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The Changing Nature of the Audit Profession

Opportunities and Challenges with Digital Transformation and the Use
of Audit Support Systems, Big Data and Data Analytics

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Abstract

This exploratory study aims to illustrate the changing nature of the audit profession by providing a comprehensive overview of the main challenges and opportunities that increasingly sophisticated audit support systems with more Big data and Data analytics capabilities induce upon the profession, and how these are addressed. The empirical findings are based on ten semi-structured interviews with eight different practitioners from the Big Four auditing firms, of which four are closely involved in the digitalisation and transformation processes at each respective firm. The key opportunities identified are how different aspects of audit support systems, Big data and Data analytics increase efficiency, enhance quality and provide more and better insights from the audit, and how this reduces information asymmetries by enhancing the auditor's role as a monitoring mechanism. The main challenges identified are how to maintain employee support and develop the right expertise of auditors, how to ensure integrity, quality, completeness and security of data, increased competition and how to avoid technology dominance and loss of vital knowledge. Other challenges identified are how to approach the separation of audit services versus consulting services, how to cost-effectively improve the quality of the audits and the accompanying problem of an increased expectation gap and less time spent with clients. Concerning technology dominance and loss of vital knowledge, the study provides preliminary evidence that the problem where the system rather than the user takes leading control over decision-making processes might not be as severe as previous research tries to illustrate, and that practitioners perceptions in the subject matter are very much dependent on their expertise and involvement in digitalisation and transformation processes. The study also contributes by highlighting both the anticipation of relaxed audit requirements and the more segmented nature of the profession as possible key trends in the industry, consequently shaping the future audit.

Keywords: *Auditing, Digital Transformation, Audit support systems, Big data, Data analytics*

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1. Introduction

This section aims to introduce the reader to the changing nature of the audit profession and to some of the opportunities and challenges brought on by the more pronounced implementation and use of audit support systems, Big data and Data analytics into audit processes. This will further be problematised, before the purpose and research questions of the thesis are presented.

1.1 Background

According to The McKinsey Global Institute, technological change is one of the fundamental forces transforming the world we live in today, consequently changing the business climate and organisations of our time (Dobbs, Manyika & Woetzel, 2014). In the same light, Rikhardsson and Yigitbasioglu (2018) identify that business executives view technology and Data analytics as the main forces driving organisational transformation, and consequently the trends that businesses of today have to adapt to. FAR (2015), a Swedish professional institute for accountants, further perceives digitalisation as one of the main structural forces, or megatrends, in society today, affecting organisations over at least 20 years ahead accordingly. Thus, advancements in digitalisation, the processing power of software and the increasing amount of available data generate considerable difficulties and challenges for organisations, but also immense opportunities if capitalised in the right way according to Bhimani and Willcocks (2014). The audit profession is not an exception and is very much in the process of adapting to these changes in light of digital transformation, heavier regulatory pressures on compliance (Dowling & Leech, 2014), competition from start-ups offering new accounting and auditing products (Alles, Brennan, Kogan & Vasarhelyi, 2006) and the fact that Big data and Data analytics can perform many routine and traditional accounting and auditing tasks, potentially replacing most audit activities in the future (Richins, Stapleton, Stratopoulos & Wong, 2017). For example, FAR (2015) expect that 80% of accounting and 45% of audit services is to be automated in the near future. Also, a common perception among professionals and industry representatives is that auditing will move from looking at the past to more real-time auditing and analysis, and where the future focus in auditing most likely will be in areas concerning fraud detection, cybersecurity and risk analysis (FAR, 2016).

The difference between technological change today and historically is the widespread amount and variety of technology, as well as the speed of change according to Dobbs et al. (2014). *“Compared with the Industrial Revolution, we estimate that this change is happening ten times faster and at 300 times the scale, or roughly 3,000 times the impact”* (Dobbs et al., 2014, p. 1). Thus, Bhimani and Willcocks (2014) claim that it is easy to argue that the embracement and adoption of increasingly sophisticated and advanced technological and digital tools into organisational processes will be a main differentiator

going forward, separating successful businesses from the rest. Furthermore, technology and digitalisation can be described in many different ways and take various forms, consequently relating to a multitude of concepts. As such, digitisation, digitalisation, Big data, Data analytics and digital transformation among others are all inter-related concepts to various degrees and can be identified as catalysts for change in today's organisations (Rikhardsson & Yigitbasioglu, 2018; Bhimani & Willcocks, 2014; Richins et al., 2017). A common perception is that the importance to adapt and cope with these new processes are increasing exponentially and are a paramount aspect of successful business models and processes going forward, to create, maintain and/or not lose a competitive advantage against peers (ibid).

Up until now, most researchers have illustrated the digital transformation and process of change for the audit profession in relation to the general implementation of new audit support systems¹ and related concepts such as continuous auditing² (CA) and intelligent decision aids³ (IDAs), and correspondingly the opportunities, challenges and consequences this brings for the audit profession. It has been shown how the implementation of new audit support systems can boost efficiency and reduce risks by facilitating compliance through enhanced monitoring and control capabilities (Dowling & Leech, 2014). The increasing employment of algorithms performing standardised and automated tests has also been shown to boost the consistency of audit processes (Sutton, 2010). Thus, the role of the auditor is changing from one that incorporates the entire audit process, from designing and performing audit tests to the final audit opinion, into one that mainly focuses on receiving and addressing red flags and alerts about potential violations or errors identified by the system in use.

Although many benefits, audit support systems and new digital tools come with their own weaknesses and challenges. One such challenge addressed by many researchers has been how to approach technology dominance, where the system rather than the user takes leading control over the process of decision-making, which can be a consequence of over-reliance on digital tools (Dowling & Leech, 2014; Sutton, 2010; Arnold, Collier, Leech & Sutton, 2004). Furthermore, since auditors do not have to perform the same amount of traditional and routine tasks, important knowledge in relation to clients such as business understanding and its associated risks when

¹ In an audit support system, the (intelligent) decision aids, electronic workpapers and knowledge stocks of an audit firm are all integrated (for further explanation, see section 2.2).

² “A methodology for issuing audit reports simultaneously with, or a short period of time after, the occurrence of the relevant events” (Alles et al., 2006, p. 138) (for further explanation, see section 2.2).

³ Software-intensive tools or systems which advice the user by providing problem-specific decision-support to enhance decision-making, based on knowledge and expertise accumulated from previous users and experts (for further explanation, see section 2.2).

conducting audits, can be seriously diminished (Axelsen, 2012). Another major challenge is the delicate line between external auditing and consultant-like services (Alles et al., 2006). Since auditors today can access and share more information to clients due to increasingly sophisticated software, auditors are in a position where they can offer both auditing and consultant services, which seriously might compromise auditor independence (Alles, Kogan & Vasarhelyi, 2005).

However, more recently researchers are turning their eyes more and more toward the increasing use and incorporation of Big data⁴ and Data analytics⁵ into audit support systems, where the increasing deployment of cloud-based services, Big data and automation are considered to transform the industry (FAR, 2016). Most of what is being done both inside and outside organisations can be stored, and the amount of stored data is increasing exponentially, thus creating great potential for the implementation of Big data and Data analytics into audit support systems (ibid). Big data and Data analytics can be used to discover new and valuable information and patterns from large sets of data, both structured and unstructured, which new inferences, strategies and behavioural consequences can be drawn from, consequently offering immense opportunities for the profession (Riahi & Riahi, 2018).

According to ACCA (2016) and BDO (2016), the most fundamental reason for engaging in Data analytics for auditing firms is to enhance and ensure audit quality, and consequently assurance. Alles and Gray (2015, p. 4) argue that *“Big data will be the future of auditing”*. Earley (2015, p. 495) shares this understanding of Big data and Data analytics, stating that *“it has the potential to be the most significant shift in how audits are performed since the adoption of paperless audit tools and technologies”*. Furthermore, increasingly sophisticated Data analytics tools enable population rather than sample testing (Earley, 2015), consequently enhancing both risk analysis and investor confidence (ACCA, 2016). Big data can also bring about enhanced anticipations regarding fraud, going concern and estimation forecasts, thus radically transforming and developing better and more efficient audit systems (Alles, 2015; Cao et al., 2015). By accessing and utilising client data into Data analytics, risks and shortcomings in clients internal control systems and financial reporting are also considered to be more easily identified (FAR, 2015). All these improved capabilities and opportunities offered by Big data and Data analytics have the capacity to improve audit quality going forward (Earley, 2015).

⁴ *“The heterogeneous mass of digital data produced by companies and individuals whose characteristics (large volume, different forms and speed of processing) require specific and increasingly sophisticated computer storage and analysis tools”* (Riahi & Riahi, 2018, p. 524) (For further explanation, see section 2.2)

⁵ *“The process of inspecting, cleaning, transforming, and modelling Big data to discover and communicate useful information and patterns, suggest conclusions, and support decision making”* (Cao, Chychyla & Stewart, 2015, p. 423) (For further explanation, see section 2.2).

Furthermore, this transformation of the audit profession puts new requirements on both expertise and technical capabilities of auditors, to use and understand Big data and Data analytics, and correspondingly the information it uses and produces (Alles & Gray, 2015; BDO, 2016; Earley, 2015). Since the main focus will most likely shift to one that focuses on recognising, interpreting and analysing anomalies and addressing red flags, a different set of capabilities and mindsets are required (Earley, 2015). It is also crucial to be at the forefront and embrace this change process to fight off competition and not being replaced by start-ups and firms outside the audit profession, offering services similar to the ones provided by traditional audit firms by employing Big data and Data analytics (Richins et al., 2017). How to ensure security, integrity and quality of data is another challenge to address when increasingly relying on Big data and Data analytics (BDO, 2016; Cao et al., 2015; Earley, 2015; Richins et al., 2017).

1.2 Problematisation

As shown in this brief introduction, existing literature has quite extensively illustrated the changing nature of business processes, and correspondingly the importance and benefits of digital transformation, audit support systems, Big data and Data analytics among others, for organisations in general and the audit profession in particular. The same goes for existing literature on potential weaknesses and challenges with dito. There has also been a shift in the research community from a focus on the effects of audit support systems in general on the audit profession, to a greater focus on Big data and Data analytics in particular. The distinction being made here is that while Big Data and Data analytics could be considered a subcategory of, or add-on to, audit support systems, the more technical and sophisticated nature and analytical capabilities of the former separates the two. Moreover, what the many challenges mentioned illustrate is the importance of being cautious before desperately embracing digital transformation no matter what, reflecting about how to resolve and avoid technology dominance and de-skilling of auditors, and how to ensure quality, accuracy and integrity of data among other factors. What has not been as broadly investigated and researched is how auditing firms internally address and reason about these dilemmas concerning opportunities and challenges with, and rationales for, digital transformation and the use of audit support systems, Big Data and Data analytics, in this period of rapid change. Although Big data and Data analytics have been attributed a great deal of attention lately, extensive empirical research is still missing in an audit setting (Earley, 2015). This is mostly because of the unwillingness of audit firms to share their audit methodologies and data in the subject matter (ibid). Since audit firms now are in the process of developing and implementing increasingly sophisticated audit support systems with more Big data and Data analytics capabilities, the aim of my study therefore is to illustrate the changing nature of the audit profession and how auditing firms internally view and address these dilemmas. I will do this by conducting an exploratory study, to know more about what goes on

“inside” these organisations and contrast this reality against what could be expected from existing literature, to guide future research and provide implications and insights of interest to audit firms, financial statement users and regulators among others. Existing literature will consist of both papers focusing mainly on audit support systems in general, and also papers primarily concentrating on Big data and Data analytics.

1.3 Purpose

The purpose of my thesis is to identify how auditing firms adapt and change their auditing processes in this time of digital transformation, and consequently how they address the challenges and opportunities that audit support systems, Big data and Data analytics induce upon the profession. To address the purpose of my study, I formulate two research questions:

1.4 Research Questions

- What opportunities and challenges do audit firms identify when more extensively integrating audit support systems, Big data and Data analytics into their audit processes?
- How do they address the opportunities and challenges identified?

2. Literature Review and Theoretical Framework

The section begins with an overview of the audit profession in terms of the purpose and different phases of an audit, to provide a foundation on which later implications for the audit profession in light of digital transformation can be drawn. The auditor’s role as a monitoring mechanism to reduce information asymmetries is also addressed. Secondly, definitions and explanations of key concepts relevant to the thesis are provided. This is followed by an extensive review of prior literature discussing opportunities and challenges with audit support systems and Big data and Data analytics respectively. Although the two are related and will later be analysed in combination, they are separated here due to the different focus taken by researchers when discussing the two.

2.1 The Audit Profession and Asymmetric Information

The main objective of an audit is to supply an independent opinion whether the financial reports faithfully represents, or gives a “true and fair” view of the financial position and performance of the organisation under review (PWC, 2020), consequently assuring that there are no material misstatements present (PWC, 2013). This is evaluated in agreement with relevant accounting and auditing standards (ibid), further providing credibility to the firm (PWC, 2020). Due to the separation between ownership and control, the audit also provides comfort and confidence to shareholders and stakeholders that the organisation is run efficiently, thus reducing information

asymmetries (ibid). Information asymmetries are present when two market participants do not have access to the same kind of information during a transaction (Runesson et al., 2018). This can be exemplified by when ownership and control are separated in a contractual agreement, where owner/principal delegates the daily operations to a manager/agent. In such a setting, there might be incentives for the agent to not work in the best interests of the principal and instead pursue own goals and maximise own utility (Jensen & Meckling 1976). To minimise the agency problem, bonding and monitoring activities are performed to align the agent's and the principal's interests, where the auditor is an example of such a monitoring mechanism. Differently put, the auditor functions both as an information intermediary and an information insurer according to Runesson et al. (2018). This means that the auditor reduces information asymmetries both by providing more information as well as assuring the quality and accuracy of the information supplied between two parties. Thus, the auditor facilitates exchanges and improves communication between an organisation and its stakeholders (Jensen & Meckling 1976).

Information uncertainty can further be separated into “measurement uncertainty” and “uncertainty from a user perspective”, where the former stems from the complex nature of many events and transactions, whereas the latter comes from deliberate incentives to mislead one party (the user) when information asymmetries are present in favour for the preparer (Runesson et al., 2018). Since information asymmetries are thought to make markets inefficient, increased audit quality and consequently reduced information asymmetries are important to uphold well-functioning capital markets (ibid). Furthermore, the auditor applies professional judgement and scepticism when conducting the audit process. *“Professional scepticism is an attitude that includes a questioning mind and a critical assessment of audit evidence. The auditor uses the knowledge, skill, and ability called for by the profession of public accounting to diligently perform, in good faith and with integrity, the gathering and objective evaluation of evidence”* (AS 1015, Section 230, Paragraph 07). The auditor is further required to provide “reasonable assurance” concerning the accuracy of the financial statements since the nature of the evidence collected make absolute assurance impractical (AS 1015, Section 230, Paragraph 10).

Moreover, an audit consists of different phases, which generally can be categorised into planning, risk assessment, audit of controls, gathering of evidence/substantive procedures and finalisation (PWC, 2013; Deloitte, 2020). After the initial planning stage, a risk assessment is made where information about the firm, its industry and the overall environment in which the organisation operates is considered to identify and address potential and significant risks (PWC, 2013). The auditor further makes various tests on internal control systems among others to make sure that processes are working efficiently and that transactions and other items in the financial statements are recorded correctly (ibid). It is under this phase that the auditor potentially identifies outliers

which need further testing to decide whether they are anomalies or exceptions and decide upon their materiality (Richins et al., 2017). This evaluation forms the basis for substantive procedures and evidence gathering, where further controls and tests are executed such as inspection of inventories and third-party confirmation of transactions (Deloitte, 2010). Throughout the process, the auditor exercises professional judgement, where the expertise and experience of the auditor are used to assess the quality of the financial statements (PWC, 2013). The finalisation stage and correspondingly the final audit opinion is based on the overall assessment of risks and an evaluation of controls and evidence collected from substantive testing. It is important to emphasise that judgement is involved in the process and that a clean audit does not necessarily guarantee that the financial statements are free from error (ibid). However, to assure the quality of the audit, the auditor must be well informed and knowledgeable about his or her client and its environment (Deloitte, 2020). This is paramount to be able to identify and assess relevant risks, significant transactions and what controls and substantive procedures to conduct, to detect material misstatements and ensure a high-quality audit (ibid), and also to reduce information asymmetries (Runesson et al., 2018). This characteristic of the audit, also relating to AS 1015 Section 230 Paragraph 07 and 10 mentioned above, is emphasised in “*The international standard on auditing 500 – Audit evidence*” Paragraph 4 which states that: *The objective of the auditor is to design and perform audit procedures in such a way as to enable the auditor to obtain sufficient appropriate audit evidence to be able to draw reasonable conclusions on which to base the auditor’s opinion*” (IFAC, 2009, p. 381), emphasis on “sufficient appropriate” and “reasonable conclusion”.

2.2 Digital Transformation, Audit Support Systems, Big Data and Data Analytics

To cope with the changing business environment and megatrends of automation and digitalisation of today, the audit profession is in a process of digital transformation, continuously evolving better audit support systems and new digital tools which consist of more and more Big data and Data analytics capabilities (Meuldijk, 2017; ACCA, 2016; BDO, 2016; Earley, 2015). This is changing the way auditors conduct the audit process, which ultimately affects efficiency and audit quality (ibid).

2.2.1 Digital Transformation

While the definition of digitisation is quite clear, which involves the transformation of information from analogue to digital form, the definition of digitalisation is more ambiguous (Schumacher, Sihn & Erol, 2016). However, for organisations in a general sense, it is about the use and implications of digital tools, IT systems and technologies to easier link and connect activities, as well as providing appropriate and timely information to potentially change business processes, operations and business models (Schumacher et al., 2016; Muro, Liu, Whiton & Kulkarni, 2017). Gartner (2020) provides a similar definition, where digitalisation is defined as “*the use of digital technologies to*

change a business model and provide new revenue and value-producing opportunities". In relation to this, digital transformation is the process by which digital infrastructure, tools and technologies are exploited to establish a new and powerful digital business model (Gartner, 2019).

2.2.2 Audit Support Systems

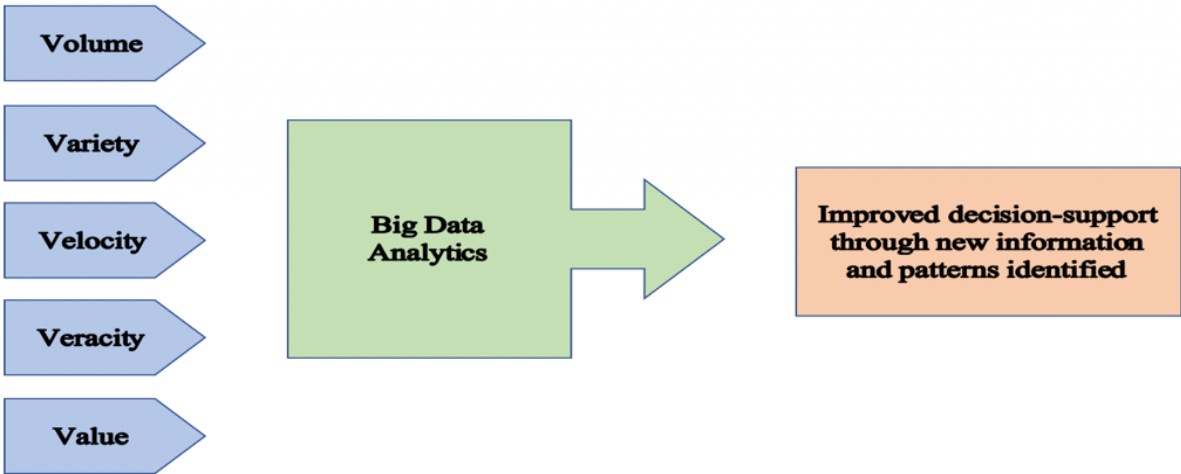
In an audit support system, the (intelligent) decision aids (IDAs), electronic workpapers and knowledge stocks of an audit firm are all integrated (Carson & Dowling, 2012). This is generally done to make the audit process more efficient and effective by putting the audit methodology into operation through the system (ibid). IDAs can generally be identified as software-intensive tools or systems which advise the user by providing problem-specific decision-support to enhance decision-making, based on knowledge and expertise accumulated from previous users and experts (Arnold et al., 2004). Thus, the knowledge and expertise about critical processes and from key employees never risk being lost due to employee leaves and terminations. Also, since the accumulated knowledge and information in the IDA is increasing the more it is used, decision-support is enhanced over time (ibid). Furthermore, the audit support systems developed today are becoming increasingly sophisticated, providing more real-time data for the systems to analyse. Continuous auditing (CA) is such an advancement, which can be defined as *"a methodology for issuing audit reports simultaneously with, or a short period of time after, the occurrence of the relevant events"* (Alles et al., 2006, p. 138), where IT capacity can be utilised to produce audits more timely and efficiently, by facilitating the process of collecting and understanding data in structured and unstructured form. Accordingly, CA is very much in line with the belief of more real-time auditing and analysis going forward (FAR, 2016).

2.2.3 Big Data and Data Analytics

Big data refers to *"the heterogeneous mass of digital data produced by companies and individuals whose characteristics (large volume, different forms and speed of processing) require specific and increasingly sophisticated computer storage and analysis tools"* (Riahi & Riahi, 2018, p. 524). Such analysis tools are commonly referred to as Big data analytics, which can be defined as *"the process of inspecting, cleaning, transforming, and modelling Big data to discover and communicate useful information and patterns, suggest conclusions, and support decision making"* (Cao, Chychyla & Stewart, 2015, p. 423). Since there is limited value in Big data without Data analytics, and no value in Data analytics without Big data, the two are usually mentioned in combination (Earley, 2015). The original characteristics of Big data are usually referred to as "the 3Vs", incorporating volume, variety and velocity of data (Riahi & Riahi, 2018; Zhang, Yang and Appelbaum, 2015). These have further been extended with veracity and value of data (ibid).

The volume of data shows the sheer amount of produced data (Riahi & Riahi, 2018). With the amount of globally produced data expected to grow at 100% every 18 months (Bhimani & Willcocks, 2014), the importance and potential of this characteristic is increasing every day. Variety of data simply refers to different forms of data, including structured, semi-structured and unstructured (Riahi & Riahi, 2018). The implication of incorporating different forms of data into Data analytics is to easier establish and understand links, patterns and correlations both within and between different sources of data (ibid). Structured data relates to organised and standardised data which originates from typical business processes and systems such as transaction-, inventory- and sales systems among others, while unstructured data does not incorporate the same amount of accuracy and rigour (Richins et al., 2017). Unstructured data comes in many different forms and from a vast array of sources such as Twitter, Instagram and other websites, which in combination represents the bulk of all available data. Historically, structured data has almost exclusively been used in analytical tools to assist decision-making and other organisational processes, but this is now changing (ibid). The velocity of data concerns the speed and frequency of data generation, processing and storing, consequently facilitating the capturing and analysis of real-time data (Riahi & Riahi, 2018). Moreover, the veracity of data refers to the quality and accuracy of data (ibid). This has become increasingly important since large sets of data (Big data) does not necessarily have to be more valuable than small sets of data, because the nature of large data sets and challenges in terms of quality assertion can make statistical analysis harder (Bhimani & Willcocks, 2014). Lastly, the value simply refers to the potential value that can be generated from data, which very much will be an output of the previous four characteristics (Riahi & Riahi, 2018). The characteristics of Big data and correspondingly the process of improved decision-support through new information and patterns identified by utilising Big data analytics are further illustrated in Figure 1.

Figure 1. Big data and Data analytics



The figure illustrates how Big data and its five characteristics (volume, variety, velocity, veracity and value) can be utilised by Big data analytics to provide enhanced decision-support through new information and patterns identified.

2.3 Opportunities and Challenges with Audit Support Systems in General

The subsection begins by providing an overview of previous literature discussing audit support systems with a theoretical underpinning to the theory of technology dominance (TTD). This is followed by an overview of opportunities respectively challenges with audit support systems in general, in addition to the ones identified in relation to the TTD. For an overview of the key papers discussing opportunities and challenges with audit support systems in general brought up in this section, see Appendix 1.

2.3.1 Audit Support Systems and The Theory of Technology Dominance

The use and implications of audit support systems have been investigated quite extensively before (Dowling & Leech, 2014; Dowling & Leech, 2007; Dowling, Leech & Moroney, 2008; Carson & Dowling, 2012). Dowling and Leech (2014) illustrate how auditor interaction and behaviour at one of the Big Four audit firms are changing by the implementation and different features of a newly introduced audit support system. The main purpose of the system was to implement process controls to facilitate compliance in terms of auditing standards and firm protocol. Dowling and Leech (2007) further examine the use of audit support systems at five major audit firms (including the Big Four) in terms of system restrictiveness as well as the kind and degree of support offered by the systems used at the different firms. Furthermore, a common theoretical underpinning addressed when investigating the implementation of audit support systems has been the TTD. The TTD was first presented by Arnold and Sutton (1998) to show under what conditions the use of IDAs was most likely to have a positive or negative impact on users. The theory addresses under what circumstances the user is most likely to confide in an IDA; under what conditions the user is most exposed to technology dominance by the system; and what long-term consequences this might have in terms of de-skilling of the user.

Arnold (2018) further highlights several implications of the TTD in relation to the audit profession. First of all, when users increasingly rely on IDAs, they risk become more passive and allow the IDA to guide the decision-making process without interfering or questioning the results and suggestions being made by the system. Next, Arnold (2018) also emphasises the high probability of de-skilling. When increasingly relying on IDAs, later generations of auditors will most likely not establish and possess the same kind of knowledge and expertise that only can be learned through traditional audit and accounting work, which potentially will work against the prosperity of the profession. This is also shown by Rinta-Kahila et al. (2018) who examine how information systems, particularly different kinds of IDAs, may result in latent de-skilling of accountants which becomes visible through system disruptions. Although increasing efficiency, they find that the increased dependence on IDAs makes it harder to maintain and develop employee skills and know-how. Especially when systems and IDAs are used over a prolonged period, this process and

corresponding level of de-skilling surfaces during system breakdowns, when auditors and accountants have to rely on their own capabilities to solve contingencies (Rinta-Kahila et al., 2018). This is also related to the final implication put forward by Arnold (2018), which addresses the increasing development and implementation of restrictive support systems where all auditors within a firm are more or less forced to perform the same audit process and methodology. Since the key to avoid stagnation and to further development of knowledge professions are the continuous production and combination of a group of individuals different thoughts, beliefs, opinions and reasonings, the increasing use of IDAs might stagnate the development of the audit profession (ibid).

In light of the above, a caveat necessary to address when introducing new audit support systems is the trade-off between emphasising system characteristics that enhance control processes and compliance, while simultaneously striving for empowerment of employees and auditor autonomy to reduce the extent of technology dominance as a consequence of system overreliance (Dowling and Leech, 2014). To address this trade-off, Dowling and Leech (2014) make a distinction between enabling and coercive systems. An enabling system emphasises empowerment by leveraging employees' current capabilities and competencies to improve efficiency by advocating employee autonomy when facing contingencies and other problems. On the contrary, a coercive system impedes autonomy by creating strict and formalised guidelines to conform to during task deployment, creating "an airtight system" (ibid). Although many differences could be identified in terms of use and system characteristics across the firms, both Dowling and Leech (2007) and Dowling and Leech (2014) find that the systems are viewed as enabling in most instances. This is exemplified by auditors mostly resolving contingencies on their own, the possibility to override recommendations by the system and by allowing preferential choices (Dowling & Leech, 2014). Dowling and Leech (2007) identify that firms with low system restrictiveness also had low decision support, providing more autonomy in the auditing process and where the system administers checklists rather than enforcing recommendations. Thus, auditors have the possibility to self-select which tests and recommendations to pursue to varying degrees. On the contrary, the firms with high system restrictiveness also had a high level of decision support, where tests and controls were prescribed by the system, consequently resulting in less autonomy and less room for auditors to apply their own judgement and knowledge to apply the system and solve contingencies (ibid). The enabling features enhance the understanding and awareness of the system's functions and capabilities, as well as the audit process in general, consequently empowering auditors and reducing the likelihood for technology dominance (Dowling & Leech, 2014; Dowling & Leech, 2007).

Furthermore, several other researchers have tested the TTD (Arnold 2018). For example, it has been shown that users of restrictive support systems and IDAs are less successful in recognising weaknesses in internal controls due to prompt and exclusive reliance on the recommendations and findings supplied by the IDA used (Seow, 2011). Also, evidence has been provided that users of more restrictive IDAs seem to establish inferior skills and capabilities compared to users of less restrictive IDAs (Stuart & Prawitt, 2012; Dowling et al., 2008). For example, Dowling et al. (2008) examine the relationship between declarative knowledge of auditors and the level of support offered by audit support systems. Declarative knowledge concerns in this instance an auditor's recollection of facts, experiences and events. In this era of constant progress in information technology and artificial intelligence, and correspondingly their impact on audit support systems, the amount of decision support offered by many audit support systems is considered to have a negative impact on auditors' declarative knowledge. Supporting this hypothesis, Dowling et al. (2008) find that auditors relying on systems with a higher level of decision support list fewer relevant business risks. This finding provides insights and implications to consider for audit firms when developing, implementing and more extensively using audit support systems, analysis tools and artificial intelligence going forward, to avoid such a scenario. Arnold et al. (2004) further provide evidence that when experienced personnel and IDAs are combined, decision-making is improved, whereas the opposite is true for novice and less experienced personnel. As such, it is worth emphasising that the TTD and its focus on technology dominance does not mean that the use of IDAs should be abandoned, but rather that to provide enhanced decision-making, the IDA and the user need to be well-matched (Arnold, 2018; Arnold et al., 2004). In other words, for smart decision aids to enhance decision-making, smart users are required as well (ibid).

2.3.2 Opportunities with Audit Support Systems in General

In addition to the implications put forth above in terms of audit support system and the TTD, Dowling and Leech (2014) and Dowling and Leech (2007) further highlight several benefits with audit support systems. The main opportunities identified include improved quality of the audits due to enhanced and facilitated compliance with auditing standards and methodology; improved documentation, risk management and control of junior employees; and a boost in efficiency (Dowling & Leech, 2014; Dowling & Leech, 2007). Relating to the paper by Dowling and Leech (2007), Carson and Dowling (2012) further examine if the differences in the audit support systems identified by Dowling and Leech (2007) have implications for audit firms (the same sample) in terms of developing competitive advantages against peers. Carson and Dowling (2012) find that the audit firms utilising a more restrictive and structured audit support system have lower cost-structures, proxied by lower audit fees to clients. They also find that firms with lower cost-structures employ multiple pricing strategies, which can be used to develop a competitive advantage

against peers. More concretely, audit firms with lower cost-structures can compete by offering lower audit fees to clients who require a more standardised audit process. However, when the audit firm also is the market leader within an area of expertise requested by a specific client, the lower cost-structure allows the firm to collect an additional fee premium (Carson & Dowling, 2012).

Furthermore, Sutton (2010) addresses the influence of IT and audit support systems on accounting and auditing, and correspondingly opportunities relating to task deployment, methods, outcomes and task characteristics. Better IT systems facilitate the collection, storing, extraction and testing of data, as well as analysis. Thus, new IT systems offer a coherent platform for the entire audit process, from data collection to analysis, consequently transforming the audit profession. Sutton (2010) further highlights that environments of CA are increasingly developing and incorporates processes such as monitoring and test execution by algorithms. This means that the responsibility of the auditor transforms into one that mainly focuses on receiving and addressing red flags highlighted by the system (ibid). Moreover, when investigating the implications and consequences of the implementation of CA at Siemens corporation, Alles et al. (2006) find that enhanced governance, reduced compliance costs, increased efficiency by improved quality and skill level of auditors in relation to technical capabilities and access to more real-time data and reporting are the main rationales behind the implementation

2.3.3 Challenges with Audit Support Systems in General

In addition to the challenges and dilemmas illustrated above when discussing audit support systems in relation to the TTD, Dowling and Leech (2014) and Dowling and Leech (2007) also highlight several additional challenges with audit support systems. The main limitations identified were overreliance and the inherent complexity of many systems. Although system restrictiveness can boost consistency, it can also result in mechanic task deployment where the focus is on ticking off assignments and where the complexity of the system might result in auditors not embracing the system and finding ways to “work around” it instead. Thus, the purpose and value of reducing risks by better monitoring and control mechanisms risks being severely diminished, inducing a false sense of security (Dowling & Leech, 2007). This highlights the importance of creating enabling systems where education and system support by management is emphasised, to better understand the rationale behind and the capabilities of the systems in use. Consequently, the likelihood that auditors find ways to “work around” the system should be reduced (Dowling & Leech, 2014). In relation to this, Arnold (2018) argue that the use of more restrictive systems where a “check-list” mentality is infused will radically change the work process of auditors. Systems that provide checklists to just conform to audit methodologies and regulatory frameworks will most likely result in less judgement and tailoring of client-specific needs, consequently reducing audit quality. As

such, this challenge has to be addressed to safeguard the prosperity of the audit profession going forward (ibid). Furthermore, Dowling and Leech (2014) illustrate that less time spent with clients due to cloud computing where work-files, documents and similar can be shared through the system, is considered a major challenge when increasingly relying on audit support systems in the audit process. In addition, Alles et al. (2006) find that everything cannot be performed by IT and formalizable into CA software, and that the increasing amount and size of data requires robust systems and processes to manage, store and understand all the data available.

Another major challenge is to separate auditing from consulting activities when more heavily relying on audit support systems and CA among others (Alles et al., 2006). This separation is mandated by Section 201 of the Sarbanes Oxley Act of 2002, to restrict and avoid situations of independence violations (Alles et al., 2005). The challenge lies in the nature of some of the auditor's tasks, such as identifying anomalies and weaknesses in terms of the clients' control features. Thus, the auditor is in the best position to find gaps and shortcomings in a client's management and control systems, and consequently to offer recommendations and solutions to the problems identified. With the introduction and increasingly growing capacity and speed of development in IT systems, CA presents new and even more advanced analytical methods to continuously audit clients flows of data. These new technical capabilities and access to real-time data put the auditor in an even better position to evaluate client methodologies and control features (Alles et al., 2005), consequently giving auditors access to information and new knowledge about a client both at an earlier stage and to a larger quantity than the management itself (Alles et al., 2006). Intuitively, instead of pointing out and correct client mistakes on a yearly basis, it would be advantageously and more efficient for the client to implement some of the audit firms process and system controls (Alles et al., 2005). However, this would result in auditors partly reviewing their own work, consequently increasing the likelihood to compromise auditor independence. Regulation No 537/2014 of the European Parliament and European Union on "*Specific requirements regarding statutory audit of public-interest entities and repealing Commission Decision 2005/909/EC*" can be considered the latest equivalence to section 201 of the Sarbanes Oxley act of 2002 in the EU. Article 5 address the "prohibition of the provision of non-audit services", exemplified by "*Prohibited non-audit services shall mean: [...] designing and implementing internal control or risk management procedures related to the preparation and/or control of financial information or designing and implementing financial information technology systems*" (European Parliament and Council, 2014, p. 86-87). Thus, in relation to the above discussion, the major restraint on CA is the demand and processes behind the development and corresponding implementation of CA, and not the technology supply itself (Alles et al., 2005).

2.4 Opportunities and Challenges with Big Data and Data Analytics

The subsection provides an overview of opportunities respectively challenges with Big data and Data analytics. Due to the absence of a theoretical foundation when discussing Big data and Data analytics in an audit setting in previous research, compared to audit support systems and the TTD illustrated above, the subsection takes a more exploratory character. For an overview of the key papers discussing opportunities and challenges with the inclusion of Big data and Data analytics into audit support systems brought up in this section, see Appendix 2.

2.4.1 Opportunities with Big Data and Data Analytics

Alles and Gray (2015) make an extensive literature overview with respect to the pros and cons of Big data in an audit setting, taking into account comments and inputs both from academics and professionals. They further identify two main driving forces behind the use of Big data within auditing, which are the “*opportunity to enable innovative new business models*” and the “*potential for new insights that drive competitive advantage*” (Alles & Gray, 2015, p. 10). This means that auditing firms that adapt to the changing nature of the profession can be considered to be driven by economic and efficiency rationalities when pursuing practice adoption. Thus, they adapt to societal trends such as changes in IT and the competitive environment to enhance performance and efficiency, and not only to achieve legitimacy in the eyes of stakeholders. Furthermore, Earley (2015) provides a similar overview to guide future research, arguing that Big data and Data analytics could revolutionise the way audits are conducted. Earley (2015) provides four key benefits by incorporating Data analytics into the audit process. They include that more transactions can be tested (from sample to population testing), both financial and non-financial; better insight and easier access to client data and processes, thus enhancing audit quality; increased technological capabilities and enhanced analytical tools make it easier to uncover fraudulent transactions and behaviour; and that both external and non-financial data can be incorporated into Data analytics tools, potentially resulting in new information about how to handle problems that can be provided to clients (ibid).

Alles and Gray (2015) further suggest that Data analytics will help auditors to deliver more and better insights to clients through easier risk identification and enhanced understanding of the client’s business environment by increasingly combining different sources of data. The possibility to move from sample to population testing will also attribute the audit more confidence and credibility. Since fraudulent transactions and misstatements usually only speak for a small proportion of transactions and events within an organisation, this increases the possibility to detect red flags and anomalies that could be included in smaller samples (ibid). Furthermore, one of the main objectives in the audit process is to find outliers which need further testing to decide whether they are anomalies or exceptions and decide upon their materiality (Richins et al., 2017). This will also become easier with population testing, increasing efficiency and quality of audits (ibid). Thus,

since audit quality improves, information asymmetries will be reduced by the increase in the supply of information as well as the enhancement in quality and insights provided from that information (Runesson, et al., 2018), which becomes possible by implementing more Big data and Data analytics into audit support systems.

Moreover, Alles and Gray (2015) show that fraudulent behaviour can be prevented to a larger degree, such as the possibility to uncover money laundering by trade through a comparison between invoices sent to customers and the weight of containers shipped. As such, the auditor's role as a monitoring mechanism is improved. Furthermore, the enhancement in the identification of risks, misstatements, anomalies and potential fraud by utilising Big data analytics is also emphasised by Cao et al. (2015) who discuss whether Big data and Data analytics can enhance the audits of financial statements. Deloitte (2020) further argues that Data analytics gives an edge due to more and better coverage, as well as quicker risk identification, consequently resulting in higher quality audits.

FAR (2015) further highlights the changing nature of the audit process, arguing that automation does not only have implications for standardisation but also when developing new and more sophisticated statistical and analytical tools. This is exemplified by the fact that Big data allows algorithms to process large amounts of transactional data to identify patterns and relations in data sets, which has been used to develop software for fraud detection. Accordingly, risks and shortcomings in clients internal control systems will be identified by the system. FAR (2015) further discusses the "three parts of knowledge" which are: what we know; what we know that we don't know; and what we don't know we don't know. Increasingly sophisticated support systems and algorithms are considered to more and more be able to identify the third part of knowledge, which creates new opportunities for the audit profession (ibid).

2.4.2 Challenges with Big Data and Data Analytics

Due to the predominant attention directed towards the opportunities and benefits of Big data and Data analytics, Alles and Gray (2015) put a greater emphasis on the many challenges as well to provide a transparent perspective of how this is changing the nature of the audit profession. In relation to the audit characteristics mentioned further above, that audit evidence needs to be "sufficient appropriate" and that "reasonable conclusions" should be provided, they state the question how Big data analytics cost-effectively can improve the efficiency of audits. Since the profession today already consider themselves satisfying these two objectives, the question is whether a full population testing compared to a threshold level of 95% adds more value on a cost-efficient basis. This question is very much connected to the binary and not the continuous

classification of an audit, either you receive a qualified or an unqualified audit opinion. This is also related to stakeholders such as regulators and investors (ibid). Historically, there has been an expectation gap between what regulators require auditors to review and to what degree they can assure a clean audit, and what stakeholders expect an auditor to detect and unravel in terms of fraudulent behaviour, anomalies and conscious and unconscious misstatements among others (Early, 2015). Due to the possibility to move from sample to population testing with the use of Big data and Data analytics, this expectation gap might very well increase even more since auditors might to a larger degree be held accountable for detecting fraud and misstatements in the eyes of investors (ibid). This means that auditors cannot justify their failure to detect anomalies by arguing that the relevant event or transaction was not in the sample anymore (Cao et al., 2015; Earley, 2015; Alles & Gray, 2015). The counter-argument is that the auditor most likely will not have the time to address all errors and red flags that become apparent when conducting full population testing in the scope and time-frame of a normal audit (Krahele and William, 2015). Consequently, the importance of analysing the systems producing the data will increase to avoid potential errors in the first place. Furthermore, what Krahele and William (2015) also illustrate is that because of more real-time data and continuous assurance and auditing, the focus has to change from a broader assurance of the financial statements on a yearly or quarterly basis, to a more continuous one at a more focused data-level. This is also of importance to assure that internal processes of data generation and control systems to detect discrepancies and deviations from plan are adequate to avoid larger errors, misstatements and anomalies later on. According to Krahele and William (2015), all of this means that the auditor's role moves away from fact-checking and instead focuses more on analysis.

Data integrity is another concern to consider for preparers and users of financial statements when discussing the impact of Big data and Data analytics in an audit setting (Earley, 2015; Krahele & William, 2015; Alles & Gray, 2015). Tampering of data and data sets that are incomplete are commonly addressed when speaking of data integrity (Zhang et al., 2015). How to make a quality assurance of external data that might have been tampered with and how to validate non-financial data will be increasingly important to ensure audit quality (Earley, 2015; Alles & Gray, 2015). Preparers of financial statements also have to take a stand regarding the "messiness of data" which can increase when integrating more Big data. This means that some inaccuracies and low-quality data might be slipped into the financial statements and further used for analysis, consequently affecting audit quality (Alles & Gray, 2015). Thus, there will be a trade-off between incorporating more and sometimes messy data to provide more thorough insights, and the possibility to receive somewhat biased results in-between. For some industries this might very well be acceptable, but for the audit profession it conflicts very much with what historically has been done (ibid).

Another major challenge is that auditors must develop the relevant technical expertise and know-how to first of all be able to use Big data to its fullest potential, but also to be able to decide how and what data to analyse (Alles & Gray, 2015). Since Big data and Data analytics only is a means to an end, the value that potentially can be derived will be very dependent on the expertise of the user in terms of what data to include and integrate, and correspondingly how to interpret and analyse the data (ibid). As such, Earley (2015) writes that audit firms need to conduct appropriate training of their auditors and also that universities need to develop new courses in data analysis to cope with the increasing focus on Big data and Data analytics. This is because, as already discussed, the main focus will most likely shift into one that focuses on recognising, interpreting and analysing anomalies and addressing red flags, which requires a different mindset than the traditional one familiar to auditors, which is still being educated at universities as well. Thus, both existing and future auditors have to be taught this new mindset through training and education. Although statistical and technical capabilities will be more important going forward, it is also important to emphasise that there are other important areas to address as well. For example, with the introduction of Big data and Data analytics, it will be very important to understand how financials, external factors and business process are related to each other, and how they can be used to identify business risks. This means that there is an increasing requirement to understand not only the what and how, but also the why of accounting and certain accounting entries or transactions occurs (ibid). Also, Heinzelmann (2017) shows the importance of having the full support of employees before enacting revolutionary change processes. His case study portrays a situation where the introduction of a new IT system was too standardised and not flexible enough, leaving no room to develop and apply professional judgement. This resulted in *“accountants feeling less “special”, in the sense that their expertise was less related to the accounting function and more associated with the IT system”* (Heinzelmann 2017, p.474), consequently reducing the rate of success of the implementation.

This more pronounced requirement of technical expertise is also related to the increased competition from start-ups and firms outside the audit profession that offer services similar to the ones provided by traditional audit firms (Richins et al., 2017). Such firms use Big data analytics to create new value for clients (Richins et al., 2017). However, in addition to large entry barriers in favour for established auditing firms (Alles et al., 2006), Richins et al. (2017) suggest that auditors that embrace Big data and Data analytics are in the position to combine their existing knowledge and professional expertise with this new technical and analytical one to compete and provide even more value to clients. Also, since the audit process encompasses a variety of different tasks and methods that together result in the final audit opinion, the entire process will be very hard to automate and offered by start-ups entirely. Instead, Big data analytics might affect and change the design and course of action in several of the tasks and methods employed in the audit process.

Thus, auditors need to capitalise this opportunity to offer clients more value and fight off competition. Although some argue that data scientists might compete against auditors in the supply of auditing services in an environment where Big data and Data analytics gain more ground going forward, it is not enough to have the right technical capabilities but also the right amount of business understanding. Even though Data analytics most likely can uncover and highlight red flags in relation to fraud risks, misstatements and other areas of concerns, the social and business understanding is very important to make a holistic judgement based on computerised systems. This business understanding can only be obtained after several years of training, which is in favour to auditors. Also, the final audit opinion requires a great amount of subjectivity, restricting the possible amount of automation and system standardisation (ibid). As such, although Big data and Data analytics can perform many routine and traditional accounting and auditing tasks, potentially replacing most audit activities in the future, Richins et al. (2017) argue that auditors can combat extinction and provide great value to clients and society by increasingly combining these two capabilities going forward. Another solution or complement to cope with the increasingly demanding digital environment is to team up with or acquire start-ups (Meuldijk, 2017).

3. Method

This section explains the research approach conducted to answer the purpose and research questions of the thesis. Some criticism against the chosen research approach will also be presented, as well as how that criticism is handled.

3.1 Research Approach

As illustrated by Earley (2015), extensive empirical research in how Big data and Data analytics affect audit firms are still missing due to the unwillingness of audit firms to share their audit methodologies and data in the subject matter, consequently restricting the possibilities to conduct quantitative research. Thus, to investigate how audit firms adapt and change their auditing processes in this time of digital transformation, and consequently how they address the many challenges and opportunities that audit support systems, Big data and Data analytics induce upon the profession, I conduct a qualitative research design with semi-structured interviews to shed some light and guide future research in the subject matter. The study will have an exploratory character due to the absence of theoretical frameworks relating the use of Big data and Data analytics to the audit profession in previous research. This is mainly because of the audit firms' recent adoption and increased focus directed towards the use of Big data and Data analytics as key variables in their audit support systems. Although, some findings about audit support systems in general will be analysed and discussed in relation to the TTD since this area of research has been attributed more attention in previous research.

The interviewees consist of Swedish representatives from all of the Big Four audit firms (Deloitte, PwC, Ernst & Young and KPMG). The rationale behind the use of representatives from the Big Four is because they should be representative in terms of how auditing firms in general address these kinds of questions due to market share and incentives to invest in new digital tools. For example, the Big Four have a market share in auditing slightly above 90% of listed companies in Sweden (Bolagsverket, 2020) and individually amount to at least 15% of the total amount of auditing fees attributed to companies of public interest in Sweden (Revisorsinspektionen, 2019). Also, the Big Four are all increasing their investments into artificial intelligence, Big data, Data analytics and related areas due to increasing regulatory pressure and to maintain their dominant market positions within auditing services (Murphy, 2017, 18 Sept).

Furthermore, since digital transformation, Big data and Data analytics can be quite complex and hard processes to understand and talk about, I first of all interview representatives with the greatest potential to provide some valuable and interesting insights into the subject beforehand, and subsequently to address my research questions. Thus, the first four interviews are with representatives involved in digitalisation and transformation processes at each firm respectively. Thereafter, I conduct two interviews with partners who have worked at respective firm over 20 years respectively. This is done to identify areas of interest in respect to digital transformation, audit support systems and related elements which might have been missed during the literature review and data collection. The choice of representatives with over 20 years of work experience is made to increase the likelihood of valuable information given by the respondents. During a time-span of over 20 years, the interviewees have most likely been exposed to a great amount of change in terms of digital transformation, and will thus be most likely to contribute with some valuable insights. Two interviews with second-year associates are also performed to achieve some perspective from younger and recently graduated auditors. Lastly, to address new knowledge and information brought up in interview five to eight, and also to supplement the data collected in interview one to four, two more interviews are performed with two of the representatives involved in digitalisation and transformation processes at two of the firms, where complementary questions are asked and clarifications are made. The majority of the information collected, and correspondingly the empirical results, are provided by the interviewees with specific expertise within digitalisation and transformation due to their positions and accumulated knowledge in the subject matter. However, both the senior and junior auditors are able to substantiate and confirm some of the results, and also provide some inputs by their own. An overview of the interviews and interviewees can be found in Table 1 below.

Table 1. Interviewee overview

Respondent	Position	Experience	Type of interview	Duration	Date of interview
D1	Partner and certified auditor with specific expertise in digitalisation and transformation	>10 years	FaceTime	65min	11 March 2020
D2	Partner and certified auditor with specific expertise in digitalisation and transformation	>25 years	VMR	57min	13 March 2020
D3	Partner and certified auditor with specific expertise in digitalisation and transformation	>25 years	Google Hangout	61min	16 March 2020
D4	Partner and certified auditor with specific expertise in digitalisation and transformation	>20 years	FaceTime	50min	20 March 2020
P5	Partner and certified auditor	>25 years	Face to Face	57min	23 March 2020
P6	Partner and certified auditor	>20 years	Face to Face	45min	24 March 2020
J7	Junior associate	<2 years	FaceTime	31min	27 March 2020
J8	Junior associate	<2 years	FaceTime	33min	30 March 2020
D1	Partner and certified auditor with specific expertise in digitalisation and transformation	>10 years	FaceTime	25min	9 April 2020
D4	Partner and certified auditor with specific expertise in digitalisation and transformation	>20 years	FaceTime	23min	10 April 2020

The table provides an overview of the interviews by which the empirical results are based on, where “D” stands for partner and certified auditor with specific expertise in digitalisation and transformation, “P” stands for partner and certified auditor and “J” stands for junior associate. The table depicts the respondents’ position within their respective firm, years of experience in the profession, type of interview, duration of interview and date of interview.

I conduct interviews since the reason with interviews is to get an understanding of what people think, to provide knowledge and give a profound understanding of the area under investigation (Bryman & Bell, 2015), which aligns with the aim of my study. Furthermore, I decide to use semi-structured interviews due to their open and flexible character, which promotes discussion and makes it easier to ask follow-up questions in a customised manner based on interviewee answers, consequently promoting a dialogue between me and the interviewee (Collis & Hussey, 2013). Semi-structured interviews are also advocated when the subjects and areas under discussion are familiar to both parties beforehand (Ayers, 2012), so the most important and interesting matters to the researcher can be addressed during the interview (Bryman & Bell, 2015). Since I have done a thorough literature review in the subject matter beforehand, this is arguably the case. The extensive literature review is further done in order for me to have good knowledge about potential opportunities and challenges with audit support systems, Big data and Data analytics beforehand. Since it is a new area of research, at least for Big data and Data analytics in relation to the audit profession, I believe that without a profound understanding beforehand, it will be easy for the respondents to dominate the interview, only talking about their main interests and promoting their firm's progress in the subject matter, due to my inability to ask relevant follow-up questions. Consequently, the focus will risk being too narrow, where the respondents' own perceptions most likely will overshadow the more general implications I aim to capture with this exploratory study.

Furthermore, to facilitate discussion and to achieve more in-depth answers from the respondents, the interview format consists mostly of open-ended questions (Collis & Hussey, 2013). A document with key questions which are aimed to be discussed during the interviews is prepared and sent to the interviewees beforehand (see Appendix 3). This is done to ensure that the participants are prepared and comfortable in relation to the topics under discussion, and also to help set a framework for the interview. According to Bryman and Bell (2015), an interview guide might also strengthen research dependability. Moreover, all interviewees are asked the same questions, although adjusted and allocated different amounts of focus depending on the interviewee's knowledge and perceived interest in the question being discussed. Also, even though the key questions are fixed and placed in an approximate chronological order for me to answer the purpose of the study, both the questions and the order of the questions are altered throughout the interview based on the interviewee's answers. This is done to understand which areas under investigation the interviewees deem most important. Finally, the interviews are concluded at saturation, in other words, when it is my understanding that no additional information can be obtained from continuing the interview (Eisenhardt, 1989).

The interviews are performed via FaceTime, Virtual Meeting Room (VMR) and Google Hangout due to the Coronavirus, except for two which are conducted at the interviewees' respective office. Furthermore, the interviews take place during March and April. March and April are chosen considering the heavy workload in January and February for auditors in general due to reviews of their clients' annual accounts. To achieve the best interview conditions and to avoid stressed and distracted interviewees, the interviews therefore take place right after this period. This is ensured by a close dialogue and contact with respective interviewee to increase the likelihood of good quality interview answers. The length of the interviews is between 23 and 65 minutes (see Table 1 further above). Moreover, in order for me to be as present as possible during the interviews and ask follow-up questions, the interviews are recorded and transcribed, reducing the need to take extensive notes (Bryman & Bell, 2015). The interviews are performed in English to avoid subsequent translation issues. However, since all interviewees are Swedish speaking, they are encouraged to speak in Swedish when they feel it can improve the quality of their answers. The data is thereafter coded and allocated to different themes in a coding frame based on opportunities and challenges with digital transformation (see Table 2 below), and how they are addressed. This is done to facilitate and structure the subsequent analysis, but also to increase validity and reliability (Silvermann, 2006; Bryman, 2011). The coding frame is based on the opportunities and challenges of digital transformation identified during the extensive literature review before conducting the interviews.

Table 2. Coding frame

Themes	Examples
Opportunities	<ul style="list-style-type: none"> • Enhanced data processing capabilities and the access to population and real-time data make it easier to see patterns, make processes more efficient and identify outliers, red flags and risks at an earlier stage than before, consequently attributing the audit more confidence and credibility, as well as the possibility to deliver more and better insights to clients. • Access to both external and non-financial data which increasingly can be incorporated into Data analytics tools also has the potential to result in new information about how to handle problems that can be provided to clients. • Improved quality of the audits due to enhanced and facilitated compliance with auditing standards and methodology. • Boost in efficiency and consistency. • Enhanced governance, documentation and technical capabilities of auditors.

	<ul style="list-style-type: none"> • Enabling innovative new business models, potentially providing new insights that drive competitive advantage.
Challenges	<ul style="list-style-type: none"> • Overreliance of digital tools and consequently technology dominance. • De-skilling of auditors through loss of vital knowledge and identification of less relevant business risks. • Less time spent with clients. • How to store, manage and understand the increasing amounts of data, which further has implications for data security. • How to address data integrity in light of data tampering, incomplete data sets and low-quality data. • How to cost-effectively improve the efficiency of audits. • Where to draw the line between audit and consultant services. • How to approach the imminent competitive threat from start-ups and enterprise- and audit software vendors, who increasingly offer new software and process solutions in accounting and auditing. • How to approach the fact that less room for errors might be accepted from regulators and investors due to population testing. • How to develop the relevant technical expertise and know-how to prosper in this new digital environment.

The table provides an overview of the main opportunities and challenges identified in the literature review, which has been constructed as a coding frame on which findings from the interviews will be categorised and related to before writing the “Empirical findings and Analysis” section.

3.2 Method Criticism

There are a few limitations present when conducting this study, where the first is the limited time and scope of the study. Ten interviews can be considered as a small basis for data collection to make generalisations, and consequently to claim transferability (Bryman & Bell, 2015). Although it has been questioned whether the purpose with qualitative research is to make any generalisations at all since it is always hard to claim any due to the contextual nature commonly present when conducting qualitative research (ibid), the purpose of using all of the major auditing firms, who together constitute a significant part of the audit market (Bolagsverket, 2020; Revisorsinspektionen, 2019), aims to alleviate this problem. Also, it can be argued that my access to key individuals in the digitalisation and transformation processes at each respective firm reduces this problem as well since the interviewees provide very rich answers and examples. Transparency is also commonly addressed as a main concern when conducting qualitative studies (Silvermann, 2006). Interviewees

illustrations and descriptions are usually taken at face value and are considered as real representations of the world, sometimes neglecting the contextual elements as well as the fact that the interviewee might not be completely transparent in his or her illustration. Perceptual biases can also be a result of bad recollection of memories and the fact that interviews only give a filtered overview of what the auditing firms actually do. These concerns are also addressed by using four firms for data collection, allowing cross-checking of information to some degree (Innes & Mitchell, 1990), as well as choosing representatives who are considered most relevant and competent to answer the subject under investigation. Since the data collected from the four firms is coherent and illustrate a similar picture, the transparency problem could arguably be alleviated to some degree.

Furthermore, observer bias is another limitation when conducting interviews, which has implications for validity and reliability. Observer bias is defined as “the tendency to observe the phenomenon in a manner that differs from the “true” observation in some consistent fashion” (Mckinnon, 1988, p. 37). Preconceptions and biased opinions in relation to the subject under investigation are common examples of scenarios where observer bias is present. To mitigate this problem, I encourage the interviewees to comment and share their opinion regarding validity and reliability, as well as the credibility of my results, analysis and conclusions drawn from the interviews before submission (Patton, 2002; Bryman & Bell, 2015). This also helps to ensure confirmability of my results, in other words, that the result and analysis are free from personal opinions and values, thus ensuring objectivity (Bryman & Bell, 2015).

4. Empirical Findings and Analysis

This section presents the findings provided from the interviews. The findings will also be related and analysed against the prior literature and theoretical frameworks already presented. The section begins by providing an overview of key trends and the changing nature of the audit profession, followed by the main opportunities and challenges identified in the interviews.

4.1 General Overview of Key Trends and the Changing Nature of the Audit Profession

What is illustrated in all interviews, particularly in those with auditors that have many years of experience, is the changing nature of the audit profession, and consequently the methodologies and processes being implemented by the auditing firms. In line with previous research, e.g., Richins et al. (2017), FAR (2015), Rikhardsson and Yigitbasioglu (2018), *interviewee D1* expresses that it is very important for the auditing firms to cope with the increasing speed of digital transformation in today’s business climate since they have seen how the quality of the audit becomes better, and their ultimate responsibility is to deliver high-quality audits. In the same light, *interviewee D3* says:

“How can we be data-driven, using Data analytics to create a competitive advantage, has been a main focus during the last few years at our firm”.

Interviewee D3 further highlight that it is about creating new value for the client as well, and not only an efficiency focus from the firm’s perspective. Which inputs and insights can be delivered to the client from this digital transformation with the increasing use of Data analytics among others are key questions being discussed. Accordingly, this focus on new value-creation and generation of competitive advantages are in agreement with Alles and Gray’s (2015) suggestion that one of the main driving forces behind the use of Big data and Data analytics within auditing is the potential for new insights that drive competitive advantage. This means that digital transformation is very high up on the agenda at the auditing firms, something that they communicate to both current and potential future clients. Also, *interviewee D2* separates between what systems and digital tools that are used today and what is being prepared and developed for the future. *Interviewee D2* means that digitalisation is not just that you go from analogue to digital form, but it is a holistic perspective that needs to be considered where audit support systems, Big data and Data analytics among others are used more and more to gradually change and enhance processes and ways of working.

Interviewee D3 further emphasises this digital transformation of the audit profession, explaining how the audit firms increasingly transform their businesses from analogue to digital form. Also, *interviewee D1* argue that digital tools are more easily accessible today than ten years back and that clients have created better possibilities to use these tools. The audit firms have had the infrastructure and tools such as Data analytics ready for some time now, but the clients have not had the data accessible or been unable to provide the data. The tools can come to use better today when the data are more easily accessible, thus facilitating the transformation process of incorporating more Big data and Data analytics capabilities into audit support systems. Furthermore, Big data and Data analytics are not used in all audit engagements, but in many and to different extents depending on the client according to *interviewee D1*. Also, it is used in more and more audits, creating a more “modern audit”.

Moreover, and in agreement with Richins et al, (2017), a common perception amongst the *interviewees* with specific expertise and roles in digitalisation and transformation within the Big Four is that traditional accounting and auditing tasks will to an increasing extent be performed by digital and smart tools as a part of their audit support systems, where artificial intelligence, Big data and Data analytics provide new opportunities and challenges for the profession to face. This is exemplified by *interviewee D3* who mentions that their firm estimate that 70% of human hours will be automated in the near future (5-10 years). Similarly, *interviewee D4* state that 60% of human hours

spent on more traditional auditing work is expected to be automated at their firm. This is even higher percentages than estimated by FAR (2015) for audit services (45%). However, although such an estimation can be very arbitrary, the difference might be due to different definitions of the “near future” and the separation between accounting and auditing services. Intuitively, and in line with Richins et al. (2017), this means that most traditional audit activities will be performed by the increasing use of Big data and Data analytics going forward. Instead, the future auditor will spend more time answering the more difficult questions that require professional judgement and scepticism. *Interviewee P5* further argues that even though many traditional auditing tasks still are being performed, the responsibility of the auditor is gradually transforming into one that focuses more on receiving and addressing risks and red flags identified by the audit support system in use, in line with Sutton (2010).

In agreement with the findings provided by FAR (2016), Sutton (2010) and Krahel and William (2015), another major trend brought up during the interviews is that the profession will more and more move away from looking at the past where clients’ accounts are reviewed ex-post, and instead take a more real-time and future perspective. *Interviewee D3* find that clients are less interested in what has already happened and are more interested in what is happening or what is going to happen in the near future based on data. As such, *interviewee D2* emphasise that he thinks the audit will become more continuous (CA) going forward, where auditors will enact a more proactive role. According to *interviewee D4*, this will be facilitated by the increasingly automated processes being executed through the audit firms audit support systems, as well as the move towards population testing, because this makes it possible to continuously and accurately monitor clients flow of data without growing the amount of work linearly. This is also very much related to the changing nature of the audit profession, where clients are more interested in the auditor providing new insights through analysis by increasingly incorporating Big data and Data analytics into audit support systems. Thus, the firm with the best use of Big data and Data analytics is in a great position to develop a competitive advantage against peers.

Furthermore, some *interviewees* expect the audit profession to be more segmented going forward, something that does not seem to be illustrated in previous literature. Traditionally (and still to a large degree), the profession consists of professionals with the same kind of education. To manage the changing nature of the profession, different competencies will be required for different parts of the audit process when moving towards more of a digital business model. Consequently, the employees will more and more be divided into functions with different competences. *Interviewee D3* provides some examples. One relevant segmentation going forward will be the “core team” or “client-facing team”, which needs to be capable of creating client relations and be very good with

people, tying relations etcetera. Another function will be the “specialist” which requires a completely different set of capabilities, more technically oriented. A third function will be delivery and competence centres with a different way of working, achieving a higher degree of efficiency. Thus, if you are the signing auditor you can check out from many posts or parts of the audit process, letting other functions and teams perform the main audit process. Instead, since you do not need to be able to master all parts of the audit process but only to certify that everything looks alright in the end, the key responsibility becomes to communicate this information to the client, put it in a context and in relation to something to satisfy the client. This stands in contrast to Richins et al. (2017) and Alles and Gray (2015), where the interpretation is that auditors need to develop the necessary skillset to combine traditional auditing skills with technical and analytical ones to continue to create value to clients and fight of competition. However, since different functions and teams will have the ultimate responsibility for certain parts of the audit process, the auditor does not need to know or understand everything and every part of the audit, because he or she can rely on a specialist or similar when necessary. As such, it seems like previous literature has used auditors and audit firms as synonymous with each other, neglecting the fact that auditors can develop diverse skillsets and that audit firms hire other professionals to complement the expertise of their auditors.

Moreover, some *interviewees* anticipate that the audit requirement might very well disappear to different degrees in the not too distant future, in particular for smaller companies, since organisations are expected to implement their own systems that partly can perform the same role as an auditor. Consequently, the audit firms are required to find new ways to create value for their clients going forward. In light of this, *interviewee D1* mentions that the future audit will be about “value beyond compliance” to a larger degree, meaning that the audit will provide more analysis and insights to clients, not only ensuring compliance. This confirms Krahel and William’s (2015, p. 41) opinion that the auditor’s role moves away from fact-checking and instead focuses more on analysis. Also, someone needs to certify that the systems implemented at a client’s organisation are working appropriately or as they should to avoid potential errors in the first place, also in line with Krahel and William (2015), something that might be incorporated in the auditing firms service package going forward. Thus, we can expect a different kind of services in the auditing profession going forward. Finally, most *interviewees* highlight that an audit is very financially oriented today, but going forward, it will incorporate more qualitative and non-financial data as well. This is because unstructured data can be transformed to structured form to an increasing extent. As such, *interviewee D3* anticipates that an audit will become “wider” and incorporating more aspects and information onwards, in agreement with Earley (2015).

In light of this changing nature of the audit profession, where audit support systems, Big data and Data analytics are being employed to an increasing extent, the interviews also illustrate the many opportunities and challenges this transformation brings, and how they are addressed. As such, a comprehensive overview of all the opportunities and challenges with this digital transformation identified in the interviews will be provided below, further demonstrating the changing nature of the audit profession.

4.2 Opportunities with Audit Support Systems, Big Data and Data Analytics

Although the opportunities identified during the interviews of incorporating Big data and Data analytics into audit support systems to a larger degree are many, all of them can more or less be grouped into one of three different categories. These are enhanced quality of the audit, increased efficiency of the audit and more and better insights provided from the audit. Since the opportunities are very inter-related and mentioned in combination with each other most of the time, they will all be illustrated together in the first subsection below. However, although the remaining three subsections of 4.2 have different titles to characterise their different focuses, these three main categories of opportunities will be brought up to different extent in these as well.

4.2.1 Increased Efficiency, Enhanced Quality and More and Better Insights

What all interviews illustrate to different degrees is the opportunity Big data and Data analytics provide in terms of increasing efficiency, enhancing quality and providing more and better insights from an audit, in line with previous research such as Dowling and Leech (2014), Dowling and Leech (2007), Rinta-Kahila et al. (2018), Alles et al. (2006), Earley (2015) and Deloitte (2020).

Interviewee D1 says that:

“Different analytical tools can be used to create more efficient and higher quality audits, consequently creating better value to the recipient”.

Interviewee D1 further states that tools such as Big data analytics which are an essential part of an audit firm’s audit support systems are closely integrated with the firm’s audit methodology. Since the methodology is based on International Standards on Auditing (ISA), the quality of the systems can be ensured while making processes increasingly efficient. Also, *interviewee 4* says that:

“This shift, where Data analytics can be used to process and make sense of considerable amounts of Big data stored in data lakes, makes processes more efficient and allows us to focus on what really matters, providing more insights and increased quality of the audit”.

This belief is shared by all *interviewees*, who in different ways express that the time saved by reducing the amount of standardised, routine and administrative auditing tasks, instead can be spent on what really matters, applying professional scepticism and judgement, and creating more value for the client. Again, this is an illustration of how the auditor's role moves away from fact-checking and instead focuses more on analysis in agreement with Krahel and William (2015). Thus, *interviewee D1* concludes that by reducing the number of standardised tasks, it is possible to run a more cost-efficient audit by cutting costs in these areas of the audit. Also, clients can receive more value for their money since clients provide more and better information to the auditor in the first place, consequently requiring fewer manual computations and preparation work. Since the need for manual computations will be reduced, the *interviewees* further emphasise that the possibility for small inaccuracies due to the human factor will be diminished, consequently enhancing consistency in line with Dowling and Leech, (2007) and Sutton (2010). According to *interviewee D2*, the reduction in traditional auditing tasks and administration duties traditionally performed by first-year and more junior auditors will also result in them immediately taking on more responsibility. It is *interviewee D1's* opinion that these traditional auditing tasks are not the best way to learn how to conduct an audit and how to develop professional scepticism and judgement. Instead, newly graduated auditors can immediately start learning how to perform "real" auditing duties and value-creating activities, and also develop the more important capabilities and expertise which is critical to become a successful auditor. This is also illustrated by *interviewee J7* and *J8* who both illustrate how they perform more value-creating and responsible tasks than they thought they were going to do before starting their careers as auditors just recently.

Moreover, *interviewee D1* illustrates the key rationales for digital transformation and Data analytics by a simple example. A while back, they launched an app which can take pictures and scan QR codes when checking inventories. Based on statistical methods incorporated in the system, it will automatically provide you with a list specifying and administering the right samples to take, consequently enhancing quality by removing the human factor when conducting sample selection. The clients can also send the inventory list in advance so the system can compute which samples to take before arriving to the client, freeing up a lot of time and consequently increasing efficiency. Also, they can send out an auditor and in real-time follow the inventory count through the app. Thus, if too many errors are found, they can tell the auditor at sight to take a few more samples and not having to return to the client later on again, further increasing efficiency. Moreover, let's say you are reviewing a group's financial statements, you can use the data from the system to show the client where the most or the least inventory differences are present, differences across subsidiaries and similar through visualisation tools. This provides the client with value-adding insights, presenting a clear picture of how their internal inventory controls and routines work. This

is a great example of how these new systems and processes work. It shows how efficiency is increased and how more and better insights can be provided, consequently resulting in higher quality audits, again in agreement with Dowling and Leech (2014), Dowling and Leech (2007), Rinta-Kahila et al. (2018), Alles et al. (2006), Earley (2015) and Deloitte (2020). Relating to this, *interviewee P6* explains how differently auditors can be perceived and valued by their clients today compared to 10-20 years back in some instances. Instead of only ensuring compliance, the value-creating insights that sometimes can be provided through audit support systems and Data analytics by analysing Big data opens up the possibility to facilitate the creation of a mutually beneficial exchange between client and auditor. In agreement with Carson and Dowling (2012), this can also be turned into a competitive advantage according to *interviewee D3*. If you can uphold a lower cost structure than peers, a competitive advantage can be developed either by cutting costs and taking market shares from competitors or by keeping the same price and thus earn more. Differently put, a multiple pricing strategy can be employed referring to Carson and Dowling (2012).

Finally, the possibility to gain deeper insights also allows the audit firms to better understand the businesses of the clients they audit. As such, a few of the *interviewees* mention that in light of the new requirement on rotation, which means that organisations have to change auditor more frequently, new opportunities open up in terms of transforming an audit client to a consulting or tax services client. For example, according to *interviewee D2*, the last year of such an engagement where the auditor has to be rotated, they focus on collecting as much information as possible to help their consulting or tax section in order for them to recruit the client for their services instead. Although to the best of my knowledge, previous literature does not discuss this aspect in relation to the new requirement on rotation, it is in accordance with Alles et al. (2005) and Alles et al. (2006) and their findings that the auditor is in the best position to find gaps and shortcomings in a client's management and control systems, and consequently to offer recommendations and solutions to potential problems. Thus, the development of increasingly sophisticated audit support systems puts the auditor in an even better position to evaluate client methodologies and control features. This means that the auditor sometimes gains access to new and better information and insights than the client itself, which offers the opportunity to convert an audit client to a consulting or tax services client, or to develop a completely new kind of service. As such, relating to Alles and Gray's (2015, p. 10) second main rationale for engaging in Big data and Data analytics, this offers the "*opportunity to enable innovative new business models*".

4.2.2 How the Different Steps of the Audit Process have Changed

To further illustrate how the use of Big data and Data analytics in audit support systems enhance quality, increase efficiency and provide more and better insights to an audit, several of the *interviewees*

explain how the different steps of the audit process have changed during the last ten years due to digital transformation. For risk assessment, quite a lot has changed, where Data analytics can be used to a wider extent to identify where the risk(s) really are. This is in agreement with Alles and Gray (2015) and Cao et al. (2015) who both identify enhanced risk identification as a main opportunity with Big data and Data analytics. *Interviewee D1* provides an example:

“Historically, you said that employee costs were a high-risk post if the client had a large number of employees with high amounts of total salary payments. Today, Data analytics can be used to populate the data. If a client has 1000 employees where 99% are regular full-time employees with average yearly salary and average yearly salary increases, these can be considered low-risk posts. However, let’s say the last 1 % have very high salaries with a large fraction variable compensation, this 1 % can be concluded as high-risk data points”.

This means that by using Data analytics, you can pinpoint exactly where the risk(s) are and put the focus there. Historically, by the use of 10 or 20 samples, you would statistically only cover the median employee, not saying very much about the riskier 1 % that can be pinpointed to a higher degree today, consequently improving efficiency and quality of the audit, and provide better insights altogether. Also, some *interviewees* mention that quicker risk identification is possible by developing more sophisticated audit support systems using Big data and Data analytics, which increases efficiency in line with Deloitte (2020).

Moreover, the biggest change relating to control and substantive testing is the shift from sample to population testing. In agreement with Earley (2015) and Alles and Gray (2015), *interviewee D4* mentions that this shift provides more confidence to the audit since the accuracy and quality of the controls and substantive procedures are enhanced by population tests. For example, *interviewee D1* mentions that instead of using samples when evaluating activations and depreciations of assets, it is possible to process a client’s entire asset register through Data analytics which immediately can compute which data points are wrong based on some prespecified criteria. As such, relating to Alles and Gray (2015), this increases the possibility to detect red flags and anomalies that could be included in smaller samples since fraudulent transactions and misstatements usually only speak for a small proportion of transactions and events within an organisation. Also, the *interviewees* highlight that risks and weak points in a client’s processes and internal control systems will increasingly be identified by the system in use, in agreement with FAR (2015). Moreover, in line with Richins et al. (2017), some *interviewees* illustrate that this move towards population testing also makes it easier

to identify outliers which need further testing to decide whether they are anomalies or exceptions and decide upon their materiality, fulfilling one of the main objectives of the audit.

Also, *interviewee D3* emphasise the changing nature of control and substantive tests by the introduction of new object computer recognition (OCR) techniques which can scan for specific data points in unstructured formats such as written contracts, correspondingly structuring this data. This structured data can thereafter be used for analysis through Data analytics, searching for patterns or specific data points from large amounts of contracts, reducing the need to manually search for and validating different kinds of contracts. This means that in a business environment where the amount of data is increasing exponentially, audit support systems and Data analytics that can process and match data becomes key. Also, *interviewee P5* emphasise that audit support systems dictate what to do and who are supposed to do it through segregation of duty. Thus, by assigning assignees and reviewers for different steps of the audit process, governance can be enhanced. *Interviewee P6* further illustrate this, mentioning that it becomes harder to not control for something since the ultimate responsibility for certain processes are more easily followed through segregation of duty, consequently reducing the incentives for a fraudulent auditor to not be independent. These findings are in line with Dowling and Leech (2014), Dowling and Leech (2007) and Alles et al. (2006), who in different ways find how audit support systems facilitate compliance of firm protocol, control of junior employees and governance respectively.

Finally, it is most *interviewees* perception that not much has changed concerning the final audit opinion. However, due to the increased efficiency, enhanced quality and more and better insights provided by audit support systems incorporating Big data and Data analytics, the final audit opinion provides more confidence. For example, *interviewee P6* says:

“By replacing junior employees with audit support systems and Data analytics when performing more standardised tasks with a lot of manual computations, accidental typos and miscalculations can be eliminated”.

Thus, the likelihood that the final audit opinion is based on inaccurate numbers is reduced, consequently providing more confidence to the audit. As such, this change and evolvement of the different steps of the audit process could arguably be considered to more and more offer a coherent platform for the entire audit process as put forth by Sutton (2010), from data collection to analysis, consequently transforming the audit profession and making processes increasingly efficient, providing more and better insights and enhancing quality.

4.2.3 CA and the Use and Combination of Different Sorts of Data

Furthermore, a few *interviewees* bring up CA. For example, *interviewee D2* emphasise that clients are interested in auditors being more proactive, reviewing their accounts and economic flows continuously during the year and not only at year-end. It is a lot easier if an anomaly or misstatement are uncovered, or that it is found out that internal controls or systems do not work effectively, during the year which immediately can be corrected, instead of doing it at years end when sequential errors might have occurred. An audit that only notes deviations and poorly working internal control systems ex-post does not generate much value. As such, if a client for instance issues a lot of credit notes since the system sends out incorrect invoices, this can be highlighted and addressed instantaneously instead, so the invoices are correct in the first place. This is in agreement with FAR (2016), Sutton (2010) and Krahel and William (2015), who also address the increased focus on CA and the more proactive nature of the audit profession. In line with Earley (2015), *interviewee D3* further emphasises that it is here a good audit starts, where Big data and Data analytics allow auditors to see not only the what and how, but the why as well, generating more value for the client. This is related to the fact that we are not really interested in the auditor noting that an organisation has gone bankrupt, but to be more proactive, ensuring that there are appropriate processes and controls in place in order for the organisation to not go bankrupt in the first place. Thus, relating to Alles et al. (2005), these more sophisticated audit support systems and move towards CA make it easier to ensure the quality of a client's processes and controls. *Interviewee D2* also concludes that:

“The only way to move to real-time or CA is to incorporate more digital systems such as Data analytics into audit support systems, which further will be the most important factor deciding which firm among the Big Four that will have the largest market share going forward”.

This is because the audit firm with the best audit support systems and Big data analytics capabilities will create the most value to their clients, providing more and better insights by increasingly matching different sorts of data. Consequently, this provides a great opportunity to develop a competitive advantage against peers.

Furthermore, what is meant by different sorts of data is that increasingly sophisticated audit support systems with Data analytics capabilities provide the opportunity to not only process structured and financial data, but unstructured and non-financial data as well. *Interviewee D3* explains that digital tools that can read texts such as annual reports and CEO letters are being implemented progressively. These systems can scan texts for inconsistencies or find where the words or speech

is changing to anticipate worse times or a potential bankruptcy for the organisation for example. This means that the systems can read between the lines to anticipate circumstances going forward. The system can also structure the data to prepare it for the following analysis through Data analytics, which can provide further insights. For example, *interviewee D3* argues that in light of the Coronavirus many companies will have going concern problems which have to be evaluated by the auditors. By reading text that is written by a client and combine it with external data, it will be possible to create a picture of the situation in different areas or markets for the client, and how severe the situation is in different countries. *Interviewee D4* also mentions that external data is being incorporated to an increasing extent to potentially provide new insights. All of this is in accordance with Earley (2015) and his finding that both external and non-financial data can be incorporated into Data analytics tools, potentially resulting in new information about how to handle problems that can be provided to clients. This also provides the opportunity to establish new insights and a competitive edge against peers, again confirming one of Alles and Gray's (2015) main rationales for engaging in Big data and Data analytics. Furthermore, most of the *interviewees* mention that an audit is very financially oriented today, but going forward it will incorporate more qualitative and non-financial aspects as well. For example, if an organisation has a bad culture or bad or greedy management, the market and investors want to know this. As such, interviewee D3 believes that the audit will be widened going forward as mentioned above, something that will be possible by integrating more Data analytics into audit support systems. Finally, relating all this to FAR (2015) and the "three parts of knowledge", this should arguably imply that all parts of knowledge can be achieved to an increasing extent since the system can read between the lines to anticipate circumstances going forward as *interviewee D3* mentions, consequently providing insights and facts about "what we don't know we don't know".

4.2.4 Reduced Information Asymmetries and the Auditor's Enhanced Role as a Monitoring Mechanism

Moreover, a common perception among the *interviewees* is that information asymmetries will be reduced between firm management and other stakeholders such as investors. *Interviewee D1* means that more and better information can be extracted from the financial statements, which provides deeper insights and consequently enhances audit quality and reduces information asymmetries. According to *interviewee D4*, information asymmetries will also be reduced due to the increasing amount of non-financial and qualitative information that is provided today. As already mentioned, this kind of data can be analysed to a higher degree nowadays than before as well due to more sophisticated audit support systems where Data analytics are used to provide insights from Big data. According to *interviewee P5*, this also strengthens the auditor's role as a monitoring mechanism since more information can be communicated to the client's stakeholders, consequently reducing

information asymmetries in agreement with Jensen and Meckling (1976). Furthermore, and as illustrated by *interviewee D1*, it is easier to identify data points or transactions that potentially could be seen as anomalies or red flags due to population testing, pinpointing exactly where further tests should be undertaken. *Interviewee P6* further implies that this shifts the auditor's role into one that mainly focuses more on monitoring, receiving and addressing risks and red flags identified by the audit support system in use as also put forth by Sutton (2010). Thus, since more time can be allocated to this, the auditor's role as a monitoring mechanism should be improved this way as well. Relating to Runesson et al. (2018) and the two sources of information asymmetries, "measurement uncertainty" and "uncertainty from a user perspective", both should be decreased. This is because audit support systems incorporating Big data and Data analytics capabilities will be used to process and secure the correctness of the sometimes complex nature of many events and transactions, as well as ensuring that no party is misled by the other by the enhancement in the auditor's role as a monitoring mechanism.

4.3 Challenges with Audit Support Systems, Big Data and Data Analytics

What is brought up in most of the interviews is that although the many opportunities that come with improved audit support systems, which can use Data analytics to process waste amount of Big data, it is vital to consider all the challenges it brings as well and to not get carried away in this digital transformation. This is also important to have appropriate processes and action plans in place to address these challenges as the firms deem necessary. Accordingly, the main challenges brought up during the interviews will be shown and discussed below under different subsections.

4.3.1 Employee Support and Knowledge

First of all, the *interviewees* illustrate the importance of having the employees support when undergoing major changes as this digital transformation brings. *Interviewee D3* says:

“The biggest challenge that comes with this digital transformation is that the profession has to move and change in a pace that the employees manage. Although the technology allows us to move faster, it is important to not become too futuristic and to gradually transform processes and ways of working”.

Moreover, some *interviewees* mention that a lot of auditors are afraid of or reluctant towards this digital transformation. *Interviewee D2* further states that a common reason why the implementation of new audit support systems or digital initiatives turns into failures is because the employees were not on board or did not support the change. This supports Heinzemann's (2017) finding that it is important to have the full support of employees before enacting revolutionary change processes

to increase the likelihood of successful implementations and avoid reluctant employees. Many *interviewees* further state that it is also important to emphasise that although a lot can be performed by audit support systems and Data analytics, there is still very much that cannot be done without people. It is hard to develop the experience, expertise and industry knowledge that only can be obtained from years of working. Relating to this, a few of the *interviewees* highlight that although the future audit might look very different from today, there will still be room for auditors in this new digital environment. To overcome the challenge of auditors' reluctance and fear of digital transformation, it becomes key to communicate this to employees and their importance according to *interviewee D4*.

According to *interviewee D3*, another challenge that has to be considered is that it is not only important to bring everyone on board and have the full support from employees in this digital transformation, but also that auditors develop the right expertise and capabilities going forward when increasingly incorporating Big data and Data analytics into audit support systems. Relating to Alles and Gray (2015), since Big data and Data analytics only is a means to an end, the value that potentially can be derived will be very dependent on the expertise of the user in terms of what data to include and integrate, and correspondingly how to interpret and analyse the data. As such, all *interviewees* explain the importance and emphasise the time and effort their respective firm puts on employee training and education to prepare and develop the required expertise for their employees, in line with Earley (2015) and his finding that audit firms need to conduct appropriate training of their auditors to cope with the increasing focus on Big data and Data analytics. For example, *interviewee D1* mentions that they offer both mandatory and voluntarily courses and educational programs for their employees to facilitate the change process and to achieve the full potential of the systems being developed and subsequently implemented.

Moreover, although the considerable amounts of resources devoted to education and training, it is still some *interviewees* believe that some employees might be overwhelmed by the digital transformation taking place. To address this challenge, it is necessary to communicate to new employees and auditors in general that it is hard or even impossible to learn everything according to *interviewee D3*. You have to focus your time and energy on one or a few audit areas where you think you can contribute the most and to develop specific expertise in these processes. Thus, the segmentation of different steps of the audit process becomes key going forward to avoid auditors being overwhelmed by the wide array and dispersed natures of the audit tasks when transforming more into a digital business model. Also, *interviewee D2* mention that they are hiring students part-time during their university studies who work with both more basic tasks still being performed at the audit firms, but also with the new digital tools being used and developed at the firm. This is a

way to prepare future potential employees (if they stay with the firm after their studies as they often do) for what to come when entering the profession after their studies, and also to facilitate the transformation process through early and gradual adaptation to new ways of working.

4.3.2 Technology Dominance

The risk of technology dominance was also brought up during the *interviewees*, where the more junior *interviewees* admit that they sometimes feel like they blindly trust the systems without always knowing exactly what it does or says. *Interviewee J8* says that the systems provide numbers and threshold levels to pertain to during the audit process, without you necessarily having to do the analysis yourselves or understand the purpose behind it. As such, *interviewee J8* indicate that it sometimes can be hard to develop professional judgement and assert a critical mind to the numbers being evaluated. Relating to this, *interviewee P6* says that:

“Especially for junior employees, it becomes easy and convenient to just execute the systems without doing the necessary analysis before, and blindly trust what it gives you”.

This is in line with Arnold (2018) and his implication of the TTD that people risk become more passive and allow the IDA to guide the decision-making process without interfering or questioning the results and suggestions being made by the system, consequently leading to technology dominance and de-skilling of auditors, which also is in agreement with Sutton (2010). *Interviewee J6* also indicate that this sometimes results in a checklist-mentality, where the focus is on ticking off assignments rather than adjusting the audit process based on client-specific needs, which is in line with the findings provided by Dowling and Leech (2007) and Arnold (2018). Although agreeing with this, *interviewee J7* also expresses that before using an audit support system, you have to make some computations by yourselves and select the most appropriate test(s) to execute and similar. As such, even though it sometimes can feel as the system takes the upper hand, you need to make your own computations, and correspondingly evaluations of the results, applying professional judgement and expertise. Thus, relating to Dowling and Leech (2007) and Dowling and Leech (2014), this kind of enabling rather than coercive features of an audit support system can enhance the understanding and awareness of the capabilities and functions of the system instead of infusing mechanic task deployment and processes with less autonomy, therefore empowering auditors and reducing the likelihood for technology dominance.

The *interviewees* with specific expertise and roles in digitalisation and transformation provide a somewhat different perspective on technology dominance and loss of vital knowledge. *Interviewee*

D1 does not think there is a high likelihood for technology dominance among auditors in this new digital environment. *Interviewee D1* says:

“It is not that you just press a button and the system constructs an audit report instantaneously, but you have to provide the system with the right values and understand the methodology and why you do it, applying professional judgement”.

Interviewee D3 has a similar perspective and refers back to the more segmented structure of the audit profession going forward. Basically, you do not have to understand everything since there for example will be data scientists and specialist present to certify that the data, insights and recommendations provided by digital tools, audit support systems and Data analytics are correct, while auditors can specialise more on the judgemental part. Before it was important to understand Excel to follow a client’s economic flows and calculations according to *interviewee D2*. However, going forward, this will not be as important since the systems being used are not Excel, but pre-built systems which identify wrongdoing by their own. This implies that it does not necessarily become more important to have great digital capabilities going forward as Alles and Gray (2015) and Earley (2015) suggest, but you are required to embrace the technology and understand what it says instead, using more analytical thinking. Also, it is very important to have a general picture and understanding of everything, how data is connected to provide and draw insights and identify red flags, consequently resulting in enhanced decision-making. As such, in agreement with Arnold (2018) and Arnold et al. (2004), the interpretation of this is that when experienced personnel and IDAs are combined, decision-making will be improved. The difference being made here is that while Arnold (2018) and Arnold et al. (2004) suggest that the auditor needs to master most aspects of the system by his- or herself, most *interviewees* mean that they can rely on a specialist in some cases as well, referring back to the more segmented nature of the audit profession previously discussed. Thus, when saying that “in order for smart decision aids to enhance decision-making, smart users are required”, smart users could mean both auditors in silo or the combination of auditor and co-worker, together being a smart user.

Furthermore, according to *interviewee D4*, a related challenge becomes how to develop professional judgement and scepticism that is necessary and vital to assess the data provided by the systems. Traditionally, this has partly been learned from performing more traditional auditing tasks today completed by audit support systems to a larger degree instead, consequently reducing the amount and ground for training. This is partly in line with Arnold (2018) and his concern that later generations of auditors will most likely not establish and possess the same kind of knowledge and expertise that only can be learned through traditional audit and accounting work, although the same

kind of severity is not expressed. However, interviewee D3 believes that the audit firms will find new ways to ensure that personnel develop the right expertise and capabilities to identify and access business risks and similar, and to develop and apply professional judgement.

4.3.3 Characteristics of Data and Data Security

Furthermore, almost all *interviewees* argue that integrity, quality and completeness of data become a challenge going forward, in agreement with Earley (2015), Krahel and William (2015), Alles and Gray (2015), BDO (2016), Cao et al. (2015) and Richins et al. (2017). *Interviewee D3* says:

“When clients have smart systems by their own that process and mine data, consequently only showing parts of the data, it is critical to be able to access the correctness of that data”.

This means that auditors need to know that the data is complete by comparing input and output data and to decide whether it shows a true and fair view of the underlying processes being evaluated, although it is less in scope. This is also critical to assure that the data has not been modified or manipulated in any way. Although the *interviewees* emphasise that there are routines and processes in place to ensure integrity, quality and completeness of data, they also highlight that the complex nature of some clients' systems and processes in place make it difficult to ensure this to 100%. This also relates to the trade-off put forth by Alles and Gray (2015) between incorporating more and sometimes messy (Big) data to provide more thorough insights, and the possibility to receive somewhat biased results in-between. Thus, it becomes key to reduce this trade-off going forward.

The *interviewees* further highlight that data security, ownership of data and the proprietary nature of some data as challenges when increasingly using Big data and Data analytics as well, in line with FAR (2016), BDO (2016), Cao et al. (2015), Earley (2015) and Richins et al. (2017). They point out this as a problem since clients do not always trust auditors with all kinds of data and that they are reluctant to provide proprietary data because they are afraid about where the data will end up. This means that data accessibility will be a main challenge going forward according to *interviewee D4* since audit support systems and Data analytics are dependent on Big data to make processes more efficient and provide the insights they are built to provide. Thus, it is important to have the right infrastructure in place to receive and store the data in such a way to reduce the likelihood of cyber risks and similar, to ensure clients of data security and consequently get access to more data. *Interviewee D3* also mentions that although access to data can be secured, clients also need to be in the same place in terms of digital systems and availability of data. It is not possible to go to a client

and ask for data for the systems to use which the client does not have. Consequently, this can become a challenge going forward when increasingly sophisticated systems are developed where clients might not be able to provide the necessary data.

4.3.4 Audit Services versus Consulting Services

Another challenge brought up in many of the *interviewees* is the delicate line that has to be upheld between consulting and auditing services when increasingly relying on audit support systems and Data analytics that provide more and better insights about a client's business, in line with Alles et al. (2005) and Alles et al. (2006). For example, *interviewee D4* mentions that questions of independence become harder, where the audit firms need to make sure that they are not a part of their clients' governance processes and internal control systems since they cannot review their own work, as mandated by Section 201 of the Sarbanes Oxley Act of 2002 and Regulation No 537/2014 of the European Parliament and European Union on "*Specific requirements regarding statutory audit of public-interest entities and repealing Commission Decision 2005/909/EC*" (Alles et al., 2005, Alles et al., 2006; European Parliament and Council, 2014). However, since the audit firms have to change and adapt to this new digital environment and potentially new services being offered, several *interviewees* further emphasise that it is vital for the auditing firms to be able to offer something more to their clients going forward to be value-creating and consequently competitive. If the audit support systems identify opportunities for improvement, *interviewee D1* argue that they should be able to recommend certain changes to the client by referring to best practice. Furthermore, the *interviewees* mean that it becomes consulting to some degree and in some respects, but at the same time the auditor's role is to ensure the quality of the financial statements, and thus they should be able to tell a client to replace several dysfunctional controls with a better one according to best practice, providing a more true and fair view of the financial statements. Also, although this is a major challenge now, and will become even more so due to the auditor's enhanced role as a monitoring mechanism and when increasingly sophisticated audit support systems are being developed in accordance with Alles et al. (2005) and Alles et al. (2006), the *interviewees* stress that this is very regulated and that the audit firms' have clear rules and internal routines to ensure independence. When discussing the most complicated cases, internal lawyers are also involved, consequently working as an internal defence mechanism against independence violations.

4.3.5 How to Cost-effectively Improve the Quality of the Audit

Furthermore, how to cost-effectively improve the quality of the audit was also discussed in some of the interviews. *Interviewee D1* mentions that although it is possible to cut costs and run a more cost-efficient audit, there are a lot of fixed costs and investments that have to be covered. *Interviewee D4* further highlight the related dilemma whether auditors should be required, or at least could be

expected, to secure a clean audit to a higher degree due to increasingly sophisticated audit support systems and the possibility to use population testing through Data analytics. This dilemma is in line with the one put forth by Alles and Gray (2015) due to the binary and not the continuous classification of an audit. Some *interviewees* believe that investors in particular might expect that auditors should be able to assure a clean audit to a higher level of confidence than before due to population testing. This is because it will be harder for an auditor to justify their failure to detect anomalies by arguing that the relevant event or transaction was not in the sample any more, in agreement with Cao et al. (2015), Earley (2015) and Alles and Gray (2015). However, it is some *interviewees* opinion that the auditor's statements and final audit opinion are unchanged. Just because you have used Big data and Data analytics you cannot say that you have tested every transaction or all data points, and the system being used can still identify a large uncertain population that needs further testing through samples. To decide whether a transaction or data point is an anomaly or not can also be circumstantial or depend on additional information being provided. This means that it is impossible to assure a clean audit to 100%, and there still is a lot of judgements and estimates that have to be done in relation to the data. This also means that it becomes a challenge for the audit profession to fulfil this expectation, or alternatively try to lower the expectations. To meet these higher expectations, more energy and man-hours have to be spent. If clients are not ready to pay for this additional workload for the auditors, it becomes hard to run a cost-efficient audit. This is in line with Krahel and William's (2015) argument that auditors will not have the time to address all errors and red flags that become apparent when conducting full population testing in the scope and time-frame of a normal audit. Thus, we are back to where we started, where auditors only can assure a clean audit in all material aspects, since this is what the clients are ready to pay for. *Interviewee P6* concludes by saying:

“Sure, our job is to provide as high-quality audits as possible, but we still need to make money. Thus, it is not reasonable to expect us to go through everything and assure the accuracy of an audit to 100%, since clients are not ready to pay for that level of comfort”.

Relating to Earley (2015), this would mean that the expectation gap between what auditors can assure and what investors expect auditors to assure and unravel in terms of inaccuracies and fraudulent behaviour might very well increase.

4.3.6 Less Time Spent with Clients and Increased Competition

Moreover, a few *interviewees* mention that less time spent with clients is something that is being discussed and considered as a challenge at their respective firm since it becomes more difficult to establish a good relationship between auditor and client. They further state that there has been a

large decline in the amount of time spent interacting with clients due to increasingly sophisticated audit support systems and Data analytics since most of the data and correspondence can be shared and performed online through cloud computing among other things. This means that work-files, documents and similar can be shared through the system, in accordance with Dowling and Leech (2014). However, according to *interviewee D1*, this reduction in time spent with clients is compensated by all the opportunities provided by Big data and Data analytics, such as the possibility to ask more demanding questions to the client based on better insights and more time freed up.

Furthermore, the audit profession has always been a competitive industry according to the *interviewees*, where a competitive edge against peers is sought after continuously to sign more client contracts. They further state that the competitive nature of the profession is increasing even more in light of this digital transformation due to the underlying potential Big data and Data analytics provide. This can be referred back to *interviewee D2* who means that the continuous development and implementation of more sophisticated audit support systems with Big data and Data analytics capabilities into audit processes will be the most important factor deciding which firm among the Big Four that will have the largest market share going forward. Consequently, this can be considered both as an opportunity and a challenge. Either way, it works as a driving force to be at the forefront of this digital transformation to develop a competitive advantage, or at least to not get behind and lose a competitive edge against peers.

Most *interviewees* further state that the increased competition in the industry is between the Big Four auditing firms and cannot be attributed to competition from start-ups or smaller firms, in contrast to Richins et al. (2017) and Alles et al. (2006) and their statement that audit firms will face increased competition from start-ups and firms outside the audit profession going forward. According to *interviewee D1*, the reason behind this is that smaller actors can compete with smaller audits fees, but they do not have the capacity or infrastructure in place to handle larger organisations, who also want to have a Big Four auditor for legitimacy reasons. As such, there are large entry barriers in favour for the Big Four auditing firms, in agreement with Alles et al. (2006). This means that Big data and Data analytics become a differentiation factor among the Big Four, which can be used as a competitive advantage for the one(s) with the best analytical tools creating the most value for current and potential clients. However, although start-ups will not pose a threat against the Big Four auditing firms (at least based on the interview answers), Big data analytics might affect and change the design and course of action in several of the tasks and methods employed in the audit process as illustrated under “How the Different Steps of the Audit Process have Changed” in agreement with Richins et al. (2017), some due to innovations provided by start-ups. This is

substantiated by several of the *interviewees* who mention that they partner up or cooperate with start-ups and other firms to improve and develop new services to enhance the audit process, in line with Meuldijk (2017) and his statement that another solution or complement to cope with the increasingly demanding digital environment is to team up with or acquire start-ups.

5. Discussion

This section provides a summary and discussion of the main findings and points of analysis in relation to the purpose and research questions of the thesis. The section presents and discusses the main trends, and correspondingly opportunities and challenges with audit support systems, Big data and Data analytics, which aims to provide the reader with a comprehensive overview of how this might affect the changing nature of the audit profession, in a somewhat shorter and generalised format.

In line with the purpose of the study, the results manifest the changing nature of the audit profession, from the perspective of practitioners and representatives from the Big Four auditing firms. The results also provide a comprehensive overview of the main opportunities and challenges when integrating more Big data and Data analytics capabilities into audit support systems identified by the interviewees, based on their own perceptions as well as their respective firm's point of view. How these opportunities, challenges and related dilemmas are approached have also been brought to light and analysed, providing insights into how the Big Four auditing firms internally view and address these dilemmas. These findings and insights have further been related and analysed in relation to prior literature. For audit support systems in general they have also been related to the TTD, whereas the findings and insights from Big data and Data analytics have been given a more exploratory nature due to the absence of theoretical underpinnings in previous research. Moreover, most findings are in line with what previously has been researched and shown. However, a few additional and complementary findings and insights have also been provided.

In order for accounting firms to avoid stagnation and stay competitive going forward, it will be essential to cope and adjust their businesses to the key trends shaping both the general business environment and the changing nature of the audit profession, as illustrated in the interviews. The reduction in standardised and traditional auditing tasks in agreement with Richins et al (2017) and FAR (2015); CA in line with FAR (2016), Sutton (2010) and Krahel and William (2015); and the inclusion of qualitative and non-financial data in accordance with Earley (2015), can all be considered acting as such key trends shaping the future audit. In addition, although not explicitly stated in previous research, the anticipation of relaxed audit requirements and the more segmented nature of the profession going forward are also considered as key movements within the profession according to some of the interviewees. The increasing segmentation of different tasks and roles

within the auditing firms seems like an obvious response to the reduction in standardised and traditional auditing tasks. With the inclusion of more Big data and Data analytics, a wide array of possibilities and paths to create new value for clients opens up. It is the auditor's responsibility to take advantage and capitalise on this opportunity, not turning a blind eye to the fact that they have to change to survive. This becomes even more important in light of the possibility that the audit requirement will be relaxed in the future since the audit firms need to find new ways to create value for clients. Also, as with everything in life, you have to put time and effort and delimitate your focus if you really want to excel at something. This means that it is not reasonable that every auditor should master all aspects of increasingly sophisticated audit support systems and everything that the future audit might bring, but focus on a specific area of expertise. When other capabilities are necessary to advance or support processes you are working with, it is important to embrace yourself by people with different skillsets to produce even greater value. Thus, in contrast to Richins et al. (2017) and their argument that auditors can combat extinction and provide great value to clients and society by increasingly combining both technical and traditional auditing capabilities, this thesis provide a somewhat different perspective on the matter, where people take responsibility for different parts of the audit process and complement each other instead. As such, although it is essential to change and develop new relevant expertise in this new digital environment, it is not something that is written in black and white as some try to illustrate, but circumstantial and a trade-off depending on your specific role within the audit process.

These key trends and the changing nature of the audit profession is further demonstrated by the comprehensive list of opportunities and challenges increasingly sophisticated audit support systems with Big data and Data analytics capabilities bring as illustrated by the interviewees. In line with previous research such as Dowling and Leech (2014), Dowling and Leech (2007), Rinta-Kahila et al. (2018), Alles et al. (2006), Earley (2015) and Deloitte (2020), the main opportunities are thought to be increased efficiency, enhanced quality and more and better insights provided from the audit. Other opportunities recognised by the interviewees, and in agreement with previous research, are how audit support systems with Big data and Data analytics capabilities enable, facilitate and enhance the employment of CA (FAR, 2016; Sutton, 2010; Krahel & William, 2015) as well as the combination of different sorts of data (Earley, 2015). In addition, the interviewees perceive that information asymmetries are reduced and that the monitoring role of auditors is enhanced in light of this transformation and the accompanying opportunities. Although this is not explicitly stated or mentioned as an implication and consequence of enhanced audit support systems and similar in previous research, they indirectly do. Since the final implication of all these opportunities, both in silo and when combined, is that the auditor can make an even better job in assuring that the financial reports are free from material misstatements and provide a "true and fair" view of the

financial position and performance of the organisation under review, they all enhance audit quality in one way or another and thus reduces information asymmetries both from a measurement- and user perspective relating to Runesson et al. (2018).

Furthermore, the main challenges identified in the interviews, relating to previous research, are thought to be; how to maintain employee support (Heninzelmann, 2017) and develop the right expertise of auditors (Alles & Gray, 2015; Early, 2015); how to ensure integrity, quality, completeness and security of data (Earley, 2015; Krahel & William, 2015; Alles & Gray, 2015; BDO, 2016; Cao et al., 2015; Richins et al., 2017; FAR, 2016); increased competition (Richins et al., 2017; Alles et al., 2006), and how to avoid technology dominance and loss of vital knowledge (Arnold, 2018; Sutton, 2010; Dowling & Leech, 2007; Dowling & Leech, 2014). Also, how to approach the separation of audit services versus consulting services (Alles et al., 2005; Alles et al., 2006); how to cost-effectively improve the quality of the audits and the accompanying problem of an increased expectation gap (Cao et al., 2015; Earley, 2015; Alles & Gray, 2015); and less time spent with clients (Dowling & Leech, 2014) are considered as challenges going forward. One of the more surprising findings was the difference in attitudes towards technology dominance and loss of vital knowledge when contrasting junior employees with more experienced personnel with a better understanding of the systems and technology in place. Also, it does not seem as big a problem as previous research discussing the matter in relation to the TTD tries to illustrate. Thus, it appears to be that people evaluating audit support systems with Big data and Data analytics capabilities from an outside-perspective, or without really knowing how they work per se, create a picture that it is something very abstract and exotic that requires a lot of effort and education to understand. This might be due to the inherent reluctance to change that most people possess. What some of the interviewees try to illustrate is that as long as there are adequate processes and infrastructure in place to ensure the correctness and adequacy of the data provided by the systems, auditors do not have to understand every aspect of how they work to risk face the consequences of technology dominance. Also, when smart systems are combined with a team of smart users, the findings illustrate how decision-making might be enhanced. Thus, while it seems that previous research tends to put more weight on the challenges of technology dominance and loss of vital knowledge when relating their findings to the TTD, this thesis provides a more optimistic picture in the sense that the opportunity of enhanced decision-making is allocated an equal weight and that the challenges might not be as problematic as some believe.

This is further related to the discussion of the more segmented nature of the profession going forward, where data specialists will ensure the quality and accuracy of these processes for example. Also, it might very well be the case that auditors might develop inferior skills and capabilities in certain instances from a traditional viewpoint or way of thinking. However, this digital

transformation creates a future audit which might look very different from what it is today or from what it has been, where many traditional auditing activities will disappear or be performed by increasingly sophisticated audit support systems. As such, to evaluate competences and capabilities from a traditional perspective might not be the best approach, since new processes and ways of working requiring a somewhat different set of capabilities of auditors will most likely be called for. This can further be related to Sutton (2010) and his statement that the responsibility of the auditor transforms into one that mainly focuses on receiving and addressing red flags highlighted by the system, which means that the auditor can spend more time answering the more difficult questions and allocate more time to value-creating activities. To conclude, as long as there are education and employee training programs in place to guarantee the development of the necessary capabilities to handle the future audit, the presence or extent of technology dominance should be reduced or more or less removed.

Moreover, the interviewees perceive that this digital transformation increases competition within the industry, although not originating from start-ups or organisations outside the audit profession as suggested by Richins et al. (2017), due to the Big Fours' dominant market positions. Instead, the increased competition is among the Big Four auditing firms. This increased competition can be considered as the key variable explaining the importance to cope with the changing nature of the profession and to address the many opportunities and challenges it brings to stay competitive. This can further be illustrated by relating to the two main driving forces behind the use of Big data and Data analytics within auditing provided by Alles and Gray (2015, p.10), which are the *"opportunity to enable innovative new business models"* and the *"potential for new insights that drive competitive advantage"* as previously shown and analysed. This also means that this change process can be considered to emerge from an economic and efficiency rationality, to address and adapt to the wider societal trends in today's business environment of digital transformation and changes in IT and the competitive environment. Thus, it can be argued that many of the key trends and opportunities with increasingly sophisticated audit support systems with Big data and Data analytics capabilities identified act as motivators for change to develop competitive advantages against peers and to develop new, or refine current, business models. Also, to address the challenges identified, some more than the others, will be essential for the audit firms to cope with the changing nature of the profession. Examples could be; establishing an empowered working environment where all employees are on board and support the change process taking place; develop appropriate expertise and capabilities to handle the change process and what comes after; implement several lines of defence to uphold the separation between auditing and consulting services to secure independence; and to implement the necessary and appropriate infrastructure in order for new systems and processes to work as effectively as possible, where storing, processing and security of increasingly large sets of data becomes key.

6. Concluding Remarks

This section aims to conclude the thesis and provide implications for practitioners, theorists and future research. The section begins with a conclusion of the thesis, derived from the above discussion, followed by how the thesis contributes to research both practically and theoretically, limitations of the study, and concludes by setting an agenda for future research possibilities.

6.1 Conclusion

The audit profession is in the process of adapting to the changing nature of today's business environment. For audit firms it primarily concerns the use of audit support systems and the increasing incorporation of Big data and Data analytics capabilities into these systems, creating new trends within the profession which become key to adapt and adhere to. These trends are considered to be a reduction in standardised and traditional auditing tasks, CA, the inclusion of qualitative and non-financial data, anticipation of relaxed audit requirements and the more segmented nature of the profession going forward.

To prosper in this new digital environment, it also becomes vital for the audit firms to be at the forefront and address the many opportunities and challenges these trends and digital transformation bring, to develop their business models and create competitive advantages to offer new and added value to clients. The main opportunities identified are how different aspects of audit support systems, Big data and Data analytics can increase efficiency, enhance quality and provide more and better insights from the audit, and how this reduces information asymmetries by enhancing the auditor's role as a monitoring mechanism. The main challenges identified are how to maintain employee support and develop the right expertise of auditors, how to ensure integrity, quality, completeness and security of data, increased competition within the industry and how to avoid technology dominance and loss of vital knowledge. Also, how to approach the separation of audit services versus consulting services, how to cost-effectively improve the quality of the audits and the accompanying problem of an increased expectation gap, and less time spent with clients are considered as challenges going forward. To address some of these challenges, it becomes important to establish empowered working environments focusing on developing the right competence and expertise, as well as implementing the required infrastructure to cope with the changing nature of the audit profession and to prepare for the future audit.

6.2 Contribution to Research

Practically, the thesis contributes by providing practitioners and professionals both within and dependent on the audit profession with a comprehensive overview of the many opportunities and

challenges increasingly sophisticated audit support systems with Big data and Data analytics capabilities generate and what implications this has for the profession going forward. The importance to cope with the wide array of opportunities to create competitive advantages and new powerful business models, as well as manage and address the challenges to not be negatively impacted of this digital transformation has also been provided.

Theoretically, the thesis contributes by adding to both the extensive academic literature illustrating opportunities and challenges with audit support systems and to the somewhat less comprehensive research area depicting Big data and Data analytics in an audit setting, from the perspective of practitioners. The thesis further contributes by introducing the more segmented nature of the audit profession and the anticipation of relaxed audit requirements going forward as important aspects to consider. Finally, the thesis also contributes theoretically by connecting the general findings of audit support systems to the TTD, and establishes the fact that the risk of technology dominance and loss of vital knowledge might not be as severe as previous literature tries to illustrate, as long as appropriate infrastructure and processes are in place.

6.3 Limitations

The purpose of using representatives from the Big Four auditing firms was because they should be representative in terms of how auditing firms in general address the kind of questions and trends discussed in this thesis. However, what was brought to light in the interviews was that smaller auditing firms might not have the resources to cope with the digital transformation currently taking place in the profession at the same pace as larger ones, still performing many traditional auditing tasks. This means that all findings provided in the thesis might not be generalisable in every aspect to smaller auditing firms, which very well could be threatened by start-ups and organisations outside the audit profession since they do not have the same reputation and infrastructure in place to fight off competition. Therefore, this might be considered as a limitation of the study. Another limitation of the thesis is the Coronavirus outbreak, which intensified just before the interviews were scheduled to start. Since most of the interviewees are partners and involved in management and decision-making processes high up in their respective firm, this was a stressful and time-consuming period for them, which consequently might have impacted the quality of the interviewees answers negatively. Lastly, although all interviewees confirmed that the illustrations and quotes used from their respective interview was correct and showed a true and fair view of what they meant, not all had time to comment and share their opinion regarding the validity, reliability and credibility of my results and analysis. As such, this can also be considered a limitation since the results and analysis can be biased by personal opinions and values, consequently impairing objectivity.

6.4 Future Research

By providing a comprehensive overview of the main opportunities and challenges with increasingly sophisticated audit support systems with Big data and Data analytics capabilities from the perspective of practitioners, the thesis presents and sets an agenda for several interesting research possibilities ahead. First of all, the finding of the increasingly segmented audit profession going forward, where auditors are expected to be responsible for more specialised aspects and parts of the audit process, can be considered one such possibility. This is also an interesting research topic in relation to technology dominance since the findings indicate that technology dominance and loss of vital knowledge from a traditional point of view might not be as severe as some researchers previously have tried to illustrate, because auditors are expected to enact and develop more specialised roles and competences. Thus, it could be interesting to research how people with different positions in audit firms and with varying degrees of previous knowledge when it comes to audit support systems, Big data and Data analytics, perceives the risk of technology dominance in relation to the TTD differently. This would provide more evidence regarding the risk and severity of technology dominance from the perspective of practitioners, and whether people with less knowledge and insight in the area are more alarmed and worried about technology dominance due to their lack of knowledge and potential reluctance to digital transformation compared to more seasoned and digitally oriented practitioners, as this study preliminary shows. If conducting such a study, it is my opinion that it becomes necessary to develop a new proxy for auditor knowledge and expertise when evaluating technology dominance, since the future audit will demand a somewhat different set of capabilities from the auditor.

Moreover, the anticipation of relaxed audit requirements is another research possibility. Firstly, it would be interesting to investigate how much substance there is to this claim, and secondly, how do audit firms response and adapt to this anticipation in terms of developing new services, business models and competitive advantages going forward to stay competitive. Furthermore, since smaller audit firms do not have the same infrastructure in place as larger ones, which act as entry barriers towards start-ups and organisations outside the audit profession, these firms should be more exposed to competitive threats. As such, a further possibility for future research is to explore how smaller audit firms are affected by the changing nature of the audit profession and how they address this change in terms of opportunities and challenges. Lastly, future research could address the changing nature of the audit profession from standard-setters and regulators point of view. Since the processes being evaluated by standards and regulatory frameworks are changing due to this digital transformation and accompanying changes such as population testing, it could be argued that these should change as well.

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Appendix

Appendix 1 – Overview of Key Papers Discussing Opportunities and Challenges with Audit Support Systems

Author/Authors	Opportunities	Challenges
Dowling and Leech, 2014	Enabling systems improve the quality of the audits due to enhanced and facilitated compliance with auditing standards and methodology	Overreliance on systems might result in technology dominance
Dowling and Leech, 2007	Audit support systems have the possibility to improve documentation, risk management, and control of junior employees, as well as a boosting efficiency	The inherent complexity of many systems can result in mechanic task deployment where the focus is on ticking off assignments and where the complexity of the system might result in auditors not embracing the system and finding ways to “work around” it instead
Dowling et al., 2008		They find that auditors relying on systems with a higher level of decision support list fewer relevant business risks. As such, the challenge becomes to combat loss in declarative knowledge
Sutton 2010	Better IT systems facilitate the collection, storing, extraction, testing and analysis of data, thus offering a coherent platform for the entire audit process. Also, the responsibility of the auditor transforms into one that	Heavier reliance on CA, audit support systems etcetera has the potential to result in technology dominance

	mainly focuses on receiving and addressing red flags highlighted by the system in use	
Rinta-Kahila et al., 2018		More extensive use of information systems makes it harder to maintain and develop employee skills and know-how, especially when systems and IDAs are used over a prolonged period, consequently resulting in de-skilling of auditors
Alles et al. 2006	Audit support systems, or more specifically CA, can result in enhanced governance, reduced compliance costs, increased efficiency by improved quality and skill level of auditors in relation to technical capabilities and access to more real-time data and reporting	Due to increased information supply and better insights provided by CA, it becomes increasingly difficult to separate auditing from consulting activities. Also, the increasing amount and size of data require robust systems and processes to manage, store and understand all the data available.
Arnold 2018	Decision-making can be enhanced if the IDA and the user are well-matched	When users increasingly rely on IDAs, they risk become more passive and allow the IDA to guide the decision-making process without interfering or questioning the results and suggestions being made by the system. Also, when increasingly relying on IDAs, a major challenge

		<p>becomes to avoid stagnation of the profession since later generations of auditors will most likely not establish and possess the same kind of knowledge and expertise that only can be learned through traditional audit and accounting work</p>
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Appendix 2 – Overview of Key Papers Discussing Opportunities and Challenges with Big Data and Data Analytics

Author/Authors	Opportunities	Challenges
Earley 2015	<p>Big data and Data analytics make it possible to test more transactions, both financial and non-financial; provide better insight and easier access to client data and processes, thus enhancing audit quality; and make it easier to uncover fraudulent transactions and behaviour</p>	<p>Due to full population testing, auditors cannot to the same degree justify their failure to detect anomalies by arguing that the relevant event or transaction was not in the sample anymore. Also, data integrity has to be considered to a larger degree, such as making quality assurances of data and how to validate non-financial data. How to ensure, maintain and develop the relevant technical expertise of auditors is another major challenge</p>
Alles and Gray 2015	<p>Data analytics can help auditors to deliver more and better insights to clients through easier risk identification and enhanced</p>	<p>Due to the binary and not continuous classification of audits in today’s regulatory frameworks, the question becomes how Big data</p>

	<p>understanding of the client’s business environment by increasingly combining different sources of data. The possibility to move from sample to population testing also has the potential to attribute the audit more confidence and credibility by preventing fraudulent behaviour to a larger degree</p>	<p>analytics cost-effectively can improve the efficiency of audits. Also, “messiness of data” which can increase when integrating more Big data can become a challenge. This means that some inaccuracies and low-quality data might be slipped into the financial statements and further used for analysis, consequently affecting audit quality. Thus, there will be a trade-off between incorporating more and sometimes messy data to provide more thorough insights, and the possibility to receive somewhat biased results in-between. Furthermore, other challenges are how to get access to sometimes proprietary client data, decide upon ownership of data and how to ensure the security of data</p>
<p>Cao et al. 2015</p>	<p>Big data analytics has the potential to enhance the identification of risks, misstatements, anomalies and potential fraud</p>	<p>As Earley (2015), due to full population testing, auditors cannot to the same degree justify their failure to detect anomalies by arguing that the relevant event or transaction was not in the sample anymore</p>

<p>FAR 2015</p>	<p>Big data allows algorithms to process large amounts of transactional data to identify patterns and relations in data sets, which can be used to develop software for fraud detection. As such, risks and shortcomings in clients internal control systems can to an increasing extent be identified by the system.</p>	
<p>Krahel and William 2015</p>	<p>Big data and Data analytics have the potential to increase transparency through better use and transmission of data, consequently reducing some estimation uncertainty from the financial statements.</p>	<p>Audit standards have to be developed in accordance with the increased standardization and availability of data due to Big data and Data analytics. Also, due to more real-time data and continuous assurance and auditing, the focus has to change from a broader assurance of the financial statements on a yearly or quarterly basis, to a more continuous one at a more focused data-level</p>
<p>Richins et al. 2017</p>	<p>Auditors that embrace Big data and Data analytics are in the position to combine their existing knowledge and professional expertise with this new technical and analytical one to combat increased competition and potentially provide even more value to clients</p>	<p>A major challenge due to the increasing deployment of Big data and Data analytics is to handle the increased competition from start-ups and firms outside the audit profession that offer services similar to the ones provided by traditional audit firms</p>

Appendix 3 – Interview Guide

- To make sure we discuss the same thing, what is digital transformation, audit support systems, Big data and Data analytics for you?
- How important is it for your firm to cope with the increasing speed of digital transformation in today's business climate?
- How do your firm work with audit support systems, Big data and Data analytics today?
- During the years you have worked in the auditing profession, how have the different steps of the audit process changed? (risk assessment, control testing, substantive testing, audit opinion etcetera)
- Why Big data and Data analytics?
- How do you think it will affect the “future audit”?
- What do you think is important to address and consider before/during/after implementation of Big data and Data analytics into audit support systems and audit processes?
- What kind of precautions and preventive measures does your firm take when increasingly implementing and correspondingly relying on audit support systems, Big data and Data analytics?
- Do you think there is a possibility that auditors become too dependent on the digital systems used?
- What new expertise and capabilities are required by auditors going forward to embrace this digital transformation and keep creating value for clients?

- When increasingly relying on Big data and Data analytics, how can you ensure integrity, quality and completeness of data?
- What implications might this have for audit quality?
- Based on today's regulatory framework, how can Big data and Data analytics cost-efficiently enhance the quality of audits?
- How does the communication to stakeholders such as investors change?
- How does it affect the auditor's role as a monitoring mechanism?