



University of
Stavanger

UNIVERSITY OF BUSINESS AT UIS

MASTER'S THESIS

STUDY PROGRAM:

Master in Accounting and Auditing

IS THE TASK CONFIDENTIAL? No.

TITLE: Audit Data Analytics in Norway: A Qualitative Study of Audit Practices

ENGLISH TITLE: Audit Data Analytics in Norway: A Qualitative Study of Audit Practices

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Preface

We would like to thank our supervisors Iris Caroline Stuart and Tatenda Mugwira for their helpful guidance, support and feedback for the completion of this thesis, as well as establishing contact with respondents for the interviews we conducted. We also thank the contacts in our employer firms, KPMG Stavanger and Deloitte Innlandet, as well as our contact person in Grant Thornton Oslo for their help in establishing connections with Professionals for interview purposes. Finally we extend our thanks to the educational institutions we have been attending throughout our educational journey; the University of Stavanger and the University of Tromsø, Department of Harstad.

Summary

This thesis explores the use and application of audit data analytics (ADA) in contemporary audit engagements. Our findings are derived from qualitative research methods based on semi-structured interviews with a small number of participant auditors from the Big 4 audit firms in Norway. We highlight discussions and findings from previous research related to general data analytics and its use for audit purposes, as well as taking a brief look at regulatory issues and auditor competencies including educational issues. The results from the interviews conducted and the discussions we had show that in general, ADA tools are used regularly by Big 4 audit firms. These talks indicated that there are important factors that go into the decisions regarding the use of ADA, such as size of the client and how well integrated the firms' digital systems are for financial reporting purposes. We find that ADA tools are used in several phases of the audit process, with the broadest use in the planning and risk assessment phases. In these phases, the ADA tools are used to create a set of expectation values based on the audits of previous years or in comparison to other client firms in the same industry. The use of ADA in these situations is exploratory in nature. When ADA tools are used to supplement audit evidence gathered through substantive testing or as part of the review phase towards the end of the audit, the use of ADA will then be confirmatory in nature to match the expected values made earlier in the audit. Potential outliers are then selected for further testing and more detailed examination.

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Chapter 1: Introduction

In this section we outline the incentive behind our writing this thesis and present the problem discussion. We then describe potential difficulties regarding the research. At the end of this section we clarify our research question and the purpose of the research.

1.1 The backdrop

Auditing as a profession is incredibly important as a trusted third party in capital markets, with the main purpose of professional activity to verify information in companies' financial statements to enable various stakeholders to make informed decisions. In recent years, various data technologies and business intelligence have grown rapidly in the professional world of business. Given this, it is likely that the audit profession will have to evolve as well to meet the growing demands and the changes in audit duties, alterations in the scope of the tasks which auditors must perform. We ask ourselves: how will this evolution in professional duties be shaped?

As we began planning research areas together with our supervisors, the authors first considered the general focus area of “digitalization within auditing”, a subject about which (we quickly discovered) we possessed very little knowledge even after nearly five years of accounting and auditing education. For this reason, we decided to write the paper with the intended readership to be students and teachers in the field, and to make our own attempt to “bridge the gap” between theory and practice in terms of digital tools. We asked ourselves the question, “*What would we like to know at this point in our study that we do not know yet?*” In this context, the thesis is structured around qualitative interviews with practitioners in the Big 4 audit firms (EY, Deloitte, KPMG and PwC) in our home country of Norway, together with a discussion surrounding digital tools (or lack thereof) in audit education in Norway.

We also attempt a brief mapping or overview of the digital tools that students are likely to come across as they finish their studies and move into professional work, a likelihood that increases substantially if students are thinking of hunting for positions within any of the Big 4. We limit our perspective and discussion to tools related to data analytics, because basic

digital tools such as Microsoft Excel and various accounting programs are widely used and well-known in the profession, regardless of size. It is our hope that future students might find this paper useful when preparing for the last leg of their educational journey, which is bound to be research-based in nature. The information presented in this paper may therefore prove especially fruitful to those with plans of applying for work in any Big 4 audit firm in Norway, as not only the previous literature in the field but the research we are basing our findings on as well, show that these firms in particular are likely to make broader and more in-depth use of new digital technologies as part of audit engagements.

As part of our own research in analysing existing literature and contemporary research in the field, in addition to our subjective impressions made during our own education we have come to understand that the auditing profession might be finding itself at somewhat of an impasse in terms of how to train for auditor competencies. The primary (an expansive) goal of the five-year study programme in Norway appears to aim at teaching students an analogous approach and understanding of the underlying mechanisms in accounting and auditing, business strategy, finance and relevant law texts. To our knowledge, only the Norwegian School of Economics (NHH) in Bergen has a course of study focused on digitalization in auditing (NHH Norges Handelshøyskole, 2021). The educational challenge of addressing changes in financial reporting and specific audit duties has long been recognized. This is not a problem unique to Norway, nor is it a new issue. American accounting/auditing research going back 30 years has been calling for changes in accounting curriculum that are suited to meet expected auditor competencies going forward. This call for education reform reflects worries about a potential gap between education and professional practice, suggesting that skills taught in the classroom fail to translate into the practical skills required in the real world (Blix, Edmonds & Sorensen, 2021).

Our study focuses on one aspect of this education-practice challenge. In recent years, digital analytics and the tools developed in that field have seen an exponential development and expanded in the professional world of business. This development has been noted in a recent survey. In a collaboration with Forbes Insights, KPMG LLP surveyed 250 senior finance executives worldwide to map out views and usage of advanced technologies (KPMG LLP & Forbes, 2018). Our study adopts some of the terminology used in this survey. The term “Advanced Technologies” covers several high level technologies that have been popularized in professional business, including cloud storage technology, data analytics, visualization

technology, artificial intelligence (AI), and workflow automation. When used with the intent of increased effectiveness and efficiency within business, the term “Business Intelligence” (BI) may be used when referring to such technologies as a collective. For the purpose of this paper, we are limiting the area to data/digital analytics specifically used by the auditing profession, also called “Audit Data Analytics” (ADA). It seemed natural to make this limitation because we are students of accounting and auditing and we hope to create a product of research that may potentially be useful for other individuals in the field.

The Forbes Insight survey mentioned above finds that 48% of financial leaders outside the United States are of the opinion that the areas of data and analytics are “must-have technologies” for their companies today (35% within the U.S.). When asked what technologies they consider "must-haves" within a two-year period, 64% of the worldwide respondents answered yes to the question in relation to data and analytics. With this increasing use of data analytics in business, firms are starting to expect that their audit firms are using them, too. According to Austin, Carpenter, Christ & Nielson (2020) who has summarized various audit firm statements between 2017-2020, audit firms are intending to invest \$9 billion in data analytics and technology. It is not farfetched to assume this means that the leading audit firms are taking the subject very seriously, and they are looking for ways to implement new technologies and analytics in the traditional audit process.

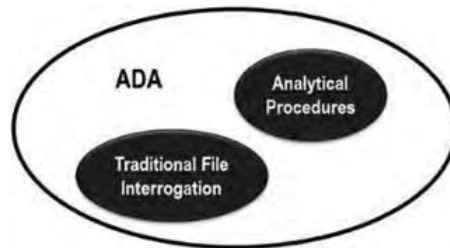
1.2 Audit Data Analytics

The American Institute of Certified Public Accountants (AICPA) defines audit data analytics in the following way:

Audit data analytics (ADA) is the science and art of discovering and analyzing patterns, identifying anomalies, and extracting other useful information in data underlying or related to the subject matter of an audit through analysis, modeling, and visualization for the purpose of planning or performing the audit. (AICPA, 2015, p. 92-93)

The definition is clarified by the AICPA as being an inclusion but not a limitation of traditional analytical procedures and traditional file interrogation.

Figure 1.1: What ADA includes



(AICPA, 2015, p. 93)

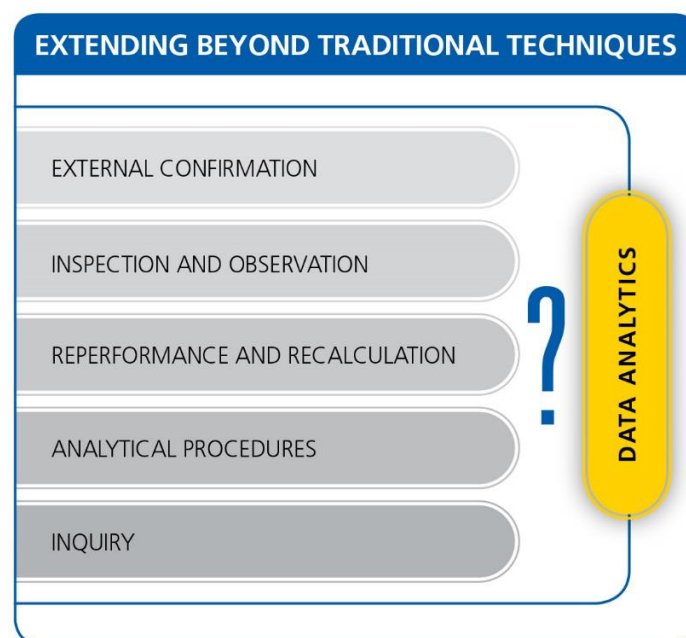
Auditors have an important role as assurance providers in terms of adding credibility to the financial statements. This assumes that a higher degree of audit quality helps support financial stability. The main objective of the auditor is to obtain a reasonably high level of assurance about whether the financial statements are free from material misstatement. A reasonably high level of assurance is not directly defined, but it is typically assumed to be a 95% level of confidence based on the auditor's professional judgment and professional scepticism used throughout the audit. The auditor's use of professional judgment and professional scepticism is improved when the auditor has a better understanding of the entity under audit and its environment. Currently the audit process follows a risk-based approach, where the audit risk model is used by the auditor to calculate an estimate of the confidence level and determine the amount of audit evidence that needs to be collected by the auditor to meet this confidence level by reducing that particular audit risk. The evidence needs to meet the requirements of sufficient appropriate evidence, further outlined in the theory section.

In an increasingly complex and high-volume data environment, the use of technology and data analytics offers opportunities for the auditor to obtain a more effective and robust understanding of the entity and its environment, enhancing the quality of the audit's risk assessment and response. (IAASB, 2016, p. 7)

Historically, the auditing profession is no stranger to digital technologies. Such methods that involve computers in the audit process are traditionally known as Computer Assisted Audit Techniques, or CAATs, and the present study assumes that modern day audit data analytics

are an extension of such techniques. We make a special note. The development of more advanced audit data analytics has raised questions when it comes to regulation, because the International Standards on Auditing (ISA) do not reference advanced data analytics tools beyond traditional CAATs, and the International Auditing and Assurance Standards Board (IAASB) theorized in 2016 that this may function as a barrier, hindering further adoption of ADAs (IAASB, 2016, p. 10). It is also important to note, however, that use of data analytics is not prohibited in the ISAs and some experts and scholars hold the view that ADA functions as extensions of traditional techniques which may in some cases make the older techniques obsolete, such as in the event of data analytics enabling testing of an entire population, potentially making sampling an audit procedure of the past. (IAASB, 2016, p. 10; Brown-Liburd, Issa & Lombardi, 2015, p. 463).

Figure 1.2: An extension of traditional audit techniques



(IAASB, 2016, p. 10)

The IAASB identifies several challenges connected to ADA in the business environment:

- 1) Data acquisition - with data sets that are getting larger in volume to the point of being defined as Big Data, storing and processing the information becomes a challenge where not only the client firms but audit firms also need to have sufficient infrastructure. Data warehousing and how to effectively Extract, Transform and Load (ETL) the data, in addition to privacy issues become great concerns.

- 2) Conceptual challenges - new concepts and challenges may appear in relation to the data requested from the client by the audit engagement team, and new questions may be asked of the client, questions that have not traditionally been previously asked. This might cause the client to be wary of providing information the client is not accustomed to providing (or has not customarily provided) for audit purposes.
- 3) Legal and regulatory challenges - data security, privacy concerns, laws and regulation can cause issues especially in cases where data will have to be moved between jurisdictions.
- 4) Resource availability - if the audit engagement employs methods that require specialized resources such as data scientists, it can be problematic to have such teams available at any given time to support the engagement team. As the use of data analytics grows, such issues can be exacerbated.
- 5) How regulators and audit oversight authorities maintain oversight when they do not have a lot of experience with data analytics themselves, and the profession as a whole implements the expanded use of ADA techniques and other advanced data analytics techniques.
- 6) The investment in re-training and re-skilling auditors becomes an important issue, because auditor competencies typically follow a path of traditional methodologies and gathering of knowledge, skills and experience. The transition from traditional techniques into ADA techniques and the changes required in the auditor's mindset in order to obtain sufficient appropriate audit evidence from these new technologies will pose a challenge.

Auditing faces rapid changes and a transition into a more data-driven environment which brings with it the potential for several advantages and disadvantages. The profession stands at an intellectual crossroads where it must respond accordingly to make sure the overall objective and purpose of auditing is maintained. Given this context, originally we wanted to determine to what extent the Big 4 auditing firms in Norway use ADA tools in relation to the services they provide for their clientele, with the focus of our inquiry being the gathering of audit evidence as part of the audit process. As we learned more about these subjects, we worked out preliminary questions for the interviews and dynamically evolved the discussion with our respondents as the interviews were being conducted.

1.3 In what way does the thesis contribute to ongoing research?

Our paper contributes to the research in the following ways. First, it serves as an exploratory study into modern day audit practice in addition to bringing confirmatory value to the theories and predictions of earlier literature and research. We extrapolate and highlight some of the results from prior research that we consider relevant to our study. Second, we discuss the usage of ADA in different phases of the audit process (planning, testing, and decision) and seek to determine to what extent the technologies can be used to obtain audit evidence based on current regulation. Finally, we highlight the role of ADA in the current educational curriculum and discuss the role it plays for a freshly educated student who begins his or her real life practice as an accountant-auditor.

1.4 Overview of the study

The remainder of our thesis is structured as follows; we first lay out a framework of general accounting and auditing theory that we consider relevant to the subject area of the thesis. As part of the framework, it is important to consider the ISAs. The Norwegian Auditing Act requires audit firms to follow and apply the ISAs as part of the audit process in accordance with the generally accepted auditing practices described within each ISA. The purpose of establishing a framework of the most relevant theories and ISAs is to acknowledge both the potential possibilities and limitations that auditors have to consider when working with data analytic tools. Next, we reasoned that the natural progression of this paper leads to the establishment of a discussion around ADA, a discussion that includes some highlights of recent periodical literature and scholarly research that precede this thesis. As part of this discussion we present the results of the interviews we conducted with participants of the Big 4 audit firms in Norway. Finally, we conclude the thesis with our interpretation and discussion of the interview results in relation to the previous research mentioned. This provides a logical context for our outline of what we think is important when considering the big picture.

1.5 Overview of main results

Our findings show that the Big 4 audit firms in Norway have established among themselves similar strategies in regards to the use of audit data analytics. The firms most frequently use data analytics techniques and instruments as risk assessment tools, as supplementary tools in the process of substantive testing, and for comparisons between yearly numbers tied to an overall review of the financial statements. Depending on where in the audit process ADA tools are used, it is assumed that they will add exploratory value, confirmatory value, or both to the audit. The firms intend that audit quality is increased as a result of using these techniques, although it is important to keep in mind that wrong or uninformed use of ADA tools has the potential to detract from rather than increase audit quality. According to our interviewees, there are subtle differences in the weight that is put on the different types of data analytic tools, with some firms making more use of visualization dashboards such as Microsoft Power BI, some making more use of their own proprietary tools such as EY's Helix or KPMG's Clara, or other mixes of the tools. There are some differences between the firms on how they market their use of the ADA tools, though at least one of our respondents claimed their firms' use of data analytics tools are often being marketed because they simply want to show that they can use these innovative methods. Microsoft Excel is still widely regarded as the "default" auditing tool by all our respondents, while certain data analytics tools such as AuditWare IDEA are regarded as more "old school" forms of audit data analytic tools.

When it comes to our interviewees' views on education and the development of auditor competencies, our interviews indicate a bit of a split of perspectives. Some respondents are of the opinion that training auditors in the use of data analytics is a non-issue because their firms are already recruiting new auditors who are competent in use of technological tools, while other respondents think that there is a definitive need of more or different types of training to enable auditors to switch from a more traditional style of auditing to one that employs the innovative digital methodologies. We find that the current accounting and auditing educational environment makes for a trajectory where the higher level university education teaches a more analogous approach to the profession. Being hired by one of the Big 4 firms introduces auditors to a training program that starts off with the use of the specific data analytic tools used in the firm.

The interviews suggest that the Big 4 only use data analytics for clients that are of a certain size or those that are publicly registered. Such a practice may indicate that smaller audit firms may use ADA less frequently (or not at all) because their practices do not have a need for the specialized competencies called for by the use of more advanced audit data analytics.

Chapter 2: Theory

In this section we describe the underlying theories upon which we base the thesis. The section includes a description of the theories and how the theoretical background can be applied to our problem discussion. To elaborate on the issues, we will split the treatment into three sections: Accounting Theory, Auditing Theory, and the relevant ISAs. We begin with a brief explanation of general accounting theory to sketch a view focused on the purposes of accounting and how accounting standards are developed, and to highlight key characteristics of a purposeful, standards-driven practice of the profession. Secondly, we will comment on general auditing theory. These remarks give a brief introduction to what an auditor's goal is, why the profession is important, and how audit practice is done. A treatment on how the auditor fulfills the purpose of the audit and how the use of data analytic tools helps in this task is the main focus of this section. We use the third section to discuss the relevant ISAs.

2.1 Accounting theory

The intellectual foundation of the thesis presupposes the centrality of accounting theory. "Accounting theory may be defined as logical reasoning in the form of a set of broad principles that provide a general frame of reference by which accounting practice can be evaluated and guide the development of new practices and procedures" (Hendriksen & Van Breda, 1992, p. 1). Accounting theory presents the principles that underlie and support accounting practice, elaborates and explains their meaning and seeks to deepen an understanding of these tenets and procedures as the generally accepted accounting principles (GAAP) (Hendriksen & Van Breda, 1992, p. 21). When new accounting standards and procedures are developed, they will often be based on and supported by accounting theory. An example of this is the Conceptual Framework.

The Conceptual Framework plays a role in the development of accounting standards. IAASB (2018) describes three purposes of the Conceptual Framework in SP1.1. One of them being "to assist the International Accounting Standards Board to develop IFRS Standards that are based on consistent concepts" (IAASB, 2018). To better understand how accounting standards are developed (and a basic Conceptual Framework for accounting practice is

established that expresses consistent concepts), we first need to identify the primary purpose of financial reporting. IAASB (2018) defines the main purpose of financial reporting to be “to provide financial information about the reporting entity that is useful to existing and potential investors, lenders and other creditors in making decisions relating to providing resources to the entity” (IAASB, 2018). In other words, we say that the purpose of financial reporting is to give an accurate and fair view of a company’s underlying operations and assets. For this to happen, the financial information needs to be an informative source for the users, a written resource that supports its users as they struggle to make crucial financial decisions about the entity under consideration. The Conceptual Framework mentions key qualitative characteristics the financial information should have to help reach this goal. Relevance and faithful representation are categorized as the fundamental qualitative characteristics, while understandability, comparability, timeliness and verifiability constitute enhancing qualitative characteristics. The enhancing qualitative characteristics will contribute to information quality of the financial statement once the fundamental qualitative characteristics are in place (Mbobo & Ekpo, 2016, p. 186).

Given that the purpose of accounting information is its being a resource for financially interested users, it is important that these stakeholders be able to understand the information expressed in the statements. The understandability factor is stressed and interpreted to mean that the accounting information is easily readable for a user with general knowledge of the entity and accounting patterns of expression. The understandability of the financial information is normally measured by five different factors: 1) The structure of the information in the annual reports, 2) Disclosure of information in notes to the account, 3) The level of presentation of information from tables and graphs, 4) If the financial statements are free of technical jargon, and 5) The financial information includes explanation of unfamiliar terminologies (Mbobo & Ekpo, 2016, p. 187).

IAASB (2018) defines the second enhancing characteristic, comparability, as a qualitative characteristic that enhances the users ability to identify and understand similarities and differences in the financial statement (IAASB, 2018). Additionally, comparability allows the user to compare the financial performance across firms (Kim, Li, Lu & Yu , 2016, p. 294). In other words, the comparability factor requires the accounting information to be expressed in a way that allows for the user to compare data from year to year, as well as to similar companies. This expectation enhances the capacity of the accounting information to play a

significant role when decision making involves comparing performances from year-to-year or between similar companies. In this circumstance, comparability in the financial statements allows the investor to make better financial decisions through improved valuation accuracy (Chauhan & Kumar, 2019, p. 115). Chen (2016) further emphasises the importance of clearly expressed accounting comparability. The entity's financial statements information quality is enhanced through a higher level of comparability, a crucial contribution because sound investing and lending decision making requires comparative information (Chen, 2016). The third enhancing characteristic, the factor of timeliness, plays another significant supporting role in the context of financial comparisons and decision making. Integrating timeliness as a qualitative characteristic ensures the financial information will be available in time to assist the user in forming a well-informed decision (IAASB, 2018, para. 2.33).

As the fourth enhancing characteristic, we have the factor of verifiability. Verifiability contributes as an enhancing characteristic through ensuring the user that the financial information represents the economic phenomena it claims to represent (IAASB, 2018, para. 2.30). The IAASB (2018) differentiates between direct verification and indirect verification. Direct verification is explained as verification of financial information via direct observation, while indirect verification is verifying financial information by comparing inputs to a model, formula or other techniques to outputs using the same methodology (IAASB, 2018, para. 2.31).

To support the earlier stated goal that accounting information be a useful resource for a stakeholder, it is important that the accounting information is relevant. Mbobo & Ekpo (2016) explains that the degree of relevance of the financial information can be categorized as having predictive value or confirmatory value. In this conceptualization, financial information has predictive value when it provides information that assists the user in forming their assessment of possible future events affecting the entity (Mbobo & Ekpo, 2016, p. 187). By contrast, if the information is directed toward the past, it is to have confirmatory value. In other words, if the financial information either confirms or affects current or previous expectations of the entity that were based on previous evaluations, the financial information is thought to have confirmatory value (Mbobo & Ekpo, 2016, p. 187).

The IAASB (2018) emphasizes that for the financial information to be useful, it needs to be faithfully represented in addition to being relevant. Three characteristics need to be in place

for financial information to be perfectly faithfully represented. The financial information must be complete, neutral and free from error. But as perfection is rarely, if ever, achievable, the goal is to enhance these qualities to the best possible extent (IAASB, 2018, para. 2.13).

To summarize, we have presented:

- 1) *The purpose of financial reporting* - The purpose of financial reporting is to give an accurate and fair view of a company's underlying operations and assets (IAASB, 2018).
- 2) *The Conceptual Framework* - The Conceptual Framework supports the IAASB in the development of the IFRS Standards (IAASB, 2018).
- 3) *The key qualitative characteristics* - Financial information should possess qualitative characteristics to help reach the goal of financial reporting; relevance, faithful representation, understandability, comparability, timeliness and verifiability.

In theory, the use of ADA in auditing should further the cause of the auditor in helping to achieve the basic purpose of assuring that financial statements convey useful information to stakeholders. These factors are all important in the process of gathering data when the auditor is trying to collect evidence to decide whether or not the financial statements have been prepared according to the applicable financial reporting framework (also referred to as GAAP). The importance of these will be further explained in the section describing and explaining the ISAs.

2.2 Auditing theory

Auditing theories are the basis for the creation of the general framework of auditing, or a way of understanding them. A general definition of the purpose of auditing theory is described by Mautz and Sharaf (1961). They say: "One reason, then, for a serious and substantial investigation into the possibility and nature of auditing theory is the hope that it will provide us with solutions or, at least clues to solutions, of problems which we now find difficult" (Mautz & Sharaf, 1961, as quoted by Ittonen, 2010, p. 2). In other words, auditing theory is there to explain why auditing is important and needed. "Auditors are part of the corporate

governance process. This process is responsible for decision making in the company and should protect outsiders from misstated financial statements" (Stuart, 2020, p. 2). The importance of the audit comes from the higher quality it gives financial information. By operating as an independent third party, the auditor offers credibility to the financial statements under review—in terms of giving an unbiased opinion on whether the financial statements are prepared according to the applicable financial reporting framework. This results in outsiders being able to make decisions based on a more trustworthy economic representation of the entity whose financial statements are being considered.

Following auditing theories, we now consider the ISAs. The ISAs are developed by The International Auditing and Assurance Standards Board (IAASB, 2018). These auditing standards are issued to give guidelines in various areas of the auditing process. "The overall objective of the auditor is to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error [...]" (ISA 200.11). Regarding reasonable assurance, it is defined by ISA 200.13m, in this context, as "a high, but not absolute, level of assurance" (ISA 200.13m). The ISA states that professional judgment will need to be used when the auditor is to decide whether he/she has gathered sufficient appropriate audit evidence (ISA 200.A33). The quality of the audit should be enhanced by the use of the auditing standards (IAASB, 2016, p. 10). DeAngelo (1981) defines audit quality as the market-assessed joint probability for the auditor to detect and report material misstatement in the financial statement (DeAngelo, 1981, p. 186). To reach the goal of the audit that is defined in ISA 200.11, the auditor should make use of the relevant ISAs.

As stated in the introduction section, the purpose for this thesis is to create an understanding of how ADA tools are used in the auditing process and how that process can be used to gather audit evidence. Analytical procedures are a big part of the auditing processes. This view is expressed in a number of ISA formulations. For example, the use of analytical procedures in the risk assessment phase is described in ISA 315, and the use of analytical procedures as substantive analytical procedures and as final analytical review is described in ISA 520. Lastly, we want to illustrate how ADA tools can be used to gather audit evidence and illustrate some advantages in their usage. Several ISAs contain additional formulations relevant to this purpose of the thesis. The requirements and explanations of audit evidence are described in ISA 500. The requirements and characteristics listed in these ISAs will be

looked at when we discuss how ADA tools can be used in these parts of the auditing process. The ISAs relevant to this thesis are therefore as follows: ISA 315 *Identifying and Assessing the Risks of Material Misstatement through Understanding the Entity and Its Environment*, ISA 500 *Audit Evidence*, and ISA 520 *Analytical Procedures*. These will be explained in more detail in the next three sections.

While attempting to reach our overall objective to demonstrate how ADA may be helpful in audit preparation, we need first to emphasise that the auditor is required to gather sufficient appropriate evidence to support the audit opinion. One question then arises: “How much audit evidence is considered to be sufficient?”

To understand what may be considered as sufficient appropriate audit evidence, we first need to understand what is meant by sufficiency in this context. “Sufficiency is the measure of the quantity of audit evidence. The quantity of audit evidence needed is affected by the auditor’s assessment of the risks of misstatement and also by the quality of such audit evidence” (ISA 200.A31). Secondly, we need to understand what appropriate means in the context of sufficient appropriate audit evidence. “Appropriateness is the measure of the quality of audit evidence; that is, its relevance and its reliability in providing support for the conclusions on which the auditor’s opinion is based” (ISA 200.A32). The quantity and quality of audit evidence needs to be higher or lower relative to the amount of risk in the audit. If the auditor has assessed a greater risk of material misstatement, there may be a need for increased efforts connected to the collection of evidence, and vice versa (Stuart, 2020, p. 192). As the ISA states that the quality of the audit evidence affects the amount of audit evidence required, one will need to note that it also states that more audit evidence does not necessarily compensate for low quality (ISA 200.A31).

Throughout the audit there will be applied procedures in the attempt to gather sufficient appropriate audit evidence. Professional judgment is required to be applied in the decision-making of these audit procedures. For the auditor to make quality judgment, the auditor should rely on their expertise, integrity, objectivity and professional scepticism. ISA 200 emphasises the importance of professional scepticism and professional judgment. IAASB (2012) states that through applying good professional scepticism, the effectiveness of the audit procedures will increase. This comes through a reduction in the possibility of the auditor applying a wrong or an inappropriate audit procedure, applying the audit procedure in

the wrong way, or analysing the results of the audit evidence in the wrong way (IAASB, 2012, p. 5). According to the auditing standards, the auditor is required to apply professional scepticism throughout the entire audit (IAASB, 2012, p. 7). In addition to professional scepticism being crucial to the auditor's conduct of the audit, the application of professional judgment is important. The auditor's ability to conduct a proper audit is heavily dependent on professional judgment, particularly in decision making regarding: 1) Materiality and audit risk, 2) Evaluation if sufficient appropriate audit evidence has been acquired, 3) Evaluation regarding to what extent management's are able to judge the entity's applicable financial report framework, and 4) Designing, planning and execution of audit procedures (ISA 200.A25).

Chiş & Achim (2014) explains why professional judgment is a key part of the auditor's ability to properly conduct the audit. The auditor will not be able to properly evaluate which auditing standards and ethical requirements are relevant, or be able to make other decisions that are crucial to the audit engagement, without professional judgment and experience (Chiş & Achim, 2014, p.219). Of course, professional judgment is not done in a vacuum. Accounting standards and the guidelines of the audit profession are also crucial. While professional judgment plays an important role in a successful audit engagement, it is necessary that the auditor has a good understanding about rules and standards related to both accounting and auditing to perform professional judgment correctly (Chiş & Achim, 2014, p. 217).

2.3 ISA 315 Identifying and assessing the risks of material misstatement

ISA 315 deals with responsibilities the auditor has with regard to identifying and assessing the risks of material misstatement in the financial statements. The ISA presents the overall goal and the objective for the auditor in this phase of the audit. "The objective of the auditor is to identify and assess the risks of material misstatement, whether due to fraud or error, at the financial statement and assertion levels thereby providing a basis for designing and implementing response to the assessed risks of material misstatement" (ISA 315.3). ISA 315 describes ways through which the auditor can achieve this goal. To achieve this goal, "the risk assessment procedures shall include the following: Inquiries of management and of other

appropriate individuals with the entity, analytical procedures, and observation and inspection” (ISA 315.6). By utilizing analytical procedures in the risk assessment phase, the auditor’s understanding of the entity’s transactions, events or other aspects of the business is enhanced (Appelbaum, Kogan & Vasarhelyi, 2017, p. 4). By increasing the auditor’s understanding of the entity, the analytical procedures will assist the auditor with identifying inconsistency, abnormal activities in transactions or events, or changes in ratios and amounts that could indicate potential implications on the audit (ISA 315.A15). The pertinent issue in this context concerns how the ADA tools might address these issues or facilitate the crucial measurement of the entities’ transactions. In brief, how can the use of the ADA tools assist the auditor in gaining a better understanding of the transactional history of the entity and its self-assessment of its financial situation and immediate future? Might these tools contribute to the risk assessment phase in another way?

2.4 ISA 520 Analytical procedures

ISA 520 describes analytical procedures as a substantive procedure and discusses the use of ADA tools at year-end audit. In the ISA, analytical procedures means “evaluations of financial information through analysis of plausible relationships among both financial and non-financial data” (ISA 520.4). These analytical procedures are further described and defined in ISA 520 A1-A3. As substantive analytical procedures are generally more relevant when used on a larger population (the Association of Chartered Certified Accountants, 2021), it will be of interest to examine how data analytics tools can be used in those circumstances. When the auditor applies a particular substantive analytical procedure, he or she is required to make sure it is suitable and the data used is reliable. The auditor should develop some form of expectation about the possible result of the inquiry and then note how much the result differs from the expectations (ISA 520.5).

According to ISA 520.6, the auditor is required to design and perform analytical procedures to help form an overall conclusion at the end of the audit. “The results of such analytical procedures may identify a previously unrecognized risk of material misstatement. In such circumstances, ISA 315 requires the auditor to revise the auditor’s assessment of the risks of

material misstatement and modify the further planned audit procedures accordingly” (ISA 520.A18). ADA tools will be looked at here to see how they might be used in this situation, and how they may contribute to this process of risk assessment.

2.5 ISA 500 Audit evidence

Because we are also going to consider whether and how ADA tools can be used to establish audit evidence, we should consider ISA 500. The current standard differentiates between risk assessment procedures, substantive procedures and tests of controls (ISA 500.A10), where substantive procedures are tests of details or substantive analytical procedures (ISA 330.4). The question will then become what type of audit evidence the use of ADA tools might provide and whether the audit evidence gained by means of the ADA tools actually fulfills the requirements of the auditing standards. “The auditor shall design and perform audit procedures that are appropriate in the circumstances for the purpose of obtaining sufficient appropriate audit evidence” (ISA 500.6). Of the audit procedures used to obtain audit evidence that are listed in ISA 500.A10, the analytical procedures that are listed are the most relevant to using data analytic tools. In addition, these audit procedures are often used in combination with the audit procedure of inquiry (ISA 500.A10). The pertinent question that emerges here is how ADA procedures support the evidence gathered from other auditing procedures? We can also ask whether the ADA tools can be used to gather audit evidence by themselves.

The standard states that “audit evidence is necessary to support the auditor's opinion and report” (ISA 500.A1). To achieve this purpose, the auditor needs to gather sufficient and appropriate evidence. The grade of sufficiency of audit evidence is determined by the quantity (ISA 500.A4). The auditor’s assessed risk of material misstatement will affect the quantity of audit evidence to reach a sufficient amount of evidence (Chiş & Achim, 2014, p.219). When determining the appropriateness of audit evidence, one will look at the quality of the audit evidence, meaning to what extent it is relevant and how reliable it is in terms of supporting the conclusions upon which the auditor opinion is based (ISA 500.A5). The appropriateness will be the more relevant factor here in terms of the degree to which ADA tools can gather relevant and reliable audit evidence. “Relevance deals with the logical connection with, or bearing upon, the purpose of the audit procedure and, where appropriate,

the assertion under consideration” (ISA 500.A27). “The reliability of information to be used as audit evidence, and therefore of the audit evidence itself, is influenced by its source and its nature, and the circumstances under which it is obtained, including the controls over its preparation and maintenance where relevant” (ISA 500.A31). The grade of reliability of the audit evidence can be hard to generalize. Addressing this difficulty, the standard states, in an attempt to generalize, “the reliability of audit evidence is increased when it is obtained from independent sources outside the entity” (ISA 500.A31). Even with this effort, AICPA (2020) states that these kinds of generalizations do have exceptions (AICPA, 2020). The information gathered through the use of ADA generally will originate from the entity itself. It will therefore be crucial that the auditor tests and gathers audit evidence of its accuracy and completeness (AICPA, 2020).

Chapter 3: Relevant literature

In this section we attempt to give an overview of the current literature that is relevant to our thesis, as well as to highlight a portion of this contemporary research that we think captures essential points about the subject of audit data analytics.

3.1 An overview

Interest in advanced technologies and data analytics tools has exploded in the professional business world in recent years, so it comes as no big surprise that the auditing profession with its accompanying audit research has also begun to focus on the possibilities of innovative technologies in professional practice, in conducting the audit. The available research discusses a number of different subjects related to advanced audit technologies and analytics, including clustering and AI technologies, but we find that most of the recent research focused on “Big Data”, a technological term which describes technologies that use immense amounts of data. Other important subject areas of previous research concern educational issues, as well as a widespread discussion of whether audit evidence obtained through use of data analytics fulfills the requirements of the auditing standards.

With the discussion around ADA becoming a popular subject in the auditing profession in recent years, we ask the following questions: How can these ADA tools be used in the auditing profession? In what way do they add value? Can this technology be used to reduce audit risk or provide audit evidence? The American Institute of Certified Public Accountants (AICPA) states the usage of ADA tools has three potential benefits: 1) Improved understanding of an entity's operations and associated risks, including risk of fraud, 2) Increased potential for detecting material misstatements, and 3) Improved communications with those charged with governance of audited entities (AICPA, 2017). Another professional body has commented: “The application of professional scepticism and professional judgment is improved when the auditor has a robust understanding of the entity and its environment” (IAASB, 2016, p. 7). As we can see based on what the AICPA and IAASB state, the usage of ADA can contribute to better professional scepticism and professional judgment. Specifically in audits with high-volume data the usage of ADA tools can contribute to a more effective

and robust understanding of the entity and its environment, enhancing the quality of the auditor's risk assessment and response (IAASB, 2016, p. 7).

3.2 Socio-technological interactions

“Compared to traditional tools, data analytics more powerfully reveals insights, patterns, and anomalies, thus transforming the way business decisions are made” (Austin et al., 2020, p. 3).

Austin et al. (2020) interviews professionals who are participants of what they call “matched auditor-client dyads”, interviewing firm managers as well as their audit partners to gain insight and a unique look into the slower-than-expected development of data analytics within the financial reporting environment. These scholars base their scientific method on socio-technology (Geels, 2004), which highlights the dynamic functions between technology, people, and their environments. The findings of their study shows that interactions between the different types of stakeholders in the financial reporting environment act in ways that actively encourage more use and development of data analytics, but at the same time, the study sees that there are constraints on this evolution. This assessment of current mix of development manifests itself through their interviews as the different types of interviewees have similar views in terms of the data analytics as a “journey” together, but also express a variety of views—especially differing when it comes to details of auditor-client relationships and most pointedly (and perhaps not surprisingly) concerning auditor fees.

Auditors are of the opinion that additional analytical business insights gained into clients' operations are a justification for higher audit fees, while the perspectives of the clients are that data analytics should increase the efficiency of audit processes, leading to lower fees. One point of contention is that client managers view the audit fees as a number that is derived based on the amount of audit work hours spent, while auditors argue that fees have become more disjointed from the number of hours due to increasing overhead costs related to greater use of data analytics technologies by client firms, pressuring the audit firms to make greater use of data analytics.

In addition, there is the issue of regulation. Austin et al. (2020) remarks that their interview results show that their respondents express the opinion that a lack of regulation is slowing down the implementation of data analytics. In another issue, when it comes to discussing how the regulation surrounding data analytics should ideally be shaped, the interviewees in the study gave indications of disjointed opinions. Some of the respondents would prefer new, more specific regulation for data analytics, while others opted for a looser style of regulation where it is up to the auditor to make use of their own professional judgment in their use of data analytics. A side note of the regulation issue which Austin et al. (2020) mentions is that the interviewees express worries about auditor independence whenever auditors make use of data analytics to aid clients with additional business insights beyond those narrowly focused on audit issues alone.

In their 2017 paper that explores research needs with audit-related data and analytics, Appelbaum et al. (2017) discuss the issues with standard setting, concerns about practice, and development of an improved data analytics. When it comes to future standard setting and whether and how these procedures might be changed, the authors point out that earlier discussions were centered around how analytical procedures are used as substantive tests to gather audit evidence and how ADA can potentially replace substantive testing. Additional discussion within the paper focuses on making adjustments to the standards in order to replace substantive tests with ADAs, although Appelbaum et al. (2017) argues that ADA usage might better be used as a lens through which to focus substantive testing.

The other area that Appelbaum et al. (2017) discuss is related to a problem area in the profession which we have seen pointed out multiple times, namely educational issues (Blix et al., 2020; IAASB, 2016). The study suggests that contemporary scholarly interest should concentrate on what the new data-driven environment demands from auditors in terms of their competencies, and the particular things that auditors can add of value to the audit when it comes to use of ADA tools. The conclusion of the study theorizes on whether auditors can use their expertise, professional judgment and professional scepticism to develop more effective data analytic-related strategies in the audit process. The auditors ask: "How can auditors remain relevant in the developing environment? Will they have to gain competence as both auditors and data scientists, or will ADAs be standardized to a point where the auditor does not need in-depth computer knowledge to make use of them?" In the authors' opinion (with which the authors of this thesis agree), this is a potentially fruitful area of research.

3.3 Big Data

We can not treat ADA without touching upon Big Data. We find that a great amount of previous research discusses the technology, and so we summarize some of the important points with the relationship between Big Data and ADA. The large amount of focus on Big Data shows much interest in the technology, and we theorize that it might become even more relevant to the auditing profession as technologies evolve to handle greater amounts of ever-changing data. We note, however, that Big Data is not an objective of our thesis and has not been a big point of discussion past the relevant literature we mention in this section.

While ADA is data analytics specific to the audit profession, Big Data as a technological term covers data which are high in variety, velocity and volume (Cukier & Mayer-Schoenberger, 2013). “Big Data analytics is the process of inspecting, cleaning, transforming, and modeling Big Data to discover and communicate useful information and patterns, suggest conclusions, and support decision making” (Cao, Chychyla & Stewart, 2015, p. 424). With the evolution of Big Data and business analytics, we can observe how business functions are changing through added business capabilities and can note that anachronistic business functions are being eliminated and processes are substantially accelerated (Appelbaum et al., 2017, p.22). As a result, we are getting entities that demonstrate increasing complexity and generating higher volumes of data, developments that call for the increased use of data analytic tools by the auditor (IAASB, 2016, p. 6). While data analytic tools are used as one of many activities within the internal audit (KPMG, 2019), Cao et al. (2015) suggests that “many internal audit activities mirror those of external financial statement audits and similar Big Data analytics can be applied” (Cao et al., 2015, p. 426).

While usage of ADA is affected by the greater use of Big Data in business entities, we can also see an effect on the audit evidence itself. Previously the majority of audit evidence was based on paper, observations, inquiries, and other physical formats, and the determination of Detection Risk was heavily dependent on the appropriateness of the audit evidence gathered through these means (Appelbaum, 2016, p. 19). With a greater prevalence of complex IT and Big Data, the nature and competence of audit evidence are of a different nature than that gathered in older methods (Caster & Verardo 2007; Nearon 2005). We make this assessment that the characteristics that delineate the sufficiency and competency of audit evidence have

been altered due to the evolution of technology in business entities (and the innovative technologies available to auditors) (Caster & Verardo, 2007).

Brown-Liburd et al. (2015) takes a look at the impact Big Data has had on auditor judgments, based on prior research that finds that it is not ineffective auditing that causes many audit failures, but rather the auditor having experienced difficulties when it comes to recognizing patterns that could be indicative of fraud or issues related to going-concerns. This is an issue that is exacerbated whenever Big Data is integrated into the audit process in an inappropriate manner. Given this possibility, the tools being used by the auditor should allow him/her to use professional judgment and professional scepticism to ensure that the information (and technology) used to gather audit evidence is relevant and reliable and can be properly used to increase audit quality. The conclusion from this study is that auditors face major limitations in an audit environment with Big Data, limitations including information overload, information irrelevance, difficulties with pattern recognition and ambiguity. The authors of the study do argue, however, that the existence of tools such as expert systems, predictive analytics and other techniques has a great potential to enhance audit quality when using Big Data. The utilization of new technology with the potential to rapidly retrieve large amounts of data and simultaneously allowing examination of every type of transaction can potentially be a massive improvement of tests of controls, rendering traditional sampling obsolete. Their conclusion is that while Big Data has a lot of potential in adding value to the audit process, auditors have to keep a professional mindset and be aware that more in-depth investigation can be necessary to obtain audit evidence that is appropriate and sufficient. Brown-Liburd et al. (2015) argues that Big Data should not be used as the sole source of audit evidence, but rather as an aid in identifying risks and supplementing other audit findings. Finally, the importance of using the correct data analytics tool is emphasized. This is because using the wrong kind of tools or using tools without possessing the necessary competence for their proper application can lead to lower audit quality through Type II errors (false negative) or can impact audit efficiency through an unnecessary amount of audit work as the result of Type I errors (false positive).

Yoon, Hoogduin & Zhang (2015) is another article that is widely referenced when it comes to Big Data and auditing. The study argues that Big Data has the potential to complement traditional audit evidence with information that is sufficient, reliable and relevant. This sentiment, which describes Big Data (and other types of data analytics in other research) as a

supplement to audit evidence that is gathered through traditional methods, is being echoed throughout recent research discussion in the field of study. The argument advanced in the study is that the auditor's abilities to collect audit evidence that meets the requirements of sufficiency and appropriateness is enhanced by the innovative technology and Big Data can play a significant supporting role in cases where traditional audit evidence is deficient (Yoon et al., 2015, p. 433). In addition, Yoon et al. (2015) argues that accounting and audit curricula should provide more content related to advanced data analytics, as an appropriate education response to the transformation we are seeing in the methods of gathering audit evidence. The study and the wider scholarly discussion acknowledges that there are major challenges posed by the use of Big Data, including the integration of its use with more traditional audit methods, standardizing information transfer with clients, and issues of information privacy.

3.4 Big Data and Analytics: How it potentially changes the game

BDA may be understood as a suite of algorithmic tools which systematically extract and analyse large and diverse data sets, both structured and unstructured, so as to facilitate the identification and visualization of patterns and connections that might otherwise be invisible but that may provide valuable insights for decision making. (Salijeni, Samsonova-Taddei & Turley, 2021, p. 1-2)

Salijeni et al. (2021) finds that there are three key areas where the interaction between Big Data and Analytics (BDA) and its proponents has managed to change not only the nature but also the organization of audits. *1) The automation of procedures for collecting and processing audit evidence; 2) the visualization of audit findings and the generation of insights to inform audit judgements; 3) the relationships between practicing individuals (auditors and data specialists) as well as functions within audit firms (audit and non-audit functions).* (p. 20).

3.4.1 Automation of Procedures

For example, *the automation of audit procedures* in terms of BDA entails the usage of scripts to shift work from humans to technology, something which Salijeni et al. (2021) states is helpful for auditors as they tackle the challenge of ensuring sufficiency and appropriateness

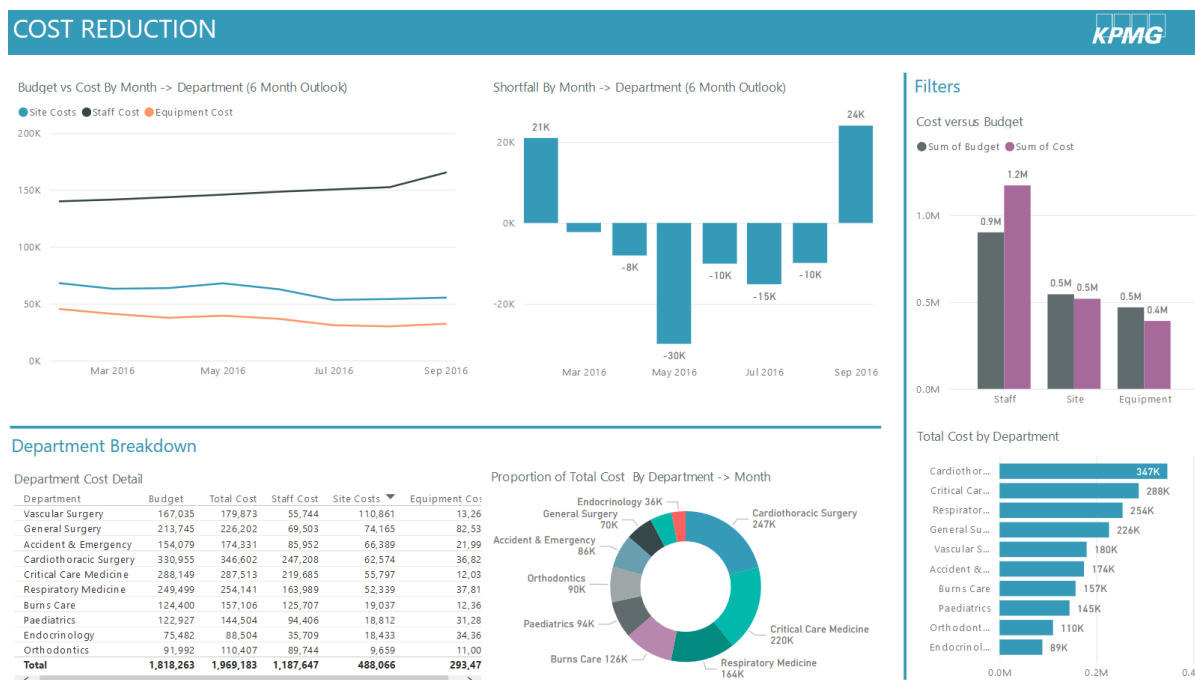
of audit evidence. As mentioned earlier, sufficiency of audit evidence is measured in quantitative terms of how much evidence is needed. Appropriateness is measured in qualitative terms of relevance and reliability. Yoon et al. (2015) is quoted by Salijeni et al. (2021) with regard to that study's findings that the issue with BDA-style data is that there may be a greater degree of uncertainty to the data. The scholars of both studies argue that this issue is likely to be more closely connected to the reliability of the audit evidence, asserting that the sufficiency requirement is satisfied by the large variety and volume that often defines Big Data. Audit evidence is considered to be more reliable when coming from an independent source rather than directly from the entity under audit, when evidence is obtained directly by the auditor through observation, for example, than through inquiry of the client, and when the audit evidence exists in documentary form rather than in digital documents (Stuart, 2020, p. 192). Audit evidence derived from Big Data can be very reliable because it is often acquired externally and directly by auditors. Even so, the noise caused by the enormous amounts and the high velocity of the data can lead to lower reliability (Yoon et al., 2015, as summarized by Salijeni et al., 2021).

3.4.2 Visualization of Information

The use of visualization dashboards to generate insight for audit purposes, as well as improving professional judgment is one of the tools that might be useful for auditors.

Salijeni et al. (2021) finds that visualization dashboards are one of the most common tools used in the BDA environment (example in Figure 3.1). Their research shows that the enhanced visualization makes it possible for auditors to pinpoint which areas might be of concern for the audit. The information derived from this process is then used as a means of quantifying how much substantive testing must be done to acquire the required audit evidence. This means that the auditors' professional judgments are not only affected by their experience and industry knowledge, but also by the insight provided by visualization (Salijeni et al., 2021, p. 21). In addition, the visual insights into the business processes of clients are used for commercial purposes to enhance the advisory role of audit firms, in an attempt to stay at the cutting edge of competitive advantage. Finally, the ability to visualize the audit process and the decisions made through the process help with communications between audit firms and their clients, to explain what is being done and why it adds value to the audit.

Figure 3.1: Visualization dashboard - Power BI



(Microsoft and KPMG UK, 2021)

3.4.3 Relationships

The relationships within the audit-specific BDA environment may be another source of evidence for the auditor.

Salijeni et al. (2021) finds that BDA changes how relationships and communications function in the cases of multidisciplinary audit teams, specifically for relationships between auditors and specialists like data analysts. Their interviews revealed that the auditors of Big 4 audit firms often work in close relation with other parts of the firms that have expertise related to Big Data, including “data assurance” and “risk advisory” teams. Salijeni et al. (2021) argues that their research shows that use of BDA-related technology creates knowledge which spills over into the aforementioned types of teams in such a way that makes traditional auditing a more generic “pool” of operations that feeds data into the other arms of audit firms (including such data assurance). As it currently stands in practice, the findings of this study show that a shift toward a closer interaction between auditors, data specialists and BDA tools is required due to a widespread lack of competencies with the extract, transform and load (ETL) model in the current auditor environment (example in Figure 3.2).

Figure 3.2: ETL model



(Rick Van Der Lans, 2012, p. 44)

*For each piece of data analytics, there is a process [. . .] that **extracts** the data from the client system, [that] once you have that data, [. . .] **transforms** that [. . .] into a common data model that [. . .] **loads** [it] into a tool [which is going] to run a number of routines that have been set up by the audit team. The output of that tool is the data analytics and that's what the audit team will get (emphasis added).*

(Director, D3, as quoted by Salijeni et al., 2021, p. 11)

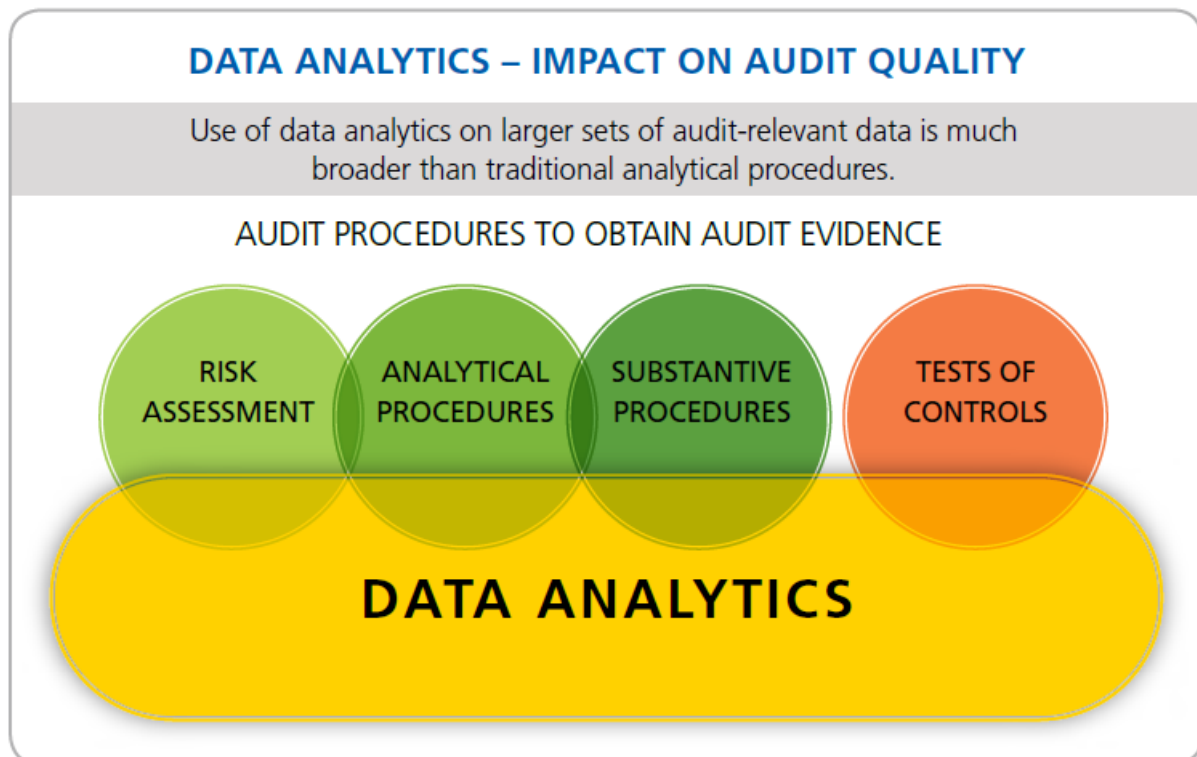
No, Lee, Huang & Li (2019) presents a so-called Multidimensional Audit Data Selection framework (“MADS” in short) to assist auditors in dealing with the main issues that arise from the use of ADA and Big Data, consider the potential of identifying too many outliers that the auditor does not have the resources to test, and address the information overload this can cause. The framework enables multidimensional filters to aid the auditor in identifying and prioritizing the most problematic items for substantive tests of detail.

3.5 Data analytics and the impact on audit quality

“Auditors play a key role in contributing to the credibility of the financial statements on which they are reporting. High-quality audits support financial stability” (IAASB, 2016, p. 5). Following from DeAngelo’s (1981) definition of audit quality, we see that it is crucial for the auditor to provide a high-quality audit because this enhances the credibility of the financial statement. As ADA is employed to enhance audit quality (IAAE, 2016), it is important to have an understanding of how the technology adds value to the audit. The

technology, however, ought not to be the sole focus of our assessment. The audit quality does not lie inherently in the technology, but rather in the insights gained through analyses and judgments as an output from using ADA tools (IAAE, 2016). Data analytics in the auditing process allows the auditor to analyse a much broader set of audit-relevant data than if the auditor was limited to traditional analytical procedures (Figure 3.3).

Figure 3.3: Data Analytics - Impact on audit quality



(IAASB, 2016, p. 7)

By utilizing data and high-powered analytics the auditor can analyse most of the data, potentially as much as 100% (KPMG & Forbes, 2015). As a result of the increased capacity of analysis, being able to analyse a larger population, the auditor’s ability to gather audit evidence increases as a result of the improvement of the risk-based selection of those populations (IAASB, 2016, p. 7). Given this, however, the IAASB states that “being able to test 100% of a population does not imply that the auditor is able to provide something more than a reasonable assurance opinion or that the meaning of reasonable assurance changes” (IAASB, 2016, p. 8).

As we see the benefits of ADA tools in the external audit, we also assert that use of ADA will be beneficial in the internal audit. KPMG (2019) states that the usage of ADA in the internal audit offers increased quality and efficiency. This comes through four elements: 1) Allows the auditor to easier identify high risk business processes and locations, 2) Supports implementing pre-incident forensic analysis routines that can be used to assess “what could go wrong”, 3) Make it easier to identify anomalies in transaction-based business processes through leveraging multiple years of data and modern visualization tools, and 4) Enables the auditor to a substantially increased coverage of high risk areas by combining “Computer Assisted Audit Techniques” (CAAT) procedures, modern tools and advanced analytics techniques (KPMG, 2019, p. 2).

3.6 How should ADA tools be used according to prior research?

It is important to have an understanding of: 1) Where in the audit engagement are ADA tools used? and 2) How are they used to gather audit evidence? Potential benefits of ADA in the auditing process have been researched; yet there is still little information regarding to what degree ADA is used in audit practice and how this use affects the conduct of audit (Eilifsen, Kinserdal, Messier & McKee, 2020, p. 78). EY (2015) stated that getting a better understanding of how analytics are used by the auditor is one of the key areas that the audit committees and finance leadership need to pay more attention to (EY, 2015).

Blix et al. (2021) points out how ADA techniques can be implemented in all six stages of the audit engagement: 1) pre-engagement, 2) planning and risks assessment, 3) substantive and compliance testing, 4) review, 5) opinion formulation and reporting, and 6) continuous activities (Blix et al., 2021, p. 2). The benefits from using ADA tools in the planning and risk assessment phase comes from the ability to perform a more efficient analysis of data to identify outliers, as well as the possibility of automating parts of the identification and assessment of material misstatement risks (Deloitte, 2016). While Blix et al. (2021) points out that ADA techniques can be applied in all six stages of the audit engagement, we also need to have an understanding of what type of mode of analysis is most suitable in the different aspects of the engagement process. Tukey (1977) separates ADA into two different modes, exploratory and confirmatory (Tukey, 1977). We then have exploratory ADA and

confirmatory ADA. The exploratory ADA is bottom-up and inductive and will be best suited for the planning phase to enhance the auditor's understanding and identify the entity's risks of material misstatement, the entity's environment and further planning of the audit (Byrnes, Criste, Stewart & Vasarhelyi, 2014). By contrast, the confirmatory ADA is top down and deductive, making it suitable in the substantive and control testing to assure that the financial statements are free from material misstatement (Byrnes et al., 2014). The research reported in Eilifsen et al. (2020) indicates that the majority of the output from ADA functions as supplementary evidence (Eilifsen et al., 2020, p. 97).

While several researchers highlight the benefits of ADA in the auditing process, there is still some uncertainty that is related to the audit evidence gathered from these tools. The Eilifsen et al. (2020) research found the firms had not yet approved audit evidence gathered from ADA tools as the only form of audit evidence. The audit evidence gathered from ADA tools are discussed by the engagement partner and the audit team to decide whether it qualifies as sufficient appropriate audit evidence (Eilifsen et al., 2020, p. 79). While research shows uncertainty regarding the use of audit evidence gathered from ADA tools, it is important to have an understanding of what role is played by the audit evidence that can be gathered by these tools. Are the tools best used as a primary source of evidence, or does the evidence gathered by means of these methods serve a role as supplementary audit evidence? Does the audit evidence gathered from ADA tools have an exploratory role, or does it mostly have a confirmatory role as evidence? In a partial response to such questions, Chartered Professional Accountants of Canada (CPA) Canada (2017) found through their research that the large firms mainly used audit evidence gathered through ADA tools as confirmatory evidence (CPA Canada, 2017).

3.7 How are ADA tools being used according to prior research?

Despite the positive interest and intention to use ADA, research by Eilifsen et al. (2020) shows that the actual use of ADA is limited, and one only sees the use of "advanced" ADA on rare occasions (Eilifsen et al., 2020, p. 97). Furthermore, CPA Canada (2017) did research on this area. They issued a survey across 394 auditors within different audit organizations in Canada. Their research supports the conclusion of Eilifsen et al. (2020) regarding the amount

of ADA usage. Their research found a rather small use of advanced ADA (20%); the survey revealed, however, that ADA's in some form were used by 63% of the respondents in large firms in major phases of the audit engagement, mainly in planning and risk assessment and substantive procedures (CPA Canada, 2017). Eilifsen et al. (2020) found through their surveys and research that the majority of audits that used ADA were related to new and tendered audit engagements. In addition, their research found an increasing use of ADA where the clients had a fully integrated accounting system that included additional ERP/IT systems. The authors of the study viewed this as an opportunity and in some way a means to force the auditor to utilize ADA in a more efficient way. As a result, Eilifsen et al. (2020) draws the conclusion that the environmental pressure to apply ADA is mostly a result of technological advancements and to a degree relationships with new clients (Eilifsen et al., 2020, p. 97). While the auditor firms are interested in the usage of ADA, Eilifsen et al. (2020) believes that the limited use of ADA will not change until we see: 1) A better integration of it in companies' methodology and reward systems, 2) The standards support and accept the use of ADA in a larger extent, and 3) Auditors are able to prove that the use of ADA enhances the audit engagement's efficiency and effectiveness (Eilifsen et al., 2020, p. 97).

3.8 How does the use of ADA tools affect the requirements in terms of auditor competencies, knowledge, skills and experience?

As we can see, the auditing profession is currently undergoing important change by becoming more and more dependent on IT systems to use ADA reports. How does this affect the skills and knowledge new auditors should learn and master? Blix et al. (2020) mentions the demand for ADA knowledge from graduates has been increased (Blix et al., 2020). The research by Lombardi, Bloch & Vasarhelyi (2014) indicates that as the automation of the auditing profession evolves, this should reduce repetitive and tedious tasks. Yet, ADA tools can not replace human judgment (Lombardi et al., 2014, p. 26). For the auditor to exercise proper judgment, expertise is required (Mock, Watkins, Caster & Pincus, 1993). As we can see, if the auditor uses ADA tools to assist in the audit engagement, he or she needs knowledge about these tools to make sound decisions.

Through the rapid technological evolution in the auditing profession, the auditor's skillset will also be affected. A joint survey by Forbes Insights was conducted in cooperation with KPMG regarding the future of change in the auditing profession as an impact of technological change. In this survey, they focused on how these changes will affect the future skillset of auditors. Their findings indicate that an auditor's ability to analyse and to evaluate critically will become more important in the technology-shaped future (KPMG & Forbes, 2015). For future audits, the auditor's judgment paired with the automation of the audit will play a very significant role (Lombardi et al., 2014, p. 26). As a result of the rapid advancement of technology, the need for further and continuous training of the auditor will be essential for the conduct of future audits (Lombardi et al., 2014, p. 26). This highlights another part of the auditor's skillset, adaptability. The auditor will have to adapt continuously as a result of these changes, and the study emphasises that the auditor needs to be willing to adapt and able to learn throughout their career (KPMG & Forbes, 2015).

Chapter 4: Methodology

In this section we present the choice of methodology and the reasoning behind it. We also present and explain our choice of participants. Lastly, we describe how the interviews were structured and conducted.

4.1 Explanation of methodology

To conduct research one first must decide on a research method. As part of this decision, the research scholar determines the purpose of the particular project. Research has two main purposes: 1) Obtain additional information to enhance knowledge within the field of research, 2) Obtain additional information to enhance the knowledge of oneself and to support the growth of knowledge among other professionals to encourage further study and advance critical understanding in the field (Ottenbacher, 1986). Scholars can gather information through qualitative research methods, quantitative research methods, or a combination of both. Bolderston (2012) discusses when qualitative research methods are the most suitable option. Following her pattern of presentation, as we stated in the introduction to our thesis, we seek to examine how data analytic tools are used in the auditing process. In our determination, information on this topic will best come from beliefs, experience, situations and perspectives of professionals and scholars working in the profession. While there is much available general information in the literature and technical periods on the benefits of ADA tools, there is not much information that focuses on the specific use of ADA tools (in conducting audits). As we can see here, we are looking at a specific phenomena that is best observed through experience, beliefs, situations and perspective with limited information on the subject. Given our assessment, we--like Bolderston--conclude that using qualitative research methods will be the best option for us for gathering information on our particular subject (Bolderston, 2012, p. 67).

Qualitative research focuses more on “why” questions than on “what” issues, and the qualitative approach focuses on gathering data to get an understanding and insight into the problem setting issues (Ahmad, Wasim, Irfan, Gogoi, Srivastava & Farheen, 2019, p. 2828-

2829). The data used in this research method is known as qualitative data. To collect this kind of data, we chose a method which would generate the best outcomes. “The researcher has several methods for collecting empirical materials, ranging from the interview to direct observation, to analysis of artifacts, documents, and cultural records, to the use of visual materials or personal experience” (Denzin & Lincoln, 1994, p. 14). The questions we wanted to answer are more of a “how is it done?” character than a “how should it be done?”. This emphasis often characterizes case study research questions (Punch, 2015); therefore it is logical to make use of such a method to gather information because it allows us to get a real-life perspective on the questions we ask (Yin, 2014, p. 14). Case study is defined as “a way of investigating an empirical topic by following a set of desired procedures” (Yin, 2014, p. 23). This approach gives an opportunity for a more in-depth investigation of a particular subject (Yin, 2014, p. 16), which increases the researcher’s capacity to discover more variables.

To get the best understanding of how data analytic tools are used in the auditing process and to get the most up to date information, we found collecting data through case study interviews to be the best solution. Yin states that interviews are a commonly used method to gather information in a case study (Yin, 2014, p. 110). By doing qualitative interviews, we can construct a framework that not only records practices and standards, but also achieves, challenges and reinforces them (Oakley, 1998). The interviews can be done in a structured, unstructured or semi-structured manner.

Structured interviews are generally conducted whenever the researcher has a set of questions constructed in advance of the conversations. In the interviews all participants are asked the same questions. This makes it convenient for the researcher to compare the answers from the different interviewees. We acknowledge, however, a downside of conducting structured interviews. These types of questions tend to limit the spontaneous response aspect of the interviews, and this may result in opportunities lost for gathering some of the personal insights of those interviewed, the loss of their personal knowledge.

By contrast, unstructured interviews are conducted without prepared questions, and questions and lines of thought emerge as the interview progresses. Even though specific questions are not prepared in advance, the researcher has decided to pursue some topics or specific aspects of the general subject that they would like to cover. This approach to preparation and interview agenda allows the interview to be conducted more or less as an informal

conversation, one that may open up for more in-depth discussion and follow-up questions/remarks on the topics. As a result, we often see the participants reveal more of their knowledge and share personal opinions and perspectives on the matters that emerge during the conversation.

While we acknowledge the positive aspects of conducting unstructured interviews, we need also to take into account the downside of this method. As participants get the chance to share their personal opinions, the researcher needs to be careful and keep in mind the objective of the interviews; that is, the researcher's own purpose of the study, the focus of the information gathered (Ghauri & Grønhaug, 2010, p. 126). The comparison aspect of the interviews will also have a reduced value from performing unstructured interviews. In unstructured interviews the various participants tend to be asked different questions because the conversations vary from person to person rather than being shaped by questions set in advance by the researcher. This leads to a problem for the researchers when they seek to compare the results of the interviews.

Semi-structured interviews are conducted as a mixture of both structured and unstructured interviews. The researcher prepares a few questions in advance, while the rest of the concerns arise in the conversation side of the interview. By conducting the interviews in a semi-structured manner, the researchers are able to cover the main subjects of the research and are also open for the participants to share their knowledge. Together the researcher and participant can explore interesting points that may arise through a free-flowing conversation. This approach allows the researcher to get the best of two worlds, and allows for later comparisons of the various interviews. There is also a downside of semi-structured interviews: the interviews will likely be less objective than a structured interview.

4.2 Participants

After reading the research by Eilifsen et al. (2020) and CPA Canada (2017), we concluded that we would get the best result by performing interviews with participants spread among the Big 4-firms as well as a participant of a Big 6-firm. The results of Eilifsen et al. (2020) and CPA Canada (2017) indicate that the most use of ADA tools is within larger firms, especially

when it comes to the use of advanced ADA tools. It seems reasonable to assume that Big 4 audit firms possess a greater degree of experience related to use of ADA tools in the audit process, considering they generally audit larger firms as well as publicly listed firms compared to smaller audit firms. Additionally, we chose firms of this size in an attempt to better capture general points of view of implementation of ADA tools in the audit engagement, due to these companies having a larger variation of clientele. The aim was to allow us to pick up on differences and similarities between entities and markets, making our results an adequate representation of how data analytic tools may or may not be used in the auditing process across a greater variation of markets and entities.

While developing a list of participants with whom to interview, we had to decide on what kind of positions and experience within the firms these participants should have. From these firms, we interviewed participants each of whom had experience with the use of data analytic tools in the auditing process. The participants had various levels and types of experience and positions within their firms, ranging from Associate to Senior Manager. Selecting participants with a variety of position and experience, we reasoned, would give us interviewees who might share a good range of information about the use of the technology, how specific tools were used and how they were implemented and affected the audit processes. We had a total of five interviews, four of them with one person and the fifth with two Participants, giving us a total of six interviewees. The Participants were told that their identities would be kept anonymous and were assured their privacy in accordance with the guidelines of conducting research interviews.

Table 4.1

Overview of participants

Participant no.	Category of firm	Position
Participant 1	Big 6	IT-Manager
Participant 2	Big 4	Senior Manager
Participant 3	Big 4	Manager
Participant 4	Big 4	Manager
Participant 5	Big 4	Associate
Participant 6	Big 4	Manager

4.3 Structure and conduct of the interviews

When we prepared for the interviews, we decided to conduct them in a semi-structured manner. Based on the benefits listed above with regard to the three types of interview structure, we found semi-structured interviews to be the most suitable option. By conducting semi-structured interviews we were able to get information on a number of our main questions, and we found it possible to analyse and compare the data conveniently enough to pick up on patterns and similarities among the participants' answers. In addition, this interview approach allowed us to ask follow-up questions that were prompted during the interview conversations. We had prepared a few questions that we especially wanted to have answered in each of the interviews, and we came ready to ask follow up questions based on the interview answers to those questions, thus enabling us to explore topics and gain more in-depth information. This question-follow up, conversational process allowed the participants to explain their answers and give more details about the interview topics. Due to the ongoing Covid-19 situation, we conducted the interviews through video call programs, including Microsoft Teams and Zoom.

Chapter 5: Presentation of results, interpretation and discussion

Throughout the interviews we collected six key takeaways and will be splitting this section into six subcategories. For each of the six subcategories we give a brief introduction, present the results of the interviews, and discuss the results in comparison to relevant theory and a selection of previous literature on the topic. The majority of the interviews were conducted in English, the remaining minority were conducted in Norwegian. The interview results presented below are based on notes taken during interviews. They contain paraphrasing and translations to English.

5.1 Which ADA tools are being used in practice?

We wanted to get an understanding of which ADA tools were used in the auditing process, and we wanted to know whether they were used alone or in addition to other tools or techniques. Secondly, we were interested in why these particular ADA tools were chosen.

As a first question in our interviews we asked about what ADA tools were used in the audit engagement. The collective responses indicated that each of the firms used a variety of ADA tools.

We are using a lot of [Microsoft] Excel in general for the audit; while for data analytics purposes, we employ a couple of different tools such as [AuditWare] IDEA or [Prisolve] Smartbob. In addition, [ERP] Maestro is being used for tax documents and similar paperwork. (Participant 1)

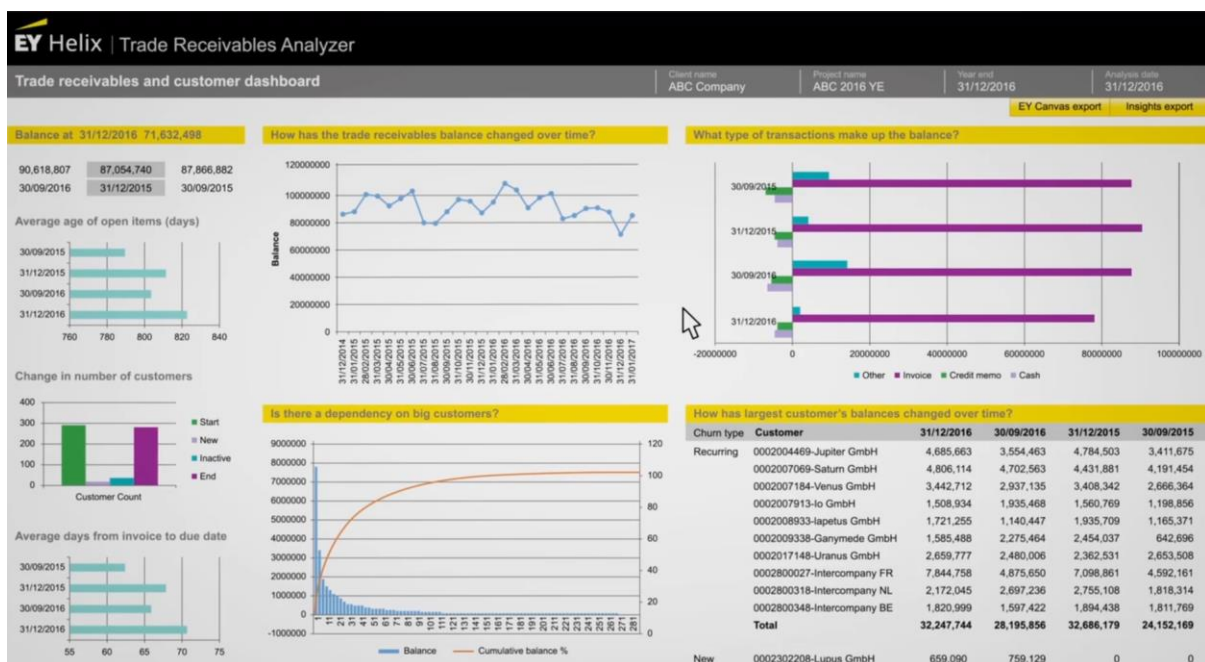
We make heavy use of [Microsoft] Power BI, but based on the macros of the audit process Excel is used as well. In addition to that, we make some use of [Tibco] Spotfire on the side. (Participants 3 & 4)

[Microsoft] Excel is the main tool we use for audits in general, in addition to

[Microsoft] Power BI as an additional way of looking at things. We have also designed our own tools that are a bit more precise, some of which are used as plug-ins in [Microsoft] Excel. (Participant 5)

One program used by all of the participants was Microsoft Excel, and this still seems to be the main tool. Participant 2 explains why in this manner: [...] Excel is still the main tool in the audit world, as it can produce new data [...] (Participant 2). When it comes to additional ADA tools between Big 4 usage and that of the Big 6, we note some differences. Based on the response from participant 5, we see ADA tools are being developed internally in the companies, such as for example “Helix” (Figure 5.1).

Figure 5.1: EY’s analyser software, “Helix”. An example of proprietary data analytics software that audit firms develop on their own.



(EY, 2021)

Power BI seems to be one of the ADA tools that is commonly used in the Big 4 firms; however, the Big 6 firm does not seem to use these ADA tools. While this information gives us a picture of which ADA tools are used, we still need to get an understanding of why they have chosen these particular ADA tools; therefore we asked about this as a follow-up question.

We are using [Microsoft] Power BI because it is one of the easier programs to use, in addition to it being basically free since it is part of [Microsoft] Office. [...]

[Microsoft] Power BI is honestly just one of the tools in the toolbox, though it is the one we prefer to use in terms of visualization dashboards. [Microsoft] Power BI is a presentation layer software compared to old school software such as [AuditWare] IDEA.[...] Visualization dashboards such as [Microsoft] Power BI enable better risk assessment and pinpointing of issues thanks to easy filtering. (Participant 2)

The reasons why are because visualization dashboards make for an easier and better graphic presentation of the data. It becomes easier to find data that stands out, though it requires a great deal of background knowledge. (Participant 3 & 4)

As we can see, Power BI is mainly used because it allows the auditor to get a better understanding of the entity and easier identify data that stand out. However, participants 3 and 4 pointed out that a great deal of background knowledge is required to do this. Our findings here confirm previous research findings by Blix et al. (2020), Lombardi et al. (2014) and Mock et al. (1993). There is a demand for knowledge within the ADA tool field (Blix et al., 2020), which can be explained in terms of how ADA tools can not replace human judgment (Lombardi et al., 2014, p. 26) and because the auditor will not be able to make a high quality judgment without expertise (Mock et al., 1993).

5.2 How exactly are ADA tools being used as part of the audit process?

Since we had gathered information and an understanding of which ADA tools are used, we wanted to find out how these ADA tools were used throughout the auditing process. Are they restricted to only one phase of the auditing process or can they be used in multiple stages or in a variety of ways? How do they add to the audit quality by being used in these auditing processes?

Data analytics are used to support the audit, help do risk assessment and to better focus the lens on the audit. We typically export data from Power BI into Excel to finish the audit. It can be used to gather substantive evidence as well. Data analytics

has primarily been used as part of planning/risk assessment but has lately evolved into being used both as analytical procedures as well as gathering some substantive evidence. (Participant 2)

Data analytics are used mostly in the planning phase and as part of risk assessment through analysing and finding deviations. If this part of the audit process helps narrow down the population, it will be very beneficial for the subsequent steps of the audit. (Participants 3 & 4)

Power BI is used extensively as part of the risk assessment and as an analytical tool to find risk in a population for the purpose of reducing the population that needs to be tested. It helps us reduce the number of manual operations required. The manual operations are standardized in a way that allows us to use data analytics more. [...] We can test a whole population instead of a narrow selection. The better the documentation, the better the quality control will be. (Participant 6)

It clearly indicated that ADA tools are being used frequently in the planning and risk assessment phase. Additionally, participant 2 tells us how ADA tools help them focus the lens on the audit. This is in line with the research we cited earlier by Appelbaum et al. (2017), where the study suggested that ADA tools could be used to better focus the lens on substantive testing. Participant 6 emphasises another benefit of using ADA tools in that by being able to test whole populations, it will contribute to better documentation, thus it enhances the quality of control. We note that our findings confirm what IAASB (2016) states when they explain how utilizing ADA tools allows the auditor to analyse most of data, if not all, thereby enhancing the auditor's ability to gather audit evidence. This enhancement will lead to an increase in the quality control. As we can see, the use of ADA tools are of value when the auditor is to assess risk of material misstatement, because they facilitate the ability to narrow down the population of tests and focus the lens of the audit; thus the use of the tools will contribute towards the goal in the planning and risk assessment phase mentioned in ISA 315.3.

Participant 2 explains how the use of ADA tools are not only used in the planning and risk assessment phase. They are gradually being introduced and used as analytical procedures and to gather substantive evidence. Participant 2 elaborates: [...] *This is because traditional audit*

processes do make use of analytical procedures to gather some degree of substantive evidence, so naturally data analytics can do so as well (Participant 2). If ADA tools are going to be used as a substantive analytical procedure in the auditing process, we will have to look at how the program fulfills these definitions/requirements and assess how the data used in these tools are in terms of reliability. When an auditor is to design and perform substantive analytical procedures as substantive procedures in accordance with ISA 330, whether they are used by themselves or in combination with tests of detail, the auditor is required to adhere to the guidelines that are listed in paragraph 5 (ISA 520.5). These requirements should be reviewed, and the auditor should determine how ADA tools fulfill these particular requirements. Participant 6 mentions some uncertainty when it comes to audit evidence gathered from ADA tools: *The findings we derive from analytics does not always fulfill the definition of audit evidence and in that case can not be used as evidence apart from situations where you are able to fully match two systems with each other.* This gives us an indication that the output of ADA tools are not always qualified as sufficient and appropriate audit evidence. This issue was also mentioned by Eilifsen et al. (2020). Furthermore, Blix et al. (2021) mentions that ADA tools can also be used in the pre-engagement with new clients. Participants 5 and 6 explained to us how and why they used ADA tools in the pre-engagement as:

Data analytics tools such as Power BI are being used to compare data on a month to month basis, finding things that stand out from the rest of the data when looking at for example payrolls or cost analysis etc. [...] The extent to which we make use of data analytics depends on how familiar we are with the client. That being said, data analytics assists us in terms of figuring out what we should expect when looking at the data of a new client. We do interim actions to confirm that the procedures related to the client are as expected. (Participant 5)

Data analytics are often used as part of the first and final meetings with the client to show them the work we have done. Data analytics are very nice to have when presenting findings and can contribute with more accurate conclusions. (Participant 6)

We saw two uses of ADA tools in the pre-engagement, stemming from the differing perspectives of old and new clients. When it comes to old clients, we find the main use in

comparing data from previous years; for example, in payrolls or in cost analysis to identify potential deviations. By contrast, we see a different use in pre-engagement when it comes to new clients. In these cases, ADA tools are more used as a means to help the auditor to anticipate transactions and risk areas, and they will do further interim actions to confirm that the procedures related to the client are those that were expected. In addition, the ADA tools are used as a way of showing the new clients what they have done to a given point in the audit engagement. The interviews emphasise how ADA tools are a good way of presenting findings. We also heard that the competitive nature in the auditing market and rapid change of technology is of interest to our participants. Participant 5 explains: *While we use ADA tools in the pre-engagement with new clients to help identify variables and what we can expect, the implementation of ADA tools also plays a role as a “We can” move to show the client we are up to date on the newest technology.* Our findings here would explain why the research conducted by Eilifsen et al. (2020) found that the majority of audits done with the use of ADA tools were related to new and tendered audit engagements.

ISA 520 also opens up for the use of these tools as analytical procedures used as substantive analytical procedures.

We make use of them in the execution phase as substantive analytical procedures, though they are not very precise and can not be used as the only tool. They have to be used in combination with other tests. The audit starts with an overall analysis, but in terms of detailed analysis we use Power BI mostly for analysing revenue. (Participant 5)

Yet, we also note a drawback of ADA tools when used as substantive analytical procedures. ADA tools used in the execution phase as substantive analytical procedures are not sufficient, and the technology should be employed in combination with other tests. This drawback is mentioned by participant 6.

Excel is used in more general terms of the audit, while Power BI functions more as a supplemental and visualizing tool. (Participant 6)

In ISA 500.A10, analytical procedures are mentioned as one of the ways of obtaining audit evidence, but the ISA also states that these procedures are often used in a combination of

others, including inspections and observations. In other words, audit evidence gathered through analytical procedures will often, but not always, be categorized as substantive audit evidence depending on whether they meet the requirements of sufficient and appropriate audit evidence. We heard the same message in our interviews, where both Participants 5 and 6 mentioned this as one of the drawbacks of ADA tools as substantive analytical procedures.

While the question originally was how ADA tools are used throughout the auditing engagement, a natural follow-up question that arises was how does their use add value to the audit quality. While this issue was addressed in the various interviews after the auditing processes were mentioned and was touched upon in several ways, Participant 5 asserted that the value added will vary. Participant 5 elaborated on this:

We are in the process of phasing out our general methodology and swapping to a more digital methodology, which opens for more in-depth analysis. [...] Data analytics adds value to the audit by making it more efficient. As we change to a more digital methodology, it will also change the value added, by for example reducing fraud risk. It does not mean the combined risk assessment gets reduced as it would through tests of controls, but it will help us be more precise in the risk assessment, make more precise risk expectations, like determining inherent risk. That is how data analytics can add value to the audit. (Participant 5)

We also heard how Participant 5 explained how they are currently undergoing a change of methodology towards a more digital methodology, and how this contributes to ADA tools being used more extensively in the audit engagement. Our findings here confirm Eilifsens et al. (2020) where the study asserted that the use of ADA tools would not increase before the companies improved their implementation into their firm's comprehensive methodology.

We use data analytics to cross-reference and compare similar firms. Comparative analysis is not used very much, though it is used a lot internally in the clients' companies. A common control environment can potentially be the base of the financial statements. We receive memos from internal specialists who confirm the completeness [of the statements] and how it is built up, the number of transactions etc. These memos are then investigated by several auditors on the audit team. (Participants 3 & 4)

Participants 3 and 4 mentioned some benefits that come through the use of ADA tools, such as comparative analysis. Yet, they also state that this type of analysis is mostly used internally in the clients' companies. This was also mentioned by KPMG (2019) as one of the elements that increases the quality and efficiency of the internal audit.

5.3 How are audit data analytics used in interim audits?

While we have now gathered information regarding how ADA tools are used throughout the audit engagement, it would be interesting to have specific information on their use in interim audits and in end-of-year audits.

In practice we make use of data analytics two times a year, in the mid-year interim audit and the end-of-year audit. In the interim audit the analytics are used in more of a supporting fashion in terms of planning and risk assessment, in sort of a priming round and to check if the processes and other details will be the same as last year. Data analytics at the end-of-year audit will typically be used to check that there are no surprises or changes. (Participant 2)

We mostly use data analytics in terms of Power BI and such at the end-of-year audit. (Participant 5)

Data analytics are mainly used as part of the planning phase and in terms of risk assessment. (Participant 6)

We hear about a good mixture of use from our participants, and indicate that they are used in both interim audits and end of the year audits. Both Participants 2 and 6 mention how ADA is used in the mid-year interim audit during the planning phase and risk assessment. ISA 315.6 mentioned ways for the auditor to identify and assess risk of material misstatement.

Participants 2 and 5 remark that the tools are used in the end-of-year audit. Participant 2 elaborates on this, explaining how ADA tools are used to check whether there are any new changes or surprises. Such a check is required by ISA 520, which mentions the use of

substantive analytical procedures being used to identify the risk of material misstatements that had not been seen previously.

5.4 What elements influence the implementation of ADA tools?

We wanted to find out if the size or other aspects (like cost vs. benefits) of a company would have an impact on the auditing firm's decision about the use of ADA tools during the audit engagement.

5.4.1 Size and complexity

In general it can be said though that the smaller a firm is, the more Excel is used and more traditional methods of auditing, such as manually going through the general ledger. (Participant 1)

It will vary between the size of the client, if the client is a large publicly listed company or a smaller firm. We always use data analytics if the size of the client is big enough. We have a dedicated team taking care of audits for smaller companies. (Participant 2)

We only use data analytics for client firms of a certain size like large publicly listed companies, for smaller firms we mostly use Excel. (Participant 5)

It definitely depends on size, the smallest of companies are not worth using large amounts of data analytics for in the audit. While it is on the other hand more useful on larger and more complex companies, like for example on large publicly listed companies. (Participant 6)

The first pattern we see in the interview has to do with the question about size. It is pretty clear that the size of the audit client affects the auditor's choice with regard to the degree to which ADA tools might be used during the audit engagement. Excel is the main tool for smaller audit clients, while more advanced ADA tools are being used frequently on larger

audit clients. This finding is in line with the results of CPA Canada 's (2017) survey which found that the majority of advanced ADA tools were used in the audit engagement with larger clients.

While there are certain real considerations in terms of cost/benefit, we do not differentiate a lot between audits as the clientele we have are mostly the same size.
(Participant 1)

The costs and benefits are not directly related to the tool per se, but more tied to the decision of actually spending time on data analytics in the audit. (Participant 2)

We saw a number of comments where the cost vs. benefit issue shows a bit of a deviation in the answers given by Participants 1 and 2. Both thought the cost vs. Benefit issue was important, but Participant 2 elaborated by stating that the decision to use ADA tools is linked more to actually being of value in the audit engagement (regardless of the cost vs. benefit issue). In addition, Participant 1 stated that they do not differentiate between their clients, because, for the most part, they are roughly the same size as each other.

When Participant 1 mentions that they mostly have audit clients of the same size, the Participant also remarks that: [...] *We mostly use the same combination of programs for every audit, and we do not audit publicly listed companies.* [...] (Participant 1). In view of how large public companies have a more complex data set than do smaller firms (PWC, 2013), we anticipate that we should see an increasing use of ADA tools in the audit engagement of larger companies (IAASB, 2016, p. 6). Our findings from the interviews are in line with this expectation and may reflect the fact that participant 1 states how they do not audit publicly listed companies while the rest of the participants' firms do (Participants 2, 5 & 6). To conclude this section: as we had now established some base information on how size of firms, as well as cost vs. benefit, affects the choice of ADA tools used through the audit engagement, we felt it would be of interest if there were any other aspects that were of importance in this decision.

5.4.2 Integration of IT systems in clients' companies

If there are very different revenue streams in the client firm which can not easily be separated, that will typically pose an issue when it comes to using data analytics. If we do not have any earlier data to reference when doing the analysis, say if the client has not been audited by us before, it can be difficult to figure out what kind of variables we should expect when looking at the general ledger. It will also depend on how widely digitalization is used in the client firm, and what their parameters are for usage of analytics. (Participants 3 & 4)

You need to have methods for extracting data where the firms are required to have good enough systems to be able to extract the data seamlessly, in addition to having enough data to make the extraction process worth it. We have a separate department that helps extract data. Extraction mostly becomes an issue with smaller clients and less of an issue with clients that are big enough to already have good systems in place. We need very detailed data which may or may not be present in the firm under audit. Different coding for different programs can cause issues with cross-referencing, and Excel will typically be the bottle-neck for this. (Participant 5)

If we are able to standardize, it becomes a lot easier and cheaper to use data analytics. If it is difficult to extract the data we need from the systems of the client, it will affect the choice of the amount of analytics we use. (Participant 6)

From this information we find a pattern in terms of the impact of how the client implements IT systems, how detailed the data is, and how the data can be extracted. In addition, Participants 3 and 4 address the issue when it comes to new clients in terms of determining variables and what to expect. This, however, does not mean that ADA tools are not used on new clients but may just indicate potential difficulties with its implementation in the audit engagement of new clients. The Participants mention difficulties with regard to how they can extract and implement data into their ADA tools. All in all, this tells us audit firms have somewhat of a reliance on client IT systems. This reliance is also a factor concerning the difficulties mentioned in regards to new clients, where Participants 3 and 4 elaborate: [...] *It will also depend on how widely digitalization is used in the client firm, and what their*

parameters are for usage of analytics. Participant 5 emphasises the importance of a well implemented IT system for the client that is being audited: *You need to have methods for extracting data where the firms are required to have good enough systems to be able to extract the data seamlessly, in addition to having enough data to make the extraction process worth it. [...] We need very detailed data which may or may not be present in the firm under audit.* These findings suggest how Eilifsen et al. (2020) found an increasing use of ADA where the clients had a fully integrated accounting system that included additional ERP/IT systems.

5.5 How is development and education related to ADA in practice?

While we have now gathered information to increase our understanding of which tools are used, how they are used, and impact made by the choice of implementing them in the auditing engagement, it is important to gather information regarding the knowledge and skills required of the auditor to make the most effective use of this implementation. This challenge is mentioned in the research of Appelbaum et al. (2017) as it suggests fruitful research in the field. Given the expanded use of the innovative tools, will the auditor be required to obtain the knowledge and skillset of both an auditor and a data scientist? In the near future, might ADA tools in the audit engagement be standardized to the point where the auditor will not be required to have in-depth knowledge about specific ADA tools? (Appelbaum et al., 2017).

5.5.1 Knowledge and skillset

We find that cooperation between IT-specialists and traditional auditors can be challenging, particularly if the auditors are lacking in terms of understanding and competency in IT. (Participant 1)

The dashboards that we build are so easy to use that there is no real need for training. However, there are a number of auditors that are interested in how the tools work and who will want to learn more in-depth. It requires a lot more knowledge to execute the analysis itself that goes into ADA tools like Power BI. When it comes to

implementation of data analytics there is a difference between partners and managers. (Participant 2)

We have our own departments of specialists who are setting up the analyses. It takes a lot of training and regular practice to maintain competency. (Participants 3 & 4)

The way I view it, there is definitely a need for training in terms of transitioning from a general to an increasingly more digital methodology thanks to more use of data analytics. The traditional audit mindset needs to change so that auditors do not get stuck in terms of comparing data to previous years. A fresh start is required each year when making data comparisons. If auditors do not receive sufficient training in the use of data analytics, there will be diminishing returns of the value added. It does not necessarily mean that it is required to learn programming as an auditor, however it is very important to acquire an understanding of how it affects the audit process, for example when it comes to risk assessment. That being said, it does help to have a basic understanding of programming and how it works. That way the auditor can better juggle traditional auditing and digital auditing. It helps with communication between people working with the two different methodologies. Better levels of communication become increasingly important at management levels. So for the future, how our mindset as an auditor needs to adapt to make better use of data analytics becomes an important topic. We need to be more sceptical and open-minded compared to today. (Participant 5)

The Power BI analysis specifically is outsourced to India. We tell them what we want analysed, and they send us the results. (Participant 5)

It definitely requires a lot of training to perform the analysis itself, though not so much to use and interpret the dashboards themselves. (Participant 6)

The first thing we notice from our results is how using visualization tools requires little knowledge; however it requires a great deal of knowledge to set up the analyses that are behind visualization tools. Furthermore we see that a majority of the analysis is either being outsourced or done by a separate team (Participants 3, 4 & 5). While it is said that the knowledge needed to use visualization tools is not especially high, Participant 5 asserts that

the lack of knowledge of ADA tools could reduce the value added from the use of the tools in the audit engagement. This indicates that the auditor will often be together with a separate team that does the analysis, with such cooperation calling for improved communication skills. For the auditor to be able to communicate what they want analysed, it is vital that the auditor possess a high level of communication skills.

In addition, we heard comments on scepticism and open-mindedness brought up as key characteristics of a future auditor (Participant 5). This is in line with the findings of the research conducted by KPMG & Forbes (2015) where the authors found that auditors need to be more critical in their evaluations as well as being adaptable and open to continuing education.

5.5.2 Standardisation of ADA tools

Overall we have a bigger focus on standardizing the analytics, so that we can spend less time on the audit. We always use a certain amount of work from Power BI and data analytics, but it will almost always be the case where we have some standardized solution that can almost be copy-pasted. The use of data analytics themselves does not save time, it is mostly used with the intention of increasing audit quality. (Participant 2)

We are also attempting to standardize more of the audit. (Participant 5)

From these responses we can see how the audit firms have developed when it comes to the discussion point of Appelbaum et al. (2017), the question of how auditors can remain relevant within an increasingly digital environment. Some wonder whether training as a data scientist has to be added on top of what is already a fairly long and demanding education as an auditor. In contrast to that speculation, our respondents give indications that the profession may land (or is already landing) on a solution of standardization. This may mean that financial statement information undergoes an ETL process conducted by the data specialist team based on the requirements from the auditor team, and the information is presented to the auditors in visualization dashboards that do not require in-depth data competencies on the part of the auditors to read and use. The insights gained in this cooperative and technology

orientated process are then used for risk assessment purposes—with the final assessments made by the auditor.

5.5.3 Future development of ADA tools

As a follow-up question, we asked the Participants about their thoughts on the future use of ADA tools in the audit engagement.

We anticipate that there will be a lot of focus on digitalization going forward, though I am of the opinion that development and implementation is slow in terms of government related tools, such as SAF-T (Standard Audit File-Tax) (Participant 1)

In terms of regulation we find that the government has strict restrictions when it comes to what is accepted as audit evidence, some of it due to lack of documentation. Regulation might be holding back the potential of data analytics. (Participant 2)

Further development and use of data analytics are moving at a bit of a slow pace because of the regulatory powers. For example, it can be difficult to determine exactly what is accepted as audit evidence. (Participant 6)

From these answers, we discern a pattern in terms of how the development and use of data analytics might potentially be affected by governmental restrictions. The question about audit evidence seems to be the main concern in this regard, more precisely about what is accepted as audit evidence. This is an issue we have seen brought up in previous research articles, including the work of Eilifsen et al. (2020). Participant 2 states that some of it may be due to the lack of documentation behind audit evidence gathered through ADA tools. However, this seems to be a question that needs further investigation.

5.6 What are the disadvantages with audit data analytics?

Lastly we wanted to gather information to have a better understanding of potential drawbacks or disadvantages in the use of ADA tools in the audit engagement. This research should lead to a greater capacity to identify and shape future research projects.

Programs that lack good API integration will make working seamlessly between applications problematic. (Participant 1)

In terms of visualization dashboards like Power BI, it can only be used for presenting data. It cannot create anything new. You can not comment, create any reports or dashboard reports to be used further in the audit process. We are still making screenshots of the dashboard and pasting it into Excel, for example. Cross-referencing between different tables, programs, reports and formats are definitive issues in practice that can make the audit really messy. (Participant 2)

The first key takeaway from the interview responses is that visualization tools have limited use in that they are not able to create anything new. Secondly we are seeing a drawback in how the programs function in terms of cross referencing between the different programs used in the auditing process. The participants all mentioned at the start of the interviews how they are using a variation of ADA tools in the audit engagement where they are of use. Participant 2 notes how the lack of options to extract and transfer data from visualization tools like Power BI for further work in the audit process is an issue in practice. Participant 1 mentions that when it comes to combining applications, the lack of API integration will have a negative impact on the fluidity of the work.

There is the risk of losing some professional scepticism later on in the auditing process; it can be easy to get stuck in a circle of doing the same automated tests year after year. It is important that the use of data analytics is there to help improve the quality of the audit, not only to be a time-saver. (Participant 5)

There is a risk that the audit quality might be reduced instead of increased. You get a lot of data and you start analysing, and at one point you might get stuck documenting

something that is not in accordance with the ISAs. You can easily get stuck in a circle where you end up auditing your own work, which is not allowed according to the regulation. We also have to be careful with what ends up being published in the cloud. (Participant 6)

As we have considered some of the benefits and value enhancing factors of ADA tools, we have also heard some issues brought up by the Participants that we think need further monitoring. For example, Participants 5 and 6 forcibly raised the concern about the risk of the auditor getting stuck in a circle. Participant 5 elaborated on how the auditor can risk losing a level of professional scepticism because an auditor might easily be stuck, performing the same procedures as those of previous years and thereby miss potential risk areas that could call for additional or new tests. While IAASB (2016) mentions how the professional scepticism can be enhanced through the use of ADA tools as a result of increased understanding of the entity, findings of the interview process suggest that ADA tools can also have the risk of reducing this scepticism later in the auditing process.

In addition, Participant 6 mentions the risk of documenting information that is not in accordance with the ISAs due to overload of information. This overload might be the result of the sheer amount of data that is possible to gather with the use of ADA tools. In other words, the risk of information overload seems to be an issue that may be exacerbated by ADA tools. This point was emphasized in the MADS framework presented by No et al. (2019). Brown-Liburd et al. (2015) mentions that Big Data also poses a similar challenge when used in the audit engagement.

In terms of risks, there are not any specific additional risks on top of what would be the typical risks connected with a more traditional audit conducted through using mainly Excel, though there is always the general issue of finding out who has made which input, and whether they have the authorization to do so. (Participant 1)

We have a dedicated IT team who calls the client and gathers info about their IT system. They test how the user access works, but it does not mean they get to test whether every single user has the correct level of privileges. It can be challenging to check if access is correctly limited. Their work does however help increase the

reliability of data gathered through the software, though it is still required for us to test the underlying data through, for example, random sampling. (Participant 2)

It is less risky than Excel however, because it is easier to make mistakes by messing up cells in the sheets. (Participant 6)

Our findings indicate that there is no additional risk that would not have also been present absent the use of ADA tools. Participant 1 asserts that there is still the traditional risk regarding reliability of the input data. Participant 2 elaborates how they attempt to lower this risk by having a dedicated IT team that attempts to ensure the reliability of the input data, which is required according to ISA 520.5. While the dedicated IT team's work contributes to enhancing the level of reliability of the input data, the auditor is still required to conduct further tests, for example, by random sampling (Participant 2). Even with these potential problems, Participant 6 does assert that the use of ADA tools is still less risky than using Excel.

Chapter 6: Conclusion

In this section of our thesis, we will cover a summary of our findings, and develop our conclusion in the light of previous hypotheses, predictions and findings. The conclusion will include what our results indicate and discuss whether these findings have either exploratory or confirmatory value with regard to previous research findings.

The findings of our thesis serves as an exploratory study into audit practice as conducted in the contemporary profession. Our results show that several hypotheses and predictions outlined in previous research have been confirmed. The research of this study has addressed and answered a number of uncertainties that were posed in recent research, thus giving this thesis confirmatory value as well. We stated the purpose of our thesis to explore and identify the use of ADA tools in the audit engagement, as well as to examine the continuing development of this area, considering the implementation of ADA tools in the audit process.

Research consistent with the purpose of this thesis is relevant to the contemporary business environment and several key challenges faced by those professionals who conduct audits for both large and small business entities. Other scholars recognize the significance of the technological developments that are currently available to the profession. Kogan, Mayhew & Vasarhelyi (2019) claims the full automation and digitalization of the audit process is inevitable, as a consequence of the evolution of information technology and digitalization in business firms in recent years. This is also heavily indicated by the fact that several audit firms have pledged to devote great amounts of resources in the area of data analytics, as outlined in our introduction.

As an introductory question for our interviews, we asked about the kinds of ADA tools used in the audit engagements. Our results show a variation of ADA tools, including Power BI, Spotfire, IDEA and Smartbob. Furthermore, we are seeing the use of ADA tools that are developed internally in the auditing firms. Even with recent innovations, our findings show that Excel is still used as the main tool in the audit engagement. According to our interviewees, this comes as a result of Excel being able to produce new data when compared, for example, to Power BI that is mentioned as a visualization tool that cannot produce anything new in terms of data. Generally speaking, our results show variety in terms of the

ADA tools used by Big 4 firms and Big 6 firms. When it comes to the specific elements that may influence the choice of implementing ADA tools in the audit engagement, the size of a client firm is found to be an important factor. Our results show the participants tend mainly to use Excel on smaller clients, but adopt broader use of ADA tools on larger clients. In addition, we are seeing more frequent use of advanced ADA tools in the Big 4 firms in comparison to Big 6 firms. In the light of our findings with ADA tools being used more frequently for larger clients, the more frequent use of ADA tools can be explained by participants from Big 6 stating that they do not audit publicly listed companies. As a result, we can conclude that ADA tools are generally used more in audit engagements with larger clients. Our findings here replicate conclusions from the research conducted by CPA Canada (2017), where the study found the majority of observations of ADA tools being related to larger clients.

Previous research has also shown findings on how audit clients' IT integrations are a relevant factor in the decision regarding whether to implement ADA tools in the audit engagement. Through our research we found ADA tools requiring very detailed data that needs to be extracted from the clients' IT systems seamlessly. Our results here serve as an explanatory role to the research conducted by Eilifsen et al. (2020) where that study described an increasing use of ADA tools being related to situations where the clients had a fully integrated accounting system that included additional ERP/IT systems.

Previous research indicates that ADA techniques can be implemented in all six stages of the audit engagement (Blix et al., 2021, p. 2), with three potential benefits: 1) Improved understanding of an entity's operations and associated risks, including risk of fraud, 2) Increased potential for detecting material misstatements, and 3) Improved communications with those charged with governance of audited entities (AICPA, 2017). Furthermore, previous research indicates that exploratory ADA is best used in the planning phase, while confirmatory ADA is best used as part of substantive testing and control assurance (Byrnes et al., 2014). Our results show a use of ADA in the planning and risk assessment phase, as substantive analytical procedures to supplement substantive tests of detail, and as part of the review phase at the end of the audit process. In the planning and risk assessment phase, ADA tools are used with an exploratory role. The auditor uses it to get a better understanding of the entity and its environment and to better focus the lens of the audit. When the auditor utilizes ADA tools as substantive analytical procedures to supplement substantive tests of detail it

will serve a confirmatory role. Using ADA tools as part of the substantive testing phase is shown through our interviews to have a confirmatory role in terms of confirming previously set expectations through the use of ADA by the audit team as part of the planning and risk assessment phases.

Furthermore, our research has shown that ADA tools serve as a confirmatory role in the end-of-year audit; however, during the interim audit it will serve as both an exploratory and confirmatory role. During the interim audit, our interview results indicated that the auditor uses ADA tools to make sure processes and other details from the previous year are still the same. Through this process, the auditor first uses exploratory ADA to establish a set of values to be expected in the audit of the current year based on audits from previous years. Next the auditor utilizes confirmatory ADA to match these values and determine whether there are deviations or outliers that should be focused on. Based on our interview results, using ADA tools in the end-of-year audit allows the auditor to ensure there are minimal amounts of surprises or changes from the interim audit. Through our findings we can conclude that ADA tools serve as both an exploratory and confirmatory role in the audit processes. These findings confirm the statement by Byrnes et al. (2014) on exploratory ADA tools being best suited for the planning and risk assessment phase, and confirmatory ADA being best suited for substantive testing and control assurance. In addition, our results confirm some of the benefits of using ADA tools in the audit engagement, as highlighted in the AICPA (2017) discussion paper mentioned above.

The question about the auditors' relevance in the future has been a popular subject during the past few years. Appelbaum et al. (2017) questions whether the auditor needs to develop the competence of both an auditor and a data scientist, or if the audit firms will attempt to standardize the use of ADA tools to the point where there is no need for in-depth computer knowledge on the part of the auditor. Through our interviews we found that there is little competence required to use the visualization tools of ADA, but it requires a lot more competence to do the analysis itself behind the visualization dashboard. However, the participants stressed the importance of having a general understanding of ADA tools and how it affects the auditing processes, because a lack of knowledge and understanding in this area would reduce the potential value added to the audit quality, or in a case of inappropriate usage might reduce the overall audit quality. Based on the results of our interviews, we are seeing the auditing practitioners have chosen to standardize the use of ADA tools. The

analysis of the financial statement information is outsourced to a team of data specialists, sometimes even in other countries such as India, who conducts an ETL process that gets presented in visualization dashboards with an ease of use that lets the auditor focus on audit specific tasks. This solution allows the auditor to read and use the data in the visualization dashboard from the analysis of the financial statement information, but without requiring in-depth data competency.

While our research shows benefits of ADA tools, there are some drawbacks and disadvantages of using them. Several researchers mentioned in our section on relevant literature highlight the risk of information overload as a result of the increasing amount of data that is involved in the use of ADA. Based on the results of our interviews, we found that this is one of the concerns the Participants have when using ADA. Through potential information overload and misuse of the information, the auditor could risk a reduced level of professional judgment which would then result in a reduction of audit quality. This can be an indication that ADA tools on a larger scale will need a lot of focus when it comes to filtering data to avoid these issues in the auditing processes. In addition, our interviews show a disadvantage when it comes to the effectiveness of ADA tools because they may be volatile in regards to input data. Our findings indicate the use of ADA tools is (very) dependent on programs having good API integration to work seamlessly and how the cross-referencing between a multitude of different ADA tools can turn out to be messy and confusing in practice.

Our research shows some of the benefits of utilizing ADA tools; however, there is some uncertainty tied to the quality of the audit evidence gathered through using ADA tools. Previous research indicates that audit evidence gathered from ADA tools is not approved in the audit firms as the only form of audit evidence, but it is not directly prohibited either. Given this, the engagement partner and the audit team have to discuss whether it qualifies as sufficient appropriate audit evidence (Eilifsen et al., 2020). Based on the results of our interviews, we consider audit evidence derived from ADA tools to be of value primarily in terms of supplementary audit evidence and most useful in combination with other, more traditional audit methods. Our research echoes the concerns posed in the research paper by Eilifsen et al. (2020), regarding whether the audit evidence qualifies as sufficient appropriate audit evidence. The Participants interviewed in our research explains this as being partly due to the lack of documentation of the audit evidence gathered from ADA tools and they cite the

difficulty behind determining what is actually qualified as sufficient appropriate audit evidence in this area. As a result, we conclude that the subject area and field of study regarding audit evidence gathered through the use of ADA tools needs further investigation and more extensive research.

Chapter 7: Reference list

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