulations, in the office, and getting familiar with the standards that guide an auditor's work. Indeed, the Junior to which the observer was allocated presented each of the ITGCs, their objective, and place in the IT audit, specifically within the financial statement audit. The rest of the first week reflected this first morning. To that effect: the observer shadowed an Associate IT auditor, corresponding to an auditor with an experience ranging from 0 to 2 years. The Junior reconciled each task with the appropriate standards justifying its existence: documenting the audit work done was linked to ISA 230.5, and mapping the IT environment to ISA 315, among others.

5.3.1.2 Auditor-in-training

Knowledge acquisition was incremental during the internship of the observer. The internship started with a week dedicated to the foundations of financial auditing. This training was dispensed by, for, and to financial auditors who either started their career or, like the observer, were there for a 6-month internship. This week was also supplemented by MOOCs that shed light upon two factors. Firstly, they focused on the culture of the firm, the good practices of an auditor and the importance of independence and corruption-free behaviour. Secondly, the MOOCs presented the risk approach according to the methodology and the external reports an IT auditor could encounter. For example, the ISAE 3402 reports on the audit done on a specific provider by an auditing cabinet. After the first week, the observer received informal training dispensed by other auditors, whether financial or IT auditors. Nonetheless, the observer was able to reconstruct a trend in the tasks allocated and the knowledge they required:

(1) Discovering the ITGCs

It is of note that the observer skill's gain was incremental and paralleled their gain in knowledge relative to IT auditing and the auditing world in general. Indeed, the observer was given the tasks to test first the ITGCs relative to access controls, then change

management, and then computer operations. Subsequently the observer was given a wider scope of controls comprising of all the ITGCs related to one application and followed by all the ITGCs of a specific audit.

(2) IT Landscape

In order to fully understand the IT applications controls needed to cover the risks, the observer was put in charge of updating, and in some rarer cases, of realizing a map illustrating the applications used by a company, also known as IT landscape. This IT environment map of the client included the interfaces and type of connection in between the applications, as depicted in Figure 11 below. The figure reported here has been simplified for the purpose of providing an example and is thus not exhaustive. IT environment of complex companies can involve up to 800 applications. However, even an incomplete IT environment landscape may help to understand the critical component of the IS system, and therefore help in the planning of the IT Application Controls (ITAC).

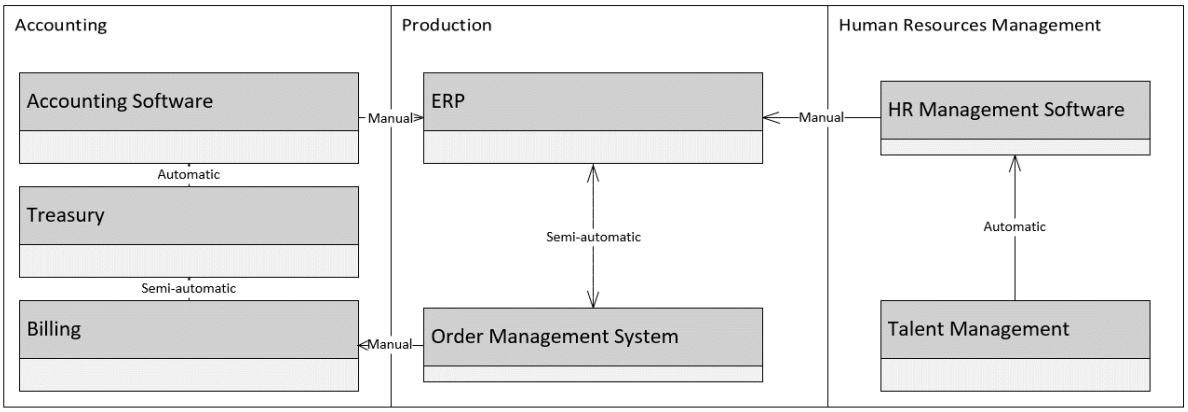

Figure 11 Example of an IT landscape (extract)

(3) Testing the ITACs

After the observer grasped an understanding of the processes and possible applications present in an IS environment, they were tasked with the conduction of specific ITACs. Those comprised of interface tests and automatic controls. The controls, whilst their nature may not be exceedingly complex, require the auditors to be able to replace the control within its place in the IT environment of the auditee, to properly measure the risk being controlled.

(4) Entity Level Control

The observer had not participated in the actual testing of the entity level controls. However, they have observed and shadowed the IT auditors tasked with them. Indeed, Entity Level Control generally happen at the start of an engagement, especially in regard

to ISA 315, relative to the understanding of the IS environment of the client or at the end with the conclusions of emitted on the states of the controls of the clients.

5.3.2 Seasonal trend

The observation period, from January to June 2021, coincided with the high season in IT audit. Indeed, the IT audit firm performs most of its work from October until March. The rest of the year is spent in audits having a different fiscal year. The financial auditors' high season starts slightly after the start of the IT auditors', from January until May. This period impacted the observer's opportunities: being a first-hand witness to and participant in the area where the IT auditors and financial auditors interact the most. Indeed, as financial auditors start conducting their audit, they require the conclusions of the IT audit. Those conclusions serve to calibrate the amount and depth of the testing done by financial auditors to certify the financial statements. However, the observer was not able to participate or witness first-hand the preparation and planning of the audit, as these happen at the start of the auditing season, mainly from May until July. In addition, the start of the testing phase and contact with the client happened outside of the observer's intervention, and as such, cannot be reported upon.

5.4 Relations between IT Auditor and Financial Auditors

Auditors do not work alone. They work with the auditee to certify the financial statements. Additionally, they work with other auditors on an engagement as the skillset, experience, and practical knowledge needs vary depending on the different tasks allocated to them. Nonetheless, the auditee (e.g., Business Relationship Manager, CIOs, or internal auditors) may be too biased and busy to clarify some elements, while other auditors might simply lack the required knowledge. Specialist auditors, such as valuation and IT auditors, are to be involved in order to fill this gap. However, specialist auditors might be involved in audit engagements for another simple reason: the GAAS and ISAs require financial auditors to complete their audit and understanding of the client through the employment of an expert. They do not, however, name which kind of experts is required.

5.4.1 Pride and Prejudice

This forced cohabitation during a financial statements audit between IT and Financial auditors may result in misunderstandings and frustrations from the different teams involved. During the observation period, the observer, as an IT auditor herself, was

especially privy to the working relations between the IT auditors and the financial auditors. For example, during a coffee chat, one IT auditor reported receiving an email from a Financial auditor requesting more IT tests to be performed on a specific application. However, the IT auditor was confused, as they had never worked together on this audit before, and the IT was on the verge of being concluded. Such an event would have only been appropriate if the manager of the IT auditor had first been contacted. Moreover, this step should have happened at the beginning, and not end, of the IT audit. The IT auditor felt confused and undervalued by the Financial auditor.

5.4.1.1 Grocery shopping – the mystery of scoping

One expression that has been recurrently heard throughout the observation period was 'grocery shopping', oft encountered in the alternative 'grocery list'. The speakers of those terms have varied across ranks and business units, yet the sentiment behind the sentence remained the same: frustration and incomprehension. In an IT auditor's jargon, a 'grocery list' derogatively refers to the tasks allocated to IT auditors by financial auditors during an engagement. The IT auditor is thus under the impression that they are ticking items off a list, without being able to have agency over their own IT audit.

Indeed, this feeling is enhanced through the common misinterpretation that the IT audit is subservient to the financial statements audit. This vision is not shared by IT auditors: "Without [IT auditors], auditors would not be able to certify with reasonable assurance the accuracy of the financial statements". In addition to the level of assurance granted by the certification of the IT environments, IT auditors are conscious of their impact on the budget and the implication of their involvement: "We take away their budget, but we reduce the number of tests they have to perform"; "[financial auditors] could focus on covering different risks". The IT auditors hence may expect more consideration during an IT audit or at least a discussion concerning their part in the engagement.

Indeed, the observer has witnessed the IT auditors' frustrations with not being involved in the earlier stages of the audit and especially the planning stage of the engagement. IT auditors feel that they are involved too late in the scoping, and therefore, that they are simply being given a grocery list to accomplish. Yet, they do not know what this amounts to, why these particular items were picked, or how this list is going to influence the audit conclusion. As shown in Figure 3**,** the scoping and planning of the audit are the first necessary steps in executing an accurate risk assessment. However, the limited

involvement of the IT auditor during this phase results in redundant work, or missing elements that may have significant impact on the financial statements.

For instance, during the observation period, the observer wondered about the testing of an ITAC and subsequent report of one application. More specifically, the observer enquired to their supervisor about the place of this application in the business processes relative to the emission of the financial statements of this particular auditee. The IT next-in-charge explained that it was required within the scoping of the audit done by financial auditors, yet the responsibility of this report was lost across the years, and the financial auditors did not rely on this report for a specific part of their work.

Another instance on an engagement was the repartition of the work between firms co-auditing an auditee. This division of work is made logically on the financial auditors' responsibilities in the audit: were the financial auditor to audit payroll, then the IT auditor of the same firm would conduct ITGCs and ITACs on applications involved in the payroll process. Nevertheless, on this specific instance, the observer's firm was tasked with the ITGCs of one application, but another auditing firm was tasked with conducting the interfacing control of the application, linked with an application in their scope. The IT auditor of the observer's firm was therefore unable to have the full assurance that the application within their scope was working as it should be and relied on another audit firm to complete their understanding and fully ensure that reasonable assurance was given.

Those two instances illustrate that the frustration felt by auditors stems from them not being involved early on in the engagement. Indeed, both IT auditors in those examples thought the issues could have been solved had they been consulted in the scoping phase of the audit, and as such, could have pointed out the issue in the division of the work or wondered about the utility of auditing a specific application.

5.4.1.2 A coffee for your thoughts

The beginning of the audit described previously does not necessarily reflect the rest of the audit engagements. Indeed, auditors, like everyone else, may not remember every little conversation that they had during their day. Unless asked specifically about informal conversations, they will focus on streamlining the process and not point out the existing effective communication between the two teams. By contrast, the observer, as they wished to integrate smoothly the firm, was hyperaware of any social encounters happening in-between IT auditors and financial auditors.

As such, the observer was able to discern differences between IT and financial auditors' interactions and link them to the factors influencing them. The first factor influencing the interactions was the physical distance between the two teams. As the audit firm is working throughout France, and especially due to the remote working put in place following COVID-19 regulations, two ways of working arose. Either financial auditors and IT auditors worked at the same branch, or they worked in different branches and interacted completely remotely. In the latter case, the observer was only privy to the IT auditors recounting their interactions with financial auditors second-hand and could not fully observe those relationships herself.

One of the most natural and fortuitous encounters happened on the way to the breakroom. The company occupies several floors of the building it is housed in. As such, each floor of the company's building harbours a different team: one for financial auditors, one for the administration and lawyers and one for the IT audit team. However, there is only one breakroom that houses the most important nutriment for auditors: the coffee machine. This is situated on the financial auditor's floor. As such, IT auditors, among others, have to go through to the financial auditor's floor every time they see the need for coffee, water, or tea. On several occasions, the observer has noticed that IT auditors make a detour to the desk of a financial auditor they are working with. This phenomenon was often observed in the breakroom itself, where IT auditors and financial auditors would separate from their colleagues to talk to one another.

The contents of those conversations ranged from deadline precision to what the financial auditors actually wanted from the tests they had asked the IT auditors for. More than small talk, important communication was prompted by the occurrence of informal meetings. One such instance of the importance of the proximity of the two teams was when the observer was working on an ITAC vital for the financial auditor's work, namely the testing of the miscellaneous operations for the General Ledger. The observer was unsure of how to interpret the findings and was able to go down to the financial auditor's floor to ask for clarification. There, they went to their corresponding financial auditor, who explained the financial concepts behind the test and therefore the implications of the findings. From there, the observer and the financial auditor managed to establish a communication where they decided on which test to perform and which to forgo, as well as on what could or could not be performed via the IT auditor's tests. Without that physical proximity and the ability to informally contact a member of the other team, the test still

would have nevertheless been performed. Yet, the quality of these tests and the presentation of the findings would have suffered.

Those moments shared between the two teams may be interpreted as an investment in the future. Indeed, the second factor influencing the communication between the IT and financial auditor was the relationship cultivated and fostered by the two actors. Throughout the observation period, the observer was able to see the differences between those auditors who were used to working together and those whose relationship was still evolving. The trend uncovered was the following: the more a financial auditor worked with an IT auditor, the deeper their understanding of the IT auditor's work was and vice versa. That deeper understanding was often accompanied by a closer working relationship and increasing mutual respect for the work done by each party.

This can be illustrated by the following observation. A financial auditor quit the firm after working at the auditing firm for more than 4 years. An IT auditor has been working with that financial auditor on the same engagements for 2 years. The IT auditor was saddened to hear the news, for several reasons, but they especially noting that "it's a shame, [financial auditor] was starting to get a good grasp on what we're doing" and that "they [financial auditor] was able to reconcile both sides [financial and IT]". The financial auditor in this case was able to bridge the needs and requirements of both audits due to their experience in working with IT auditors and their willingness to interact with every actor of an audit to understand the bigger picture. As such, the time spent understanding IT audit was later gained back through streamlined needs and communications in joint work.

Another instance of the importance of this factor was the observation already recounted about the observer and the miscellaneous transactions tests. This financial auditor chooses to see the time spent explaining the principles and reasoning behind the tests to the observer as an investment. Indeed, this investment resulted in the observer being able to create a template for the tests. The template created served two purposes: a gain of time and an increase of the quality of the work done by the IT auditor catered to the needs of the financial auditor.

Physical distance and relationship investment are not the only factors influencing the relations between IT and financial auditors. Indeed, other factors may influence the relationship, such as personality, desire to learn, and curiosity. However, these two factors occurred repeatedly throughout the observation period. They are most relevant because of their particular importance within the COVID-19. In contrast to the other factors,

minding the physical distance and investing in a remote relationship required an active mindset and purposeful interactions.

5.4.2 Cooperation and Collaboration

Effective communication, whilst fundamental in itself, cannot be a guarantee for the quality of an audit. Communication is the first step into financial and IT auditors working as one single team. The following steps involve using that communication to first cooperate and then collaborate on audit engagements.

5.4.2.1 One puzzle, two teams

Throughout the observation period, the observer was able to witness, report and take part in cooperation with financial auditors. Here, cooperation means IT auditors working to support the financial auditors' goals, which are ultimately to certify the integrity and fairness of the financial statements presented by the auditee. Throughout the observation period, the observer has seldom seen financial auditors helping or supporting IT auditors during their work. As such, the working relationship between the two entities is unbalanced, resting solely on the IT auditor supporting the financial auditor through their work.

For instance, the observer once created work files and an algorithm in a data management program for the financial auditors to perform their control. The role of the observer was to enable the control, not perform nor work with the financial auditor. In contrast, the assistance offered by the financial auditors to the IT auditors was mainly focused on documents, or on helping the IT auditors to communicate with the client. One such instance occurred when an IT auditor performed an ITAC. This IT auditor, in order to not over solicitate the client, asked the financial auditor for the file needed for the specific control. As the file was the General Ledge, the IT auditor knew that the corresponding financial auditor had access or had received it from the auditee. In this instance, the assistance helped the IT auditor perform the control, yet the document could have been received from the auditee. Consequently, whilst useful and mindful of the auditee, this interaction does not enable the testing of the control, simply easing its execution.

This unbalanced relationship may be experienced as the two teams, IT and financial, working together on a single puzzle, whilst the IT auditors are simultaneously working on their own puzzle within it.

5.4.2.2 Bigger picture

The perception of IT auditors and their role within a financial statements audit is an important observation worth reporting. More specifically, the point of view of IT auditors on their own audit, the IT audit within the financial statement audits, is interesting. Indeed, it was established through observation that the financial auditors were focused on certifying the financial statements.

The observer, as an IT auditor, reports on a different tendency in IT auditors. Indeed, first as a participant, the observer had noted their own singular perspective. They were thinking of the IT audit as the main audit and the financial statements as a removed objective. This perspective was pointed out as a characteristic of beginner IT auditors by other more experienced IT auditors. Nonetheless, the observer has witnessed the same tendency in other IT auditors, albeit in a smaller capacity. Indeed, there is a slight struggle among auditors to constantly remind themselves that they are not conducting the audit to certify the IT environment or internal control, but to certify the financial statements of the auditee. It is important to note that this tendency has been observed in this specific instance and team of the company. As this IT audit team does not only conduct control assurance (financial audits) but other kinds of audits, they might not effectively represent the sentiment of IT auditors focused solely on certifying the financial statements.

Nevertheless, the fact persists that whilst the financial auditors were observed to focus more on their own audit, IT auditors may be subject to the same tunnel vision effect.

5.5 Evidence of the communication

As established earlier, communicating, whether with clients or with co-workers, is an important facet and duty of an IT auditor, as they cannot conduct an IT audit and relate it the financial statement audit on their own. The audit firm of the observer was, consciously or not, aware of the need to encourage communication. Indeed, the firm had put into place several tools for the auditors to communicate. Those tools can be divided in two categories, the ones offering an official way to communicate and the tools enabling an auditable trace of the communication that takes place within an engagement.

5.5.1 Official communication

Throughout the observation period, the observer was able to witness and take part in official communication. Through official communication is meant communication that

happens formally and whose content is able to be traced back and examined. Nonetheless, this communication is private and does not belong in an audit file, special considerations excepted. In the firm the observer was interning, the official communication had three conducts: a chat application, emails, and meetings.

In contrast to auditable communication, official communication is not saved and archived within the engagement's file. Its main purpose also differs from auditable communication, whereas the purpose of auditable communication is to provide an audit trail, whether external or internal, the official communication's purpose is to inform on a new status of the process and share relevant information. The use of official communication tools varies and mainly depends on the intent behind the communication.

The observer noticed that simple questions or detail requests were done through the chat application (either Skype or Google Chat). When it came to logistical and organizational matters, the information was best transmitted through meetings, which took place remotely due to the circumstances brought on by the COVID-19 pandemic. Finally, emails were used to either reach recalcitrant or unknown correspondents, or most often to formally emit a request. Indeed, the trend identified was that IT auditors are more formal in emails and tend to keep those forms of communications for important purposes. The function CC and BCC are also used to keep the superiors "in the loop" and as such, it was a managerial tool to support and supervise the work of auditors in a passive manner.

The observer used mostly emails to communicate with financial auditors, and chat applications were used at a lower frequency. Being low on the hierarchical ladder, the observer rarely needed to participate in or organize meetings. The emails were used to communicate effectively with financial auditors and keep their manager informed.

However, the observer was able to notice that their use of the official communication did not liken the ones of their fellow IT auditors. Indeed, relative to communication with financial auditors, IT auditors had a tendency towards primarily using meetings and chat applications. Emails were used as a last resource or to formally clarify certain points with all the actors involved in the engagement. By contrast, meetings were used to give an update on the advancement of the work and more specifically to discuss audit points between IT and financial auditors responsible for a process. Those meetings may range between a duration of 5 minutes to 25 minutes in average, by the observer's estimation. The most common way of communicating was through chat applications. Those were used for planning, documents requests, information sharing, among others.

5.5.2 Auditable communication

5.5.2.1 Pandora's box

In order to respect and satisfy the conditions imposed by the audit documentation ISA 230 norm, the audit firm of the observer created a central software, referred to as Pandora in this thesis. Pandora comprises one base per audit engagement per year. The software divides the engagement into two categories: actual engagement and archived engagement. The difference between the two stems from the rights allocated to the team members: an archived base cannot be modified, but only 'read' upon request. Within a base, there is one area for each phase of the audit: Planning, Execute and Conclude. Additional areas are present in the software, but they are there for administration and logistic purposes. The financial auditors are in charge of creating a base and preparing it for the engagement. Indeed, they conduct this task by scoping the risks present and deploying the controls needed to cover those risks. Each of those controls is performed within an audit paper.

The observer notes that whilst the base is mainly administrated by financial auditors, IT auditors perform their work in their own audit papers within Pandora. As such, IT Auditors and financial auditors only interact on specific audit papers and controls.

Throughout their participation in engagement and inquiries with other IT auditors, the observer managed to identify the following 3 audit papers. The first one takes its place in the Planning activities of the audit engagement. IT auditors must, in collaboration with financial auditors, understand and report on the IT environment of the client and its maturity, as per ISA 315. The second audit paper is in the one relating the conclusions and opinions of the IT auditor on the auditee's IS environment. In addition, this audit paper presents the weaknesses of the controls of the auditee, the risks brought by those weaknesses and how the auditee managed to mitigate and alleviate the related risks. The financial auditors need to acknowledge and understand this audit paper in order to adjust their work if necessary. The final audit paper is the one related to IT auditors scoping the risks associated with their audit. As this audit paper is highly involved with the scoping phase, the financial auditor must understand the risks faced by the auditee.

5.5.2.2 Meeting-itis ('la reunionite')

The IT auditors' time is punctuated with various and numerous meetings. Whatever the advantages or disadvantages of holding those meetings may be, the most relevant point for this thesis is that those meetings allow for official and auditable communication.

Indeed, throughout the observation period, the observer prepared reports for meetings and then subsequently took part in those meetings. The reports presented and shared during those meetings, sometimes accompanied by the minutes, are then logged into the corresponding audit paper in Pandora.

During an audit engagement, IT and financial auditors meet often to exchange on the organization of the work, context of the client, conclusions, or an update of the work done. The audit firm of the observer makes the following mandatory. First, there is a team planning meeting, in which the entirety of the audit team of a specific engagement, including specialists, is gathered for an extensive presentation of the auditee, its risks, the repartition of the work and the deadlines. The report shared is a PowerPoint file. The team planning meeting, during COVID-19, is held through the remote video-communication software used by the audit firm. This is followed by a conclusion meeting in which the IT auditor present their audit conclusions to the financial auditors. The conclusions' report is then uploaded on Pandora, in the IT conclusion audit paper. Other meetings may take place, as per the demand or need of the audit. The observer has only participated in conclusion meetings, as team planning meetings happen only at the start of the audit before the integration of the observer into the firm.

This official communication is supplemented with minutes or a presentation, thus offering evidence of the communication shared between teams. Furthermore, this communication allows for the two teams to be exhaustive in their findings and matters of interest, as they can rely on the reports to base their work on thereafter.

5.6 Intermediary discussion

The results, summarised in Table 8, reveal four main types of actions performed by IT auditors: ITGCs, ITACs, IT Landscape, and understanding the IT environment. The approach taken by IT auditors starts with a macro understanding of the IT environment. Subsequently, the IT auditors delve into specific details through the testing of IT general controls. Once those controls are evaluated, through the ITAC, the IT auditors link their IT understanding with the business processes in charge of transporting financial information. Finally, in order to share their conclusions with the Financial auditors, the IT auditors translate their findings in terms of financial implications. This is in line with Gantz (2013), who defines the concrete actions of the responsibility of the IT auditor.

Table 8 Summary of the results

Observed IT Audit Phases*	Audit		Post-Audit
	Planning	**Conduction**	
Seasonal observation	*May-August* *Few observations opportunities*	*September-March* *Significant observations opportunities*	*March-June* *Significant observations opportunities*
Purpose of IT auditor	Translating the IS environment and its risks to an IT audit plan. Communicating (new) risks related to the IS environment and financial business processes	Measuring the controls necessary to evaluate the maturity of the IT environments Testing the integrity of the financial dataflow coming through essential applications	Building action plans to mitigate the potential risks uncovered by the audit Explaining the implications of the conclusions to Financial auditors
Task of IT auditor	Meeting with the client (+) research to understand and update the IT auditor's comprehension	Testing ITGCs and ITACs for the scope defined in the Planning. Measuring the impact of the potential deficiencies	Finalizing the documentation of the IT audit Presenting the conclusion of the IT audit to auditee and Financial auditors
Interactions	Mainly one-sided (Financial > IT) Occurrences of two-sided (Financial <> IT)	Absence of formal interactions Occurrences of informal one-sided reports (Financial < IT)	Mainly two-sided (Financial <> IT) Occurrences of one-sided (Financial < IT)
Communication form	Audit Software (AS), Mails, Meetings	Mails, instant messages, and calls	AS, Mails and Meetings
Formalisation of the interactions	AS: Planning Workpaper (testing to the norm ISA 315) Team Planning Meeting (one-sided Financial > IT)	/	AS: Conclude Workpaper (theoretical collaborative exercise) Conclusion Meeting (two-sided Financial <> IT)
Potential conflict	No involvement of the IT auditor at the moment of construing the planning and scope. Presentation of the Planning to IT auditors	Tunnel vision of the IT auditor: focusing on IT audit solely Financial auditors unaware and uninterested on the tests performed by the IT auditors	Lack of exchange or collaboration on the risks found by the IT auditors and the solution to mitigate their repercussions

**due to the nature and context of the observation, the author could not report on the pre-audit phase, as it happens outside of the scope of this thesis. Reminder: this research took place from January to May.*

Moreover, it is coherent with the standard SAS108, which defines the intervention of the IT auditor as experts able to understand and evaluate the complexity of the IS environment of the auditee. Indeed, through those actions, the IT auditors are able to weigh in on whether the IS of the auditee is mastered and the processes focusing on emitting the financial statements are reliable. These findings answer research question (1b) relative to the tasks performed by IT auditors during an audit engagement.

Research question (2a) is answered through an interesting discovery in the observation of the audit cycle. Indeed, the results indicate the existence of two crucial moments in which the IT and Financial auditors interact. The first moment relates to the planning activities of the audit, namely the risk assessment, understanding the client's IT landscape, and defining the activities that must be performed by IT auditors. Nonetheless, the role of the IT auditor is less defined and less formalized. Indeed, their role is to understand what is expected of them and to accomplish their tasks. The second moment in which IT and Financial auditors interact occurs when the IT auditors present their conclusion to the Financial auditors. Similar to a relay race, this constitutes a formal 'pass the baton' moment from IT auditors to Financial auditors. Here, the IT auditors signal the end of their involvement and their responsibility over the audit engagement. After this moment, the IT auditor's role ends, and their race is over.

Those two moments encompass, respectively, the start and the end of the IT audit involvement in the financial statements' engagement. However, the results do not reveal a formal interaction occurring mid-IT audit. This absence furthers the line of thought expressed by Bauer et al. (2019) outlining IT as a service done to financial auditors. The observations indicate that the Financial auditors are interested in the IT auditor insofar as the practical impact on their own audit work. This suggests a clear hierarchy between financial and IT audit, whereby IT audits carry less weight in the resulting financial statements. This finding is in accordance with Boritz et al. (2020), who observed a hierarchical trend in the subordination of IT auditors to Financial auditors.

In regard to research question (2b), the results indicate that the official formalization of the IT audit takes the form of a workpaper in the Audit Software. However, only two workpapers require the input of both IT and Financial auditors. Those workpapers correspond to the Planning of the IT activities and to the Conclusion of the IT audit, as represented in Figure 18 and Figure 19respectively. They parallel the main moments of interaction between two teams: the start and end of the IT audit. No interaction is formalized in the audit, the work performed by the IT and Financial auditor being perfectly divided

and separated. This suggests that there is no collaborative work during an audit engagement: they work in parallel. This inference is further supported by the existence of other types of formalization, which are only used in a communicative manner. In those, Financial auditors are informed of the work done by the IT auditors, ergo a one-way communication channel. This reinforced the idea promoted by Boritz et al. (2020) that the IT audit is considered as subservient from the Financial Audit.

The findings derived from the analysis of the observations have implications for the next part of this paper. One of the most relevant implications is the contextual elements and interpretations that will potentially enrich the analysis and the data collected and analysed in Chapter 6. Through observation and participation, the most relevant audit papers were identified, namely the IT audit planning and scoping workpaper, henceforward referred to as Planning and the workpaper in which the conclusions of the IT audit are presented named Conclude. They were selected according to the participation of both IT and financial auditors, and as such, might offer an insight into the formalization of the communication of IT auditors with financial auditors within the scope of the financial statements audit.

5.6.1 Limitations

The results and observations made in the preceding chapter are discussed in the following section. This intermediary discussion is split into three sections. First, the limitations of the methodology and of the qualitative part of this thesis are presented. Then, an attempt will be made to preliminarily answer the research questions. Finally, the implications for the quantitative analysis of the thesis will be given.

This paper endeavoured to study the role of the IT auditor within a financial statement audit, and more specifically, their relationship with the financial auditors. Within the scope of this study, some limitations must be noted. Firstly, the choice of using participant observation, like any other methodologies, does not permit to exhaustively answer the research questions. Indeed, as the data gathered describes a group observed in a specific context, it is incomplete by nature. Furthermore, the data collected is subject to the will of the researcher, simultaneously being the researcher and the participant. The duality of the role must be considered as this may translate into the existence of a subconscious bias. The observer must make instant judgement calls as to which data is pertinent and which adds noise to the collection. This subconscious bias intervenes in the later stage of the analysis, as it is reflected through the lenses of the observer. However, steps have been

taken to mitigate the risk. For the bias concerning data collection, any document and resources that could corroborate or add more information were kept by the observer. The bias is further mitigated through the use of peer-review and triangulation of data.

Secondly, participant observation relies on observing one group within its natural environment in order to understand it (Spradley, 2016). The conclusions drawn from those observations may relate to this group specifically and be hard to generalize to other groups. In this thesis, the group observed forms its own microcosm within a Big 4 and may not be applicable to different groups from other Big 4 or offices. Nonetheless, Big 4 are known to recruit individuals according to the same guidelines and principles. Therefore, the risk of the group not being representative is limited, as the group is formed of individual that were recruited on equivalent if not the same criteria. As the subject of this thesis is the IT auditor themselves and not the IT auditors' team, the individual hiring criteria can be relied upon to ensure a possible generalization to most IT auditors.

Thirdly, the social-economical context surrounding this thesis may have influenced the data collection. Indeed, this thesis and subsequent internship occurred within the second year of the COVID-19 pandemic. As France instituted a curfew, remote working regulations and finally a partial lockdown within a 5-month period, the working conditions changed, and the status quo was never reached. This resulted in a loss of opportunity for natural interactions with co-workers and an inability to observe auditors in a pre-COVID setting. Nonetheless, while the IT auditors were not observed in their natural state, namely at the client with the financial auditors, this situation brought novel opportunities. Consequently, as the occurrence of physical conversations lowered, remote communication and auditable exchange gained in importance and in intensity.

6 PROCESS MINING ANALYSIS

This chapter the reports results of the quantitative analysis, Process Mining. The dataset described and prepared in Chapter 6.2 is mined to discover the underlying processes.

6.1 Protocol

The protocol described below is followed for both audit workpapers in order to obtain coherent results and minimize the number of variables considered in the discussion.

6.1.1 Definition of the roadmap

The analysis was performed in various stages. The first step dealt with the testing and preparing the data. Indeed, the data was not collected in a single instance but incrementally. The reasoning behind this collection stands is that the object studied are workpapers in the audit software, and the cases allocated to the researcher were not archived and are still active. As such, the incremental data collection and data preparation allowed the researcher to gather a test sample through which the research protocol can be created.

Two software tools were used for the analysis: Disco and ProM. ProM is a research-based software supporting a multitude of process mining techniques and related add-ons (ProM, 2010). This software was used to gather general process statistics on the process mined and a clearer depiction of different elements of the process. However, subsequently, Disco was preferred. Indeed, Disco is a discovery process mining software; thusly focusing on automated process discovery and highlighting actionable insights (Fluxicon, 2020). The figures below represent the depictions for each software of the same process: Disco as Figure 14, and ProM in Figure 13**.** The complementary utilisation of those software allows for an in-depth perception of the entire process being mined.

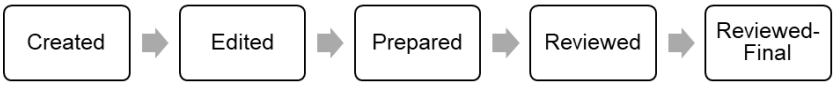

Figure 12 Theoretical workflow of workpaper's formalization in Pandora

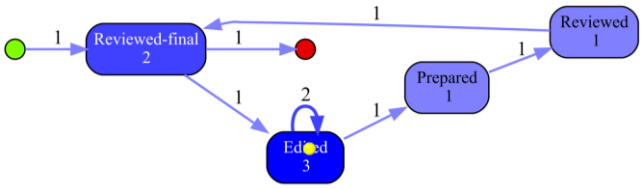

Figure 13 Visualisation of Mined Process of Extract (Table 10) with ProM

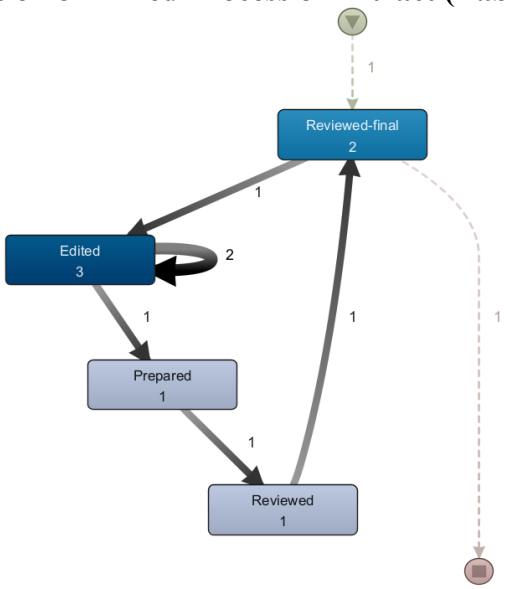

Figure 14 Visualization of Mined Process of Extract (Table 10) with Disco

The data was extracted from the software Pandora (see Chapter 4.2). It was first stored in a comma separated .csv file. The headers were chosen according to the usual denomination found in process mining. Only three headers are required when mining a process: case_id, activity, and timestamp. The additional information, here 'resources', enrich the interpretation and mining process.

Table 9 Description of the headers used in the data preparation

Header	Definition	Example
case_id	Instance of a series of events constituting a process.	*integer:1, 2…*
activity	Event, step of a process.	*string: Created, Edited…*
case_id:actor	Person in charge of doing the activity relatively to the instance of the process.	*string: Manager, Associate…*
timestamp	Time at which the event occurred, specifying both the date and the time.	*dd/mm/yyyy hh:mm:ss* *14/04/2021 09:00:00*
team	Additional information about the actor's audit team	*Stored as a string:* *IT or Financial*

The data is prepared as an event log and is presented as seen below, in Table 10. The following extract of an event log illustrates the definitive format used in the process mining analysis. Several types of formatting were tried, yet only the final version can be used in all the software without manipulation in between, therefore guarantying the validity of the trans-software analysis.

Table 10 Extract of data prepared as an Event Log

case_id,activity,case_id:actor,timestamp,team
1,Reviewed-final,Manager,14/04/2020 09:00,IT
1,Reviewed ,Manager,14/04/2020 08:00,IT
1,Prepared,Associate,11/04/2020 08:00,IT
1,Edited,Associate,11/04/2020 07:00,IT
1,Edited,Associate,18/02/2020 07:00,IT
1,Edited,Associate,17/02/2020 10:00,IT
1,Reviewed-final,Manager,13/02/2020 09:00,IT

It is noteworthy that the specific hour at which the action was realized was not available. The hours seen in the extract above are factice and are meant to keep the order of the events as presented in the software Pandora. Without this timestamp, several activities performed on the same day for the same case would have different orders. Figure 15 and Figure 16 both represent the mined extract in Table 10 through the software ProM. In Figure 15, the hours keeping the order are deleted. In Figure 16, the same process is seen with the addition of the hours. As can be seen by comparing the figures below and Table 10 , only Figure 16 retains the integrity of the data. It is also interesting to note that the software Disco can use a different column to differentiate actions with the same date, however, this functionality is not available in ProM.

Figure 15 Mined Process of Extract (Table 10) without time

Figure 16 Mined Process of Extract (Table 10) with time

6.1.2 Conduction of the analysis

The analysis was conducted through the two aforementioned softwares: ProM and Disco. Prior to the analysis, a testing phase was performed to test each software and their respective capabilities against the same sample. The data collection was incremental, which

allowed for an extensive testing phase. The process was then calibrated and compared to suit the available data. The protocol below was generalized to the two complete datasets.

The steps of the chosen protocol are enumerated below:

(1) Data was extracted and stored in a .csv format

(2) Preparation of data to suit the template agreed upon

(3) Primarily mine the process on ProM

   a. Verify the logical conformity of the data

(4) Mine the process on Disco

Disco offers the possibility to gather descriptive statistics about every process mined, as exemplified in Figure 17. These are reported for each process that is mined. The software also provides statistics on the different factors entered as input through process mining. For instance, the dashboard presented below provides an overview of the statistics relative to the Activity inputs performed in the process. A time-perspective or resource-based perspective may also be generated if required. However, Disco does not offer the possibility to see the processes under a 'trace' format simultaneously for all the cases in the dataset. This functionality, as exemplified in Figure 16, is useful in validating the conformity of the data through a comparison with the event log. The software ProM is therefore used in this step.

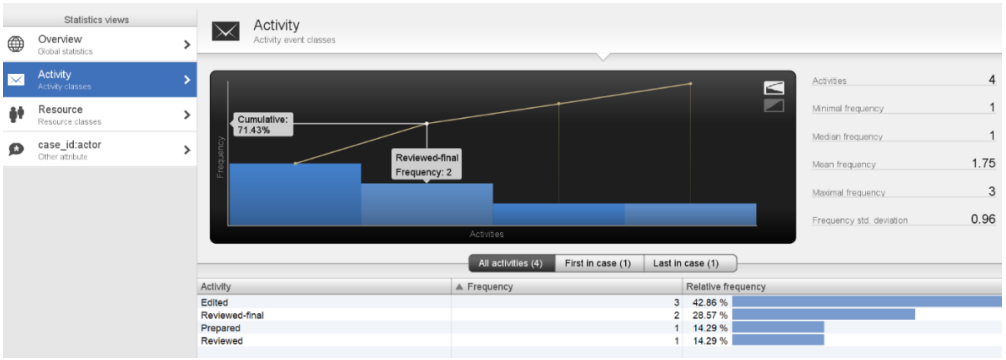

Figure 17 Instance of an Activity Dashboard of Extract (Table 10) with Disco

6.1.3 Choosing the settings

Both softwares have a limited number of elementary settings to choose from. The process mining is fairly uniformized and already configured within the software, with the difference that ProM offers a variety of mining processes. For the sake of this thesis, the most commonly used, directly-follows graph, is used throughout the analysis process.

One setting present in both softwares is the adjustment of the Activities and Paths parameters. This is pivotal in visualizing and interpreting the mined processes. The Activity (*a=x*) parameter allows the researcher to adjust the numbers of activities displayed in the process, with *a = 0* showing only the most frequent activities and *a=1* showing all the potentials activities of a process. The Path parameter influences the number of paths displayed in the visualisation of the process being mined. Thus, a Path with *p = 0* will indicate only the predominant process flow, whilst *p = 1* will reveal all potential paths.

The arbitration for sliding the scale of the parameters may not be built on literature: there is no optimal setting which would produce the best mined process common for all cases. Nonetheless, there are good practices to follow and reflect upon. Indeed, Disco will automatically pre-select a combination of *(a,p)* to efficiently visualize the process (Fluxicon, 2020). The software user manual Fluxicon (2020) advises to start from this selected position and use the sliders to refine the process according to the needs of the researcher.

6.2 Reporting – Planning IT Audit workpaper

6.2.1 Description of cases

The process analysed here, the formalization of the Planning workpaper, has a total of 124 events logged. The event log is composed of 5 different activities, also known as events, which may be performed by either an IT auditor or a Financial auditor. In contrast, the activity 'Created' is initiated, in every instance, by the software itself. Therefore, the total number of different activities *(2x5 +1=)* is 11. As such, the minimum of events that occurred in the cases mined is *min=10* and the maximum is *max=20*. The median number of activities per case is 12. The mandatory steps 'Created' and 'Reviewed-final', hence the start and end of each process, is included in the calculations. The mean duration of a process is 29 weeks, and the median duration of a case is 29.2 weeks.

6.2.2 Planning – Points of interest

6.2.2.1 Composition of the events

Table 11 Composition of the Planning Process

Activity	Frequency	Relative Frequency
Created – /	9	7.26%
Edited – Financial	24	19.35%
Edited – IT	25	20.16%

Prepared – Financial	3	2.42%
Prepared – IT	11	8.87%
Reviewed – Financial	21	16.94%
Reviewed – IT	7	5.65%
Reviewed-final – Financial	19	15.32%
Reviewed-final – IT	2	1.61%
Sent Back – Financial	2	1.61%
Sent Back – IT	1	0.81%

Table 11, above, reveals that the distribution of the activities within the process is not equally divided. Indeed, the most performed activities are 'Edited', with a cumulated frequency of f=49, consequently constituting F=39.51% of the Planning Process. By contrast, 'Sent Back' is cumulatively the least occurring activity (f=3), thusly having a relative frequency of F=2.42% throughout the process. The activity 'Created', with a cumulated frequency of f=9 (rel. F=7.26%), happens in every instance of the process, thus offering a baseline of comparison. Indeed, any cumulated relative frequency above F=7.26% signifies that the event occurs at minima once in every case. Conversely any relative frequency inferior to F=7.26% means that the event does not occur in every instance of the process.

In addition to the occurrence of the events, Table 11 indicates the team performing the activity in the Planning Process. A trend may be identified within the table, whereby the frequency at which an IT auditor performs an action decreases progressively throughout the process. Indeed, notwithstanding the 'Created' and 'Sent Back' events, the highest frequency of IT involvement is at the beginning of the process with 'Edited – IT' event having occurred f=25 times. By contrast, the last action performed during the Planning Process, 'Reviewed-final' is performed by an IT team member only twice (f=2) against f=19 performed by a Financial team member.

It is noteworthy to mention that this trend is inversed in Financial team members, with Financial Team members keeping a stable frequency of involvement throughout the Planning Process.

6.2.2.2 Part of Financial/IT auditors

Table 12 Repartition of the events in the Planning Process Mining

Team	**Frequency**	**Relative frequency**
Financial	69	55.65%
IT	46	37.1%

/ (*i.e., Pandora*)	9	7.26%

In the mined process, financial auditors participated more in the planning workpaper, as may attest the relative frequency F=55.65%, against the IT auditors who contributed only F=37.1% of the process. It is of note that whilst the creation process is automatically done through the initialisation of the Pandora base, the initialisation act is always performed by financial auditors. Table 13, below, further illustrates the distribution of the tasks per team and per part of the process. The disequilibrium between the IT and Financial auditors is notable. Indeed, the IT auditors seem to mainly focus on the completion part of the process, whilst the Financial auditors concentrate on reviewing of the process. Nonetheless, Financial auditors remain present, at a lesser scale, in the completion process, conversely to the IT auditors whose contribution to the reviewing process may be considered anecdotical.

Table 13 Repartition of the Team per Part

Part	IT	Financial	Total
Completion	37	29	66
Reviewing	9	40	49

6.2.2.3 Repartition amongst the ranks

Table 14 Composition of the ranks intervening in the Planning Process

Rank – Team	Frequency	Relative frequency (n=124)
Senior Associate – Financial	23	18.55%
Partner – Financial	20	16.13%
Associate – IT	15	12.10%
Senior Manager – IT	12	9.68%
Senior Manager – Financial	12	9.68%
Senior Associate – IT	11	8.87%
Pandora - /	9	7.26%
Associate – Financial	5	4.03%
Director – Financial	5	4.03%
Manager – IT	4	3.23%
Manager – Financial	4	3.23%
Director – IT	4	3.23%

Throughout the process, the events are performed by auditors either from the Financial or IT team, with the notable exception of the ‘Created’ activity. In addition to the team,

the actors may be separated and recognized according to their ranks. It is noteworthy that both teams comprise fully of auditors, and consequently have paralleled ranks. Table 14 gives an overview of the consolidated ranks intervening on the Planning process. All teams considered, the Senior Associates have the most influence in the process with a cumulated occurrence of F=27.42%, intervening in each process at least thrice.

Nonetheless, an interesting observation is that amongst the Senior Associate and their relative frequency of F=27.42%, the Financial Senior Associates account for F=18.55%, and the IT Financial Associate for F=8.87%. This unequal repartition within the teams may be identified in other ranks. Indeed, in contrast to the prevalence of financial auditors within Senior Associates, the Associates are primarily IT auditors, with F=12.10% against F=4.03% for Financial auditors. Furthermore, whilst IT Partners do exist, they are not involved within the Planning workpaper (rel. F=0%). Conversely, the occurrence of Financial Partners is high (rel. F=16.13%) and they intervene in every case of the dataset. However, this trend may not be generalized for every rank and auditor. IT and Financial Directors, Senior Managers and Managers are equally distributed in the involvement in the Planning Process.

Table 15 Repartition of the activities per Rank and Team for the Planning Process

Activity	Frequency	Relative frequency
Edited - Senior Associate - Financial	11	8.87%
Reviewed - Partner - Financial	10	8.06%
Reviewed-final - Partner - Financial	10	8.06%
Created - Pandora - /	9	7.26%
Edited - Associate - IT	9	7.26%
Edited - Senior Associate - IT	8	6.45%
Prepared - Associate - IT	6	4.84%
Edited - Senior Manager - IT	6	4.84%
Reviewed - Senior Manager - Financial	5	4.03%
Reviewed-final - Senior Associate - Financial	5	4.03%
Reviewed - Senior Manager - IT	4	3.23%
Edited - Senior Manager - Financial	4	3.23%
Edited - Manager - Financial	4	3.23%
Reviewed - Senior Associate - Financial	4	3.23%
Prepared - Senior Associate - Financial	3	2.42%
Reviewed-final - Senior Manager - Financial	3	2.42%

Edited - Associate - Financial	3	2.42%
Prepared - Senior Associate - IT	3	2.42%
Reviewed - Manager - IT	2	1.61%
Reviewed-final - Manager - IT	2	1.61%
Sent Back - Associate - Financial	2	1.61%
Edited - Director - Financial	2	1.61%
Reviewed - Director - Financial	2	1.61%
Edited - Director - IT	2	1.61%
Sent Back - Senior Manager - IT	1	0.81%
Prepared - Director - IT	1	0.81%
Reviewed - Director - IT	1	0.81%
Prepared - Senior Manager - IT	1	0.81%
Reviewed-final - Director - Financial	1	0.81%

The tables presented in the analysis have insofar focused on isolated factors and inputs of the Planning process. By contrast, Table 15 seeks to present an overview of the dataset used as input to mine the Planning process. It enables further investigation of the involvement of each rank per activity per team. A primary observation can be made concerning the distribution of tasks amongst the ranks. The higher ranks, i.e., Partner, Senior Manager and Director, are in charge of ‘Reviewed’ and ‘Reviewed-final’ in most cases. This separation of rank may be further observed within the ‘Prepared’ activity; the relative frequency of a lower rank, namely Associate and Senior Associate is of F=9.68% against F=1.62% for the higher rank, here Director and Senior Manager.

An additional interesting observation lies with the repartition of the tasks from a team perspective. The frequency of the IT team’s involvement in the earlier steps of the process, namely editing and preparing, is higher than the Financial auditors’. This observation is clear when comparing the ‘Edited’ and ‘Prepared’ actions rank by rank within the teams; for instance, the frequency of an Associate from the IT team is F=7.26%, whereas the relative frequency of an auditor of the same rank within the Financial team is F=2.24%. Conversely, the Financial auditors are predominant in the reviewing process of the Planning Workpaper, their cumulated relative frequency being F=32.25% against F=7.26% for the IT auditors.

6.2.3 Planning – Mined Process

6.2.3.1 Explanation of the process

The workflow illustrated in Figure 19 below was extracted from Disco with the parameter for activity, a=0.7 and for the path, p=0.3. There are two sets of numbers on the workflow defined below. It is noteworthy that the case frequency ignores all the repetition of an action, focusing rather on the numbers of cases for which the particular path was followed. Conversely, the absolute frequency considers and reports on the possible rework or repetition of an event.

The processes illustrated in this thesis, namely Figure 18 and Figure 19, mined by Disco, adhere to the following conventions (Fluxicon, 2020):

(1) On the events

   a. The white bolded number is the case frequency, namely the number of times the event happens in the visualisation of the process.
   b. The white number in brackets is the total occurrence of the event throughout the entire process, all variants included.

(2) On the arrows

   a. The black number is the case frequency, representing the number of times the process follows this path.
   b. The grey number is the absolute frequency, namely the number of times this particular path has been followed in total.

Example: Reviewed-final – Financial occurred 19 times throughout all the cases. However, it followed this particular path, Reviewed-final – Financial to Finish, 8 times.

6.2.3.2 Commentary on the Planning process

Figure 18 below represents the mined process of the Planning workpaper, and therefore the process of the formalization of the Planning audit work by IT and Financial Auditors. The process has a unique starting point through the activity ‘Created’, performed in every case by the software Pandora. The end of the process may only be initiated by the activity ‘Reviewed-final’, however this activity does not necessarily prompt the end of the process. Indeed, the process ends after ‘Reviewed-final’ is executed and there are no other activities being performed. Once those two conditions are met, the process ends.

The process is generated with the parameters set at a=0.7 and p=0.3. This allows the most relevant events, namely the events with the most occurrences, to be visualized. In addition, setting the parameter Path at p=0.3 allows for a consolidated visualisation of the process, revealing the predominant paths. The path created in Figure 18 may be compared to the ideal process structure illustrated in Figure 12, thus approximating the optimal process. This resemblance stops in two different steps: first, there is a loop between Edited-Financial and Edited-IT, bypassing the activities 'Prepared' and 'Reviewed'.

An additional interesting observation is of the different teams interacting and sharing the 'Edited' activity; it may be translated to information added to the workpaper. A second loop may be observed in the reviewing process, where the process diverges from the standard established in Figure 12**.**

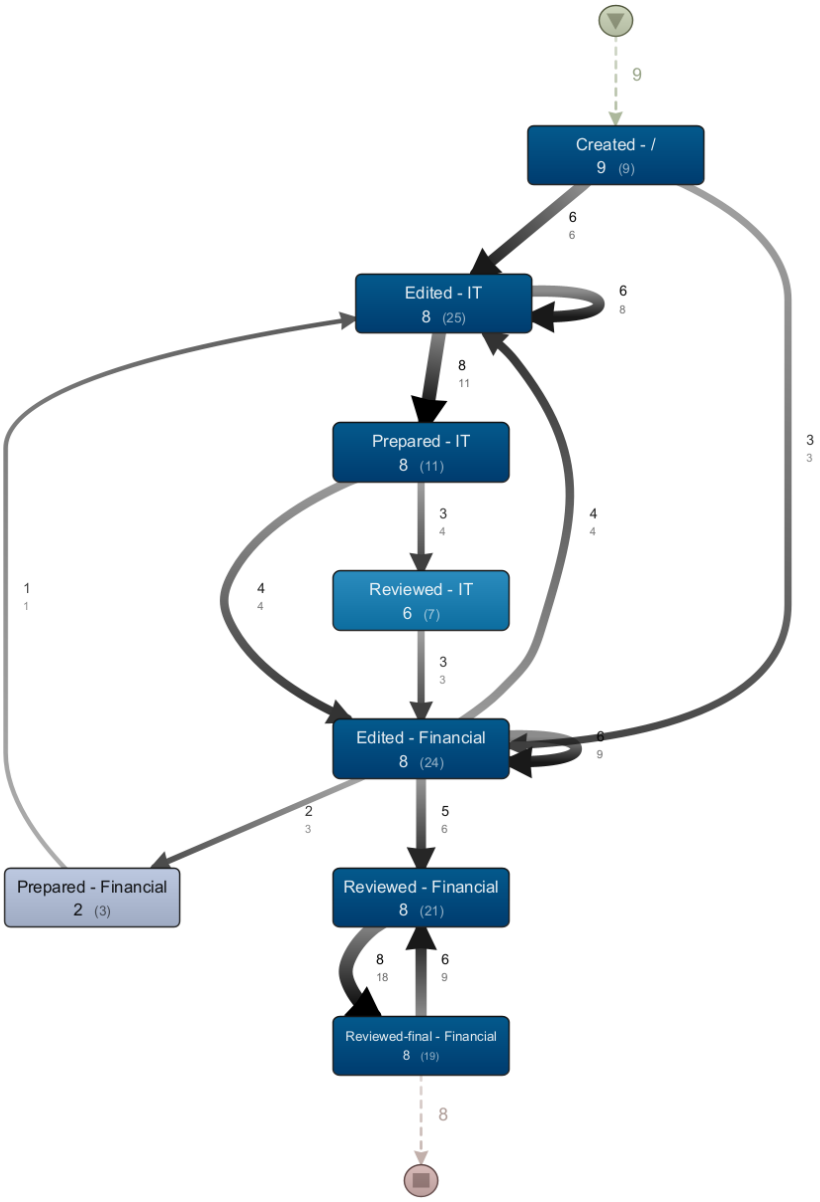

Figure 18 Process Mined from the Planning Workpaper (a=70, p=30)

A phenomenon that may be observed in the mined process below is the distribution of the different audit teams within the process. Indeed, the IT audit team tends to intervene in the earlier part of the process, especially in modifying and filling the workpaper. In contrast, the Financial audit team occupies the later stages of the process, namely the activities linked to the reviewing process. The central placement of 'Reviewed – IT' in the process is particularly notable, as the optimal process shown in Figure 12 postulates that reviewing activities should happen after the completion process. Additionally, the workflow reveals that whilst both teams share the same range of activities, some activities, namely 'Prepared' and 'Reviewed-Final' are, for the majority, under the responsibility of one team. Indeed, the 'Prepared' activity is mainly performed by IT auditors and conducted by Financial Auditors only in specific paths. In contrast, 'Reviewed-Final' is mainly a Financial auditor task. This is notwithstanding the 'Created' activity, which is uniquely initiated by the Pandora software itself.

6.3 Reporting – Conclude IT Audit workpaper

6.3.1 Description of cases

The Conclude process is mined through the analysis of 65 events logged into 7 different cases. In contrast to the Planning Process, which comprised of 11 different activities, the Conclude process comprises (*2x5=)*10 activities. There are 5 unique activities, 'Created', 'Edited', 'Prepared', 'Reviewed' and 'Reviewed-final', which may either be performed by an IT auditor or a Financial auditor. An exception is noted for the 'Created' activity which is performed either by the software Pandora or initiated by a Financial Auditor.

The shortest case with regards to the events being performed has min=7 activities, the longest case has an event log of max=14 activities. The median number of events per case is med=9. Every case starts with the activity 'Created' and ends with 'Reviewed-final'. Those activities are included within the calculations. The mean duration of a process is 37,1 weeks and the median duration is 35 weeks.

6.3.2 Conclude – Points of interests

6.3.2.1 Composition of the events

Table 16 Composition of the Conclude Process

Activity	Frequency	Relative frequency

Created - /	5	7.69%
Created - Financial	2	3.08%
Edited - Financial	7	10.77%
Edited - IT	20	30.77%
Prepared - Financial	1	1.54%
Prepared - IT	7	10.77%
Reviewed - Financial	7	10.77%
Reviewed - IT	7	10.77%
Reviewed-final - Financial	6	9.23%
Reviewed-final - IT	3	4.62%

Table 16 above reveals that the distribution of the activities within the process does not bear the same influence and weight upon the process. Indeed, the most dominant activity within the Conclude process is the 'Edited' activity with a cumulated occurrence of f=27, resulting in a relative frequency of F=41.44%. As such, the workpaper undergoes a note-worthy amount of editing before being sent to the reviewing process. In contrast, every other cumulated activity has a relative frequency ranging $F \in [10.77\%: 21.44\%]$. The least dominant activity is 'Created', which mandatorily occurs only once per case (rel. F=10.77%). This signifies that any event having a higher relative frequency appears at minima once per processed case.

In addition to the occurrence of the events, Table 16 precises the frequency of IT and Financial auditors performing one event in the Conclude process. Interestingly, Financial auditors intervene both early and late in the Conclude process and their involvement is superior to the IT auditors' solely for the 'Created' and 'Reviewed-final' activities. Hence this trend may signify a divergence in their role and duties in this specific workpaper when compared to the Planning process.

Conversely, IT auditors have a considerable influence in the content of the workpaper as may attest their participation in the 'Edited' activity (f=20) and the 'prepared' activity (f=7). Their involvement throughout the Conclude workpaper is degressive and becomes inferior to the Financial auditor's, the 'Created' activity notwithstanding.

6.3.2.2 Part of Financial and IT auditors

Table 17 Repartition of the teams' involvement in the Conclude Process

Team	Frequency	Relative frequency (n=65)
IT	37	56.92%

Financial	23	35.38%
/ (i.e., Pandora)	5	7.69%

The substantial influence of IT auditors on the Conclude workpaper is also illustrated in Table 17. Indeed, IT auditors are predominant with a relative frequency of intervention of F=56.92%, thusly being responsible for more than half the actions performed in this process. Conversely, the Financial auditors have an involvement rate sensibly lower than the one in the Planning: F=35.38% against F=55.65%. Tt is noteworthy that the roles appear to have been reversed in the involvement of the different teams in both the Planning and Conclude processes. Indeed, as Table 18 illustrates, the IT auditors are dominant in the competition part with f=27 against f=8 for the Financial auditors. Furthermore, whilst Financial auditors do constitute the majority of actors in the reviewing part, the difference is lessened when compared to the Planning process.

Table 18 Repartition of the activities per Team per Part

Part	**IT**	**Financial**	**Total**
Completion	27	8	35
Reviewing	10	13	23

6.3.2.3 Repartition amongst the ranks

Table 19 Distribution of the rank intervening in the Conclude Process

Rank – Team	**Frequency**	**Relative frequency**
Associate – IT	11	16.92%
Senior Manager – IT	11	16.92%
Partner – Financial	10	15.38%
Manager – IT	6	9.23%
Senior Associate – Financial	5	7.69%
Pandora - /	5	7.69%
Senior Associate – IT	5	7.69%
Senior Manager – Financial	4	6.15%
Director – IT	2	3.08%
Intern – IT	2	3.08%
Associate – Financial	2	3.08%
Director – Financial	2	3.08%

Throughout the process, two teams and the software Pandora are involved in the formalization of the workpaper Conclude. Those teams, whether IT or Financial, are comprised

of several actors with different ranks. Whilst the rank paralleled themselves within the teams, it is noteworthy that the IT auditors have two ranks intervening in this process that are not paralleled by the Financial auditor team: an Intern and a Manager.

Another interesting observation illustrated in Table 19 is the dichotomy in the distribution of ranks implicated in the Conclude process. Indeed, within the IT team, Associates and Senior Managers share the same relative frequency of involvement within the process (F=16.92%). However, the first Financial team member to take part in this process is the Financial Partner (F=15.38%). This different distribution in the roles borne by team members may point to divergences in the responsibilities of each team concerning this workpaper. This supposition is further enhanced by the Financial Associate participating F=3.08% and the Senior Manager having a participation of F=6.15%. Conversely, there is no IT partner involved within the Conclude workpaper. This is consistent with the absence of the IT Partner in the Planning process.

Therefore, an interesting discovery that may be extracted from Table 19 pertains to the substantial involvement of the IT auditors. Indeed, the workpaper is manned by a wide array of IT auditors. Contrariwise, the intervention of Financial auditors is spearheaded by the Partner (F=15.38%) and accompanied the Senior Associate (F=7.69%).

Table 20 Events performed during the Conclude Process per Actor and Team

Activity – Rank - Team	Frequency	Relative frequency
Edited - Associate – IT	9	13.85%
Reviewed - Senior Manager – IT	6	9.23%
Reviewed-final - Partner – Financial	5	7.69%
Created - Pandora - /	5	7.69%
Edited - Senior Associate – Financial	4	6.15%
Reviewed - Partner – Financial	4	6.15%
Edited - Manager – IT	3	4.62%
Reviewed-final - Senior Manager – IT	3	4.62%
Edited - Senior Associate – IT	3	4.62%
Prepared - Manager – IT	2	3.08%
Edited - Senior Manager – IT	2	3.08%
Reviewed - Senior Manager – Financial	2	3.08%
Edited - Intern – IT	2	3.08%
Prepared - Senior Associate – IT	2	3.08%
Prepared - Associate – IT	2	3.08%
Created - Senior Manager – Financial	1	1.54%
Reviewed - Manager – IT	1	1.54%
Created - Senior Associate – Financial	1	1.54%
Edited - Director – IT	1	1.54%
Prepared - Director – IT	1	1.54%

Edited - Partner – Financial	1	1.54%
Edited - Associate – Financial	1	1.54%
Prepared - Associate – Financial	1	1.54%
Edited - Senior Manager – Financial	1	1.54%
Reviewed - Director – Financial	1	1.54%
Reviewed-final - Director – Financial	1	1.54%

Table 20 allows us to examine the behaviours and tendencies observed insofar in more depth than in the prior tables. A primary observation can be made concerning the repartition of tasks amongst the ranks. The higher ranks, composed of Manager, Senior Manager, Director and Partner, whichever team they may belong to, oversee the reviewing process of the workpaper. This observation is coherent with the distribution of roles made in the Planning Process. Conversely, the lower ranks, namely Intern, Associate and Senior Associate, are in charge of completing the workpaper, or at minima, of adding information to it. It is of note that whilst the lower ranks predominate the editing and completing process, higher ranks may play a role and intervene in the process.

Nonetheless, there is an event that does not follow the aforementioned trend, namely the ‘Created’ event. In contrast to the Planning event where this activity was fully performed by the Pandora software itself, the Conclude workpaper was created in some instances (f=2) by Financial Auditors. Those financial auditors had different ranks, one instance was performed by a Senior Manager and another was performed by a Senior Associate. The other instances of the ‘Created’ activity were all conducted by Pandora (f=5).

6.3.3 Conclude – Mined Process

The following workflow, Figure 19, was extracted from Disco using the parameters (a=0.7; p=0.2). Those parameters were selected in order to reveal the most relevant activities in the Conclude process. Indeed, a selection of activities with its parameters lower than a=1 enables an automatic filtering of the most performed actions. This filtering is important in this specific dataset, as there is a substantial number of activities only performed once throughout all the events recorded in the dataset. This may be observed in Table 20. The path parameter was chosen at p=0.2 to further highlight the most dominant pathway followed by the process.

The mined process of the Conclude workpaper is presented hereafter in Figure 19 and illustrates the formalization process of an audit workpaper between IT and Financial auditors. As the Planning Mined Process, the Conclude process is initiated by the activity

'Created' and stops at the activity 'Reviewed-final'. Interestingly, the activity 'Reviewed-final' does not stop the process but is always the last action performed.

It is noteworthy that the structure of the process reflects the structure presented as the ideal or, at least theoretical, structure of the formalization process of a workpaper illustrated previously in Figure 12. There is a clear progression in the tasks, first with the completion of the workpaper, starting with 'Created', followed by 'Edited' and finishing with 'Prepared'; this succession of events is coherent with the theoretical structure. The reviewing process, including the action 'Reviewed' and 'Reviewed-final', are thus, to a certain extent, compliant to the ideal structure. Indeed, the reviewing process may be interrupted, or enriched, by an editing process, through the activity 'Edited'.

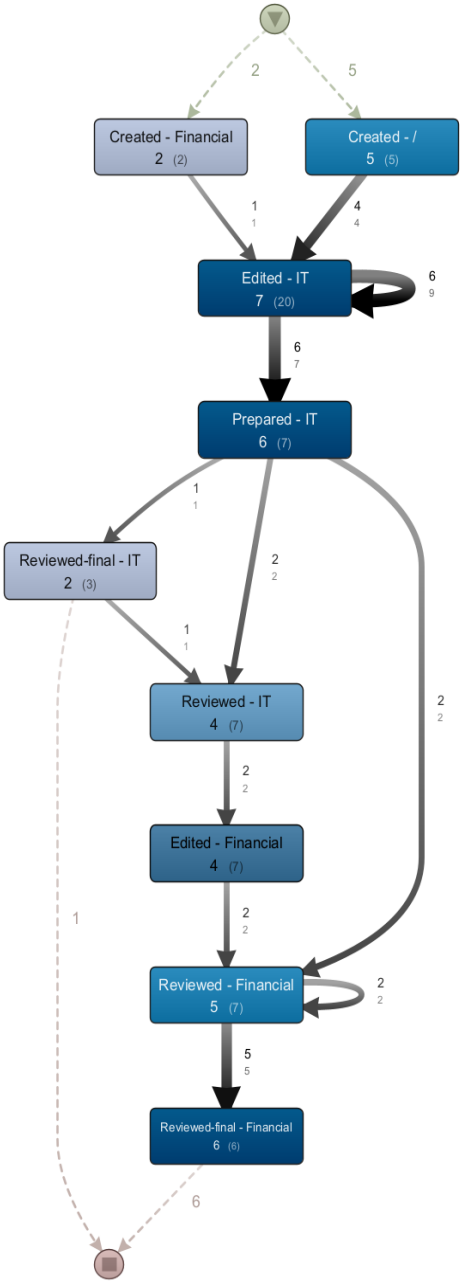

Figure 19 Process Mined from Conclude Workpaper (a=70, p=20)

Furthermore, the distribution of the reviewing process tasks amongst the teams differs sensibly to the one illustrated in the Planning Process in Figure 18. Indeed, the IT auditors play a more substantial role in Conclude than in the Planning workpaper, as illustrated through the instances where the IT auditors complete the Conclude process in autonomy. As such, in this instance they are responsible from the 'Edited' event until the 'Reviewed-final', without needing a Financial auditor's input. This trend is not observed within the Financial auditors, who require the input of IT auditors at least in the completion part of the process, i.e., 'Edited'.

6.4 Interest points of the Process Mining Analysis

Table 21, hereafter, summarizes the important factors uncovered in the analysis. For each process, those can be divided into three themes: constitution of the process, distribution of the responsibilities and apparent teamwork between IT and Financial auditors. These themes and the subsequent implications will be further explored in the following Chapter.

Table 21 Synthesis of the Process Mining Analysis

IT Audit workpaper	Planning	Conclude
Cases	*n= 11*	*n= 7*
Events	*124 events*	*65 events*
Overall team distribution	Predominance Financial auditors	Prevalence IT auditors
Completion Part	Slight predominance IT auditors (f=37 out of n=66)	Prevalence IT auditors (f=27 out of n=35)
Reviewing Part	Prevalence Financial auditors (f=40 out of n=49)	Slight predominance Financial auditors (f=13 out of n=23)
Compliance to the theoretical structure	Yes - additional steps may be observed. Notably, a 'Edited-Prepared' cycle appear to happen repeatedly per process	Yes – additional 'Edited' and 'Reviewed' steps appear to happen repeatedly per process
Most | Least common activity	Edited IT | Reviewed-final IT	Edited IT | Prepared Financial
Influential actor in the process per team	IT: Associate (f=15) Financial: Senior Associate (f=23)	IT: Associate & Senior Manager (both f=11) Financial: Partner (f=10)
Teamwork	Both Financial and IT auditors modify and read the workpaper. The validation is mainly done by Financial auditors.	Mostly modified and completed by IT auditors. The IT and Financial auditors share the reviewing process.
Expectations Teamwork	*IT and Financial both share the weight of the completion part and the reviewing part. Slight predominance of Financial auditors is expected.*	*IT auditors first modify the workpaper and information is added by Financial auditors. Four-eyes reviewing principle is applied.*

7 DISCUSSION

The present paper sought to better comprehend the role and purpose of the IT auditor within a financial statements audit. Two specific aspects were addressed within the research questions. The first comprised the responsibilities of the IT auditor, addressed through research question (1) and its sub-questions (1a,1b,1c). The second comprised the place of the IT auditor in the audit team vis-à-vis the Financial auditors, addressed through research question (2) and its sub-questions (2a,2b,2c).

7.1 Themes emerging from the analyses

Table 22 The IT Auditor's role, responsibilities, and teamwork tendencies

IT Audit Phases	Audit		Post-Audit
	Planning	**Conduction**	
Role	Expert: understands and vulgarizes the IT environment in terms of risks and controls Advisor: guides the Financial auditors within the scoping of the IT audit and attention points in the Financial audit	Auditor: tests and controls the IT environment to certify its integrity and reliability	Expert: explains the conclusions in terms of risks, controls and mitigations performed Auditor: gives an opinion on the reliability and integrity of the IT environment relatively to the financial statements
Responsibilities	Establish effective communication with Financial Auditors Transcribe their IT environment understanding into actionable plan to cover potential risks	Communicate findings to Financial Auditors Document ensure a sustainable audit trail. Perform the IT audit	Share conclusions with Financial Auditors Build actionable plans to mitigate risks Ensure the adequate formalization and documentation of the IT audit
Teamwork with Financial auditors	Coordination: Financial auditors share the scope of the IT audit and the key deadlines	Cooperation: IT auditors mainly operate without the Financial auditors	Coordination: IT auditors pass the baton to Financial auditors via the presentation of the implications of their work

In the conceptual model, Figure 8, the IT auditor was defined through three sub-concepts: the role of the IT auditors, their responsibilities, and their teamwork tendencies. Table 22, above, reprises those sub-concepts with the results from the Participant Observation and the Process Mining.

The first theme evoked in the present research focuses on the IT auditor. More specifically, research questions (1), englobing sub-questions (1a,1b and 1c), sought to define the role of the IT auditor in the specific context of a conduction of an IT audit within a financial statements audit. The participant observation analysis sheds light onto the purpose given to the involvement of IT auditors, namely, that they must evaluate and measure the IT environment of the auditee. This evaluation is formalized through a synthesis of the Conclusions, wherein the controls tested and the IT auditor's opinion on those controls are stated. The purpose revealed in the results corroborates Curtis et al. (2009)'s finding**.** Namely, the purpose of an IT auditor is to comprehend and investigate the Information Systems of an auditee, and thereby certify its relatability in regard to the veracity and integrity of the information passing through.

Nonetheless, this discovered purpose must be in adequation with the tasks performed. The observations, as discussed in Chapter 5.6, reveal three main types of actions falling under the scope of an IT auditor. Following these results, they are categorised as such: entity-level controls, IT general controls, and IT application controls. This separation of tasks is coherent with the literature's perspective on IT auditing, i.e., Gantz (2013) and Richards et al. (2005)**,** and also with the dual concepts addressed in the purpose of the IT auditor: evaluate and measure. The results, both from Participant Observation and Process Mining, however, illustrate the existence of an additional action, the Conclude step. In this uncategorized task, the IT auditor presents their opinion and synthetises the audit work done. This opinion is destined to be read and understood by quality management, but especially by Financial auditors.

This implies that the responsibilities of IT auditors lay first and foremost in performing the IT audit but include the ancillary transmission of the construed opinion with Financial auditors. The latter suggests that the IT auditor is accountable for the comprehension of the conclusions and their implications of the IT audit on the Financial audit.

These findings suggest that a preliminary definition of an IT auditor's role within the context of a Financial statements audit constitutes a formalized service offered to financial auditors, wherein IT-specific knowledge is contributed to the financial statement. The lending of this expertise allows Financial auditors to focus on specific financial matters,

therefore encouraging greater specialization within teams. This directly addresses the Statements on Auditing Standards 108, which define the role and use of *experts* within financial statements audit. Moreover, this indicates an added benefit of the formalized role of IT auditors, whose contributions are clearly defined. Thus, the intervention process within the engagement becomes streamlined, which in turn allows for a better valuation of their duties and responsibilities. To summarize, by clearly delimiting these duties within the engagement, the IT auditor's role can be leveraged to improve audit quality.

The second theme evoked in the present study concentrates on investigating the organizational structure and repartition of the tasks in between IT and Financial auditors within a shared engagement, namely a financial statements audit. Therefore, research questions (1c), (2c) are followingly addressed. The results reveal a persistent feeling of frustration when IT auditors interact with Financial auditors. This feeling is further enhanced by referring to the list of IT tasks in context of the financial statements audit as *grocery list*. Those two observations are in line with the findings from Estep (2019) and Bauer et al. (2019)**.** In addition, the mined processes highlight a disproportionate distribution both in the composition of the team and in the repartition of the tasks. Indeed, in the Planning process, f=*69 (out of 124)* of the actions were performed by Financial auditors, yet their intervention appears to be concentrated within the reviewing part, with f=40 activities. Conversely, the majority of actions were performed by IT auditors in the Conclude process with f=27 against f=8 activities performed by Financial auditors. However, the reviewing process appears still to have been performed predominantly by Financial auditors, with f=13 against f=10 for IT auditors. This suggests a hierarchical distinction between IT and Financial teams, wherein in the Financial auditors may possess a more dominant role within the financial statements audit. As such, the IT auditors would seem to be relegated to a supporting role. It appears, then, that Financial auditors are the main actors in the certification of the financial statements, for which they resort to the employment of IT auditors to certify the related IT environment. Consequently, Financial auditors appear to use IT auditors as an in-house IT audit as a Service.

Interestingly, the formalized role of IT auditors outlined in the first theme may come with downsides. Indeed, the rigidity of this subservience to Financial auditors has been pointed out by IT auditors as a potentially negative consequence, whereby they feel their work is either not consulted in detail or not valued enough. Thus, they may be confined to the tasks spelled out by the *grocery list*, and not be able to make use of their own initiative and expertise during the audit. Whether a more collaborative role of IT auditors

within the Financial statements audit would increase the audit quality is indeed an interesting question, which would benefit from being addressed in future studies.

Following on from the previous themes, it convenes to turn to the foundation and nature of the collaborative aspect of the relationship between Financial and IT auditors. This facet of the IT auditor's work was addressed through research question (2), which sought to define and frame this relationship. The IT auditors' relationship with Financial auditor has revealed itself to be neither based on standards nor immutable. Indeed, the observations illustrate that the relationships between the two teams are organic, and as such, subject to change depending on the actors involved. Nonetheless, two inclinations can be identified throughout the results. One the one hand, the observations revealed a relationship based on a to-do list and minimal communication. This type of relationship leads to a less integrated way of working, with the IT auditors respecting the vision shared by the Financial auditors and working alone. In line with the definition given throughout the literature, this is a relationship based on cooperation, wherein each auditor has their own goal and must participate to group activities to fulfil the main goal of the audit engagement, namely the certification of the financial statements.

On the other hand, the observations highlighted a coordinative bond between IT and Financial auditors during audit engagements. In this setting, the IT auditors and Financial would establish deadlines but especially communicate on the relevance of the planning and the scoping of the IT audit. Furthermore, the results also indicated that the communication was continuous during the engagement. Concretely, this translated into, for instance, IT auditors and Financial auditors communicating on the conclusions of the former and deciding together on which actions to perform to mitigate or affirm those conclusions.

Those trends were both observed at intervals during the participant observation and were further remarked during the process mining analysis. However, the dominant relationship model remains unclear. Further research should therefore focus on comparing the IT/Financial cooperative and coordinative relationships in order to determine the potential existence of an optimal model most suited to the context of an IT audit within a financial statements audit. Research would also gain from studying the factors that may influence those models, such as the respective size of both teams, the personalities within them, Financial auditors' knowledge or apprehension of IT, and even the type of client audited. Interestingly, there was no instance of collaborative work as defined in the literature. Such an absence of an observed collaborative model must be researched in similar

contexts to establish the reasons behind it. An in-depth understanding of the relationship's models would allow us to establish a framework of the observed dynamics and factors influencing them. Through this newly defined framework, firm policies and academic recommendations could be drafted to more closely define the context in which the intervention of the IT auditor occurs. Consequently, those findings translate into an optimized and flexible integration of the IT audit within the Financial audit which at term enhance the audit quality produced. Moreover, a seamless integration would strive toward a collaborative relationship, when necessary, and thus create value through extensive understanding of the work of both IT and Financial auditors.

Interestingly, the process mining analysis sketches comparable trends in the workpapers and may help address research question (2c). Through this question, the author sought to investigate the responsibilities of the planning and scoping of the IT audit. Both the Planning and Conclude workpapers had instances wherein both the IT and Financial auditors participated in the completion process, namely the 'Edited' activity. The Planning process reports an almost equal number of modifications done by IT (f=24) and Financial (f=25). These results may indicate the existence of *at minima* a cooperation between the two when it comes to this workpaper. However, as this workpaper has a dual purpose, scoping the IT activities and synthesising the IT environment of the client, the distribution of those two facets is not clear. Nonetheless, the Financial auditors do seem to have a higher rate of intervention in the Planning process (f=69 against f=46 for IT auditors). This predominance in the Planning process is in adequation both with Boritz et al. (2020) and the observations made in Chapter 6. The responsibility of Planning and Scoping the IT audit rest ultimately with the Financial auditors. The duties of IT auditors are hereby concentrated on the synthesis of the IT environment, a completion duty. As such, this reinforces the implication that the IT audit is subservient to the financial statements audit. Nevertheless, the exact happenstances within the Planning activities should be further investigated in other to decipher truly the responsibility of the IT auditor within them.

7.2 Notable findings

Both the results from the Process Mining analysis and the reports from Participant Observation point toward a strict reviewing process of the work and audit within itself. Indeed, the audit firm in which the study was conducted applies a reviewing system following the 4 eyes principle, wherein at least two different actors separately review a

workpaper before its final validation. This implies that the work accomplished is conducted by a third auditor. The rare exceptions notwithstanding, the processes mined appear to follow the 4 eyes principle consistently. The latter is further illustrated through the distribution of the ranks amongst the processes. The higher ranks (from Manager to Partner) seem to be confined to performing the reviewing, conversely, the lower ranks (from Intern to Senior Associate) take the responsibility of completing the workpaper.

This suggests a strict separation of duties, whereby the higher ranks must control the quality and relevance of the work being performed. Moreover, the preponderance of Partners as final reviewers is in adequation with both the regulations and the firms' stance on the responsibility of the engagement. Indeed, Partners have the duty to sign-off the audit engagements and they are thus held accountable for the audit opinion built on those work papers. Their preponderance may hence be explained by the requirement of acknowledging the tenants of their responsibility. However, the extent to which different factors influence Partners' involvement, and the nature of this involvement, in the reviewing process remains unclear.

Another interesting finding in the analysis conducted is the composition of each trace constituting the process mining. The composition of the processes indicates that the activities may be divided in two successive parts: completion and reviewing. The transition between the two seems to be always marked with the Prepared activity. This is in accordance with the reports obtained in participant observation and the description of the activities in Chapters 4 and 5 , especially regarding the frequency of occurrence of the activities. Indeed, the 'Edited' activity occurs, in any case studied, several times per process. This may translate into two implications. Firstly, the fulfilling of the workpapers, Planning and Conclude, is iterative and incremental. As knowledge is acquired, it seems to be transcribed within the workpaper.

This leads to the second implication: the workpapers are used as work documents and not as synthesis of the work done. Therefore, the software serves an ancillary function for auditors, wherein they work and record their work done. This is interestingly in adequation with the first and foremost function of the software, which is to provide an elaborated audit trail for controllers and audit quality management. The trend evocated there is illustrated in both mined processes. However, it would be interesting to investigate how this separation between the reviewing and completion processes is reconstructed within other auditing firms, and more specifically, whether it does in fact impact audit quality.

A notable finding that is unrelated to the research questions set out in this paper is the correlation between experience, training, and decision-making in IT auditors. The topic has been studied in depth from a financial auditor perspective, however, it has not been researched, as of yet, with regards to specialist auditors. Indeed, the participant observation revealed that IT auditors functioned in a mentor-mentee fashion, namely that one less experienced IT auditor could rely on and shadow a more experienced IT auditor. This led to a reliance from mentee on mentor when it came to helping with decision-making and brainstorming the next step. As such, better decision making was enabled, and, in addition, this coaching approach allowed for practical knowledge transmission. This practical knowledge transmission is supplemented by formal training, which re-asserts the notions learnt during practice. Two more research interests emerge from this correlation.

The first one is related to knowledge management in audit firms, specifically, identifying niche experts and giving the opportunity for collaborators to learn from them. Indeed, auditors, whether they belong to a Financial or IT team, do collaborate with one another on a regular basis. In the participant observation, a trend was observed where auditors instantly recognized what kind of and whose expertise they needed, and how to connect with the local expert on the matter. This intra-team organization may help the firm better understand knowledge management, and as such, heighten audit quality through improved access to knowledge and expertise.

The second topic of interest are the dynamics created between members of the same IT audit engagement. The participant observation highlighted a pack mentality, whereby auditors engaged in collaborative decision-making, information sharing, and the upholding of accountability. Interestingly, comparing the rigid hierarchy with the role attributed to each collaborator in practice may help us to understand what sets the Big 4 mindset apart from the other audit firms.

7.3 Limitations

This thesis, as any research, suffers from limitations. Those limitations may stem from the conjunctural setting or from a methodological choice, or a specific research context. For instance, the conjunctural setting, namely the COVID-19 pandemic, impacted and influenced the research process through the regulations instituted: remote working, mask wearing, and social distancing. Furthermore, the decision to conduct a participant observation led to its inherent limitations. Those limitations were discussed in Chapter 5.6. In

this sub-section, the following limitations focus on Process mining and context-based constraints.

A first limitation concerns the methodological arbitration performed in order to accommodate for the structural and social context of the thesis. Indeed, the time granted to accomplish this thesis was of four months, which included a full-time internship. This implies that time was valuable, and decisions had to be made in order to optimize the results and analysis. As such, the analysis focused solely on the IT auditor within the context of a financial statements audit. This limits the generalizability of the study to other audits, auditors, or experts. Furthermore, as the point of view adopted is of an IT auditor, this may not be generalized to the audit field in general. However, focusing solely on an IT auditor point of view brings a unique opportunity to fill the gap in research, traditionally oriented towards Financial auditors, and gather preliminary data on IT auditors.

The generalizability of the findings is also limited by the size of the data sample collected throughout this thesis and subsequently analysed. This sample was limited due to operational and confidentiality issues. As this type of data is considered sensible, granting extensive access to an intern is not justifiable. Furthermore, treating the authorized data, namely identifying, and collecting the appropriate data, proved to be a complex and time-consuming endeavour. However, focusing on a small dataset allowed for an in-depth and extensive understanding of the data and its context. Consequently, the process mining analysis and its practical implications benefited from both a higher quality and better understanding of the data. Furthermore, the findings resulting from the dataset were triangulated through a mixed-method approach. Indeed, through participant observation and informal interviews, the results were either infirmed or confirmed, and in some cases, enriched. The adequation of the dataset was hence measured through practice.

7.4 Further research

Further research should be conducted on IT auditors and their environment in order to corroborate and further explore the research interests mentioned above. Indeed, as the research protocol has been established, a broader sample should be analysed to increase to statistical validity of the results. This would not only confirm or disprove the findings of this paper but would also increase the generalizability of the mined processes. Furthermore, the present research may be considered as a steppingstone for studies also looking at IT auditors in the context of a financial statement audit. A replication of this study is necessary to understand the creation of team dynamics in various branch environments.

Specifically, it is needed to detect any emergent patterns or trends in the conduction and formalization of the IT audit within a financial statement audit. The addition of different variables into the study, such as for instance, a different country or culture, different audit firms, would allow for a more comprehensive grasp of the role and duties of the IT auditors.

The replication of the study may use different methods to corroborate the results via different angles. For instance, this may include engaging in a Social Network Analysis of the different auditor teams. The creation of a network would permit both academia and the studied firm to identify the key players within an IT audit and its related financial statements audit. The value of such a study lays in analysing the communication patterns and correlating them to the team dynamics. Another interesting method that may be used to replicate this study are the Focus groups interviews. Whilst the Social Network Analysis would concentrate on the actors within the audits, the Focus group interviews would allow us to define the role and duties of the IT auditor more precisely, both from an IT and Financial point of view.

Finally, another interesting study to consider is on the underlying dynamics between IT and Financial auditors. In the present research project, the team dynamics were breached solely from an IT auditor perspective. Future research would benefit from an aggregation of the perspectives of both Financial and IT auditors in order to frame the ties between the teams. This research would hence concentrate on the notion of working together, in terms of cooperation, coordination and collaboration, and would thus build a preliminary framework. Such a framework would contribute to the elaboration of optimal working conditions and thus enhance audit quality.

8 CONCLUSION

In a context of rapid digitalisation of the IT landscape of companies and the emergence of new technologies constantly disrupting the as-is, companies must adapt their internal control to acknowledge, control, and mitigate the inherent risks linked to the ubiquity of new technologies. Moreover, for companies that deny this reality, the risk does not lessen, as they must adjust their controls to face off technological obsolescence. The auditing field is not untouched by those changes. Indeed, auditors increasingly resort to the employment of IT auditors to help them via a certification of the IT environment of the auditee. This expertise leads IT auditors to perform an IT audit within a financial statements audit. However, the role of the IT auditor, while fundamental to the financial statements audit, is neither well defined, nor understood by standards and the auditing field. This situation is at the source of questions that the literature fails to answer convincingly.

The present thesis sought to contribute to the auditing information systems and auditing field literature by proposing a closer exploration of role of the IT auditor within an audit engagement and to understand the nature and timing of the involvement of the IT auditor within the engagement. For that purpose, the author used a mixed method composed of a participant observation and a process mining analysis.

The findings suggest that the role of the IT auditor contains a plurality of sub-roles. Amongst these, three can be singled out: the expert, the advisor, and the auditor. The latter constitutes the main purpose of the IT auditor. In contrast, the former two appear to be specific to the IT auditor within the context of a financial statements audit. There, the IT auditor must offer his services of a consulting nature to the employ of Financial auditors. Therefore, in this particular setting, the theory that the IT audit is subservient to the financial statements audits is in adequation with practice. Moreover, it can be said that IT auditors therefore offer an Audit as a Service to Financial auditors. Indeed, Financial auditors establish their needs and communicate with IT auditors insofar as it serves the primary goal of their financial statements audit. This is coherent with the less integrated way of working adopted by both teams, namely the predominance of cooperation and coordination within the audits.

Both IT auditors and Financial auditors act within the bonds of the standards defining their relationships and their respective works. As such, the uneasy working relationship between the two teams, both observed in practice and in the literature, lies within the ambiguity of the standards regulating the IT audit in the context of a financial statements

audit. This ambiguity leads to potential conflicts, miscommunications or wasted resources, and ultimately affect the audit quality of not only the audit of the financial statements, but rather the entire auditing process. Indeed, the Financial auditor's apprehension of technology or undervaluation of its importance can result in missed opportunities or a scoping issue. Furthermore, the tunnel vision effect from which IT auditor may suffer results in them losing the primary goal of their intervention, namely, the certification of IT environment from which are emitted the financial statements.

These results have implications for both academia and practice. Indeed, the present thesis is an opportunity for companies to initiate a reflection on the role of IT auditors in their midst. The purpose would be to redefine and explore the role given to those auditors in order to streamline their intervention. In addition, the results highlight the chiasm present between IT and Financial auditors, notably in terms of work valuation and communication. By understanding and solving this chiasm, IT auditors feel more valued and as such, more contented in their work. This might give them the tools and comprehension needed to conduct more suited audits, thereby improving audit quality. The definition and practical observations of the IT auditor highlighted in this thesis offer a recontextualization and exploration of the working relationships between IT and Financial auditors. This is fundamental for professional services companies versing in auditing as a seamless integration of the IT audit within the financial audit would enhance also audit quality.

This thesis proposes an extensive comprehension of the duties and tangible responsibilities through a listing of the tasks an IT auditor may perform. Whilst no definition suits every instantiation of IT audit, this thesis proposes a contextualisation of the definition of the IT auditor within a financial statements audits through three pillars: the role, the responsibilities, and the teamwork abilities of an IT auditor. These pillars may help fill the literature gap regarding the IT auditor within a financial statements audit, as well as help draft precise and details standards of regulating the role of the IT audit within a financial statements engagement.

Furthermore, the results highlight the existence of different paradigms governing the working relationships between IT auditors and Financial auditors. Cooperation and coordination were the predominant paradigms with a notable absence of the more integrated way of working within the continuum, collaboration. The reasons of this absence should be investigated to better understand the relationships between IT and Financial auditors. Through those lenses, and via the solving of the existing relationship issues put in exergue in this thesis, a framework can be established in order to optimize audit quality.

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APPENDICES

Appendix 1. Additional documents regarding the Planning process

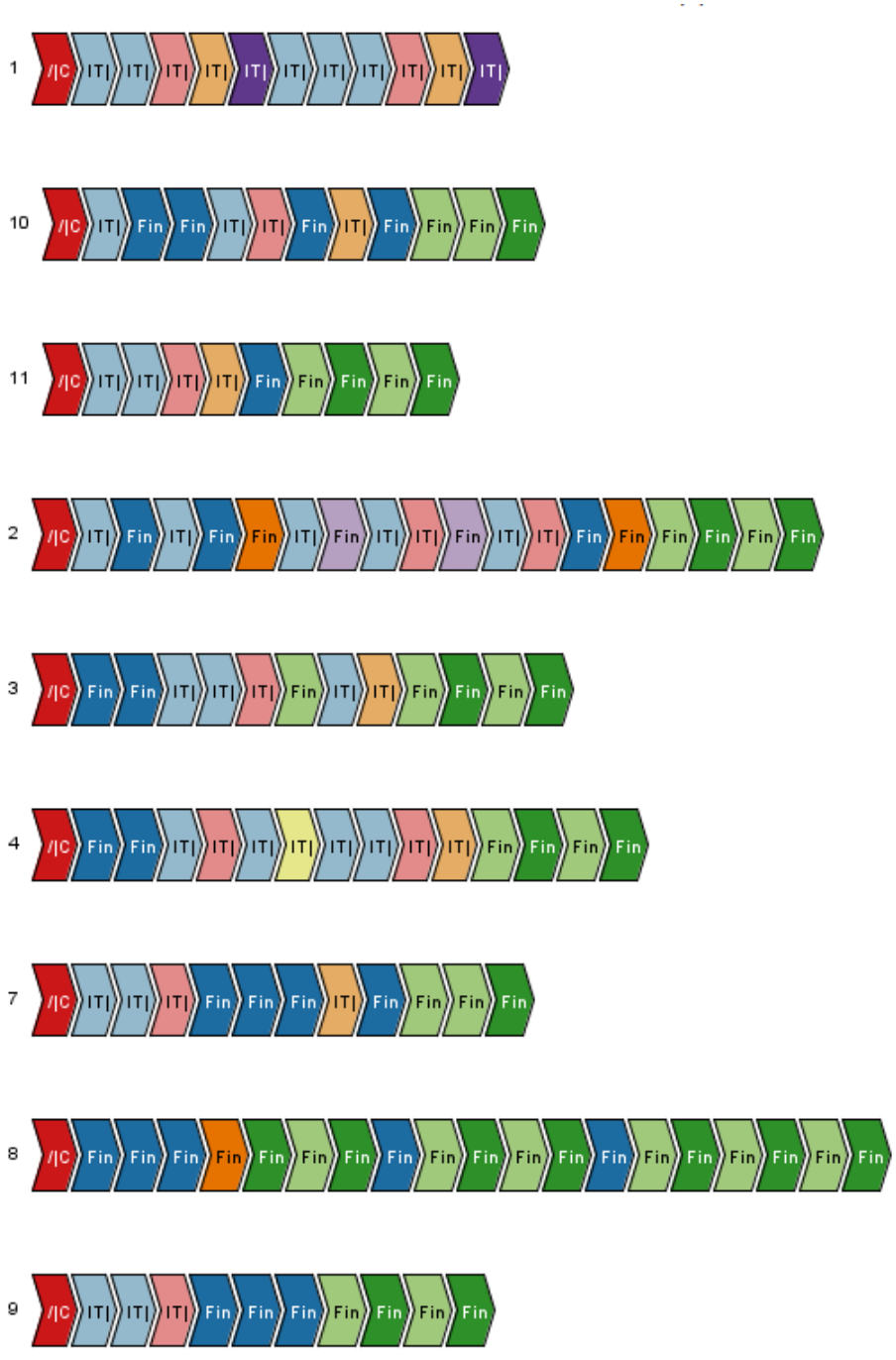
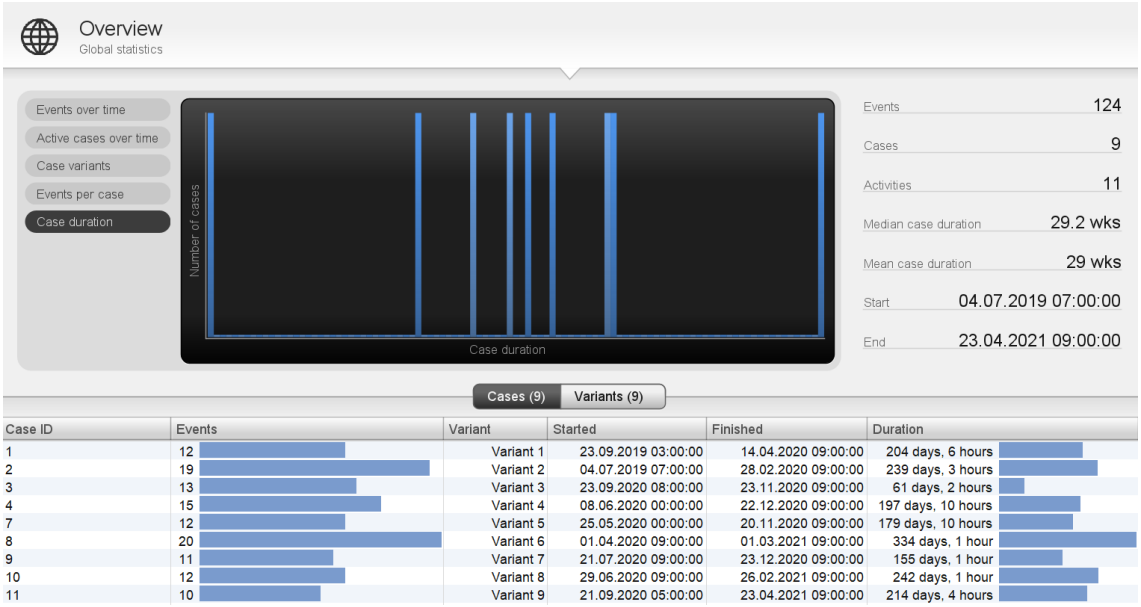


Figure 20 Traces of the cases included in the Planning sample



Case ID	Events	Variant	Started	Finished	Duration
1	12	Variant 1	23.09.2019 03:00:00	14.04.2020 09:00:00	204 days, 6 hours
2	19	Variant 2	04.07.2019 07:00:00	28.02.2020 09:00:00	239 days, 3 hours
3	13	Variant 3	23.09.2020 08:00:00	23.11.2020 09:00:00	61 days, 2 hours
4	15	Variant 4	08.06.2020 00:00:00	22.12.2020 09:00:00	197 days, 10 hours
7	12	Variant 5	25.05.2020 00:00:00	20.11.2020 09:00:00	179 days, 10 hours
8	20	Variant 6	01.04.2020 09:00:00	01.03.2021 09:00:00	334 days, 1 hour
9	11	Variant 7	21.07.2020 09:00:00	23.12.2020 09:00:00	155 days, 1 hour
10	12	Variant 8	29.06.2020 09:00:00	26.02.2021 09:00:00	242 days, 1 hour
11	10	Variant 9	21.09.2020 05:00:00	23.04.2021 09:00:00	214 days, 4 hours

Figure 21 Overview of the Planning Process

Appendix 2. Additional documents regarding the Conclude process

Figure 22 Traces of the cases included in the Conclude sample

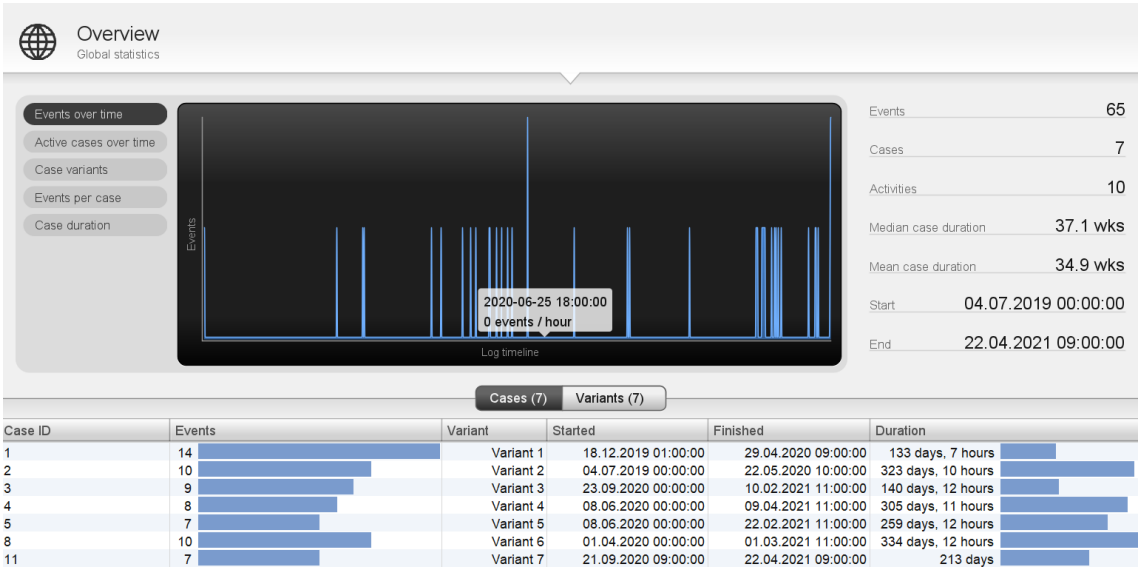


Figure 23 Overview of the Conclude Process