Lund University
School of Economics and Management
Faculty of Business Administration
BUSN79
Business Administration: Degree Project in Accounting and Finance
Spring 2019

Big Data Analytics and Auditing

Implementation and knowledge

Authors:
Emelie Bengtsson
Mikael Zago

Supervisor:
Amanda Sonnerfeldt
Examiner:
Reda M. Moursli

Abstract

Title: Big Data Analytics and Auditing - Implementation and knowledge.

Course: BUSN79 Business Administration: Degree Project in Accounting and Finance, Postgraduate level, 15 University Credits Points (ECTS)

Seminar date: 2019-06-03

Authors: Emelie Bengtsson and Mikael Zago

Supervisor: Amanda Sonnerfeldt

Keywords: Big Data Analytics, Big Data, Auditing, Audit knowledge, Knowledge sharing

Purpose: The purpose of the thesis is to increase the understanding of phenomena surrounding the implementation of Big Data Analytics into the audit methodology, within the context of medium and large-sized audit firms, and how auditing knowledge and its dissemination affects the implementation process.

Theoretical perspectives: An analytical model based on previous research regarding Big Data Analytics and Auditing, The Audit Profession, Legitimacy Theory in the context of the implementation of new technology, Audit Knowledge and Knowledge sharing.

Methodology: An iterative qualitative thesis, where a literature review was conducted to scope the field, find areas of interest and gaps to cover. Lacking research covering Big Data Analytics in the context of auditing was discovered and an area of interest decided. Semi-structured interviews were conducted to capture and analyse practitioners perceived notions regarding the implementation of Big Data Analytics into the audit methodology.

Empirical foundation: 11 interviews were conducted with 13 people within the audit profession, with roles including senior analytics, certified auditors, and associates, see Appendix 3 for full disclosure.

Conclusions: The implementation of Big Data Analytics into the audit methodology is perceived to enable improvements in the form of increased audit quality and efficiency, albeit these opportunities are dependent on the profession's ability to handle the inherent risks and issues associated, where this thesis has identified perceived risks including expanded expectation gap, deprofessionalisation, and two knowledge gaps.

Acknowledgements

Firstly, we would like to thank our supervisor, Amanda Sonnerfeldt, for valuable feedback and support during the process of writing the thesis. Secondly, we would like to thank all of our respondents for taking the time to participate in our study. Thanks to your in-depth answers, we have been able to conduct the thesis. Your answers made us discover the importance of knowledge, which has been a huge contribution to the current research within the field of auditing. Thirdly, we'd like to thank fellow students for discussions and feedback during the writing process.

Lund 2019-05-28

…… ……

Emelie Bengtsson *Mikael Zago*

1. Introduction **1**
1.1 Background 1
1.2 Problematization 3
1.3 Research Purpose 5
1.4 Research Questions 5
1.5 Delimitations 5

2. Methodology **6**
2.1 Theoretical Methodology 6
2.1.1 Research Approach 6
2.1.2 Choice of Methodology 7
2.1.3 Choice of Analytical Model 8
2.2 Empirical Methodology 9
2.2.1 Research Strategy and Design 10
2.2.2 Semi-structured Interviews 10
2.2.3 Selection of Interviewees 11
2.2.4 Construction of Interview Questions 12
2.2.5 Data Analysis 13
2.2.6 Data Presentation 14
2.2.7 Quality of the Chosen Research Methodology 14
2.2.8 Ethical considerations 15
2.3 Method criticism 16

3. Literature Review and Theoretical Framing **18**
3.1 Big Data and Auditing 18
3.2 The Audit Profession 20
3.3 Legitimacy Theory 21
3.4 Audit Profession and Legitimacy 23
3.5 Audit Knowledge 26
3.6 Knowledge Sharing 27

4. Empirical Findings and Analysis **32**
4.1 Implementation of Big Data Analytics 32
4.1.1 Current implementation of Big Data Analytics 32
Interviews with Certified Auditors and Analytics Specialists 32
Interviews with Associates 37
General Analysis of BDA Implementation 40
4.1.2 Possibilities 42
Interviews with Certified Auditors and Analytics Specialists 42

Interviews with Associates 45
General Analysis of Possibilities 48
4.1.3 Risks and Issues 49
Interviews with Certified Auditors and Analytics Specialists 49
Interviews with Associates 53
General Analysis of Risks and Issues 56
4.2 Knowledge 57
4.2.1 Audit and Technical Knowledge 57
4.2.2 Knowledge Sharing 61

5. Discussion 69

6. Concluding Remarks 73
6.1 Conclusion 73
6.2 Contribution to Research 73
6.3 Limitations 74
6.4 Suggestion for Future Research 74

References 76

Appendix 81
Appendix 1 - Overview of the Literature 81
Appendix 2 - External Communication Regarding Big Data Analysis 83
Appendix 3 - Table of Interviewees 86
Appendix 4 - Main Interview Questions 87

1. Introduction

In the initial chapter, the background provides the reader with an introduction to Big Data Analytics (BDA), providing a picture of how tools such as BDA influence the audit methodology. Furthermore, areas of interest regarding gaps in previous research are concluded. Stemming from this, the purpose and research questions of the thesis is formulated. Lastly, the delimitations of the study are presented.

1.1 Background

Almost as long as there have been business corporations, audit in some form has existed, with evidence dating back as far as the 13th century. In early corporations, the audit was conducted by internal or external stakeholders but gradually evolved until the independent external auditor emerged fully with the first English companies act, 1844 (Watts & Zimmerman, 1983), and has continued to evolve since. A modern audit consists of several stages of; planning, risk assessment, audit of internal controls, substantive procedures, and processing of information and communication (Deloitte, 2019a), where the auditor needs to make judgement calls relying on professional knowledge (Power, 2003). Technological change has always been a driving factor for change in audit methodology, as auditees strive to ensure higher quality of their reports, as of late with the introduction of IT audits (Stoel, Havelka & Merhout, 2012), data analytics, digitalization and robotics. The continuous change regarding the traditional role of auditors and are nowadays forcing auditors to broaden their knowledge and increase their knowledge of technology (EY, 2018). A study shows that close to half of the participating auditors and accounting consultants used online tools to administer their work and considered the integration of software to be a focus area for developments (Glantz, 2016b). One major contributor to the advancements within digitalization and automatisation is, according to their study, technical advancements combined with a demand for a move towards real-time information. The study also shows that companies are twice as happy with firms that embrace and offer digital services, due to the accompanying efficiency and speediness being valued highly by clients. Two-thirds of the firms part of the study state that the integration of software is an area where improvements can be sought. Another

technological advancement is the continuous development of data analytics to handle the vast amounts of data available and to enable more complex analysis of it (Glantz, 2016a).

As of today, Big Data is growing in importance and this is particularly prominent when looking at the attention given to Big Data both in business media as well as by the investor community (Alles, 2015). Various definitions have been given in relation to BDA. In auditing, BDA is commonly defined as:

> the science and art of discovering and analyzing patterns, identifying anomalies, and extracting other useful information in data underlying or related to the subject matter of an audit through analysis, modeling, and visualization for the purpose of planning or performing the audit. (AICPA, 2014, p. 5, cited in Salijeni, 2019)

Big Data consist of different kinds of data such as emails, social media, news media, and phone calls, and is a relatively new topic, evolving from the technological advancement where everything can be recorded, measured and turned into data (Zhang, Yang & Appelbaum, 2015; Cao, Chychyla & Stewart, 2015). The main part of research within the field has been published after 2011 (Buhl, Röglinger, Moser, & Heidemann, 2013). Big Data's main attributes are volume, velocity, variety (Cao et al., 2015), while some argue that veracity also should be included (Zhang et al., 2015). Connected to this, Big Data Analytics (BDA) is the notion of looking at Big Data and transforming the huge amount of data into manageable information that can be used to discover bits of information otherwise missed and identifying different patterns within the data in order to be able to form conclusions and support decision making (Cao et al., 2015).

When looking at documents published by the large audit firms, it is evident that automatization and digitalization is a growing trend within the audit profession (see Appendix 2). A common topic discussed in the documents is the notion of Big Data as well as for analytics and the firms have created their own tools for BDA (Salijeni, 2019). The new tools are said to positively affect audits, by increasing audit quality, help identify risks, and increase flexibility (Deloitte, 2018; EY, 2018; Grant Thornton, 2018; KPMG, 2018, PwC, 2018). In the light of these new tools, one can question what effect BDA has on auditing.

1.2 Problematization

With Big Data, auditors now have the possibility to access complete datasets and with this new additional data capability, traditional auditing is changing to move beyond merely looking at small samples of the data (Alles & Gray, 2018). BDA is not only changing how much data is accessible in the audit but it's changing the traditional picture of audit evidence since research has shown that Big Data could be used to complement traditional audit evidence and increase the reliability of the audit when traditional evidence is insufficient (Yoon et al., 2015). Previous research has identified different benefits and issues in regards to the implementation of BDA in the audit process. Benefits that could arise while implementing BDA, and something that is highlighted is the increased possibility for auditors to identify material misstatements with the use of BDA (Cao et al., 2015; Alles & Gray, 2018). Issues in relation to BDA implementation were identified as privacy issues along with higher pressure on auditors to find material misstatements (Alles & Gray, 2018; Cao et al., 2015).

As previously mentioned, positive and negative aspects with BDA implementation in the audit methodology has been identified in previous research, but even though this is the case research has failed to provide knowledge related to how BDA shapes the delivery and outcome of the audit (Salijeni, Samsonova-Taddei & Turley, 2019). Furthermore, the question of whether BDA is more suitable than a traditional audit when it comes to collecting audit evidence is also unclear (Richins et al., 2017). Moreover, the main part of previous research within the field tend to stick to theoretical pros and cons by looking either at previous research or business media, but fail to provide a deeper understanding of what practitioners within the field perceive as the effects of BDA within auditing (Cao et al., 2015; Alles & Gray, 2018; Yoon et al., 2015; Appendix 1). By looking at practitioners thoughts about the possibilities and risks with implementing BDA in the audit methodology, this thesis theoretical contribution to existing research is to provide more insight on the topic and will touch upon the topic of how BDA is perceived to actually shapes the delivery and outcome of the audit. When highlighting the perceptions of practitioners active in the audit field, the thesis could also offer a practical contribution by shedding more light on interlinked aspects,

such as whether or not BDA could be more suitable in relation to traditional audit evidence under certain circumstances. Since regulation is currently rather non-existent when it comes to how BDA should be used in auditing (Salijeni et al., 2019), the thesis will contribute to the knowledge from practitioners within the field by providing information about the perceived possibilities and risks with using BDA in auditing. Furthermore, the thesis will also provide professional bodies with more research and hence more knowledge which in turn could be of help when it comes to future regulatory practice.

Furthermore, previous research highlights the need for further research within the field of BDA in auditing (Salijeni et al., 2019; Alles & Gray, 2018). As of today, the research field of BDA within auditing is still rather unexplored and researchers have come up with several research questions that would need to be addressed by future research. A common topic seems to be what effect BDA could have on auditing; are audits becoming better, does it affect the audit quality, and in what way does it improve efficiency and effectiveness of financial statement audits, are some of the research questions proposed (Salijeni et al., 2019; Alles & Gray, 2018). By studying the benefits, disadvantages, and risks perceived with using BDA in auditing, the thesis will contribute theoretically by adding on to the scarce amount of research available within the field and in particular, the thesis will shed light on topics which have been depicted as important by other researchers. The thesis will be able to help fill an identified gap existing in current research.

Previous research has found several benefits of using BDA within auditing (Cao et al., 2015; Alles & Gray, 2018; Yoon et al., 2015). However, research has also pointed out that BDA is scarcely used within auditing today (Cao et al., 2015), and the audit firms typically do not use the term Big Data within published documents, such as e.g. transparency reports (see Appendix 2). This could hence indicate on something possibly restraining the implementation of BDA within auditing. Furthermore, Alles and Gray (2018) emphasize that the same thing has happened in the past, where the major audit firms make major investments in new technologies, but in the end, these technologies do not become a regular part of the audit methodology. A crucial observation is that an organisations' knowledge management is essential for handling technological development and can be seen as a prospective source of sustainable competitive advantage (Lippmann & Rumelt, 1982, Dierick & Cool, 1989;

Winter, 1995; Croasdell, 2001, cited in Lauer & Mohan, 2001). Knowledge in the audit profession constitutes codified rules and regulation regarding best practice and is shared through both formal and informal methods but the potential benefits of new knowledge and technology only materialize once the new technology is publicly accepted (Power, 1996). Furthermore, there are different factors affecting to what extent knowledge sharing is used, and the main factor affecting how knowledge is shared, created, and used is the organisation's culture, which could either promote or hinder knowledge sharing (Ipe, 2003). To understand the effect of BDA implementation on the audit methodology, it is essential to look further into the benefits, disadvantages, and risks with BDA, as well as knowledge and knowledge sharing, which leads to the purpose of this thesis.

1.3 Research Purpose

The purpose of the thesis is to increase the understanding of the implementation of BDA into the audit methodology, within the context of medium and large-sized audit firms, and how auditing knowledge and its dissemination affects the implementation process. To be able to answer the purpose, two research questions were constructed.

1.4 Research Questions

- How is the implementation of Big Data Analytics in the audit methodology perceived by practitioners, in regard to possibilities, risks, and issues?
- What role does knowledge and knowledge sharing play in the implementation of Big Data Analytics in the audit methodology?

1.5 Delimitations

To make the thesis feasible, some delimitations exist. Firstly, the thesis focuses only on the Swedish context, and the findings could hence be different if not constrained to the Swedish context. However, because of the qualitative nature of this study, the aim is to look at individuals perceptions. Secondly, knowledge was chosen as a factor which could affect the implementation of BDA as a result of the findings of the interviews, along with research indicating the importance of knowledge in relation to new technologies. Although other factors might also influence the implementation of BDA, these are not covered in the thesis.

2. Methodology

The second chapter describes the methodological considerations made throughout the thesis and aims to guide the reader and increase transparency. The chapter is divided into 3 parts. Firstly, the theoretical methodology, where arguments for the chosen research approach, choice of method, and an analytical model is presented. Secondly, the empirical methodology, where a more detailed picture of how the study is conducted is presented, by describing the choice of interviewees, and how the interviews were conducted. Lastly, the methodological choices made are discussed critically.

2.1 Theoretical Methodology

This section will begin by describing the choice of research approach, the thesis uses an iterative approach, later the arguments for why a qualitative method is chosen is presented, and the section ends with arguments for the chosen analytical model.

2.1.1 Research Approach

For qualitative methods, an inductive approach is most commonly used as the researcher first collects the empirical data and afterwards seek to analyse the data through the use of different theoretical frameworks (Bryman & Bell, 2015). However, in this case, a purely inductive approach was not used but rather a combination of a collaboration of deductive and inductive approaches. When looking at which theoretical framework was best suitable for the thesis, the process was iterative, meaning that the data collected was constantly checked against the chosen theories in order to ensure that the theory could be applied on the collected data. Since the thesis builds on a qualitative method, it is not beforehand entirely possible to know in which direction the interviews will go. Hence, you can not anticipate the result. Therefore, by using an iterative approach, this study was able to conduct the interviews as freely as possible, letting the respondent lead the way. The initial set of theories was as a result revised as interesting points were highlighted in the interviews, which had not been thought of beforehand.

2.1.2 Choice of Methodology

The purpose of the thesis is to increase the understanding of the implementation of BDA into the audit methodology, within the context of medium and large-sized audit firms, and how auditing knowledge and its dissemination affects the implementation process. To be able to fulfil the purpose of the thesis, it is necessary to gain an in-depth understanding of practitioners own perceptions. As the thesis seeks to provide a deeper understanding of BDA within auditing, the most appropriate method is a qualitative interview method (Bryman & Bell, 2015).

In an attempt to nurture deeper knowledge and experience sharing of the interviewees, a semi-structured interview was chosen. With a semi-structured interview, a set number of interview questions are present but flexibility is achieved by allowing the sequence and wording of questions to be adapted to each interview instance and follow up questions asked for further clarification or on relevant new interesting bits of information that present themselves during interview instances. The focus lies with the interviewee's point of view rather than the researchers' concerns. To facilitate a more detailed narrative in the interviews, interview guides were sent out to the interviewees prior to the interviews. Choice of respondents for the thesis was handled by sending out interview requests to six medium and large-sized auditing firms in Sweden and asking the companies to present three representatives. The representatives sought had different roles; one certified auditor, one with technical know-how regarding BDA, and one audit assistant at the beginning of their audit career. This was done in order to generate insight from different points of view in order to corroborate underlying characteristics both at the individual and at the firm level. In order to strengthen empirical findings, respondents were offered to validate their contribution. This is done to ensure a good correspondence between the findings of this thesis, and the experience and perspectives of the respondents.

Since the thesis utilizes a qualitative method, the results are subjective to chosen respondents and cannot be generalised. The method consists of systematically gathering qualitative data that is compiled and analyzed with the help of the chosen analytical model. Qualitative studies consist of studying chosen subjects, either as an individual or as groups, to discover

their stance on a social phenomenon (Bryman & Bell, 2015). The aim is a deeper understanding of what motivates parties decisions and actions from the subjects on a subjective perspective. The openness and flexibility inherent to qualitative studies will suit this thesis well since the aim is to examine and describe the opinion and perception of the subjects.

The research field is still relatively unexplored and lacks knowledge whereas a qualitative study might be most appropriate in the early stage. Furthermore, proposed future research questions presented in previous research such as the impact of BDA on the delivery and outcome of the audit, and which characteristics of BDA that has the greatest potential to improve the efficiency and effectiveness of audits (Salijeni et al., 2019; Alles & Gray, 2018) imply the need to gather more in-depth knowledge about the research field. Hence, it can be seen as they suggest that there currently is a need for qualitative studies to be carried out.

2.1.3 Choice of Analytical Model

In pursuit of the most suitable analytical framework, an iterative method was used to choose theories that were a good match to the results found through the literature review and semi-structured interviews. Starting out, legitimacy theory (Suchman, 1995) was chosen as a theoretical framework. Additionally, it was evident to discuss the audit profession to be able to discuss legitimacy. Later, when conducting the interviews, the findings indicated that there was an apparent knowledge gap between different levels within organisations. In the light of these findings, a theoretical aspect related to knowledge sharing and knowledge transfer was added into the analytical framework.

The audit profession as a self-regulated system is pervaded with opinions regarding what the profession could and should be (Power, 2003). The role of the auditor is not set but fluid and idioms are used in order to put words to actions in an attempt to show a legitimate presentation of problems and solutions of the profession. Image management is a regular fixture for both regulatory and professional bodies in the profession, and some studies indicate legitimacy to be more important for the profession than the truth of efficiency (Power, 2003; Holm & Zaman, 2012). The importance of legitimacy can be rooted in the lack

of solid evidence of the efficiency and effectiveness of the work performed by the profession and an ever-present expectation gap (Power, 2003). The theory of legitimacy stems all the way back with the Greeks, where Aristotle was concerned regarding the government (Zelditch, 2001), and with the ever-changing audit profession, where even change itself is becoming something legitimate (Watts & Zimmerman, 1983), one can argue that the theory is as relevant today as it was back then. And as this study aims to increase knowledge surrounding the implementation of BDA within auditing, in the context of the medium and large-sized audit firms, this new change will require moves to convey continued credibility and legitimacy.

After conducting a few of the interviews, it was clear that one of the major findings was knowledge within the firm, and especially the notion of knowledge sharing. Since this thesis is iterative, the analytical framework had to be revised to account for the findings related to knowledge. The aim when searching for research articles was to gather a broad picture on the topic, and preferably collect information about professional service firms and knowledge sharing, since a professional service firm typically differs from other types of organisations. The search for research articles was conducted in Lund University's database LUBsearch and Google Scholar, using keywords such as *audit, auditing, professional service firms, knowledge sharing, knowledge transfer, knowledge typology*. Furthermore, the articles searched for should be peer-reviewed to ensure high credibility. To provide a broad picture of the subject of knowledge, it was decided to not only focus on articles related to professional service firms but also to include an article reflecting the research field of knowledge sharing in general.

2.2 Empirical Methodology

This section will describe how the interviews were planned to be conducted, how the interview questions were derived, and what has been done to promote candid responses and minimize the effects of bias. Further, how compiling of the empirical data derived from the interview was conducted and prepared for analysis.

2.2.1 Research Strategy and Design

Stemming from the purpose of this study, the research strategy chosen is a qualitative method to be able to explore the opinions and perceptions of practitioners within the audit field. The main findings of this thesis stem from the data collected from interviews but are complemented by using secondary data such as external documents posted by the audit firms. The chosen research design is to examine the implementation of new technology, i.e. Big Data Analytics, in the context of auditing with a focus on how the environment affects the profession (Llewelyn, 2003). A schema is constructed using legitimacy theory and a literature review covering BDA in auditing, the introduction of new technology in the audit methodology and how knowledge is identified and disseminated within the audit profession. This type of research design is prevalent in the accounting area and covers the relationships of professionals working in organisations of the setting of human activity. One theory showcased in this perspective is legitimacy theory, which deals with organisations dependence of their environment (Llewelyn, 2003).

2.2.2 Semi-structured Interviews

A common method in qualitative research is interviews, mainly due to its flexibility (Bryman & Bell, 2015), although, it is also a way for the researcher to look more in-depth on individuals thoughts, ideas, and experiences (Denscombe, 2016). Interviews emphasize the way in which the interviewee understands and interprets different issues and is a tool to gain an understanding of a topic. Since the purpose of this thesis is to increase the understanding of the implementation of BDA into the audit methodology and how auditing knowledge and its dissemination affects the implementation process and the thesis uses a qualitative method, interviews will help answer the research questions and purpose to gain a deeper understanding of the practitioner's own thoughts. Interviews can be split up into two categories, unstructured and semi-structured, where unstructured could be seen as a conversation without any clear frames and semi-structured is more structured and includes a topic intended to be discussed as well as interview questions constructed in advance (Bryman & Bell, 2015).

Through interviews with the major auditing firms, we hope to summarize which areas of the audit process where BDA is present and to what extent it is used. Further, we hope to entail the possibilities, risks, and issues perceived by the interviewees in regards to BDA in auditing. As the thesis aims to explore the practitioner's own opinions and perceptions, a semi-structured interview method was seen to be the most appropriate. When conducting the semi-structured interviews, the interview questions were split up into different themes. These themes aimed to guide the interviewer while at the same time provide the respondent with the flexibility of being able to steer the interview. Although, even if sub-questions were prepared in advance, the opportunity was given to the respondent to explore different paths than anticipated beforehand by the researchers, and gave room for supplementary questions. Furthermore, the interviews were not conducted in a "box-ticking" way, where certain questions had to be answered, but rather the interviews searched for the respondent's thoughts and ideas about the different questions, resulting in unique interviews with each respondent.

2.2.3 Selection of Interviewees

In order to be able to fulfill the purpose of the thesis, the study aimed at interviewing at least three persons at different levels, one assistant who has been working for up to two years at the firm, one person from the IT or risk department with more in-depth knowledge about the digital characteristics of BDA, and one person with more hands-on knowledge of BDA in auditing, such as a certified auditor or a partner. The aim of interviewing persons with different experience levels within the same organisation was to ensure a truthful picture and to be able to compare the interviewees' thoughts and in which way their views would differ or correspond. E-mails were sent out to six major auditing firms in Sweden; KPMG, PwC, EY, Deloitte, Grant Thornton, and BDO. The choice to only reach out to auditing firms within Sweden was mainly due to a convenience sampling. At some of the firms, the researchers had previous contacts and at some firms, the HR-department, student contact or the office manager was contacted. To select the interviewees, non-probability sampling was used since the interviewees were not selected randomly (Bryman & Bell, 2015). Snowball sampling was used where the person who was contacted later contacted other persons which might have the relevant knowledge and the specific position asked to answer the questions

(Bryman & Bell, 2015). Since the study was conducted in between March and May, it was in the middle of the busy season, and as a result of this as well as time constraints, the ambition of interviewing three people at each of the six major auditing firms was not met.

The main source of data used in this thesis is the primary data derived from interviews. The interviews gave the possibility to provide a deeper understanding of the interviewees' own experiences, thoughts, and actions. The interviews were conducted face-to-face, via video or voice interviews using technology, and via e-mails, please see Appendix 3 for further details. Using information technology for interviewing was mainly due to convenience since some of the respondents lived far away, along with being a time-efficient way to conduct the interviews. The ideal would have been to interview all the interviewees face-to-face to ensure to not miss out on the respondents body-language, which could serve as a complement to verbal answers. When conducting the interviews via voice information technology, there was a lack of visual and hence, the body language of the interviewees was left out. Although using information technology could ensure that the respondent was not disturbed by anything in their surroundings and could concentrate fully on the interview. Furthermore, one interview was conducted via email, along with supplementary additional questions which were sent out to all respondents, although communicating through email resulted in a lack of ability to ask follow-up questions, and resulted in less detailed answers. In total, a number of 11 interviews with 13 interviewees were conducted with respondents from six audit firms. Five respondents are referred to as senior staff (respondent S1-S5) due to their experience level, e.g. partners, managers, and certified auditors and eight respondents are referred to as associates (respondent A1-A8) due to their lower experience level, please see Appendix 3 for a more detailed picture.

2.2.4 Construction of Interview Questions

To be able to fulfil the purpose of the thesis, valid interview questions is essential. To derive the questions for the interview guide, previous research was used. In the works of Cao et al. (2015), Yoon et al. (2015), and Alles and Gray (2018), benefits and risks have been identified and to contribute to the existing research, the findings in previous research was used as possible sub-questions to see whether these opinions were reflected in the answers of our

interviewees or not. The main questions were constructed to give the respondent the possibility to think freely without being biased (please see Appendix 4). To provide a more in-depth picture of the interviewee's thoughts, the sub-questions were used as a compliment depending on the degree of detail in the answer to the main question. Furthermore, Alles and Gray (2018) constructed possible interview questions made for auditors that future research could use. When constructing the questions, some questions were based upon the questions presented by Alles and Gray (2018).

To be able to differentiate between the individuals own thoughts and answers that reflected the firm's values, different sub-questions were constructed to be able to separate the thoughts of the individual from that of the firm and of the profession. Since the research field is currently rather limited, it was important to try to minimize bias and not in any way control the interviewees since new and interesting thoughts would be of great value. Furthermore, to ensure a friendly atmosphere between the interviewer and the interviewees, the interviews started off with basic questions about the interviewee such as background information. To be able to grasp the connection to knowledge, questions based upon audit knowledge, and knowledge sharing was also constructed. The interview guide was structured by dividing the questions into head questions and sub-questions with the intention of having a free interview where the interviewee controls the interview, not the interviewer.

2.2.5 Data Analysis

All of the interviews were recorded, which made it possible for the researchers to go through the interviews again to secure the credibility of the findings from the interviews to minimize the chance of bias from the researcher's interpretation. The notes from the interviews were complemented with additional information and direct quotes from the respondents when listening to the interviews again. When conducting the interviews one of the researchers conducted the interview, putting a lot of focus on the respondent to promote a friendly atmosphere, along with observing the respondent's body language, while the other researcher was focused on taking notes, resulting in the notes gathered from the interview to be rather extensive. Along with additional notes gathered when listening to the recorded interviews, the choice was made to not transcribe the material since the notes already were very detailed.

Since most of the interviews were conducted in Swedish, translation took place when paraphrasing the results of the interviews. When direct quotes were used, the interviewee was consulted and given a chance to revise the translation.

Furthermore, to analyse the first research question, the findings from the interviews were split into themes, which were derived from the literature review. This resulted in the following three themes: current implementations of BDA, Possibilities, and Risks and Issues. The coding by themes help build an initial overview of the findings and to see if a general orientation of the data could be identified. This thematic coding was then used as a base to structure the empirical findings, analysis, and discussion.

When analysing the second research question, findings from the first research question regarding areas of interest in relation to knowledge were complemented with interview questions regarding how knowledge can be shared formally and informally.

2.2.6 Data Presentation

Data from the interviews were presented with a concurrent analysis with the aid of the analytical model built using previous research regarding BDA and Auditing, implementation of new technology in the audit methodology and knowledge sharing, anchored in the legitimacy of the audit profession. The presentation of the data was based on the five themes: implementation of BDA, possibilities with BDA, risks and issues with BDA, audit and technical knowledge, and knowledge sharing.

2.2.7 Quality of the Chosen Research Methodology

The quality of the chosen research method is assessed by ensuring high reliability and validity. Reliability and validity are mainly used by assessing quantitative research but can also be used in qualitative research, although in which case the meaning must be altered (Bryman & Bell, 2015). However, since this is a qualitative study, the quality of the research method is best assessed by looking more into the two criteria of authenticity and trustworthiness, the second which in turn relies on the following four criteria: credibility, transferability, dependability, and confirmability.

To uphold authenticity in the study, the interviewees selected had a variety of different firms and positions to attempt to ensure that the research conducted represented the whole picture, hence, that different viewpoints among the different levels of workers were represented.

The trustworthiness of this study is assessed by the four criteria credibility, transferability, dependability, and confirmability (Bryman & Bell, 2015). To ensure high credibility it is important that the researcher interprets the respondent correctly, and this is confirmed by using respondent validation where the interviewees got a question about whether or not the researchers had interpreted their answers correctly. In this way, the credibility of the findings is ensured, hence not biased by the researcher. Another way to ensure high credibility in the study is the use of corroboration. In this study, corroboration is used by using different sources of data. The initial literature review was complemented by documents publicly available, posted by the firms, in order to increase the understanding of the current state of implementation. Using these multiple sources to conduct the study is helpful since it entails that the researchers understand the context and hence could provide a more accurate interpretation of the findings from the interviews. Furthermore, transferability is met by providing in-depth descriptions of the specific culture and social world that is examined. Providing an in-depth understanding entails future research to be able to determine whether or not the specific findings are transferable to another study. Moreover, dependability is the notion of constantly arguing for the different choices made while conducting the study and also, a description of every step in the research. This criterion has been met by constantly providing the reader with information regarding the different choices made, along with a detailed description of how the study has been conducted. Further, the criterion of confirmability relates to objectivity. Although it is impossible to be completely objective, the researchers have tried to be as objective as possible throughout the study and thus tried to minimize bias by refraining from personal thoughts and values throughout the entire research process, as well as when interpreting the findings (Bryman & Bell, 2015).

2.2.8 Ethical considerations

Bryman and Bell (2015) discuss four main ethical principles that should be considered when conducting research. These four are harm to participants, lack of informed consent, invasion of privacy, and deception. The principle of harm to participants as well as lack of informed consent is considered by informing the participants of the aim and purpose of the study when sending out the question of whether or not they want to participate. It has also been made clear that the participation is voluntary and that each respondent has the option of not answering a question if they do not feel comfortable, and also the ability to end the interview whenever the respondent wants. The principle of invasion of privacy has also been taken into account by asking the respondents in which way they want to be presented in the thesis and what level of anonymity desired. Some of the respondents were concerned with anonymity, and some were not. Some respondents were not sure about how anonymous they wanted to be, and to ensure that everyone felt comfortable with what was presented in the thesis, the fraction of text related to specific respondents was sent out to each participant to ensure both for the credibility of the study but also as a way to ensure that everyone was comfortable with their level of presentation and anonymity related to the text. Furthermore, the principle of deception was also paid attention to by only using the material gathered from the interviews in this thesis and not let anyone else get access to the material.

2.3 Method criticism

The chosen research method was considered most suitable with regards to the study's purpose and research questions although, some limitations still exist. Firstly, because of the qualitative nature of the study, the findings are not generalizable to other settings (Bryman & Bell, 2015), both because of the limited number of respondents and by looking only at the respondents' individual thoughts and perceptions. Secondly, the empirics gathered from the interviews have been analysed through the researchers own perception about what main areas of the answer is relevant and important, hence risking being affected by the researcher being subjective (Bryman & Bell, 2015), although this has been tried to be minimized by both researchers opinions being weighed in, the risk still exists. Thirdly, since the study took place in a Swedish context in order to ease the facilitation of interviews, results can differ if a similar study took place in a different context, but due to the inherent lack of generality of

qualitative research, this should not pose an issue (Bryman & Bell, 2015). Furthermore, the respondents were chosen through a snowball sampling, where a contact at each firm provided us with possible interviewees, although this could be a limitation since the contact at the firm could have been biased when selecting possible interviewees. Furthermore, the interviews were not transcribed, but instead, detailed notes were taken and amended, although transcribing the recorded material from the interviews could have provided the researcher with additional information not found in the notes. Moreover, the direct quotes gathered from notes and listening to recordings, have been translated from Swedish to English, which could affect the original meaning and interpretation of the respondents' answers, although since the answers were sent out to each respondent for approval this should not be an issue.

3. Literature Review and Theoretical Framing

This chapter introduces the literature and theoretical perspectives chosen to suit the purpose of the thesis. Firstly, Big Data within auditing is introduced, highlighting the possibilities, risks, and issues presented in previous research. Secondly, an introduction about the audit profession is presented, followed by an explanation of legitimacy theory. This is followed by discussing the connection between the audit profession and legitimacy, leading to a discussion about audit knowledge. Lastly, knowledge sharing is presented.

3.1 Big Data and Auditing

Big Data can be explained by three attributes, volume, velocity, and variety (Cao et al., 2015), while some argue that veracity also should be included (Zhang et al., 2015). Volume refers to a large amount of data, velocity to the high speed of data, variety reflect the variety of different data sources, and veracity to the integrity of the information (Cao et al., 2015; Zhang et al., 2015). Big Data is often referred to as a large amount of data from different transactions systems, as well as data from internet activities, social media, phone calls, e-mails, and much more (Cao et al., 2015; Zhang et al., 2015). The notion of big data can be seen to affect the work of auditors since they now need to include analysis of big data into their audit work. The effect BDA has on audits is currently rather unclear (Salijeni et al., 2019) but the firm's transparency reports provide a picture of how it is used today, please see Appendix 2 for a more detailed view.

Previous research has identified different benefits that could arise while implementing BDA (Cao et al., 2015). Cao et al. (2015) list five possible benefits of using BDA in auditing. Firstly, BDA could be beneficial when identifying and assessing risk when it comes to accepting or continuing an audit engagement. Secondly, it can be helpful in order to identify and assess material misstatement due to fraud. Thirdly, BDA could be useful when forming a picture of the entity and its environment, which is of importance when identifying the risk of material misstatement. Furthermore, BDA is beneficial when conducting analytical procedures as a result of the auditor's assessment of the risks related to the financial statements. Lastly, the authors argue that BDA will be of importance in the later stages of the

audit since it will be useful for the auditor when forming an overall conclusion about the financial statements (Cao et al., 2015). Alles and Gray (2018) also stress the positive effect of implementing BDA in auditing and emphasize that BDA could be a way to increase the likelihood of detecting fraud since it becomes harder for fraudsters to disguise the fraud due to auditors having access to all data. In traditional auditing, auditors only look at a sample of the data which leads to risk that fraud if present, isn't included in the sample. Since BDA looks at data beyond what is included in traditional auditing, fraud is hence more reliably discovered, since traditional evidence only represents a small percentage of all transactions made. Yoon et al. (2015) have found that Big Data can be seen as a useful tool for auditors because it can be used to complement traditional audit evidence. Big Data can help auditors when traditional evidence is insufficient and be useful when it comes to detecting fraud. In certain cases, Big Data can appear to be even more reliable than traditional audit evidence, since it might be harder to tamper with Big Data. The use of external data from, e.g. newspapers, could enrich the auditor's scope of information about the client, hence provide independent benchmarks of trends in financial accounting (Yoon et al., 2015).

As with all other things, BDA also has a negative side, e.g. privacy is a possible issue since auditors have access to sensitive information about their clients, although, this is not an issue that arises only because of BDA but is a constant issue for auditors (Cao et al., 2015; Yoon et al., 2015). Cao et al. (2015) describe that analytics might involve nonpublic information of the client, which is not used in a traditional audit and might be especially sensitive. Furthermore, Yoon et al. (2015) argue that clients might be concerned with the use of the data, and especially if the Big Data collected is personal and sensitive, such as the employees' internal emails, which could increase the possibility of finding fraud. Difficulties that can arise with Big Data is, among others, that when having full access to the data, auditors will have more pressure to discover fraud since nowadays, only looking at a statistical sampling gives auditors a possibility to defend themselves when failing to detect fraud since it gives them the possibility of stating that the fraud was not part of the sample (Alles & Gray, 2018; Cao et al., 2015). Furthermore, non-financial data can be seen as a difficulty due to the fact that it is often somewhat messy and thus, it requires a vast amount of time invested by auditors to identify the usability and applicability of the data in the audit. BDA could also result in a lot of false positives, resulting in unnecessary time invested (Alles

& Gray, 2018; Yoon et al., 2015). In order to be fully able to implement BDA in auditing, several changes must be set in place. For example, auditors need to gain access to more data from their clients, also audit firms need to invest in educating the audit teams in analytics as well as increase the knowledge of the link between non-financial and financial data (Alles & Gray, 2018; Cao et al., 2015).

3.2 The Audit Profession

A profession constitutes of different characteristics, but previous research differs a bit when explaining which these are (Brante, 1998). Brante (1998) states that the profession is characterised by being based on scientific research, training and education, examination of the knowledge, and that the service provided is of public interest. The audit profession can be seen as a self-regulated system influenced by both the profession itself, in the form of normative standards, and from society, in the form of laws and regulations (Power, 2003). Traditionally, accounting has been pictured as being a neutral phenomenon seeking to increase organisations effectiveness (Humphrey & Moizer, 1990). But this picture has been questioned and accounting has instead been presented as something socially and politically constructed serving a wide variety of roles and functions (Humphrey & Moizer, 1990).

The auditing profession can be seen to be characterised by expert decision makers seen as rational economic individuals whose main purpose is to serve the public interest and auditors can be pictured as gatekeepers, assuring the quality of published accounts (Humphrey & Moizer, 1990) but this view is not the only viable one as the profession is pervaded with opinions regarding what the profession could and should be (Power, 2003). Hence, the role of the auditor is not fixed but fluid and idioms are used in order to concretize the effects of the auditor's labour in an attempt to present legitimate reasoning around the position of auditors. Due to this, image management is a regular fixture for both regulatory and professional entities within the profession. Further, studies indicate that image management possibly is given higher importance than even the truth of efficiency (Power, 2003; Holm & Zaman, 2012).

Image management is also visible in the auditing profession, and ultimately professionalism in general, through the appearance of the individuals within the profession and the major auditing firms often have internal rules depicting how to behave and dress (Grey, 1998). This importance can be connected with the lack of physical evidence of the effects of the auditor's labour (Power, 2003) of serving the public interest, which is essential for upholding the current status of auditing as a profession (Carnegie & Napier, 2010). Furthermore, for auditors to be able to serve the public interest, it is important that auditors remain independent from their clients, as independence is seen as the most fundamental asset possessed by the auditing profession, as well as use their professional judgement when conducting their work (Humphrey & Moizer 1990; Johnstone et al., 2001). In their study, Humphrey and Moizer (1990) found that auditors themselves are aware of their own actions and thereby, auditors are responsible for working in a way that does not compromise the professional integrity. Considering the varying views surrounding the audit profession, it comes as no surprise that there always has been an expectations gap between what auditors perceive to be their role and society's perceptions about the nature and purpose of the audit function (Kaplan, 1987, Humphrey, 1990, cited in Humphrey & Moizer, 1990).

3.3 Legitimacy Theory

The theory of legitimacy stems all the way back with the Greeks, where Aristotle was concerned regarding the government (Zelditch, 2001) and with the ever-changing audit profession, where even change itself is becoming something legitimate (Watts & Zimmerman, 1983), illustrates that the theory is still relevant. Which connects with the purpose of this study to increase understanding surrounding the implementation of BDA in the audit methodology. This new change will require moves to convey continued credibility and legitimacy for the auditors' operations to be perceived as a contributing part of society and functioning within its norms, which is something that organisations continually work to ensure according to the legitimacy theory (Deegan, 2009). The theory also implies the existence of a "social contract" between business organisations and the societies they operate within (Deegan, 2006). In order for a business to continue its operations, they need to maintain their legitimacy in regard to this contract.

Within legitimacy theory, society is seen as a whole and not a group of individuals and therefore the theory concerns the relationship between an organisation and society as a whole (Deegan 2002). Society allows for the continued operation of an organisation, only for as long as it deems the benefits to society from the organisation to be greater than its cost. Further, the theory suggests that an organisation must appear to share the same values as the society it operates in, in order to continue its existence (Adams et al., 2010). Legitimacy theory, unlike shareholder theories, holds that an organisation must take all stakeholders', i.e. society's, requirements in consideration in order to been seen as legitimate and warrant continued operation (An et al. 2011). This, in connection with what was presented above concerning the profession, shows that it is obvious that audit organisations need to treat legitimacy with great importance in order to ensure continuous operations. This need can be further connected with Power's (2003) observations of production of legitimacy within areas of the audit process and the formal structure of the profession, of auditing as a business and finally of image management.

The theory of legitimacy can be divided into two schools of legitimacy; strategic and institutional, with either a managerial perspective or an industry-wide pressure (Suchman, 1995). Further according to Suchman, the theory identifies three types of legitimacy; pragmatic, moral, and cognitive and how they are gained, maintained, and repaired. Pragmatic legitimacy can be divided into 3 parts, one is based on how main stakeholders perceive consequences and value of the practice, one connected to the stakeholders' interests, and one reliant on convincing stakeholders that the practice will benefit them (O'Dwyer, Owen & Unerman, 2011). Moral legitimacy works in connection with a practice perceived as the correct action and constitutes a normative view on the practice and if it contributes to society. This type of legitimacy can be judged on four different criteria; on what it accomplishes, embracing socially accepted procedures and techniques, based on status, reputation and charisma of leaders and staff or that of an organisation. Cognitive legitimacy, on the other hand, is based on practices connected with generally accepted, and even taken for granted, objectives and activities, and can further be gained by popularising practices through the use of cultural accounts (O'Dwyer et al. 2011). Suchman (1995) has identified three ways to increase legitimacy; to show how new practices and technologies meet instrumental

demands, how they provide positive effects for society, and building of the organisation's own or another organisations' previous legitimacy and reputation to give credibility to the new practice.

When looking at implementing new technology within auditing, a good fit would be the conform strategy presented by Suchman (1995). Within the conform strategy Suchman identified a key way each type of legitimacy can help in the generation of legitimacy. Regarding pragmatic legitimacy, the way forward is to show that the new practice meets the crucial demands and needs of important existing stakeholders or through the reliance on current legitimacy in related practices. With moral legitimacy, the way forward is to associate the new practice with socially accepted organisations and that the new practice generates a socially valued output. Lastly, with cognitive legitimacy, it is important to show the compliance of current standards with the new practice (Suchman, 1995).

3.4 Audit Profession and Legitimacy

Audit firms and professional institutes collaborate in attempts to standardize the audit process but still, differences in style and application of standards and routines can be observed, which classifies auditing as a semi-institutionalised profession (Power, 2003). This can be more clearly observed when comparing firms that have a more structured method with firms that encourage individual judgement. This struggle between structure and judgement is according to Power the academic definition of a problem that touches at the core of professional identity. A struggle also illustrated by the levels presented by Power in relation to the audit profession, one of mechanism and one of organism. The mechanism level of auditing advocates algorithmic knowledge while the organism presents a view of knowledge as something that creates a sum greater than the individual parts. Further, a study by Humphrey and Moizer (1990) found that a gap between what officially is conducted in the audit process and what practically happens has been observed, and raises the question if official standards and guidance does little more than legitimize the auditors work if questioned by the client or any other stakeholder. Power (2003) continues that studies also have found that staff often did not follow audit plans correctly and a skewness for positive evidence detection was

evident, which led to the conclusion that sampling and confidence levels often are based on faith within a mechanical and bureaucratic process as a function, more often than not used, to legitimate individual and organisation behaviour than supporting efficient auditing. This mechanism level of audit knowledge is what risks being automated away from the auditors as it is strictly ruled based but on the contrary, the organism level relies on both the judgment and social interaction of the auditors in order to fulfil the desired purpose of the clients. Despite, or maybe because, this harsh line of thought in a sensitive area, research covering the audit profession has a lot of gaps (Power, 2003).

In a practice like financial auditing, the processes entail more than simply collecting and evaluating evidence (Power, 2000). This means that auditing goes beyond the technical steps of the process and the idea of what audit can or might deliver is something that can be up for public scrutiny. Although, the claim that audit services are considered expert services and cognitive practices that have emerged from techniques and claims of expertise, can according to Power (1992) be overlooked as it gives an unjust image of how audit values and practice have evolved and that the notion of naturally verifiable evidence to be questioned. Even though the verification of evidence is presented at the core of the audit practice, the two are so strongly tied together that one could not exist without the other, Power (1996) means that what is vital to the notion of auditing is independent authentication of evidence, which ties in the values of publicity, objectivity and replicability. The concept of verifiability can also be connected to the fair representation of events without error or bias which constitutes cornerstones in the framework of both FASB and ISA. One primary issue of auditing is creating a legitimate base of auditable facts to base professional judgements on, something that can be connected with the apparent need for the production of legitimacy presented by Power (2003), which he concludes can be connected with the lack of hard evidence regarding efficiency and effectiveness of auditing. This can be illustrated by the initial phase of the audit, planning, which uses is utilised as more than just what is apparent in its traditional role of structuring future tasks and serves as a source of legitimacy, as well as a tool for marketing. This can further be connected to the lack of verifiable details which opens up to interpretations regarding what auditing must and can do (Power, 2000). Even technical procedures are subject to attempts to standardization, in an attempt to make the process appear more legitimate (Power, 2003). One internal area where this is exemplified is Value

for Money auditing, where public opinion on the subject was formed far earlier than it became an actual practice among firms and something that is continuously discussed, sometimes without direct connections to actual operational tasks (Power, 2000). This hinted discrepancy between idealistic and practical views will be covered further.

As with any other practice, auditing can be said to be divided into an idealistic (normative) and a practical (operational) level (Power, 1997). The normative level of auditing is one of concepts and ideas which determine the mission of auditing and reconciles practice with wider politically motivated policy goals, which are formulated with the capabilities of the audit practice in mind. It is against this level that institutional demands are checked at a regulatory level and the ideal of auditing are communicated through policy disclosure. The operational level of auditing is one that concerns the routines of practitioners and the actual practical steps of the audit process, the operational knowledge base of the profession, which over time has been formalized and codified. It is at this level that efficiency and cost-saving solutions regarding assurance are discussed but even at this level, a normative touch can be observed about potential improvements and claims that cannot be separated from the stories regarding the hypothetical improvements and possibilities of auditing (Power, 1997).

Another way to divide the auditing profession is with the aspirations consisting of structure (mechanism) and judgement (organism) (Power, 2003). The mechanism aspiration holds the allure of automatization through algorithmic knowledge, while the organism aspiration suggests that the sum of the whole is greater than the value of the parts and that the knowledge of the profession cannot easily be codified as aspired by the mechanistic view. Although opposing, Power enforces that neither of the views are unproblematic and neither can ever be fully implemented. The tension between the two is multileveled and the perceived increase in structured, mechanical audit procedures echoes an increased demand for legitimate and transparent audit procedures. This can be coupled with the difficulties of managing seasoned judgements, based on individual, local, and intuitive knowledge, at a distance from the head office. This trend jeopardizes the independent reasoning behind judgements in favour of institutionalisation, efficiency, and litigation protection. Even though the mechanism aspiration holds an ideal of universal audits based on logical steps encoded by algorithms, they will never be a substitute for professional judgement Power (2003).

3.5 Audit Knowledge

The legitimacy of procedures and techniques depends on their acceptance directly at a public level, either through codification or as part of informal practice (Power, 1996). To deeper understand the profession of auditing, thought needs to be given to the knowledge system within the profession, consisting of a knowledge system of core values. Within this system, four main levels can be identified; knowledge, education, practice, and control. These main values can be used to build a system of auditing knowledge.

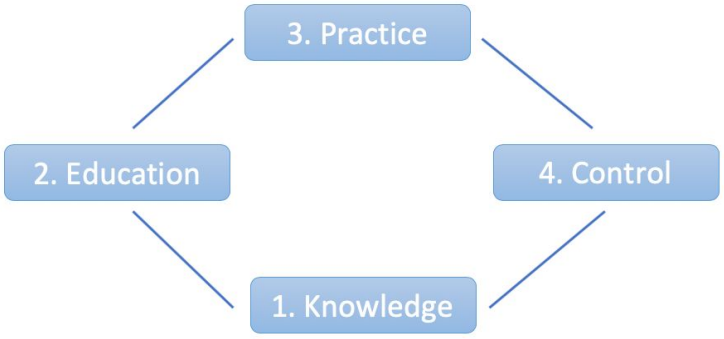

Diagram 1: Illustration of the System of Auditing Knowledge (Power, 1996, p.292)

At the first level, the knowledge structure of the audit profession consists of codified rules and regulation, both internal and external to firms, about correct behaviour and procedure that has developed through time and constitute best practice within the profession. Best practice is something that prides itself for being admissible in court for the profession and the publications and reproductions surrounding it can be seen as an attempt to reconcile the public assumptions of auditing with that of the profession and in reverse practitioners have an incentive to follow them in order to appear legitimate (Power, 1996).

At the second level, the dissemination of knowledge happens through different types of education, varying in both location and formality. This is where the practitioner is constructed in terms of behaviour and recording practices along with the institutionalization of audit knowledge through formal examination and further legitimacy sought, both through the possibility of internal judgment of profession members but also though a function of entry barrier to the profession (Power, 1996).

At the third level, audit judgements are produced and executed within the practices of the profession. Further, careful internal interactions of the audit process result in the production of public comfort and legitimacy surrounding the audit process. Further, negotiations regarding "facts" happens between auditor and auditee, a process that relies on knowledge to be stable and acceptable. This is also the level where the struggle between formal and localized knowledge takes place. In lieu of this, rationalization of vague intuition concerning assurance levels is conducted to shape a product to present for public consumption and relies on official and legitimate myths surrounding the practice of auditing. A conflict between practitioner values and institutional demands exists, which can be tied to the struggle between idealistic and practical views within the profession and regards mainly how the audit process is perceived and not as much the practical steps of involved (Power, 1996).

The fourth level, where control of the system lies, covers the areas of feedback and quality control, through mechanisms such as peer review. Further, amends are sought regarding audit procedures and new forms of practice sought, all in an aim to add further value to the audit process. These benefits only come into fruition when new technologies are accepted by the public as part of the institutionalized audit practice and the restructured audit knowledge is put to use. Although quality control functions as intended, the procedures main purpose is less about making the quality more observable and more about defining what substitutes as quality within the audit practice (Power, 1996).

3.6 Knowledge Sharing

In professional service firms, such as audit firms, knowledge is valued as the firm's primary resource. To be able to increase the value for their clients, it is essential that the employees are able to learn from previous experience and can apply knowledge when facing new situations (Løwendahl, 1997, cited in Weiss, 1999). In broad terms, knowledge can be divided into tacit and explicit knowledge at either the individual or collective level (Løwendahl et al., 2001). Tacit knowledge is knowledge received from experience, which is difficult to transfer to another individual but can be done through mentorships or working together, while explicit knowledge is more hands-on knowledge which can be gathered from reading a book (Løwendahl et al., 2001).

Furthermore, research has found that explicit knowledge can be divided into two dimensions and that it might not be as easily shared as depicted by Løwendahl et al. (2001). Weiss (1999) divide explicit knowledge into rationalized knowledge, which is easily shared between individuals, and embedded knowledge, which is difficult to share between individuals. Rationalized knowledge include methods, templates, and standards of knowledge that often is generic and can be applied to a variety of clients. The characteristics of rationalized knowledge are that they are generic, widely applicable, independent of context, depersonalized, and official. Embedded knowledge is context-dependent and personalized, and might be professionally or personally sensitive. People may not want to share their knowledge and factors such as trust, power, and incentives influence whether or not knowledge is shared. Embedded knowledge is especially sensitive since it is dependent on the individual, whom might keep the knowledge to themselves, and if not shared the knowledge will be lost if the individual decides to leave the firm. Embedded knowledge is, in contrast to rationalized knowledge, difficult to transform into written documents, and embedded knowledge is often rather time-consuming to share, making it even more difficult since professional service firms think of time as equal to money and seeks to make the client satisfied (Weiss, 1999).

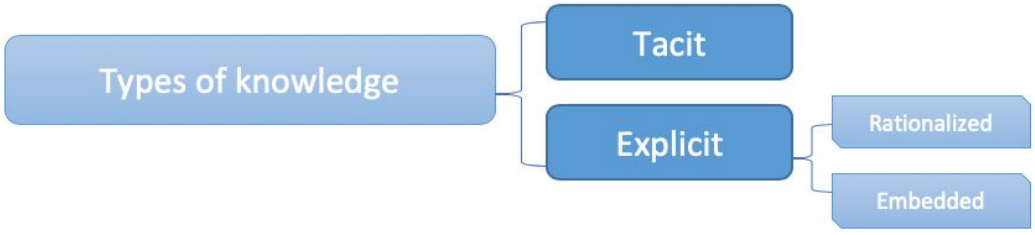

Diagram 2: Illustration of the Types of Knowledge (Løwendahl et al., 2001; Weiss 1999)

Løwendahl et al. (2001) divide knowledge to the individual level and the collective level. Knowledge at the individual level can be important for when an organisation seeks to create value, and especially three types of knowledge, information-based, experience-based, and dispositional knowledge. Information-based knowledge is objective and task-related, experience-based is tacit and subjective, and dispositional knowledge is personal, such as

intelligence and talent. For the collective level, knowledge is seen to be a combination of skills, values, norms, rules which are shared by at least two people. For the collective knowledge, Løwendahl et al. (2001) emphasize the impact of culture, which includes norms and rules regarding the individual's behaviour.

In professional service firms, the employees often have a high level of education, hence the individual possesses certain knowledge, additionally such firms also typically have a strong relation to professional organizations from which the individuals get additional education and training (Løwendahl et al., 2001). These individuals then possess similar information-based knowledge. Professional service firms often include employees from other professions as well and in those cases it is important to develop a shared knowledge base internally (Løwendahl et al., 2001). One of the most important internal processes is knowledge collection and knowledge connection (Weiss, 1999). Knowledge collection involves storage and accumulation, while knowledge connection is the notion of connecting knowledge seekers with knowledge sources to enable an exchange of knowledge (Weiss, 1999). Organisations can take certain actions in order to ease knowledge connection regarding embedded knowledge. An organisation should work towards developing personal relationships and networking amongst the employees. Furthermore, it should be clear where an individual can gather new knowledge, involving information regarding who to talk to and where to find information. An important factor of whether or not embedded knowledge is shared is incentives, and organisations should hence ensure that the incentives facilitate knowledge sharing. A typical notion for professional service firms is to put the client's interest first, and therefore it is essential that the incentives are clear, so that the employees share knowledge which in the end will bring more value to the client. Incentives should encourage both knowledge collection, but also knowledge connection within the firm. This can be done by evaluating the employees on a regular basis and after each project, the one in charge of the team should be evaluated based on their capability of sharing knowledge to team members (Weiss, 1999).

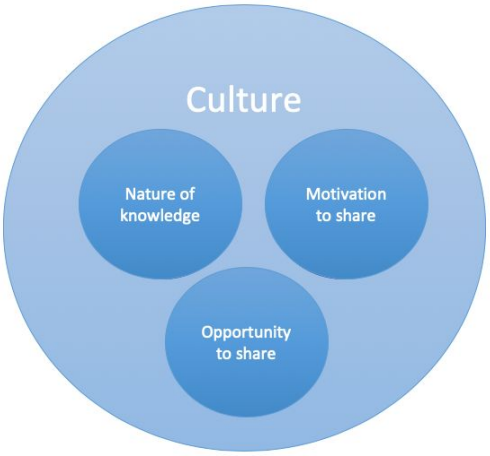

Diagram 3: Illustration of the Factors of Knowledge Sharing (Ipe, 2003)

Ipe (2003) has looked at previous research and has found four major factors which affect knowledge sharing amongst individuals within an organisation, but even though these factors have a significant impact, they are constantly affected by each other. The four factors are the nature of knowledge, motivation to share, opportunity to share, and lastly, the culture of the work environment. Firstly, the nature of knowledge stems from different definitions and characteristics of knowledge, such as the division of knowledge as tacit or explicit. Knowledge is often seen as something of value, and if an individual in an organisation perceives the knowledge they possess as something of high value, or as a competitive advantage, they might be reluctant to share their knowledge. Furthermore, individuals within professions, such as the audit profession, might be reluctant to share their knowledge, since their value to the firm is based on the knowledge they possess.

Secondly, individuals will typically not share knowledge without motivation. Factors that affect the motivation to share knowledge can be divided into internal and external, where internal factors are the power of possessing the knowledge, and external factors stem from relationships within the organisation and also include incentives such as rewards. For the external factors, individuals have to see knowledge sharing as something value-adding for themselves, Furthermore, the relationship is important and have to build on trust, or be a result of the power of the recipient. Individuals with low power generally share information with individuals with more power, whereas an individual with high power typically share information with people with the same amount of power, and not towards those with less

power. Moreover, the reward or penalty associated with knowledge sharing will affect if knowledge is shared. But research has shown that extrinsic motivation might not be sufficient, and that intrinsic motivation might be what motivates professionals to share knowledge.

Thirdly, there must be an opportunity to share knowledge, opportunities can be divided into formal and informal. Example of formal opportunities is training programs, and to work in teams, and informal can be personal relationships and social networks.

Lastly, the culture of the work environment has an effect on knowledge sharing and previous research has found this factor to be a major barrier to knowledge sharing, creation, and use. Culture can be seen as the core of an organisation and this includes norms, values, and practices. However, culture is very complex since it does not only include the organisation's culture but also include different subcultures which can be hard to control. Of these four factors, culture is the most important factor since it affects the other three factors (Ipe, 2003).

4. Empirical Findings and Analysis

In the fourth chapter, the findings from the interviews will be presented and analysed. The chapter begins with describing the implementation of BDA, consisting of the current implementation, possibilities as well as risks and issues. Furthermore, the chapter continues by describing the audit and technical knowledge within the firms, followed by how knowledge is shared within the firms.

4.1 Implementation of Big Data Analytics

Analysis has always been part of the audit methodology but the trends of digitalization and data analytics have already made a difference on the methodology, the question is what perceived effects the implementation of Big Data Analytics will have?

4.1.1 Current implementation of Big Data Analytics

Interviews with Certified Auditors and Analytics Specialists

A general finding of the interviews is that data analytics is an integrated part of the audit methodology while big data analysis in its infancy, something that, at least partially, matches what is found to be communicated externally. This is something that can be illustrated by the use of an older tool for analytics, according to respondent S2, that is getting replaced by a new platform that can handle bigger amounts of data as well as handle simpler forms of BDA without requiring any specialized knowledge. This new platform is aimed at making BDA available directly to auditors and help visualize analytical findings, which in turn aims to ease the understanding of results and constitute a base for professional judgements. Even though this tool will enable auditors to conduct simpler forms of AI, specialists will still be needed to handle bigger companies due to the huge amount of data involved and more complex processes utilized. The respondent continues that the tools are mostly used for substantive testing and fraud detection, in order to get a better, preferably complete, coverage compared to statistical sampling, which does not always give adequate assurance.

A similar view is presented by respondent S4, who emphasizes the importance of data analytics and emphasises that it has become a staple of the audit methodology and implemented throughout the firm. The technology is perceived to increase efficiency,

understanding of the client's organisation along with general audit quality. Data collection and consolidation is handled by specialist teams, while auditors conduct analysis on demand through available tools, which are seamlessly tried into the audit methodology. But the respondent also points out that there is a discrepancy in usage between employees, were younger teams utilize the new technology more frequently.

The importance of data analytics is mirrored by respondent S3, who has seen an increased in the amount of data handled over the years and how the data is used and analysed. One of those changes is a move away from statistical samples in substantive testing and towards the use of analytics to identify material misstatements and risks. This depends on the quality of data derived from the client, where good data quality can eliminate the need for sampling altogether and enable a complete audit of the account. Another shift is in the data requested from audit clients, according to respondent S3, where raw data is preferred over processed data, as it is unaltered and more malleable. Further, time is spent in the initial audit process deciding how the data is best structured and the information presented. BDA is used throughout the audit process but is an important tool in risk assessment during the planning phase and of help in substantive testing for identifying outliers and mismatched posts. Although more advanced analytics are run by analytical specialists, some interested and knowledgeable senior auditors use BDA to some extent directly in their audit process. Furthermore, the respondent indicates that the diffuse user group of the profession production contributes to what the respondent perceives as a lagged implementation of BDA in the audit methodology compared with other industries that have more direct client pressure.

Similar views are shared by respondent S1, who says that analytics is something well integrated into the audit methodology and is used from planning, through risk assessment to the selection of samples in substantive testing, while BDA is something only scarcely used. Further, analytics provides aid in handling large complex clients and complex areas of accounting, with a shift towards more BDA integration ongoing with a new platform housing stronger BDA support being implemented later this year, which will further impact the audit methodology. One area of audit methodology definitely affected by BDA is when it comes to identifying material irregularities and risk as well as fraud, and the technology enables auditors to make identifications that would be impossible otherwise. Another area where

BDA is beneficial is at the end of the audit process when the going concern of the organisation is examined and a forward point-of-view is taken in order to check the next year's forecast against the figures of the present year.

In a similar fashion, respondent S5 indicates that the process of BDA is still young and is under continuous development with impending incorporation of AI and machine learning, and analytics is still being incorporated in the audit methodology. The technology is already used in various stages of the audit process and the respondent presents 4 areas of implementation. Firstly, scoping of data, running risk assessments and presenting the results visually, guiding the audit teams in their decision process. Secondly, more specific testing, e.g. testing revenue and checking that the revenue cycle can be followed. Analytics is used to consolidate the data into an accurate and complete dataset, and compared to the general ledger to identify outliers in terms of unexpected values or multiple repetitive transactions all authorized by a single person. Thirdly, generating analytical output that is not only used in the audit process to form an understanding of the client's business and its processes but also to help the client get a deeper understanding of their own organisation through the use of data visualisations. Lastly, analytical support in sample selection for statistical sampling in substantive testing. Further, respondent S5 does not see a decisive effect regarding organisation understanding as a result of BDA, rather than the ease of data retrieval from the client and their technical knowledge level gives an understanding of how well they know their own systems, and is something that can be compared to peers. This, amongst other statistics, can be used as a basis for benchmarking between firms and helps provide a fuller understanding of how a client functions. Further, auditors at the firm have access to globally developed BDA tools to perform basic analytics, e.g. journal entry testing, while more advanced analytics are handled by a specialist team within the firm.

All respondents emphasise the importance of analytics and its integration into the audit methodology. Most of the respondents state that data analytics is well integrated into the audit process, while respondent S5 views the process as an ongoing implementation. Contrary to this, respondent S2 indicated that data analytic tools are being replaced by new improved BDA tools, enabling enough processing power to handle bigger datasets and more complex analytics, partly with the aid of AI, along with a superior presentation of the analytical

results. The development within the field of analytics is echoed by all the interviewees, and indicators of BDA implementation are omnipresent. The increased analytical power can also be sensed in respondent S3 answer regarding the type of data requested from clients, where a shift to preferring raw over structured data has taken place. Additionally, they all seem to foresee an improvement in audit quality as a result of the implementation of BDA in the audit methodology. This improvement can be connected with the legitimization of new technology through the use of conform strategy with meeting demands from main stakeholders, producing socially desirable outcomes and connecting to established standards (Suchman, 1995).

Another recurring procedure in the interviews is that of statistical sampling, which is identified by Power (1992) as an area of duality between ideal and operational practice desires within the audit profession. Respondent S5 sees data analytics as a support tool in the sampling process to ensure a better selection, while respondent S2 and S3 thinks that the technology will make the technique of statistical sampling redundant as full population coverage becomes achievable.

The respondents all had quite different experiences regarding at what level within the firm BDA is currently used. Respondent S2 explained that it is the certified auditors that use BDA in the usual audit engagement. Furthermore, the respondent noted that the person using BDA differs between smaller and larger clients, and when conducting an audit for a large client, the certified auditor had to be complemented with further expertise from the risk department, whom then performs the more complex analysis and presents the results to the auditor for interpretation. However, respondent S2 also stated that there are technical tools available for all levels within the firm that provide an easy way to perform more simple analytics. Although, the respondent highlighted that even if the tool is present within the firm, there is a perceived resistance among the employees to use the tools. The apprehensiveness to use the tools is due to a lack of knowledge surrounding BDA both how and why it's used and how it can be beneficial for the audit client, continues S2.

Furthermore, respondent S4 designated specialists to be the ones that gather the data from clients, and load their internal tools with the data retrieved. The audit teams then perform the

analysis using the prepped data dependant on the needs of the audit. Furthermore, the respondent explained that in fact, the whole audit team works with performing the analytics, but highlighted that senior employees and partners might not be involved in the analytics while younger employees of the teams perform these types of analytics.

Moreover, respondent S3 stated that in general, it is the IT-auditors that perform advanced data analytics, while on a more basic level the analytics is performed by all associates, although not BDA, but more basic forms of data analytics. Furthermore, the respondent highlighted that this is the general practice but it differs from person to person, e.g. some certified auditors that have an interest in BDA and good analytical knowledge also perform more advanced data analytics.

Respondent S1 mentioned that data analytics currently is used within all levels of the firm, while BDA is scarcely used. S5 said that they have a team of specialists, consisting of finance and IT experts, who gather the data and perform the analysis which is then interpreted by the auditors.

All the interviewees, except respondent S5, responded that analytics, at least at a basic level, is implemented and used throughout the firms audit teams, while respondent S5 indicated that data collection, consolidation, and analytics are performed by specialists and the generated reports are then used by the auditors and subjected to their professional judgement, which is a meeting point between the mechanism and organism levels of professional knowledge (Power, 2003). Respondent S4 also responded that collection and consolidation of data were handled by a specialist team but that the analytics was done by the auditors based on what is needed in the audit process. Respondent S2 states that certified auditors use BDA in their audit process and are backed up by specialists when more complex analytics needs to be run but also that the respondent has perceived a knowledge gap that slows the implementation of BDA, which can be connected with Power's knowledge model (1996) that indicates that a lack of knowledge can impact practice unless mitigated with the application of education. Also, respondent S3 mirrors that advanced analytics are run by specialized IT-auditors, although some certified auditors with the knowledge and interest of BDA also conduct some of these analytics, again showing how knowledge impacts practice (Power, 1996).

When it comes to handling sensitive information that the audit firms get access to while conducting the audit, the respondents all state that their respective companies have developed secure systems for handling this type of information and that no defining changes have taken place due to the implementation of BDA. Furthermore, respondent S5 discusses the importance of data protection and to be able to handle the data in the correct way in relation to laws and regulations, such as GDPR, to be a greater difficulty than BDA implementation. Moreover, respondent S2 emphasize that there is a standard in Sweden for exporting financial data called SIE-files, which are used for transferring accounting information between systems. However, in large, multinational firms, this standard is not applied as it is not an international standard. Meanwhile, respondent S3 reported that a lot of clients had out of date accounting systems, where the output was incompatible with their analytical tools and had to be preprocessed to be of use.

All firms seem to have handled the risks regarding sensitive data presented by Cao et al. (2015) and Yoon et al. (2015) in regard to the implementation of BDA, although GDPR still seems to present complications according to respondent S5. Further, the external standardization of data expressed by respondent S2 promises increased efficiency and quality from the BDA implementation in the audit process, something that will help the procedures socially desirable outcome (Suchman, 1995) and is something that is needed, as illustrated by respondent S3.

Interviews with Associates

Respondent A1 and A4 do not know how or if BDA is used in the audit process within either firm. Moreover, respondent A2 states that the usage of BDA differs between clients and that large datasets cannot be handled in their current programmes for data analytics. Further, the respondent also states that it is only possible to get access to partial data and that full coverage of the auditee's data is not a possibility with current technology. Furthermore, respondent A2 states that all Swedish offices within the firm work in a similar way regarding analytics. Additionally, respondent A3 states that BDA is used in the planning stage of the audit by the risk department, who among other things examines internal controls, as well as in the substantive testing and late stages of the audit, while respondent A7 states that the use

of BDA is most prominent within the substantive testing. Respondent A8 describes that specialists in the IT-department prepare analytics for the auditors, who subject the results to their professional judgements in the audit process. Furthermore, the respondent states that automated trend analysis is used based on external data from different state agencies, where the Swedish Companies Registration Office is used to gather information from the Business Registry and the Swedish Competition Authority is used to source information regarding competitors and industry index. Furthermore, the respondent continues that the firm collects data from annual reports from peers within the industry to see if the company stands out in relation to general trends. Moreover, the firm has also introduced a tool utilizing AI on select audit engagements, where a robot automatically and efficiently reviews a company's accounts, sorts and compiles the data based on materiality, and presents trend and deviation reports.

A unified emphasise on the importance of analytics is lacking and instead, the actual practical application is covered. Respondent A2 states that there is unison in how analytics and BDA are used within the Swedish part of the firm, and respondent A3 states that BDA is utilized throughout the audit process, by specialists in the planning stage and by auditors in the later stages of the audit process. Further, respondent A7 emphasizes that BDA is mostly utilized in substantive testing. Furthermore, respondent A2 presents a limitation in current technology to achieve full population coverage. Meanwhile, respondent A8 describes that specialists prepare analytics for the auditors to use in the audit process, where professional judgement is used. Further, external data is used in trend analytics in order to generate a deeper understanding of the organisation and its environment. Furthermore, a new tool utilizing AI is being rolled out, which at least partly automates the initial part of the audit process and saves time in the data preparation process. The judgement and automatisation presented by respondent A8 resonates with the levels of professional knowledge relating to automatisation and judgement (Power, 2003).

The associates all have a relative different picture regarding which levels of the firms currently conducts BDA, where respondent A3 and A8 state that BDA is mostly utilized by specialists, while respondent A2 and A5 state that BDA is utilized through all levels of the firms, whereas respondent A7 state that BDA is mainly utilized by associates and seniors

auditors. Notably, respondent A1 and A4 do not know at all how or if BDA is used by the firm, and hence nor at which level the technology is utilized. Furthermore, respondent A2 states when it comes to more advanced analytics there is a need for expert knowledge and specialists get involved and conducts the analytics. Contrarily, respondent A5, state that while specialists gather and compile the data, it is the audit teams that performs the analytics. Moreover, respondent A3 stated that large amounts of data are processed by a division of specialists, and the respondent, as an associate only handles SIE-files. A similar view is shared by respondent A8, who highlight the fact that they have a specialist division who only work with data analytics. Further, the respondent also notes that auditors only perform more basic analytics and that the general view within the firm is that auditors should be able to build a more comprehensive understanding of the company and should focus conducting the audit while being aware of when specialist expertise is needed. Further, respondent A7 state that associate and senior auditors are the ones who are most driven in the work with BDA and that they constantly communicate with people higher up in the hierarchy. Contrary to this, respondent A4 saw a resistance within the group of ageing senior auditors and that full BDA implementation would not be possible until a generation shift had taken place.

The performers of BDA differs between firms and how the division of complexity is handled. In some cases, the preparation of data is handled by specialists and the analysis, at least to an extent, handled by auditors and in other cases specialists handle all the analytics and auditors only interpret the results. One area to note is the discrepancy of the accounts of respondent A4 and A7. While it could at least partly be explained by the fact they are active in different firms, respondent A7 presents senior auditors as advocates for BDA implementation while respondent A4 presents them as a barrier which likely can be explained partly by set practical procedures and partly by an educational challenge as presented by Power's (1996) knowledge system.

Generally, all respondents state that their firms work with data security by handling the client's information on special programmes or platforms designed to share information securely and that the process is largely unaffected by the implementation of BDA. Something to point out is that respondents A2, A3, A5, and A8 all emphasize the complication due to the legal requirements on handling data, especially GDPR and that it has increased the pressure

on the firms regarding how data is stored and handled. However, respondent A4 emphasizes that this complication is handled by uploading financial data into a secure programme. Meanwhile, respondent A2 discussed that clients use of SIE-files to upload their data to a server created by the firm which enables secure data transfers. Furthermore, respondent A2 highlights the fact auditors have professional secrecy and are bounded by laws, regulations, and professional conduct regarding data handling. Furthermore, respondent A8 noted that GDPR only has contributed to minor changes in their way of collecting data, although the increased availability of data through the use of analytics and BDA has reduced the number of additional data requests needed during an audit. Additionally, the respondent mentioned XBRL as an upcoming technology for standardization of accounting data that should have a positive impact on BDA utilization.

Similar to the findings of the more senior staff, the associates all express that the implementation of BDA has not altered the data retrieval or storage in any particular way, except respondent A8 that has noted a reduction in the number of additional information requests needed during an audit. As above the risks of processing sensitive data (Cao et al., 2015; Yoon et al., 2015) are perceived as handled. Further, the complication due to GDPR is present but respondent A4 sees this solved by proper data handling. Again external standardizations of accounting data are mentioned, both SIE by respondent A2 and A3 under the implementation segment but also XBRL by respondent A8, a standard that unlike the SIE-format is international which further enhances its ability to assist providing a socially desirable outcome (Suchman, 1995).

General Analysis of BDA Implementation

When covering the current state of implementation and utilization of BDA in the audit methodology, senior staff emphasize the improvement in audit quality, in line with prior observations of Suchman (1995) and Power (2003), and although there are clear technological advancements of the technologies, the unified vision presented does entice the thought of image management (Power 2003), especially when dealing with a profession as dependant on legitimacy as auditing (Power, 1992). Associates, on the other hand, focus on the practical application of the technology and touch on the levels of professional knowledge and the balance of structure and judgement. This difference in focus could be explained with

the different roles inhabited, where the senior staff has more client contact and are relied upon by the firms to both to sell the services of the firm and also the legitimacy of both the firm and the profession as a whole (Power, 2003). Further, senior staff connects the implementation with BDA with the current utilization of data analytics and views the implementation as a technological advancement while the associates to varying degrees have difficulty separating the two technologies, a discrepancy that can be caused both by lack of experience and education, in other words, knowledge (Power, 1996). Both senior staff and associates presents a similar utilization of BDA within the firm, with differentiating roles performing different tasks dependent of firm but with similar views within each firm, although some differences do exist, i.e. between the answers of respondent A7 and S5 both active at the same firm, which further indicates a knowledge discrepancy in accordance to the system of audit knowledge (Power, 1992).

With data processing procedures, there was a predominantly unified trust in the implemented systems ability to handle sensitive data (Cao et al., 2015; Yoon et al., 2015) in regard to BDA implementation and the increased volume of data involved, with mentions of externally standardized accounting data further benefiting implementations of BDA, to further increase its contribution to stakeholder demands and societal benefits (Suchman, 1995).

Advanced knowledge about analytics, and BDA in particular, seems to reside within specialist teams, while tools are widely available. Different user groups have been identified outside of the specialist groups, varying between firms. While respondent S3 states that senior staff with knowledge and interest are offered opportunities to use the technology, respondent A4 indicates that distrust of the technology among aged senior auditors can delay the implementation. In a similar fashion, respondent S4 indicates user dominance among junior staff. Further, respondent S5 emphasises that BDA is a young technology that is still being implemented, while respondent A7 says BDA is already being utilized within substantive testing. Similarly, respondent A2 indicates that current tools can't handle the amount of data present in large corporations, while respondent A3 indicates that BDA is being implemented and respondent S2 states that advanced analytics is possible with the aid of specialists and a new tool, allowing for simple BDA analytics without advanced knowledge. This new tool is currently being implemented but a resistance based on a lack of

knowledge is present, according to the respondent. These observations, along with the statements of respondents A1 and A4, indicate a discrepancy between formal and localized audit knowledge (Power, 1996).

4.1.2 Possibilities

The implementation of Big Data Analytics holds promises of improvements in the audit methodology but how do practitioners perceive these possibilities?

Interviews with Certified Auditors and Analytics Specialists

Respondent S1 sees a possibility for improvements in the audit quality, through assistance in the selection process of statistical sampling process in the substantive testing, with development towards the processing of the complete population and a shift from sampling to expected values based on organisational and industry data. This shift is a result of BDA implementation affecting the audit methodology in areas where the technology is deemed beneficial and future iterations will incorporate AI. Further, the respondent believes that the technology will help assure that the correct methodology is utilized in the audit process, further increasing audit quality. Furthermore, the respondent believes the technology will improve the detection of material errors, especially systematic errors, as these otherwise are next to impossible to identify. Additionally, the reliance of BDA will at some point reach a level where it can substitute traditional audit evidence as development continues, dependant on case-by-case circumstances, according to the respondent.

Further, respondent S2 foresees the implementation of BDA to make full population coverage possible in analytics and a shift in focus to anomalies instead of using statistical sampling, which contains analytically correct information. Even though BDA potentially provides aid with the identification of anomalies, the respondent stresses that an auditor's professional judgement will always be required to interpret the results. Furthermore, the respondent believes that BDA results will have enough reliance and validity to substitute audit evidence in some instances, dependant on the subject of the analysis and the quality of the underlying data. Additionally, the respondent believes that AI and robotics will be incorporated in the BDA process in the near future and with a longer time perspective the audit methodology will

switch from being reactive to proactive, potentially with software installed within the client's information systems to monitor data streams.

Furthermore, Respondent S3 states that the implementation of BDA helps the understanding of the client's business and its environment. The implementation will further increase the possibility to identify material errors, due to larger datasets and increased analytical capabilities, which according to the respondent will enable a move away from statistical sampling. These potential benefits are according to the respondent dependent on the quality of the underlying data and entered parameters in the analytical process. Gazing forward, the respondent envisions a utopia where information systems are integrated, e.g. with automated credit bashing of doubtful trade receivables and control stock takes, along with integrated connections to external databases as well as AI utilization.

In a similar fashion, respondent S4 indicates that increased audit quality can be attained through the implementation of BDA in the audit process, as the technology provides a whole new basis for professional judgement, by enabling full disclosure of clients' transaction flows and a focus on abnormal areas of risk. Further, the respondent continues that the development of analytical tools is continuous and paints a similar picture as above, with integrated systems and continuous auditing, but here dependent on the standardisation of the client's information and accounting systems.

Respondent S5 echoes the belief of improved audit quality through the implementation of BDA, through the support of the technology, manual errors in the audit process can be avoided and the full available datasets can be examined, compared to previous statistical sampling, which enables auditors to conduct their work with a useful insight into the client organisation. The technology even holds a promise to unveil things about the client's organisation that they are unaware about, according to the respondent, which will enable the auditor to go beyond what is required and deliver a more detailed audit. This is something that the respondent suggests will increase the expectations by the clients, risking to further expanding the expectations gap. Further, the respondent indicates that BDA can be beneficial in identifying material errors and characteristics that indicate fraud, dependent on set parameters in the analytical process. Looking ahead, the respondent contemplates further

development of BDA and the implementation of capabilities such as automated data extraction from clients with the aid of AI, along with reconciliation and cleansing of retrieved data, while emphasising that audit judgement always will be needed to interpret the final analytical results and that the perceived possible benefits of BDA rely on the quality of client data.

A unified view is presented of the possible benefits to audit quality by the implementation of BDA, which is in line with the legitimization of new technology (Suchman, 1995), with a shift from statistical sampling towards focusing on anomalies. This shift is driven by the possibility of attaining full analytical coverage of available data, according to respondents S1, S2, and S5, which will aid in materials error identification and fraud detection, according to respondents S1, S3, and S5, something that coincides with Power's (1992) claim regarding the duality of the auditing profession in regard to the practice of sampling. This is also in line with what both Cao et al. (2015) and Alles and Gray (2018) presents in regard to the ability of BDA to increase the possibility to detect misstatements and fraud. Additionally, respondent S1 believes the structural procedure will assure that a correct audit methodology is followed. Further, this deeper analysis will help build a better understanding of the client's organisation and environment, according to respondents S2 and S3. This is also in line with the findings of Cao et al. (2015), who found that BDA can affect the auditor's picture of the entity and its environment. All the above statements correlate well with the notions of legitimising new technologies presented by Suchman (1995) and the production of legitimacy (Power, 2003). This deeper understanding will, according to respondent S5 enable auditors to not only more efficiently conduct the audit but deliver extra value to the client (Weiss, 1999; Power, 2000).

Furthermore, respondents S1 and S2 foresee the reliance of BDA becoming strong enough to generally be able to substitute traditional audit evidence, with goes along with the high reliability of BDA (Yoon et al., 2015). Although, the benefits presented are dependent on which areas of accounting being tested and circumstances in the analytical process, according to respondent S1, circumstances further defined as the knowledge of the analyst, according to respondents S3 and S5, and the quality of data input for the analysis, according to respondents S2, S3, and S5, but the latter is something that can be remediated by external

standards of accounting information, according to respondent S4, this duality of perceived benefits and operational limitations can be related to Power's (1997) statements about the audit society, as well as the levels of audit knowledge (Power, 1996).

A future vision of continuous auditing is presented by respondents S2, S3, S4, and S5, where collection and consolidation of data are automated and external data is used, and even cleaned based on materiality according to respondent S5. The future iterations of BDA are perceived to be reliant on AI, according to respondents S1, S2, S3, and S5, but respondents S2, S4, and S5 emphasises that audit judgment will always be needed to interpret the actual results, correlating well with what Power (2003) wrote about levels of audit knowledge regarding automatisation and judgement.

Interviews with Associates

Respondent A1 feels that he currently does not see any direct benefit of BDA implementation in his daily tasks, which according to the respondent can be due to extensively covering smaller companies but that this is something might change as development continues. Further, the respondent believes automatisation will help alleviate auditors from manual tasks and allow focus on areas of more importance.

On the other hand, respondent A2 indicates that a benefit with BDA is that it enables the auditors to easier see and track material errors, check that the client organisation has conducted themselves correctly, and will also aid in the identification of material errors and anomalies due to the scope of the analysis. The implementations will, according to the respondent, increase the efficiency of the audit process by eliminating manual steps and present the accounting data in a new way. Although, the respondent believes that the results of BDA will never be strong enough to be self-sufficient evidence and that an auditor always will be needed for their professional judgement.

Further, respondent A3 states that BDA contributes to increased audit quality through aid in risk identification and fraud detection. Further developments of BDA will, according to the respondent, be thoroughly implemented in the audit methodology, emphasising manual tasks and statistical sampling as areas of important improvements with the introduction of robotics

and more advanced, and complex, analytics. Regarding the reliance of BDA as audit evidence, the respondent believes that the technology will likely stay as a complementary tool in the audit process.

Furthermore, respondent A4 identifies real possibility for improvement of audit quality and efficiency through the implementation of BDA, e.g. through the inclusion of sustainability data in the analysis, and the respondent presents substantive testing as an area what could especially improve with the aid of the technology, e.g. with controlling securities, something that is a time-consuming manual task. Looking forward, implementation of AI in BDA technology would over time enable the reduction of time-consuming manual tasks in the audit process. This could lead to an increase in the reliance on BDA to enable substitution of traditional audit evidence but at the same time the respondent notes resistance to new technology with senior staff in the form of distrust of its reliance.

Additionally, respondent A5 mirrors this stance and means that BDA can guide the auditor to focus on anomalies when you have access to a comprehensive understanding of the organisation instead of using statistical sampling, and this comprehensive understanding enables auditors to contribute additionally to the client than previously possible. On the other hand, the respondent is hesitant if BDA ever will be able to fully substitute other audit evidence and regards BDA more as a complementary technology.

Additionally, respondent A7 indicates that BDA implementation increases audit quality by supporting both wider and deeper understanding of the client's organisation and its environment, and yield a more accurate audit, contributing additional value for the client and foresees this development to be continuous.

Moreover, respondent A8 states that BDA is beneficial to audit quality and efficiency by aiding in identifying material errors through the use of trend and anomaly analysis, yielding greater precision in the audit, along with a short-term aid in the selection process of statistical sampling and replacing the procedure in the long term. One area emphasised where BDA could provide improvements is peer comparison and industry analysis, where the respondent believes BDA will help make the enormous amounts of data involved interpretable. Looking

to the future, the respondent remarks that self-learning AI is already being implemented into the BDA process, promising rapid improvements ahead, involving automation in various steps of the audit process. Still, the respondent indicates that the reliance of BDA is still subject to judgement and will need to be carefully evaluated over the coming years.

A mostly unified view is presented of the BDA implementation's possible beneficial effects on audit quality, with only reservations due to scope of experience. The implementation of BDA is perceived to help with the understanding of organisations and their environment, according to respondents A5, A7, and A8, with respondent A2 adding that the tools help better visualize the data and will according to respondent A7 generate additional value for the clients, which ties in with the legitimacy production for new technology (Suchman, 1995; Power, 2003). Furthermore, these findings indication of BDA as a possibility to form a picture of the client and its environment, in line with Cao et al. (2015).

Further, BDA will enable analysis of data in a way that will aid in the identification of material errors using anomaly and trend predictions, according to respondents A2 and A8, something that according to respondents A3 and A8 will involve a shift away from statistical sampling, which goes in line with the findings of Power (1992) regarding the duality of the sampling practice. Furthermore, the results from the empirics show that similar to previous research, BDA can aid in identifying fraud and material errors (Cao et al., 2015; Alles & Gray, 2018).

Looking at further implementations, automatization of manual tasks is listed as an improvement by all respondents but A7 indicates that this will be incorporated in the future. Respondent A3 envisions this happening in conjunction with more advanced analytics, while A4 envisions that implementation of AI in the BDA procedure will be part of future developments, something that respondent A8 indicates is already being implemented. In regard to automatization, respondent A2 emphasises that even though improvements will be made, BDA will not be able to be self-sufficient and audit judgement will always be needed, which respondents A2 and A3 corresponds with saying that BDA technology, while a good complementary technology, will not be able to substitute traditional audit evidence, something that respondent A5 is hesitant about and respondent A4 disagrees with, but also

adds that ageing auditors appear to have reservations regarding the reliance of the new technology, which is similar to what is shown by Power (2003). Notably, respondent A4 believes that BDA can substitute traditional audit evidence because of its reliability, similar to Yoon et al. (2015). Although, respondent A2 and A3 only think it could be a compliment, which is in line with Yoon et al. (2015).

General Analysis of Possibilities

Judging by the expressed views of the interviewees, the implementation of BDA in the audit methodology is anticipated to bring a lot of benefits. The potential benefits range from improved audit quality and efficiency, through a move away from statistical sampling towards full population coverage and the greater understanding of the client's organisation and environment the implementation could bring, which fulfils all the conditions of Suchman's (1995) model for legitimising new technology. This further fits with Power's (2003) statements about the need and importance for the audit profession to fabricate a base for evaluation due to the lack of natural hard evidence of how this new technology will benefit both the audit profession and the users of their services. Additionally, the claims of added value for the client goes in line with previous research regarding the value for the customer (Weiss, 1999; Power, 2000). Further, the move away from statistical sampling could be seen as a mending to a legitimacy "fix" of the past identified by Power (1992). The differentiated views regarding the reliance of BDA as audit evidence and the emphasis on professional audit judgement are in line with Power's (2003) and the dualism of structure and judgement.

The findings indicate that the possibilities of implementing BDA mainly are to aid when forming a picture of the entity and its environment, and foremost to identify misstatements and fraud, which is in line with Cao et al. (2015), and Alles and Gray (2018), although something that has been prominent is the respondents' belief that BDA will improve audit quality, something that has not been covered in previous research covering BDA and auditing. Furthermore, previous research has identified far more possibilities, such as to identify risk within the planning phase to decide whether to accept or continue with client engagement and to aid the auditor when forming the audit opinion (Cao et al., 2015), something that are not found to be perceived as possible benefits by the respondents.

4.1.3 Risks and Issues

The implementation of BDA does not just open up possibilities for improvements in the audit methodology but also just carry its own risks and issues.

Interviews with Certified Auditors and Analytics Specialists

Respondent S1 state that with the implementation of BDA, there comes a risk of deprofessionalisation. The respondent further explains that this professionalisation is based on the possible issue arising with automatisation, and as the respondent state *"letting the machines do too much of the work"*, which can result in the professional ability being lost. Furthermore, the respondent anticipates a possible risk that could emerge from the implementation of BDA, namely that the expectations gap could increase due to the fact that the auditors now have the ability to analyse all the available data. However, respondent S1 further explains the importance of clear communication with the clients and explaining the basics of auditing, namely risks and materiality. Clients need to have a clear picture of what exactly is the purpose of the audit and that it is not possible for the auditor to audit everything.

Furthermore, respondent S3 states that with these new analytical tools, a risk arises regarding trusting that the data input is correct, since if the data is incorrect all the analytics will be based on faulty data, and hence the analytics will be inaccurate. As a result of this, BDA can only be seen as a complement to traditional audit evidence due to the risk of faulty data, and an auditor still needs to perform substantive testing. Moreover, it is essential that audit teams understand the data, which parts of it that are relevant and how the data can be analysed. Furthermore, there is also a risk of losing the understanding of the business, but this is extremely important in auditing and is something that cannot be afforded to be lost. Further, if the audit team do not have sufficient knowledge regarding data with understanding, knowing which data is relevant, and how to analyse the data, there is also a risk of a lot of false positives, meaning that the analysis will show that a lot of the data is inaccurate. However, this would be a result of a lack of knowledge, which would lead to a vast amount of time having to be invested by the audit team, resulting in higher costs for the client.

Furthermore, respondent S3 argues that there is an increased pressure from clients for the audit firm should be able to handle large amounts of data. However, the respondent has not perceived any pressure regarding the higher assurance of the audit statements.

Furthermore, respondent S2 also highlights a risk with BDA is the result of analytics is that the client has a lot of anomalies, so-called false positives. According to the firm's audit methodology, the audit team is required to look into each anomaly, which results in extra work for the audit team. To minimize the risk of these false positives, respondent S2 argues that correct parameters for running analytics and a good relationship with the client in order to understand the client's business are essential for interpreting the analytical results optimally. Furthermore, respondent S2 is aware of the risk regarding the expectations gap, since clients, as well as society in general, have an expectation of auditors being similar to police detectives. But auditors should not actively search for fraud, rather evaluate the risks of a certain company and within the areas of risk, report if indications of fraud are discovered. However, it is generally expected that an auditor should find fraud if it exists, and if not the auditor gets questioned regarding why the fraud was not discovered, even if the fraud is outside of the scope of the audit and the auditor role according to laws and regulations. Furthermore, respondent S2 also notes risks related to the data collected, since auditors now look at a vast amount of data, it is important that the data is handled in a secure way.

Respondent S5 states that a risk with BDA is that the client might not know how to extract data or that the data is incorrect, which do not result in any benefits to the audit since the data is incorrect, which results in wasted time and effort, which also affects the materiality of the findings. A related issue is that ERP systems differ between clients and that some use uncommon output formats not compatible with the firm's analytical tools, requiring manual processing to be made useable. Another risk is that when working with a client for the first time, it is generally more difficult to understand the areas of risk and when utilizing BDA, this can result in false positives which cannot be refined. When this happens, the audit team have to investigate each of the false positives. Otherwise, the population has to be refined, e.g. by either communicating within the team or with the client in an attempt to retrieve an explanation about the false positives and avoid making any assumptions. Furthermore,

respondent S5 perceive that BDA can result in higher pressure on the audit, and an increased expectations gap, mainly due to the change from statistical sampling to looking at complete available data sets. Moreover, the respondent highlighted that the other Big 4 also are advancing within analytics, which results in higher expectations from the client regarding ability to use analytics and analyse full populations.

Generally, it seems as if respondent S1, S3, and S5 do not perceive privacy related to the new amount of data collected to be a problem, rather, as said in part 4.1.1, the respondents feel as if their firm has developed a secure way for data collection and transfer. With that said, they do not believe BDA to increase these risks, but instead that the risk already is handled in a sufficient way. However, respondent S2 note that BDA implementation results in increased risks related to handling increased amounts of sensitive data and that it is essential that the data is handled in a secure way. Furthermore, previous research has found that one of the possible risks related to the use of BDA is privacy (Cao et al., 2015; Yoon et al., 2015). Furthermore, respondent S2 and S5 highlighted in section 4.1.1 the role of regulations and laws, such as GDPR, have on how data is handled.

Another risk identified in previous research is the increased pressure on auditors to discover fraud since they will have the ability to analyse all the available data (Alles & Gray, 2018; Cao et al., 2015). Our findings are in line with previous research and indicate that respondent S1, S3, and A5 all believe that BDA will result in higher pressure on the auditors to discover fraud, and result in an expansion of the expectations gap. Moreover, respondent S2 does not state that the expectations will increase, but that certain expectations exist. Additionally, respondent S1 and S2 both emphasize that auditors are unable to look at everything and that this is not part of the audit scope, and respondent S1 highlights the need to communicate this to the clients to help minimize the expectations gap. This can be connected to the duality of the audit profession regarding idealistic and practical levels (Power, 1997) and how conceptual ideas and understandings do not always coincide with the practical possibilities, along with how the lack of hard evidence regarding the effects of auditing (Power, 2003) makes it hard for the public to evaluate the profession's output.

Furthermore, research has found that with BDA comes the risk of false positives, which leads to unnecessary time invested (Alles & Gray, 2018; Yoon et al., 2015). In line with previous research, respondent S2, S3, and S5 all argue that there is a risk of false positives. Further, respondent S2 from firm 2, and respondent S3 from firm 3 state that their firms have decided that when anomalies are identified, the audit team has examine everything that has been identified as possible misstatements, no matter how many. Respondent S2, S3, and S5 all state that these false positives all result in unnecessary time invested, which is in line with what is said by Alles and Gray (2018), and Yoon et al. (2015). One of the causes for false positives, the wrong calibration of parameters when running the analytics, can be connected to a lack of knowledge and a discrepancy in the dissemination of the audit knowledge within the firm (Power, 1996) as well as a knowledge requirement for the benefits of the technology to come to become reality. The interaction with clients to resolve the issue of false positives correlates well with the findings of previous research, that states that a legitimate base for auditing needs to be constructed (Power, 2003) and that this base is jointly constructed between auditor and auditee (Power, 1996). Additionally, respondent S5's reference to the Big Four indicates a strives for unified practice and moral legitimacy (Suchman, 1995).

Other possible risks that have been highlighted in the interviews is the risk of deprofessionalization, that respondent S1 highlighted. Furthermore, respondent S3 notes that there is a risk of losing the understanding of the profession. Respondent S3 and S5 both stress the risk of inaccurate data and as a result of this, respondent S3 only believes that BDA could be seen as a complement to traditional audit evidence. Research has found that several changes must be made to be able to implement BDA (Alles & Gray, 2018; Cao et al., 2015). One of these changes is that audit teams need to have more knowledge about analytics, and the link between financial and non-financial data. Respondent S3 further confirmed this, stating that the audit team must have sufficient knowledge regarding data and analytics, to understand the data, to be able to know which data is relevant and how the data should be analysed. The risk of losing professional identity can be seen as an increased need for legitimacy production (Power, 2003) but also changes in the entry barrier to the profession (Power, 1996) as well as changes in the knowledge demands of the profession and presenting a risk of the potential erosion of the professional knowledge.

Interviews with Associates

Respondent A1 primarily works with owner-managed companies and says that a possible issue with BDA is that it is only applicable in larger companies and not in small companies. Furthermore, respondent A1 believes that implementing BDA will lead to higher pressure on the audits, and hence an increased expectations gap. When having the ability to look at all transactions and data, the pressure of finding material misstatements increase, however the respondent emphasizes that it is not possible for an auditor to look at everything, especially as a result of a tight budget. Furthermore, the respondent thinks that BDA only will serve as a complement to traditional audit evidence, since audits cannot be automated through every step of the process.

Furthermore, respondent A2 states that there is a risk of analysing too much and not just what is material, which in turn result in decreased efficiency. Also, there is an increased risk of not understanding what is being analysed. Furthermore, the respondent noted that there is a risk of a decrease of manual work, which could lead to a reduction in demand at the audit associate level of the workforce, although since the clients themselves cannot perform the analytics, there is an increased demand for these services, resulting in more job opportunities in other parts of the firm. Furthermore, respondent A2 believe that BDA increases the expectations gap since it will lead to clients expecting that the auditors should find any misstatements that exists. Moreover, the respondent emphasises society's view of the auditor’s role, which is to ensure that there are no misstatements or fraud.

Respondent A5 describe the risk with relying too much on the data, as relying on a faulty dataset results in the analytics also becoming incorrect. However, they are constantly working to minimize this risk by involving IT-specialists within almost each audit engagement to ensure that the data is correct. Furthermore, the respondent noted that the risks always differ between different companies, but that the importance is the final product, to provide assurance to the financial stakeholders.

Furthermore, respondent A3 emphasise that with the new tools and digitalisation, there is a risk that future employees will lack understanding of the whole audit process, since the basic knowledge gathered from more basic, standardized tasks will be lost due to future

automatisation. Furthermore, the respondent believes that the expectations gap might increase as a result of BDA implementation in auditing. Because the firm is at the forefront regarding BDA, more pressure is put on the audit since you are expected to find all misstatements when you have access to all the data. Furthermore, respondent A3 says that even though the audit team will not be able to find all misstatements, large, abnormal misstatements should be identified.

Respondent A7 state that a risk arising with BDA is that the client gets annoyed since it can be difficult to collect the right data. Usually, someone from the IT-department is involved with collecting the data to ensure that the right data is collected.

Furthermore, respondent A4 states a risk with BDA is to rely too much on the data, even if the data is incorrect. The data can be faulty when collected from the client or can become incorrect as a result of gathering data from different sources. Another perceived risk is that those conducting fraud might learn how the tools and programmes for BDA works, and find new ways to manipulate the data without it being detected. Further, the respondent does not believe that the expectations gap will increase directly as a result of using BDA, at least not for a very long time. However, the respondent notes that misstatements always will exist, and all will not be able to be identified by the auditor, but that the contribution will be greater than the risk.

Respondent A8 highlights that the expectations gap will increase in the long run, but that this is an effect of BDA resulting in finding more of the material misstatements compared to traditional auditing, and that this is not a result of the implementation of BDA (rather a result of the effect BDA has on the audit). Furthermore, respondent A8 notes the risk of false positives, where the risk is handled by looking at monetary unit sampling, where a confidence interval is set and the largest possible misstatement is estimated, something that can be made worse when dealing with poorly structured data.

One of the risks portrayed by previous research is that of data privacy since auditors have access to additional sensitive information about their clients (Cao et al., 2015; Yoon et al., 2015). However, the findings from the interviews indicate that audit associates do not see this

as a risk, but rather that the risk is already covered by the use of secure programmes and platforms for collecting and storing data.

Furthermore, research depicts the increase of the expectations gap as a possible risk stemming from using BDA, because the auditors move away from statistical sampling and instead analyse all data (Alles & Gray, 2018; Cao et al., 2015). In line with previous research, respondent A1, A2, A3, A4, and A8 agree that there is a risk of increased pressure on the auditor to find misstatements, and hence an increase in the expectations gap. However, respondent A4 and A8 believe that the effect on the expectations gap will not be seen immediately, but further in the future once BDA is fully implemented. This is in line with previous research both regarding the need to legitimize practice due to lack of natural verifiable evidence and the perceived need to produce it (Power, 2003) as well as misconceptions regarding the idealistic and practical levels of auditing (Power, 1997).

Research has also found a risk of false positives arising with BDA (Alles & Gray, 2018; Yoon et al., 2015). The majority of the associates did not have any knowledge about this, but respondent A8 agreed with previous research and said that there is a risk of false positives which can be handled by the correct usage of the audit methodology. Furthermore, respondent A2 also touches upon the topic, stating that there is a risk of analysing too much. Moreover, respondent A2 state that there is a risk of not understanding the analytics, and respondent A3 said that there is a risk of new employees lack understanding of the audit process as a whole. This could be linked to previous research that has found knowledge to be an area in need of change (Alles & Gray, 2018; Cao et al., 2015). The respondents also found additional risks, respondent A1 believe that BDA is not applicable in small firms. Moreover, respondent A2 state that it can be difficult to collect the right data, resulting in clients being annoyed. Respondent A4 state that there is a risk of relying on the data since the data can be incorrect, furthermore, the ones conducting fraud could find new ways of manipulating data. These difficulties are connected to structural advancements in the audit methodology (Power, 2003) and the need for judgemental input from the auditors, as well as a requirement that the audit knowledge needed is in place (Power, 1996).

Furthermore, respondent A2 stress that the role of auditors depicted by the society is to ensure that there are no misstatements, and respondent A5 state that the importance is that auditors provide assurance to financial stakeholders. This correlates with the previous research on how legitimacy is created and maintained (Suchman, 1995).

General Analysis of Risks and Issues

The findings from the interviews indicate that privacy is not seen as an increased risk, by 3 out of 4 of the certified auditors and technical staff, and none of the associates. Although, one possible reason for this is that the implementation of BDA is still in its infancy and that audit teams mainly focus on financial data, and not on non-financial data which potentially contains more private sensitive data. Yoon et al. (2015) explain the issue of privacy related to BDA by the example of internal emails used to discover fraud. Furthermore, this could become a possible issue when the firms expand their utilization of BDA to include non-financial data.

In line with previous research, the main part of respondents, both among senior staff and associates, believed that the expectations gap would increase as a result of being able to analyse all the available data. With this said, something that was prominent in the interviews was that clients already often have too high expectations on auditors, expecting auditors to do more than what they are bound to do by law. Hence, it could be further discussed in what degree BDA actually will affect the expectations gap, since it seems as if auditors conducting traditional audits already are expected to look at everything, and find misstatements if they exist, no matter how small.

The results from the findings of the senior staff, as well as one associate show that there is a risk of false positives, which has a negative effect on the audit, something that is in line with previous research. Research has also shown that more education and knowledge of BDA is needed (Sao et al., 2015). Respondent S3 said that a lack of knowledge results in these false positives. Furthermore, since BDA still is rather new within the audit methodology, it is possible that the knowledge is still rather scarce on how and when to use BDA, which could help explain why several respondents found false positives to be a risk.

Respondent S3, A5, and A4 believe one risk with BDA utilization within auditing to be relying too much on the data since there is a risk of the data being incorrect. However, previous research such as Yoon et al. (2015) describes that Big Data typically has higher reliability because of its vast size, and due to the use of external sources of data. Although, the firms are not yet in the stage of using a lot of external data, but rather uses the client's internal data, which could explain their view. Moreover, respondent A1, do not believe BDA to be applicable in small firms, although this could be a result of the respondent's lack of knowledge regarding how or why BDA is used within the firm, since BDA should be applicable to small firms as well, but perhaps not to the same degree as with large firms. Furthermore, respondent S1 discusses the risk of deprofessionalization and respondent S3 discusses the risk of losing understanding of the client's business as well as respondent A3 discusses the risk of new employees lacking understanding of the whole audit process, all which can be associated with the knowledge requirements of the profession (Power, 1996).

4.2 Knowledge

When implementing new technology, knowledge is an intrinsic part of the process. Through the conducted interviews, areas of importance have been identified regarding how knowledge affects the implementation process. Knowledge has been identified as both an enabler and an obstacle for understanding how the technology can be used and how to practically apply the new technology in the audit methodology, where a knowledge discrepancy between role levels has been found. Therefore, the following chapter will examine knowledge by firm, in order to further examine this knowledge gap. Additionally, a threat to the knowledge base needed for professional judgement has been identified.

4.2.1 Audit and Technical Knowledge

In total, 11 of the 13 respondents has a formal education of at least three years within business administration, one respondent a post-graduate academic education within another field and one respondent with a high school education within business administration and plans on getting a higher education within business administration in the near future.

Firm 1

In firm 1, the interviews were conducted with two individuals, one partner who is also a certified auditor, and one associate auditor. S1 said that the firm generally offers quite a lot of courses internally. However, the respondent emphasised that internal training covers both theoretical knowledge and practical knowledge of how to use different tools. S1 has been involved with conducting internal education and educated lower level employees about technology and different technical tools. However, they are currently developing a new tool and in order to train the employees in using the new tool, one representative of each office will get an education centrally in the network and be in charge of educating the rest of their office.

In contrast to what S1 said, A1 claims that the firm offers internal education each autumn but these are complemented by external education related to standards and regulations, not BDA or technical tools. Furthermore, A1 got curious under the interview about whether or not any internal courses about BDA existed, but found no available course. Furthermore, A1 felt like there was no need for such a course since the respondent did not see in what way a course like that would be useful when conducting the audit within his scope of small businesses. Additionally, A1 states that education is offered as need arises.

Firm 2

The respondents from firm 2 were one certified auditor with technical knowledge and two associates. The respondents all agreed that the firm offers a lot of internal training consisting of different courses, and respondent A2, an associate, said that the firm offers internal education each month. Furthermore, respondent A2 stated that they are also supposed to participate in external educations with regards to regulation, although these are less frequent than the internal ones. Moreover, respondent A2 do not know if the firm will offer any internal education related to BDA, but the respondent notes interest if education was available. Respondent A3 emphasises that auditors are supposed to understand the outcome of the data, to be able to analyse the results but are not supposed to understand how the data is used in the analytical process since the data is processed by a division of specialists. Furthermore, respondent A3, an associate, states that:

> We always work in teams, and the team composition varies depending on the size of the client, but there is always someone who has more experience of the technological tools used. But whenever a new tool is developed, the firm offers internal education in using the specific tool.

However, respondent A2 stated that the new tool for data analytics is currently only in the beginning phase, and there are only a few people who have tried the programme. Furthermore, respondent S2, state that auditing is an experience-based profession by stating:

> Auditing is a profession of experience, through the experience you know what to focus on and why you should focus on it, there is no right or wrong, but through motivating your actions, you do things.

Firm 3

In the third firm, two persons were interviewed, one partner and certified auditor, and one associate. Respondent S3, the partner, said that they have a special group specialising in BDA and data analytics. Furthermore, some employees seen as key staff get more than the standard education. Furthermore, respondent S3 notes that when working within audit nowadays, you have to possess certain IT-knowledge, e.g. to be able to analyse data and know how to use certain programmes. However, the respondent would want more IT-education and the respondent state that *"sometimes I wish that I had a more IT-technical background"*. Furthermore, respondent A4 who mainly works with small companies, had not had much education regarding BDA but has some knowledge of Power BI. Furthermore, the respondent notes that further education about BDA would probably not benefit his daily work anyway, and hence it would not bring any value but perceived it would be offered if there was a perceived benefit. For those that have more experience, there is a possibility to receive education about more advanced analytical programmes. Furthermore, the respondent described that the firm offers different guides that can be used for self-learning.

Firm 4

Within firm 4, interviews were conducted with a group who all had technical knowledge. One was a certified auditor, one an audit associate, and one was a technical associate without audit

knowledge. Respondent A6 emphasized that a lot of internal education has been conducted about analytics, which the other respondents agreed with.

Firm 5

In firm 5, one senior manager with technical knowledge, but without audit knowledge, and one audit associate were interviewed. Respondent S5 is involved with delivering internal training to other specialists about how to use technical tools, and in addition, the firm is now developing a more structured educational form for non-technical staff regarding analytics. Respondent S5 is now working with general education to non-specialists within auditing, teaching them how to use and analyse data, and explain the benefits of data analytics. Furthermore, respondent A7 describes that the firm offers some internal education in regards to BDA, but mainly internal and external education about standards and regulations. Furthermore, there is a team of specialists within analytics at the firm who help educate the audit teams about BDA to inform about how the audit can be improved.

Firm 6

From firm 6, one audit associate with technical knowledge was interviewed. The respondent said that the firm has ongoing internal educations for those who work with auditing. However, the firm does not provide more in-depth training in regards to BDA, but rather more about trend analysis and how to structure large amounts of data. However, since the firm has a special division that focuses on data analytics, along with the notion within the company that auditors should have more general knowledge and know when a specialist is needed for a more advanced interpretation.

General Analysis of Audit and Technical Knowledge

Generally, all respondents seemed to agree that their own firm offers a lot of internal education, and respondent A1 (firm 1), A2 (firm 2), and A7 (firm 5) further noted that external education was offered as well, related to audit standards and regulation. This is in line with the education level of the system of audit knowledge, which states that formal and informal knowledge is shared inside or outside the organisation (Power, 1996). Furthermore, 11 of 13 of the respondents has an equivalent academic background. These findings confirm what Løwendahl et al. (2001) states regarding members of professional service firms often

have a high level of education and that professional organisations offer additional education. Furthermore, the respondents background along with the additional education indicate that all respondents have similar information-based knowledge (Løwendahl et al., 2001). However, important to note is that respondent S3 and A4 from firm 3 note that some people are offered more education because they are seen as key staff, or because they have more experience. This is something that is also touched upon by respondent A2 from firm 2, who noted that the new tool that has been developed currently only has been used by a scarce number of people. This could indicate that even if people generally have the same information-based knowledge, it could differ a lot from person to person.

Furthermore, something interesting is that respondent S2 from firm 2, stated that auditing is an experience-based profession, since it is through experience that you know what to focus on and why, which is in line with how the profession's knowledge base develops over time based on preferred procedures and behaviour (Power, 1996). It could also indicate that the respondent believes that auditing is based on tacit knowledge rather than explicit knowledge (Løwendahl et al., 2001). Furthermore, respondent A3 (firm 2) and A8 (firm 6) say that some knowledge is gathered from others with more experience or from specialist, and this provides an example of knowledge connection within the firms (Weiss, 1999), since the respondents both indicate that they know who to talk to if in need of more information. Moreover, respondent S5 (firm 5), who is not a part of the audit profession but rather a technical specialist, share knowledge to non-specialists within auditing by arranging general training. This can be seen as a way for the firm to create a shared knowledge base and to improve knowledge connection (Løwendahl et al., 2001; Weiss, 1999).

4.2.2 Knowledge Sharing

Firm 1

From firm 1, one associate was asked questions related to knowledge sharing. Respondent A1 state that *"my firm has a casual setting that promotes speaking up, we assistants can without question ask anyone for help whether it is a partner or a more experienced assistant"*. Furthermore, the respondent describes that this is a part of the company's culture, which eases the development of personal relationships. But in general, respondent A1 typically

share his personal knowledge to persons at the same level, not towards those on a higher level. The reason for this is according to the respondent *"since we usually work with companies of the same size and type, the same issues often arise"*. Furthermore, the respondent described that this could be the reason due to the associates often might not have the right answers since they lack a lot of knowledge due to them still being juniors. Additionally, the motivation to share knowledge is mainly seen as a chance to learn by repeating the newly learnt knowledge, and also the respondent emphasizes the notion of being a team player, trying to add value to the group. Furthermore, with regards to how knowledge is shared between divisions, the respondent described that general knowledge beneficial to everyone usually is shared through office meetings. However, more specific knowledge is typically shared on an ongoing basis through the interactions between individuals, and the respondent further notes that *"since everyone is in contact with each other, it becomes natural to share knowledge with each other"*. Furthermore, with regards to how the firm values knowledge, the respondent stated that knowledge is important in order to gain trust from the auditors, but that there probably are other factors which influence this as well.

Firm 2

At firm 2, an associate was interviewed in regards to knowledge sharing. Respondent A2 mainly shares personal knowledge to colleagues at the same level, by increasing the knowledge of how to use different computer programs. At the firm, they have an intranet where information about each division is spread. Also, when working in audit teams the people within the team constantly share their knowledge, and usually employees from other divisions, e.g. tax, is consulted to provide the team with more knowledge. Furthermore, the respondent state that the firm constantly works to improve relationships between both clients and employees by arranging different events. Furthermore, the respondent is motivated to share knowledge because of two reasons. Firstly, knowledge sharing leads to higher efficiency and quality and secondly, sharing knowledge to clients will result in an added-value for the client, which might affect if the client continues with the firm in the future. The cultural values within firm 2 is to act with integrity, contribute to society and to build relationships. Further, the respondent believes that the value of contributing to society increase the possibility to share knowledge within every level in the firm. Furthermore, the

respondent provides an example based on if a new employee gets a broad knowledge-base, then this person can assist colleagues in their work, and as a result the auditor can focus on creating added-value for the client. Moreover, the respondent describes how knowledge is valued within the firm, and state that *"knowledge is clearly sought after by colleagues, who believe that the more knowledge the colleague has, the better because the colleague can assist the others better"*.

Firm 3

From firm 3, an interview was conducted with respondent A4 regarding knowledge sharing. The respondent stated that *"I myself do not have such experience so I share it, those who share their experience with me are those with more experience than me"*. Furthermore, the respondent described that knowledge is shared mainly through oral communication, and since the office is rather small, it promotes people to build personal relationships and generally, others share their knowledge to be kind and helpful. The reason motivating respondent A4 to share knowledge is to help colleagues. Knowledge at firm 3 is often spread between divisions through the intranet and other electronic communication tools. Furthermore, the respondent said that the firm arranges after works, courses abroad along with regional and national meetings in Sweden in order to promote the employees to build relationships. Furthermore, the respondent describes that;

> the culture in the office is such that you are happy to help people in order to increase their performance and there exists no rivalry which means that you yourself would not benefit from keeping information to yourself.

Furthermore, the respondent believes that in one way you become more sought after as a result of increased knowledge, in such a way that you might get responsibility for more complicated tasks and take on larger projects.

Firm 4

No empirical data regarding knowledge sharing was gathered from firm 4.

Firm 5

One senior manager with technical knowledge and one audit associate from firm 5 were interviewed regarding knowledge sharing. Respondent S5 describes the notion of knowledge sharing and would share technical knowledge to an equal or lower level of the firm. When it comes to knowledge about how analytics can be applied to an audit, it would be shared across all levels of the firm. Furthermore, respondent S5 state that the firm combines the knowledge of different employees, people working with analytics and auditing work in or with the audit teams and hence the knowledge is shared within teams. With regard to how the firm promotes personal relations, the respondent describes the following:

> This an excellent part of the firm's culture. The firm strongly believes in having excellent communication and working together as a team. It is a flatter organisation. so more junior members of staff feel comfortable approaching more senior members of staff.

Additionally, respondent S5 state that the motivation behind sharing knowledge stems from the respondents own will to help others gain knowledge which makes them perform more effectively and also to grow professionally as individuals. Further, the respondent state that *"the firm expects us to be able to share knowledge effectively to help juniors grow and develop."*. Furthermore, the respondent notes that employees are assessed on their leadership abilities and how well they work with other people, which promote knowledge sharing. The respondent continues that *"sharing knowledge with other member firms is also essential as we don't want to rebuild or redevelop other analytical tools that other firms have built."*. Moreover, the willingness to share knowledge and help others is seen as one of the key pillars of the firm. And with regards to how knowledge is valued within the firm, the respondent believes that characteristics are valued higher than knowledge.

Respondent A7 states that knowledge typically is shared between all different levels at the firm. With regards to how different divisions spread their knowledge, the respondent says that several divisions typically are involved at the beginning of an audit engagement, which promotes insights and understanding of how different divisions operate. Further, the firm arranges several social events each year as well as internal education and the firm encourages

employees to interact with other people within the firm and network. The factor that motivates the respondent to share knowledge is that *"by sharing my own knowledge, you get at least as much back, I would say."*. When describing the culture, the respondent emphasizes that the firm has an open climate where you are encouraged to ask questions. Furthermore, knowledge is valued high in the firm according to respondent S5, who notes that *"people with good IT skills in auditing are quickly sought after by colleagues who would like to see them in their audit team."*.

Firm 6

Respondent A8 states that personal knowledge mainly is shared by communicating with colleagues and by sending e-mails to the divisions shared e-mail. Furthermore, the respondent states that *"I often share knowledge with colleagues at lower-levels, less often with those at the same level, and rarely to those at a higher level"*. Moreover, the firm arranges summits periodically to promote knowledge sharing in order to increase the overall knowledge level within the firm. Through these arranged summits, cross-division exchanges and e-mails, the firm works with knowledge sharing between divisions. Further, the respondent notes that the firm has an education portal where anyone within the firm can choose which courses to take, whether it is related to the individuals own division or another division. Additionally, the respondent states that the firm has rules related to how work should be conducted. When asked about the firm's culture, the respondent explained that *"the norm we have is to share all knowledge that does not seem to be widely known. Although, sometimes it costs a lot to call the experts in certain specific areas, which can constitute an obstacle to knowledge sharing."*. Furthermore, the respondent is motivated to share knowledge because it improves the general quality of the office and since it leads to more satisfied clients as a result of the higher quality provided. Moreover, regarding how the firm values knowledge, the respondent said *"knowledge is power. I would like to say that knowledge is the whole starting point in your wage setting, work ability and delivered client experience"*. Further, the juniors within the firm have a mentor and each individual has certain performance goals, which are evaluated at the firm's regular appraisals.

General Analysis of Knowledge Sharing

Research stresses the importance of an organisation's culture, since it can influence knowledge sharing, creation and use (Ipe, 2003; Løwendahl et al., 2001). Generally, all respondents in one way or another indicated that their firm's culture encourages knowledge sharing, through communication, working in teams, helping each other and emphasizing the value of knowledge sharing. Furthermore, this could indicate a use of knowledge connection (Weiss, 1999), since the firm encourages the connection between knowledge seekers and knowledge sources. Moreover, it can also be seen as a way for the organisation to increase the employees' opportunity to share knowledge (Ipe, 2003), both through formal opportunities by working in teams and informal opportunities through personal relationships and social networks, which are developed through communication and by helping each other.

As noted by Løwendahl et al. (2001), it is important for professional service firms to work with sharing knowledge between different divisions in order to create a shared knowledge base internally. In line with this, all respondents described that each of the firms continuously works with creating a shared knowledge base, whether it is through the intranet, office meetings, cross-division exchanges or within audit teams. Furthermore, Weiss (1999) stresses that firms internally have to work with knowledge collection and knowledge connection. Where the use of an intranet can be seen as a way to use knowledge collection, and knowledge spread through arranged meetings or within audit teams can be seen as a way to use knowledge connection. Further, all respondents described that their respective firms work with arranging different sorts of events in order to promote personal relationships to be developed between employees, which is a way to ease knowledge connection regarding embedded knowledge (Weiss, 1999). Moreover, this type of knowledge connection of embedded knowledge is also a way to increase the informal opportunity to share knowledge (Ipe, 2003).

Additionally, the nature of knowledge has been depicted as one of the major factors which affect knowledge sharing within an organisation (Ipe, 2003). Moreover, research states that individuals within professional service firms can be reluctant to share knowledge since knowledge typically is valued highly (Ipe, 2003). Respondent A1 (firm 1), A2 (firm 2), A4 (firm 3), A7 (firm 5), and A8 (firm 6) state that knowledge is valued highly within their

firms. Although, respondent A2 from firm 2 states that the reason for this is that it increases efficiency since the more knowledge, the more added-value to the group. Furthermore, respondent S5 from firm 5 had another view and believed that personal characteristics were of more value than knowledge. However, respondent A8 from firm 6 had a contradicting view, and stated that *"knowledge is power"*. Even though the majority of the respondents believed that knowledge was valued highly, their general thoughts about knowledge sharing shows that their firm works a lot with improving collective knowledge, and hence this finding is not in line with that of Ipe (2003), that individuals within professional service firms might be reluctant to share knowledge.

Furthermore, the motivation to share knowledge is also an important factor affecting knowledge sharing (Ipe, 2003). The respondents all had quite different views on what motivates them to share knowledge. Respondent A1 from firm 1, and respondent A7 from firm 5, stated that they get motivated because knowledge sharing is beneficial to themselves, which is in line with what Ipe (2003) says about knowledge sharing as something value-adding for the individual themselves. In addition, the findings of respondent A2 (firm 2), A4 (firm 3), S5 (firm 5), and A8 (firm 6) indicate that their motivation to share knowledge mainly relates to the firm, as a way to increase general quality and efficiency, but also through helping each other and to add value to the group. This could be seen as external motivation to share knowledge through personal relationships (Ipe, 2003). Furthermore, respondent A2 (firm 2) and respondent A8 (firm 6), also emphasize that knowledge sharing can result in added-value for the client. Weiss (1999) note that professional service firms often put the client first, and hence it is especially important for such firms to have clear incentives in order to promote knowledge sharing, which in the end adds value to the client. Notably, it seems as if firm 2 and 6 both work with incentives in order to promote knowledge sharing but something not perceived as prevalent in firm 1, 3, and 5. Further, this is in line with what firm 6 presents related to appraisals and evaluations, which according to Weiss (1999) can work as an incentive to promote knowledge collection and connection. However, when looking more in-depth on the respective answers, respondent S5 from firm 5 also note that the firm work with such incentives as they are assessed based on their capability to share knowledge, which indicates that firm 5 also work with such incentives as mentioned in Weiss (1999).

Furthermore, external motivation to share knowledge could also stem from the power of the recipient (Ipe, 2003). Respondent A7 and S5, both from firm 5, state that they share knowledge to every level within the firm, while respondent A8 from firm 6 mainly share knowledge to those at lower levels and respondent A1 from firm 1 along with A2 from firm 2, share knowledge to those at the same level. These findings do not go in line with what Ipe (2003) found, and hence it could be indicated that the respondents are not motivated to share knowledge as a result of the power of the recipient.

5. Discussion

In the fifth chapter, the results and analysis from the interviews will be discussed and problematised in relation to the study's purpose and analytical model. The discussion aims to provide the reader with a comprehensive picture of how the perceived possibilities, risks, and issues with the implementation of BDA is connected to audit knowledge and knowledge sharing.

The overall perceived possibilities presented in the interviews, concerning the implementation of Big Data Analytics into the audit methodology, are overwhelmingly positive. Increased audit quality is perceived both through a more precise risk assessment in the early steps of the audit process and through advancements through a shift from statistical sampling to full population coverage in substantive testing, which will enable a greater understanding of clients and their environment. This deeper understanding will enable auditors to identify material errors to a greater extent and find evidence indicating fraud otherwise impossible to detect, as well as an ability to provide greater value through the delivery of an audit previously not possible, as well as information about the client they themselves do not even have. This optimistic perception goes in line with the need for the audit profession to produce legitimacy for its practices (Power, 2003), along with the claim that the benefits of new practices are connected to the legitimation of the new technology (Power, 1996). This legitimization is sought in the form of perceived benefits for clients and for society as a whole, along with connections to the accepted standards of statistics (Suchman, 1995).

One of the drawbacks with all the perceived benefits of BDA implementation is that the implementation also carries a perceived risk for an expanded expectations gap, although this was not perceived as something new, but instead as an omnipresent threat of the audit profession, that needs to be handled through communication with the clients. Auditors are publicly viewed as gatekeepers, assuring the quality of published financial reports (Humphrey & Moizer, 1990) which sometimes clashes with what auditors can and must do (Power, 2000) and is a clear example of the struggle between the idealistic view of the audit profession and what is practically possible to achieve (Power, 1997). Due to the lack of hard

evidence regarding the effects of the auditors' efforts, the profession relies on the production of legitimacy to bridge the gap (Power, 2003).

Another drawback is the risk that auditors will become too reliant on the new technology and deplete the knowledge base needed to conduct professional judgements as part of the audit process, causing a deprofessionalisation of the audit profession. The audit profession is perceived as expert decision makers by the public who serve in the public interest (Humphrey & Moizer, 1990). Due to the lack of naturally verifiable effects of the professions' services, it relies on the production of legitimacy to secure their role in society (Power, 2003). At the moment, the audit professions role in society can be seen as taken for granted but if the knowledge base shrank to the point that the profession failed to complete their social task, their social contract could be seen as revoked (Suchmann, 1995; Power, 1996). The production of legitimacy happens through the practice of auditors' profession, which relies on the underlying base of audit knowledge (Power, 1996).

An additional concern about the implementation of BDA, as always with more advanced analytics, is the risk of false positives. This risk can derive either from incompatible, incorrect or corrupt data from clients or other sources or due to operator error when defining the parameters of the analysis, something that can be caused by incompetence or a lack of knowledge regarding the analytical tool or surroundings of the data. The identified knowledge gap affecting the quality of analytics can be said to contain both rationalized and tacit knowledge (Weiss, 1999; Løwendahl et al., 2001). The knowledge needed to utilize the basic analytical programs and basic construction of analysis parameters can be identified as explicit knowledge, since it is generic and codifiable, while the knowledge needed for more advanced analytics and the handling varying data quality can be identified as tacit, as the knowledge is contextual it can be shared through mentorship. Rationalized knowledge fits Power's (1996) definition of audit knowledge, while tacit knowledge isn't directly mentioned by Power. On the other hand, Power does state that audit knowledge can be both formal and informal and be shared both internally and externally, fitting both the knowledge types identified. Furthermore, the firms should work with knowledge collection regarding rationalized knowledge through methods, templates or standards (Løwendahl et al., 2001). Further, tacit knowledge could be shared through working in teams, or through mentorships

(Løwendahl et al., 2001), although this is often done within auditing, it should be further emphasized when working with BDA by sharing experiences of different clients, which will increase the opportunity to share knowledge (Ipe, 2003).

Big Data Analytics cannot be said to be as thoroughly implemented in the audit methodology as data analytics, and a discrepancy of opinions is present, both between and within firms, regarding current utilization. Currently, BDA focuses on the utilization of structured financial data, with unstructured data seen as a future feature and is primarily used in the risk assessment process for trend and anomaly predictions, with some firms in the implementation stage of using the technology in the collection, consolidation and preparation of data. Advanced analytics is predominantly handled by specialists, while simpler tools are generally widely available. This correlates with the superior knowledge presented by senior staff about the current state of implementation and presents current and future capabilities in the light of both practical and idealistic views while the associates present a predominantly practical view. This discrepancy indicates a knowledge gap, which partly could be explained by some education only being offered to key individuals or when need arise. The type of knowledge lacking in the identified knowledge gap between seniors and associates can be identified as rationalized knowledge since it is generic and codifiable (Weiss, 1999), which coincided with Power's (1996) definition of the quality of audit knowledge. According to Power, this type of knowledge can be spread through education where the practitioner is shaped in terms of practice.

The knowledge gap between different levels could be a result of only offering some education to key people and not to all employees at the firm. This can be a problem, since it affects knowledge connection (Weiss, 1999), and less experienced staff will not know where or how to get access to certain information, or even that knowledge exists within the firm. This is particularly clear in two firms, where the associates did not know how or if BDA is used in the audit process within the firm. Although, interviews with senior staff showed that the firm had or was in the process of implementing BDA. In addition, only providing certain knowledge to a limited number of employees, who has more experience or are specialists, could be interpreted as an indication that knowledge is something of value, as depicted by Ipe (2003. Since knowledge typically is valued highly in professions, individuals within a

profession can be reluctant to share knowledge (Ipe, 2003). Furthermore, the respondents agreed that knowledge was seen as something valuable, but did not show any indication of them being reluctant to share it. Although, even if the respondents agreed that the firm's culture promoted knowledge sharing, they also agreed upon the notion of knowledge as valuable. Since the value of knowledge could be interpreted as something rooted within the firm's culture, this could be a possible explanation of the knowledge gap surrounding the implementation of BDA, since the firm's culture is the one factor that has the most influence on whether or not knowledge is shared (Ipe, 2003).

6. Concluding Remarks

The final chapter begins with the conclusion of the thesis, which is derived from the discussion. Furthermore, the thesis' practical and theoretical contributions are presented, followed by the limitations of the findings. Lastly, suggestions for future research are presented.

6.1 Conclusion

The audit firms are in the process of stepping up from data analytics to BDA but this is not quite yet a reality. The implementation of BDA in the audit methodology is full of promising potential about improvements to audit quality and efficiency, in the form of more accurate risk assessments, full coverage of the available data during substantive testing resulting in improved detection of material errors and indications of fraud, as well as a greater understanding of the client organisation and its environment. Though the fruition of these promises relies on how the incorporated risks and issues are handled.

Connected with the implementation of BDA and its perceived benefits, there is also a perceived risk of an expansion of the expectation cap, as well as three areas where knowledge has a decisive influence is, as presented above; a risk of deprofessionalisation, a knowledge gap affecting the quality of analytics and a knowledge gap between senior and associate level employees regarding BDA. The conclusion can hence be made that knowledge can work as enabler or obstacle to the implementation of BDA and knowledge sharing can reinforce the enabling effects while reducing obstacles .

6.2 Contribution to Research

The thesis contribute practically by providing those within the audit profession with increased understanding of the current level of implementation of BDA and views on further development, from the perspective of practitioners. Furthermore, the thesis contributes by presenting audit knowledge and knowledge sharing as possible factors influencing the implementation process of BDA within the audit methodology and hence provide practitioners with direct concerns which could arise with the implementation, and what the firms could take into consideration to improve the implementation process.

The thesis contribute theoretically by adding on to the scarce amount of research, depicting the implementation of BDA in the audit methodology as perceived by audit practitioners and the importance of knowledge and knowledge sharing in this process. This, in turn, contributes to the understanding of the implementation of new technology into the audit methodology. Further, it contributes to the general field of change in the Big Data environment. As a result, the findings gathered from this thesis opens possible agendas for future research.

6.3 Limitations

The study has some limitations related to the obtained findings. Since knowledge was something that was found to be of importance when some of the interviews have already been conducted, we were only able to gather additional information regarding knowledge by 6 out of the 13 respondents, from five of the six firms. Furthermore, these findings are mainly based on associates views (apart from the findings from firm 5), and it is hence not possible to investigate if the view differs or not depending on the level. Moreover, another limitation is the group interview conducted with firm 4, which resulted in a lack of answers when looking at each individual respondent, furthermore since it was a group interview, there is an increased risk of bias.

6.4 Suggestion for Future Research

The theoretical contribution of the thesis is that it opens up for possible future research agendas. Firstly, the findings have shown that with BDA, there is a future risk of deprofessionalisation. Although, something that also came up during the interviews was that it instead might lead to auditors being able to focus on more core competences instead of manual tasks, which are time-consuming. However, this is not covered in much detail in this thesis but rather something of interest, and hence future qualitative research should look more in-depth on whether BDA is perceived to lead to deprofessionalization or result in a more professionalized audit, and why. Secondly, this study indicates that knowledge sharing could solve the current knowledge gap between senior staff and associates, and future studies should look more into how and why knowledge sharing could solve the gap and why firms allow this gap to exist. Thirdly, this thesis only cover knowledge as a factor that can affect the implementations of BDA, but there surely are more factors affecting this, and therefore it

would be interesting to further investigate possible factors that can affect the implementation of BDA.

Moreover, the study has found some additional subjects for future research. This study focuses on the perceived possibilities with implementing BDA, where the findings indicate that a future possibility is moving from statistical sampling to full coverage of the available data within the substantive testing. This is something that the thesis does not cover and it would be interesting to study whether or not it is technically doable for BDA to replace statistical sampling within the audit methodology, and if it is perceived as legitimate enough to be accepted. Furthermore, it would be interesting to follow the technical development with and beyond BDA, towards RPA and AI implementation, and see how both the audit methodology and the audit profession change to incorporate these advancements.

References

Adams, C., Gray, R. & Owens, D. (2010). Some theories for social accounting?: A review essay and a tentative pedagogic categorisation of theorisations around social accounting. *Advances in Environmental Accounting & Management*, vol. 4, pp.1-54.

An, Y., Davey, H. & Eggleton, I. (2011). Towards a comprehensive theoretical framework for voluntary IC disclosure. *Journal of Intellectual Capital*, vol. 12, no 4, pp.571-585.

Alles, M. G. (2015). Drivers of the use and facilitators and obstacles of the evolution of Big Data by the audit profession. *Accounting Horizons*, vol. 29, no. 2, pp.439-449.

Alles, M., & Gray, G. (2018). The pros and cons of using big data in auditing: a synthesis of the literature and a research agenda. *Rutgers.* pp.1-37.

Buhl, H. U., M. Röglinger, D. K. F. Moser, and J. Heidemann. (2013). Big Data: A fashionable topic with(out) sustainable relevance for research and practice? *Business and Information System Engineering,* vol. 5, no. 2 pp.65–69.

BDO. (2016). Data analytics & enhancing audit quality. Available online: https://www.bdo.com/insights/assurance/corporate-governance/data-analytics-enhancing-audit-quality [Accessed 15 May 2019].

BDO (2017). Transparency Report 2017. Available Online: www.bdo.se/getmedia/806dad77-cbdf-40ef-a375-55c290fb0e7a/Transparency_report_2017.aspx [Accessed 7 May 2019].

BDO (2019) What is Data Analytics? | Big Data. Available Online: https://www.bdo.com.au/en-au/services/advisory/consulting/data-analytics/what-is-data-analytics [Accessed 15 May 2019].

Bryman, A., & Bell, E. (2015). Business research methods. Oxford university press.

Cao, M., Chychyla, R., & Stewart, T. (2015). Big Data analytics in financial statement audits. *Accounting Horizons*, vol. 29, no. 2, pp.423-429.

Carnegie, G. D., & Napier, C. J. (2010). Traditional accountants and business professionals: Portraying the accounting profession after Enron. *Accounting, Organizations and Society*, vol. 35, no. 3, pp.360-376.

Croasdell, D.T. (2001). IT's role in organizational memory and learning. *Information Systems Management*, vol. 18, no. 1, pp.8-11.

Deegan, C. (2002). The legitimising effect of social and environmental disclosures - a theoretical foundation. *Accounting, Auditing & Accountability Journal*, vol. 15, no. 3, pp.282-311.

Deegan, C. (2006). Legitimacy theory, in Z. Hoque (ed), *Methodological Issues in Accounting Research: Theories, Methods and Issues*, Spiramus, London, U.K., 161-181.

Deegan, C. (2009) “Financial accounting theory”. McGraw Hill, North Ryde, NSW, Australia.

Deegan, C. & Unerman, J. (2011). Financial accounting theory. 2nd ed. London: McGraw-Hill Education.

Deloitte. (2016). The bigger the challenge, the bigger the opportunity. 2016 Global Impact Report. Available online: https://www2.deloitte.com/content/dam/Deloitte/ru/Documents/about-deloitte/2016-global-impact-report.pdf [Accessed 19 April 2019].

Deloitte. (2018). 2018 Transparency report. Available online: https://www2.deloitte.com/content/dam/Deloitte/be/Documents/audit/TransparencyReport/Deloitte%20Transparency%20Report%202018.pdf [Accessed 19 April 2019].

Deloitte. (2019a). Our Audit Approach. Available Online: https://www2.deloitte.com/lu/en/pages/audit/articles/our-audit-approach.html [Accessed 7 May 2019].

Deloitte. (2019b). The Deloitte Audit. Available online: https://www2.deloitte.com/us/en/pages/audit/solutions/audit-technology-solutions.html [Accessed 15 May 2019].

Denscombe, M. (2016). Forskningshandboken; För småskaliga forskningsprojekt inom samhällsvetenskaperna. 3:2 ed. Lund: Studentlitteratur AB.

EY. (2015a). Big data and analytics in the audit process. Available online: https://www.ey.com/Publication/%20vwLUAssets/ey-big-data-and-analytics-in-the-audit-process/$FILE/ey-big-data-and-analytics-in-the-audit-process.pdf [Accessed 13 May 2019].

EY. (2015b). How big data and analytics are transforming the audit. Available online: https://www.ey.com/en_gl/assurance/how-big-data-and-analytics-are-transforming-the-audit [Accessed 13 May 2019].

EY. (2018a). Transparency report 2018. Available online: https://www.ey.com/Publication/vwLUAssets/Transparency_Report_Sweden_FY18/$FILE/FY18-Transparency-Report-Sweden.pdf [Accessed 19 April 2019].

EY. (2018b). EY global review 2018. Available online: https://assets.ey.com/content/dam/ey-sites/ey-com/en_gl/topics/global-review/2018/ey_global_review_2018_v11_hr.pdf [Accessed 14 May 2019].

EY. (2019). EY Helix. Available online: https://www.ey.com/en_gl/audit/technology/helix [Accessed 19 April 2019].

Glantz, S. H. (2016a) Framtiden är redan här. *Balans*, nr 8. Available online: https://www.faronline.se/dokument/balans/2016/balans_nr_08_2016/balans_2016_n08_a0004/?q=big%20data%20analys [Accessed 15 April 2019]

Glantz, S. H. (2016b) Brittisk branschboom – 45 procent använder digitala lösningar. *Balans*, nr. 10 Available online: https://www.faronline.se/dokument/balans/2016/balans_nr_10_2016/balans_2016_n10_a0011/?q=digitalisering%20och%20automatisering%20av%20revisionen [Accessed 15 April 2019]

Grant Thornton. (2018a). Transparency report 2018. Available online: https://www.grantthornton.se/globalassets/1.-member-firms/sweden/pdf/om-oss/arsredovisning/180828_transparency_report_2018_0.8.pdf [Accessed 19 April 2019].

Grant Thornton. (2018b). Innovation driving the audit of the future. Available online: https://www.grantthornton.com/library/articles/audit/2018/innovation-driving-audit-of-future.aspx [Accessed 15 May 2019].

Grant Thornton. (2019a). Data analytics. Available online: https://www.grantthornton.com/services/advisory/business-risk/data-analytics.aspx [Accessed 15 May 2019].

Grant Thornton. (2019b). Innovation drives improved audit quality and value. Available online: https://www.grantthornton.com/services/audit-services/audit-of-future.aspx [Accessed 15 May 2019].

Grey, C. (1998). On being a professional in a "Big Six" firm. *Accounting, Organizations and Society*, vol. 23, no. 5-6, pp.569-587.

Holm, C., & Zaman, M. (2012). Regulating audit quality: Restoring trust and legitimacy. In *Accounting forum*, vol. 36, no. 1, pp.51-61.

Hsieh, H. F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative health research*, vol. 15, no. 9, pp.1277-1288.

Humphrey, C., & Moizer, P. (1990). From techniques to ideologies: An alternative perspective on the audit function. *Critical Perspectives on Accounting*, vol. 1, no. 3, pp.217-238.

Ipe, M. (2003). Knowledge sharing in organizations: A conceptual framework. *Human resource development review*, vol. 2, no. 4, pp.337-359.

Johnstone, K. M., Warfield, T. D., & Sutton, M. H. (2001). Antecedents and consequences of independence risk: Framework for analysis. *Accounting Horizons*, vol. 15, no. 1, pp.1-18.

KPMG. (2015). Audit Data & Analytics: Unlocking the value of audit. Available online: https://home.kpmg/nz/en/home/insights/2015/02/audit-data-analytics-unlocking-value-of-audit.html [Accessed 13 May 2019].

KPMG. (2018a). Transparency report 2018 KPMG International. Available online: https://assets.kpmg/content/dam/kpmg/xx/pdf/2018/12/transparency-report-2018.pdf [Accessed 19 April 2019].

KPMG. (2018b). KPMG Clara - a smart audit platform. Available online: https://assets.kpmg/content/dam/kpmg/xx/pdf/2017/05/kpmg-clara-a-smart-audit-platform.pdf [Accessed 19 April 2019].

KPMG. (2018c). Transparency report 2018 UK. Available online: https://assets.kpmg/content/dam/kpmg/uk/pdf/2018/12/annual-report-2018-transparency-report.pdf [Accessed 13 May 2019].

Lauer, T. and Tanniru, M., 2001. Knowledge Management Audit-a methodology and case study. *Australasian Journal of Information Systems*, vol. 9, no.1.

Llewelyn, S. (2003). What counts as "theory" in qualitative management and accounting research? Introducing five levels of theorizing. *Accounting, Auditing & Accountability Journal*, vol. 16, no. 4, pp.662-708.

Løwendahl, B. R., Revang, Ø., & Fosstenløkken, S. M. (2001). Knowledge and value creation in professional service firms: A framework for analysis. *Human relations*, vol. 54, no. 7, pp.911-931.

O'Dwyer, B., Owen, D., & Unerman, J. (2011). Seeking legitimacy for new assurance forms: The case of assurance on sustainability reporting. *Accounting, Organizations and Society*, vol. 36, no. 1, pp.31-52.

Power, M. (1992). From common sense to expertise: Reflections on the prehistory of audit sampling. *Accounting, Organizations and Society*, vol. 17, no. 1, pp.37-62.

Power, M. (1996). Making things auditable. *Accounting, organizations and society*, vol. 21, no. 2-3, pp.289-315.

Power, M. (1997). The audit society: Rituals of verification. Oxford: Oxford University Press.

Power, M. (2000). The audit society—Second thoughts. *International Journal of Auditing*, vol. 4, no. 1, pp.111-119.

Power, M. (2003). Auditing and the production of legitimacy. *Accounting, organizations and society*, vol. 28, no. 4, pp.379-394.

PwC. (2014). Data analytics - Delivering intelligence in the moment. https://www.pwc.co.uk/assets/pdf/data-analytics-january-2014-without-inserts.pdf [Accessed 13 May 2019].

PwC (2018) Transparency report. Available Online: https://www.pwc.com/gx/en/ghost/sweden.html [Accessed 1 April 2019].

PwC. (2019a). Revision. Available at: https://www.pwc.se/revision [Accessed 14 May 2019].

PwC. (2019b). Audit explorer - The best people empowered by market-leading technologies. https://www.pwc.com/gx/en/audit-services/assets/pdf/audit-explorer-at-a-glance-on-screen.pdf [Accessed 14 May 2019].

Richins, G., Stapleton, A., Stratopoulos, T. C., & Wong, C. (2017). Big Data analytics: Opportunity or threat for the accounting profession?. *Journal of Information Systems*, vol. 31, no. 3, pp.63-79.

Salijeni, G., Samsonova-Taddei, A., & Turley, S. (2019). Big Data and changes in audit technology: contemplating a research agenda. *Accounting and Business Research*, vol. 49, no. 1, pp.95-119.

Salijeni, G. (2019). *Big Data Analytics and the Social Relevance of Auditing: An Exploratory Study* (Doctoral dissertation, The University of Manchester (United Kingdom)).

Stoel, D., Havelka, D., & Merhout, J. W. (2012). An analysis of attributes that impact information technology audit quality: A study of IT and financial audit practitioners. *International Journal of Accounting Information Systems*, vol. 13, no. 1, pp.60-79.

Watts, R. L., & Zimmerman, J. L. (1983). Agency problems, auditing, and the theory of the firm: Some evidence. *The Journal of Law and Economics*, vol. 26, no. 3, pp.613-633.

Weiss, L. M. (1999). Collection and connection: The anatomy of knowledge sharing in professional service firms. *Academy of Management Proceedings,* vol. 1999, no. 1, pp.A1-A6.

Yoon, K., Hoogduin, L., & Zhang, L. (2015). Big Data as complementary audit evidence. *Accounting Horizons*, vol. 29, no. 2, pp.431-438.

Zelditch., M. (2001). Theories of Legitimacy, in Jost, J., & Major, B. (eds). *The Psychology of Legitimacy: Emerging Perspectives on Ideology, Justice, and Intergroup Relations*. Cambridge University Press.

Zhang, J., Yang, X., & Appelbaum, D. (2015). Toward effective Big Data analysis in continuous auditing. *Accounting Horizons*, vol. 29, no. 2, pp.469-476.

Appendix

Appendix 1 - Overview of the Literature

Authors	Empirics	Key findings
Cao et al (2015)	Look at different documents, such as scientific articles, complemented with publications from the big 4, and ISA, etc.	BDA is not used in audits today but is found to be a way to increase efficiency and effectiveness of financial statement audits. The researchers provide information about the possibilities and limitations of BDA and suggest how BDA can be implemented within auditing in the future.
Zhang et al (2015)	Look at previous research and complement this with additional documents.	Look at BDA and identify current gaps that exist between how it is used, and how it can be used in continuous auditing. The authors found the following five gaps: Data Consistency, Data Integrity, Data Identification, Data Aggregation, and Data Confidentiality.
Alles & Gray (2018)	Use previous research, and complement with documents from standard setters and literature published by practitioners in blogs, white papers, and other non-academic outlets.	Show the pros and cons with using Big Data in audits, and present aspects of Big Data that could be beneficial to auditors. The authors also propose research areas in future research to fill the current gaps in research.
Yoon et al (2015)	Look at scientific articles and combine this with additional documents such as standards.	Look into the possibility of using Big Data as audit evidence. Conclude that Big Data will complement traditional audit evidence

		and will result in auditors being less dependent on data provided by the client. The article also touches upon the benefits and risks with implementing Big Data in auditing.
Salijeni et al (2019)	Interview 20 persons, both auditors and members of regulatory bodies. The study also look at previous research, as well as additional sources such as standards, and documents published by the large auditing firms.	The study looked at the impact of BDA on the nature of the relationship between auditors and their clients, the consequences of the technology for the conduct of audit engagements, and the common challenges associated with embedding BDA in the audit context. Additionally, suggestions for future research is also presented.

Appendix 2 - External Communication Regarding Big Data Analysis

KPMG

KPMG is today using two audit platforms, KPMG Clara and eAudit, where eAudit is going to be replaced by KPMG Clara by 2021 (KPMG, 2018a). These audit platforms is seen to have several different positive effects, such as for example improved audit quality. KPMG Clara can address risk by identifying transactions with unexpected or unusual account combinations, and provide helpful insights about the industry (KPMG, 2018b). Although, even if the term Big Data is not explicitly mentioned in the documents looked at, looking more closely on what picture is presented, it is in fact Big Data which is discussed. By for example stating *"Predictive & Valuation analytics provides the audit team with the ability to analyse projections, sensitise assumptions and assess scenarios, as well as use inputs from external market data."* (KPMG, 2018c, p. 25), or *"By effectively interrogating and understanding data, companies can gain greater understanding of the factors affecting their performance – from customer data to environmental influences – and turn this into real advantage. Data & Analytics is helping businesses to become smarter, more productive, and better at making predictions."* (KPMG, 2015). Furthermore, BDA is included in the process of obtain audit evidence and communicate with clients and in turn, new technologies for forming an audit opinion both faster and with more accuracy than ever before (KPMG, 2018a). KPMG themselves argue for data analytics as a tool for improving audit as it makes it possible to investigate a larger amount of data and audit can now move beyond the traditional audit, making audits more secure, and transparent, and at the same time enhancing audit quality. In turn, using BDA will lead to an increased use of other technologies such as RPA and machine learning (KPMG, 2018a).

PWC

PwC has also had the notion of Big Data and analytics on their agenda for years, for example in a report from 2014, PwC explains the benefit of Big Data for companies to evaluate their future, as well as risks (PwC, 2014). PwC describes how they conduct data analytics and argue that they can now cover entire populations of large transaction volumes and that these analyses provide information about underlying trends that result in a more value-creating audit (PwC, 2019a). Furthermore, PwC is continuously developing new tools to support auditors in the work process with the aim to improve audit quality and efficiency (PwC, 2018). Regarding data analytics, PwC is developing a new tool named Halo, that will assist in data analysis and help evaluate business risks and focus auditing in the correct area of operations. Halo is meant to help analyse and visualise patterns and trends as well as identifying anomalies in transaction records and areas of heightened risk. Three key areas are included in the tool, collection, compiling and automatic testing and analysis of data. Auditors specifies criteria for the tool and uses its built in functionality to identify high risk

posts (PwC, 2018). Although, even if the term Big Data is not used much in the reports by PwC, several statements such as *"Halo uses data and visualisation to analyse internal and external drivers of your business, to identify areas of higher risk, direct audit work, and generate insights to share with you"* (PwC, 2019b, p.5) indicate that it is in fact BDA which is discussed. Furthermore, PwC argue that these new market-leading technologies result in higher quality and value than before.

EY

In a document published by EY, they state that *"Both internal and external auditors are combining big data and analytics, and greater access to detailed industry information, to help them better understand the business, identify risks and issues, and deliver enhanced quality and coverage while providing more business value."* (EY, 2015a, p. 1). Later on in the document, it is also stated that the implementation of BDA continue to be a problem but that they are progressing with implementing it. Moreover, EY is today working with integrating data analytics with auditing and has developed several different technological tools for a more digitized audit (EY, 2018a). The platform handling analytics is called EY Helix, which analyses a vast amount of data by identifying patterns, and trends within the data which helps EY to know where to invest their audit efforts. Furthermore, EY Helix provides auditors with deeper knowledge and insight in both risk factors as well as transactions (EY, 2018a). Implementing EY Helix in auditing is seen to enhance audit quality, increase the level of professional scepticism, and as an outcome, result in a more client-relevant audit (EY, 2019). In an article published in 2015, EY argue that BDA will have a huge impact on audit resulting in a more relevant audit with higher audit quality and better business insights, but at the same time, EY states that "*While we are making significant progress and are beginning to see the benefits of big data and analytics in the audit, we recognize that this is a journey."* (EY, 2015b). In their 2018 global review, EY state that *"EY Helix allows analytics to be embedded in every significant aspect of the audit. Rather than testing smaller samples, we can now capture, transform and analyze full populations of structured and unstructured data using our Hadoop platform."* (EY, 2018b, p. 5). This is an indication of EY's usage of BDA within auditing today.

Deloitte

Furthermore, Deloitte also has developed an audit platform for data analytics, named Deloitte Illumia, with the intention to increase audit quality and also the accuracy of the audit (Deloitte, 2018). With Deloitte Illumia, it is possible to analyse large amount of datasets to discover trends, patterns, and anomalies, which entails auditors to look at the entire population of data to identify hidden risks (Deloitte, 2016). When describing technology used in the audit, Deloitte state that they use data and conduct advanced analyses with large data sets consisting of both structured and unstructured data (Deloitte, 2019b). For analysing unstructured data, Deloitte has developed a technology called Argus, which uses cognitive

technologies to produce analyses of vast amounts of data (Deloitte, 2016). Deloitte Argus is now implemented in US, Canada, Australia and The Netherlands (Deloitte, 2019c).

Grant Thornton

Further, Grant Thornton has developed a new tool in cooperation with Microsoft which is meant to enhance the flexibility and scalability and in turn increase audit quality as well as making the audit more relevant for the client (Grant Thornton, 2018a). Grant Thornton also states that data analytics is incorporated in every step of their audit process, from planning to the final report (Grant Thornton, 2019a). Furthermore, Grant Thornton states in an article that they are able to analyse the full population, which creates the possibility of getting a more in-depth picture of the company and its risks and possibilities (Grant Thornton, 2018b). Grant Thornton is also working with data analytics of both structured and unstructured data within auditing (Grant Thornton, 2019b). Moreover, Grant Thornton explains that analytics is a cultural change and highlight the need to embrace change instead of resisting change (Grant Thornton, 2018b).

BDO

Furthermore, BDO has also developed a suite of data analysis tool called BDO Advantage, which utilizes summarizes data and visually presents a complete picture based on outliers and anomalies. The tool is used for risk assessments and can be configured for customized tasks (BDO, 2016). The software has come a long way and is now able to handle large datasets and complex analytics (BDO, 2019).

Appendix 3 - Table of Interviewees

Firm	**Position**	**Experience** (years)	**Interview type**	**Duration**	**Respondent** (nr)
Firm 1	Certified Auditor, Partner	~30	Face-to-face	31 min	S1
Firm 1	Audit Associate	<1	Facebook (voice)	22 min	A1
Firm 2	Audit Associate	<1	Facebook (voice)	56 min	A2
Firm 2	Certified Auditor, Technical Knowledge	8	Google Hangout (video)	36 min	S2
Firm 2	Audit Associate	2	Face-to-face	26 min	A3
Firm 3	Certified Auditor, Partner	11	Face-to-face	38 min	S3
Firm 3	Audit Assistant	<1	Face-to-face	20 min	A4
Firm 4 (group interview)	-Certified Auditor, Partner, Technical knowledge -Auditor Associate with Technical Knowledge -Analytical Assistant	~30 2 <1	Skype (voice)	39 min	S4 A5 A6
Firm 5	Audit associate	2	E-mail	-	A7
Firm 5	Analytics Leader, Senior Manager	7	Skype (voice)	58 min	S5
Firm 6	Senior Audit Associate	2	Facebook (voice)	46 min	A8

Appendix 4 - Main Interview Questions

- What knowledge and education do you have regarding Big Data Analytics?
- Please explain how your firm works with education.
- How is BDA utilized today in at your place of work?
- What future development do you see for BDA within the audit process?
- What knowledge, characteristics and values do you perceive as important for an auditor to possess?